ECOSYSTEM PROFILE

Indo-Burma

Biodiversity Hotspot

2020 UPDATE

CRITICAL ECOSYSTEM PARTNERSHIP FUND

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Ecosystem Profile

Indo-Burma Biodiversity Hotspot

2020 Update

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ACRONYMS

ACB	ASEAN Centre for Biodiversity
ADB	Asian Development Bank
AFD	l'Agence Française de Développement [French Development Agency]
AIPP	Asian Indigenous Peoples Pact
ARBCP	Asia Regional Biodiversity Conservation Program
ARREST	Asia's Regional Response to Endangered Species Trafficking
ASAP	Asian Species Action Partnership
ASEAN	Association of South East Asian Nations
ASEAN WEN	ASEAN Wildlife Enforcement Network
AZE	Alliance for Zero Extinction
BANCA	Biodiversity and Nature Conservation Association
BCI	Biodiversity Conservation Corridors Initiative
BCST	Bird Conservation Society of Thailand
BEWG	Burma Environmental Working Group
BIOFIN	Biodiversity Finance Initiative
BMU	Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit [German Federal Ministry of the Environment, Nature Conservation, and Nuclear Safety]
BMZ	Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung [German Federal Ministry of Economic Cooperation and Development]
CBD	Convention on Biological Diversity
CCCA	Community Conservation Concession Agreement
CEPF	Critical Ecosystem Partnership Fund
CI	Conservation International
CIRUM	Culture Identity and Resources Use Management
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
COMINGO	Committee for Foreign Non-governmental Organization Affairs
COP	Conference of Parties
C-PFES	carbon payment for forest ecosystem services
CPI	Corruption Perceptions Index
CSO	civil society organization
CSR	corporate social responsibility
Danida	Danish International Development Assistance
DEFRA	Department for Environment, Food and Rural Affairs (UK)
DFAT	Department of Foreign Affairs and Trade (Australia)
DFID	Department for International Development (UK)

DNP	Department of National Parks (Thailand)
DoF	Department of Forestry (Lao PDR)
ECCDI	Ecological Conservation and Community Development Initiative
EIA	Environmental Impact Assessment
ELC	economic land concession
ENV	Education for Nature Vietnam
EU	European Union
FA	Forestry Administration (Cambodia)
FAO	United Nations Food and Agriculture Organization
FCO	Foreign and Commonwealth Office (UK)
FFI	Fauna & Flora International
FLEGT	Forest Law Enforcement, Governance and Trade
FREDA	Forest Resources, Environment, Development and Conservation Association
FSC	Forest Stewardship Council
GAPE	Global Association for People and the Environment
GCF	Green Climate Fund
GDLC	General Directorate for Local Communities (Cambodia)
GDNCAP	General Directorate for Nature Conservation and Protection (Cambodia)
GDP	gross domestic product
GEF	Global Environment Facility
GEI	Global Environment Institute
GHG	greenhouse gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit [German Agency for International Cooperation]
GMS	Greater Mekong Subregion
GNI	gross national income
GONGO	government-organized nongovernmental organization
IKI	Internationale Klimaschutzinitiative [International Climate Initiative]
INDC	Intended Nationally Determined Contribution
INL	United States Bureau of International Narcotics and Law Enforcement Affairs
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for the Conservation of Nature
JICA	Japan International Cooperation Agency
KBA	Key Biodiversity Area
KESAN	Karen Environmental and Social Action Network
KFBG	Kadoorie Farm & Botanic Garden
LMC	Lancang-Mekong Cooperation

LEAF	Lowering Emissions in Asia's Forests
LOI	letter of inquiry
LUCF	Land-Use Change and Forestry
MAFF	Ministry of Agriculture, Forestry and Fisheries (Cambodia)
MARD	Ministry of Agriculture and Rural Development (Vietnam)
MEE	Ministry of Ecology and Environment (China)
MERN	Myanmar Environment Rehabilitation-conservation Network
METT	Management Effectiveness Tracking Tool
MFA	Myanmar Forest Association
MoE	Ministry of Environment (Cambodia)
MoFA	Ministry of Foreign Affairs (Norway)
MoNRE	Ministry of Natural Resources and Environment (Lao PDR, Thailand and Vietnam)
MoNREC	Ministry of Natural Resources and Environmental Conservation (Myanmar)
MoU	memorandum of understanding
MPA	marine protected area
MRC	Mekong River Commission
NBSAP	National Biodiversity Strategy and Action Plan
NCEA	National Commission for Environmental Affairs (Myanmar)
NDC	Nationally Determined Contribution
NGO	nongovernmental organization
Norad	Norwegian Agency for Development Cooperation
NPA	national protected area
NTFP	non-timber forest product
NWCD	Nature and Wildlife Conservation Division (Myanmar)
ODA	Official Development Assistance
OECM	Other Effective Area-based Conservation Measures
PES	payment for ecosystem services
PFES	payment for forest ecosystem services
RAFT	Responsible Asia Forestry and Trade
RECOFTC	Center for People and Forests
REDD	reducing emissions from deforestation and forest degradation
REDD+	reducing emissions from deforestation and forest degradation, and the conservation and enhancement of forest carbon stocks
RIT	Regional Implementation Team
SAR	Special Administrative Region
SARS	Severe Acute Respiratory Syndrome
SDC	Swiss Agency for Development and Cooperation

SDG	Sustainable Development Goal
SEA	Strategic Environmental Assessment
SEZ	Special Economic Zone
SFB	Supporting Forests and Biodiversity
SIDA	Swedish International Development Cooperation Agency
SMART	Spatial Monitoring and Reporting Tool
SSC	Species Survival Commission
STAR	System for Transparent Allocation of Resources
TNC	The Nature Conservancy
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNF	United Nations Foundation
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development
USFWS	United States Fish and Wildlife Service
VFD	Vietnam Forests and Deltas
VPA	Voluntary Partnership Agreements
WARECOD	Center for Water Resources Conservation and Development
WCS	Wildlife Conservation Society
WDPA	World Database on Protected Areas
WMPA	Watershed and Management Protection Authority
WREA	Water Resources and Environment Agency (Lao PDR)
WRS	Wildlife Reserves Singapore
WWF	World Wide Fund for Nature; World Wildlife Fund
ZSL	Zoological Society of London

EXECUTIVE SUMMARY

The Critical Ecosystem Partnership Fund (CEPF) is designed to safeguard the world's biologically richest and most threatened regions, known as biodiversity hotspots. It is a joint initiative of l'Agence Française de Développement, Conservation International, the European Union, the Global Environment Facility, the Government of Japan, and the World Bank.

A fundamental purpose of CEPF is to engage civil society, such as community groups, nongovernmental organizations (NGOs), academic institutions and private enterprises, in biodiversity conservation in the biodiversity hotspots. To guarantee their success, these efforts must complement existing strategies and programs of national governments and other conservation funders. To this end, CEPF promotes working alliances among diverse groups, combining unique capacities and reducing duplication of efforts for a comprehensive, coordinated approach to conservation. One way in which CEPF does this is through preparation of 'ecosystem profiles': shared strategies, developed in consultation with local stakeholders, which articulate a five-year investment strategy informed by a detailed situational analysis.

This document represents the ecosystem profile for the Indo-Burma Hotspot, which comprises all non-marine parts of Cambodia, Lao PDR, Myanmar, Thailand and Vietnam, plus parts of southern China. With its high levels of plant and animal endemism, and limited remaining natural habitat, Indo-Burma ranks among the top 10 biodiversity hotspots for irreplaceability and the top five for threat. Indo-Burma holds more people than any other hotspot, and its remaining natural ecosystems, already greatly reduced in extent, are subject to intense and growing pressure from habitat loss, degradation and fragmentation, and over-exploitation of natural resources.

Updating the Ecosystem Profile

CEPF has been making grants to civil society groups in the Indo-Burma Hotspot since July 2008, guided by an ecosystem profile developed in 2003 and updated in 2011, in both cases through extensive processes of stakeholder consultation. A total of 315 grants have been awarded to date.

Much has changed in the nine years since the ecosystem profile was last updated. There have been some changes in knowledge about the status of biodiversity of global significance, including globally threatened species and Key Biodiversity Areas (KBAs). There have been changes to the nature and relative importance of threats to biodiversity and their root causes. In particular, there has been an acceleration of (already high) rates of deforestation, with the rate of tree cover loss during 2010-2019 almost doubling compared with the rate during 2000-2010. Habitat loss and over-exploitation have placed increasing pressures on plant and animal populations, with the number of species recognized as globally threatened on the IUCN Red List increasing by more than 70 percent between 2011 and 2020. At the same time, the impacts of climate change have started to be observed in the hotspot: average temperatures have gone up; rainfall patterns have changed; sea levels have begun to rise; and extreme weather events are being recorded more frequently. These three trends: accelerating habitat loss, over-exploitation and climate change have combined to create an ecological crisis with major implications for biodiversity, human health and economic development.

The last nine years have also seen changes in the enabling environment for civil society in the hotspot. The political space available to civil society remains restricted, and several international donors that had been an important source of support to civil society organizations have ended their programs in the region. Finally, there is a growing body of evidence on the effectiveness (or otherwise) of different conservation approaches that have been tested in the hotspot since the emergence of the modern conservation movement in the early 1990s. A number of approaches with positive impacts on biodiversity and human wellbeing have been demonstrated in specific local contexts, although these remain limited when compared with the sheer scale of threats to the hotspot's biodiversity.

In light of these changes, there was a need to update the ecosystem profile and the investment strategy it contains, in order to inform the next phase of CEPF investment in the hotspot. This was done through a participatory process, with a view to developing a broad platform on which funders interested in supporting conservation efforts led by civil society could build shared goals and strategies that address the highest priorities, take advantage of emerging opportunities, and align well with existing investments by governments and other donors.

The ecosystem profile was updated through a consultative process coordinated by the CEPF Secretariat between May 2019 and August 2020. More than 170 stakeholders were consulted during the updating process, whether through the final assessment workshop, email correspondence or providing comments on the draft profile. Additional stakeholders were involved indirectly, by contributing to the main source documents that were drawn on to update the ecosystem profile.

CEPF Niche

The ecosystem profile presents an overview of the Indo-Burma Hotspot in terms of its biodiversity conservation importance, and socioeconomic, policy and civil society contexts. It defines a suite of measurable conservation outcomes, at species, site and corridor scales, and assesses the major direct threats to biodiversity and their root causes and enabling factors. The situational analysis is completed by assessments of recent conservation investment, and the implications of climate change for biodiversity conservation. The ecosystem profile then goes on to articulate an overarching investment strategy for funders interested in supporting conservation efforts led by civil society. The strategy includes a niche for CEPF, where its investment can provide the greatest incremental value. In essence, the niche for CEPF is to demonstrate approaches to responding major conservation issues facing the hotspot (i.e., illegal wildlife trade, hydropower development, expansion of industrial agriculture and limestone quarrying) that leverage the capabilities of civil society and that are scalable, though replication by civil society or private sector actors or incorporation into government programs.

The CEPF niche builds on experience from the first two investment phases (2008-2013 and 2013-2020) by focusing on approaches that have demonstrated success, moving from pilot projects to longer-term interventions, and integrating results more concretely into public policy and private sector practice. Recognizing that CEPF investment cannot realistically respond to the full range of conservation issues at play in the hotspot, the CEPF niche focuses on actions where civil society organizations can add the greatest value, and addresses gaps in the overall landscape of donor funding for conservation.

The shared investment strategy is both ambitious and indicative of the scale of the conservation challenges still facing the Indo-Burma Hotspot. The amount of resources required to adequately support work under all parts of the strategy over the next five years very likely exceeds the amount of resources available to any individual funder for investing in civil society. To this end, the implementation of the shared strategy will be coordinated through regular meetings between CEPF and other funders, under the auspices of the Lower Mekong Funder Collaborative. As other funders make decisions about investment in the region and develop their grant portfolios, CEPF will adapt the development of its own portfolio to avoid duplication, address gaps and take advantage of opportunities for collaboration, synergy and amplification.

Biological Priorities for Investment

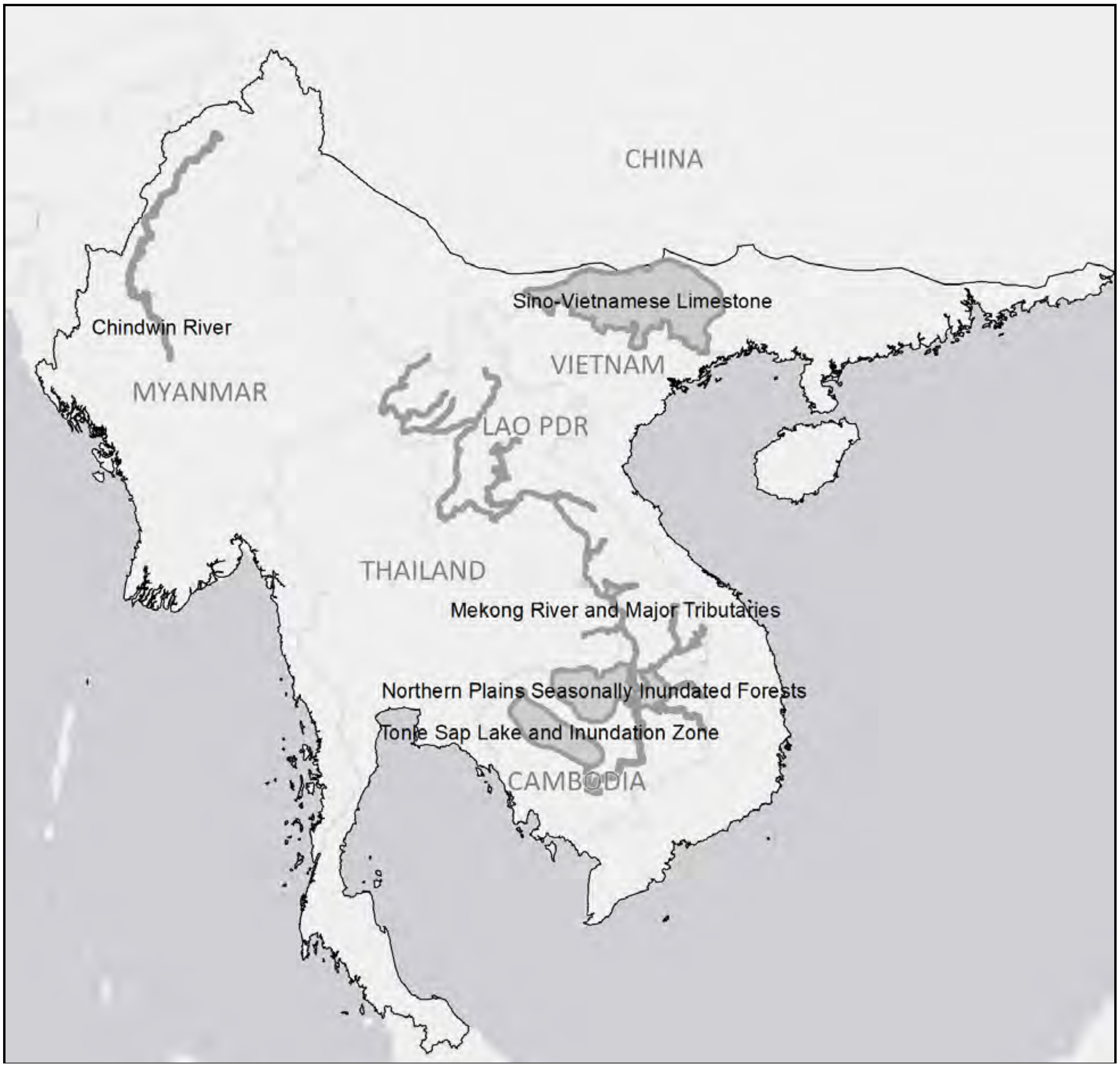
The biological basis for CEPF investment in the Indo-Burma Hotspot is provided by conservation outcomes: the quantifiable set of species, sites and corridors that must be conserved to curb loss of global biodiversity. The conservation outcomes for Indo-Burma were defined during the preparation of the original ecosystem profile and then updated in 2011. During the new update, the conservation outcomes were revised again, to reflect new information on the status of species, sites and corridors. In order to enable investment by CEPF and other funders to be directed effectively, the conservation outcomes were prioritized using standard criteria, including urgency of conservation action and opportunity to enhance existing conservation efforts.

The list of species outcomes increased from 754 in 2011 to 1,298 in 2020, reflecting increases in the number of globally threatened species officially recognized on the IUCN Red List. The greatest increases were among reptiles and fishes, for which close-to-comprehensive Red List assessments were completed in the interim period. The list of site outcomes increased from 509 to 555, reflecting the identification of new KBAs, including in freshwater ecosystems in the Mekong Basin and limestone karst ecosystems in Myanmar. The 555 site outcomes cover a combined area of approximately 390,000 square kilometers or 16 percent of the total area of the hotspot (2.3 million square kilometers). The list of corridor outcomes remained relatively stable, with 65 in 2020, compared with 66 in 2011.

Five corridor outcomes were prioritized for conservation investment. They contain a total of 66 site outcomes, which were all automatically selected as priority sites. In addition to the six corridors, a network of 24 limestone karst KBAs in Myanmar was identified as a geographic priority for investment. The five corridors and the network of limestone karst KBAs cover a combined area of 120,623 hectares, equivalent to 5 percent of the total area of the hotspot. This is a major reduction in area from the geographic priorities in the 2011 ecosystem profile, which covered 786,551 hectares, or 34 percent of the hotspot. This is due to a tighter focusing of geographic priorities in Myanmar, from the whole country to one corridor and one network of sites. The Hainan Mountains corridor was dropped as a priority and replaced with the similarly sized Northern Plains Seasonally Inundated Forests corridor.

In terms of taxonomic priorities for investment, 136 globally threatened vertebrate species were selected as priority species. These comprise 39 reptiles, 34 mammals, 31 fishes and 27 birds but only five amphibians, reflecting the fact that amphibians require species-focused conservation action only in exceptional cases. The priority species include 28 turtles, 15 primates and 10 ungulates, reflecting the high threat posed to all these groups by overexploitation, mostly driven by demand from the illegal wildlife trade.

Priority Corridors for CEPF Investment in the Indo-Burma Hotspot



Note: not shown on this map is Myanmar Limestone Karst, a network of small sites dispersed throughout the country; these sites are too small to appear on a map this scale.

The list of priority species is a reduction from the 152 priority species identified in the 2011 update to the ecosystem profile. This is due to experience from the previous investment phase that prioritizing individual species is not an effective strategy for engaging civil society in the conservation of globally threatened plant species in the Indo-Burma Hotspot. For the new phase, CEPF will concentrate on site-based conservation, adopting an ecosystem approach, which is likely to be a more effective strategy for plant conservation.

Thematic Priorities for Investment

The thematic priorities for conservation investment in the hotspot were defined through the stakeholder consultation process, based upon an analysis of the main threats to biodiversity in the hotspot and their root causes. The overall ranking of threats did not change greatly from that generated by the stakeholder consultations during the 2011 update of the ecosystem profile. In both exercises, the top-ranked threats were poaching, trade and consumption of wildlife and industrial agriculture. Large infrastructure was ranked third in both exercises. In 2011, the threat was defined narrowly as hydropower dams; this definition was broadened to large infrastructure (dams, roads, ports, etc.) in 2019, reflecting the impacts of large hydropower projects are not limited to the dams themselves but include access roads, river engineering for navigation, transmission lines, and other ancillary infrastructure. In both exercises, the next five highest ranked threats included logging, intensification and expansion of smallholder agriculture, and climate change. These can be considered the next suite of threats in terms of overall severity.

To respond to these and other threats, and to begin to address some of their root causes, the five-year investment strategy was updated. The 11 strategic directions were retained with some modifications. For example, Strategic Direction 2 on illegal wildlife trade was modified to reflect the particular contributions that investments in this area can make to mitigating the risk of zoonotic disease emergence. The list of 38 investment priorities included in the 2011 ecosystem profile was increased to 45, drawing on experience from stakeholders about which conservation approaches are most effective and incorporating lessons learned from the previous phase.

Of the 11 strategic directions in the overall strategy, six were included within the CEPF investment niche. These six strategic directions contain 23 of the 45 investment priorities in the overall strategy, focusing on ones that play to the unique strengths of the fund and contribute directly to its global objectives, while complementing the investment strategies of other funders.

Strategic Directions and Investment Priorities in the Indo-Burma Hotspot

Strategic Directions	Investment Priorities
COMPONENT I: CONSERVATION OF PRIORITY SPECIES	
1. Safeguard priority globally threatened species by mitigating major threats [CEPF niche]	1.1 Sustain long-term conservation programs for core populations of priority species
	1.2 Reestablish viable wild populations of priority species in line with global guidelines
	1.3 Conduct research on globally threatened species for which there is a need for greatly improved information on status and distribution
	1.4 Research and pilot innovative funding sources for species conservation
	1.5 Support species champions at the community level to implement locally identified actions for priority species

2. Mitigate zoonotic disease risks by reducing illegal trade and consumption of and threats to wildlife [CEPF niche]	2.1 Support enforcement agencies to unravel high-level wildlife trade networks by promoting the application of global best practice with investigations, intelligence and informants
	2.2 Facilitate collaboration among enforcement agencies involved in combatting illegal wildlife trade, as well as with other sectors as part of a One Health approach
	2.3 Work with private and state-owned companies, with a particular focus on logistics and online platforms, to reduce their involvement in wildlife trafficking
	2.4 Support targeted campaigns to reduce demand and mobilize public participation in detecting and reporting wildlife crime
	2.5 Understand and support action to address linkages between biodiversity and human health, including the role of biodiversity loss in the emergence of zoonotic diseases
COMPONENT II: PROTECTION AND STEWARDSHIP OF PRIORITY SITES	
3. Strengthen management effectiveness at protected areas as a tool to conserve priority sites	3.1 Support the use of global standards and tools for protected area management by all stakeholders and embed in national policy
	3.2 Develop accredited training programs for protected area practitioners within domestic academic institutions and other qualified bodies
	3.3 Pilot the direct involvement of civil society organizations in protected area management and document best practice
	3.4 Support the use of the results of global standards and tools for adaptive protected area management and budgeting
4. Empower local communities to engage in conservation and management of priority sites [CEPF niche]	4.1 Support communities to analyze conservation issues and inform them about rights and opportunities related to natural resource management and conservation
	4.2 Pilot, amplify and develop sustainability mechanisms for community forests, community fisheries and community-managed protected areas through authentic, community-led processes
	4.3 Develop co-management mechanisms for protected areas that enable community participation in zoning, management and governance
	4.4 Revise KBA identification in the hotspot using the new KBA standard
	4.5 Undertake third-party evaluation of project impacts in the priority sites
5. Strengthen biodiversity conservation by promoting sustainable livelihoods and incentives for local communities at priority sites	5.1 Promote sustainable livelihood projects that demonstrably link livelihood and socio-economic improvements to conservation outcomes at priority sites, and document and share practices and lessons
	5.2 Develop and strengthen best-practice ecotourism initiatives at priority sites

COMPONENT III: ENHANCEMENT OF ECOLOGICAL CONNECTIVITY AND RESILIENCE	
6. Demonstrate scalable approaches for integrating biodiversity and ecosystem services into development planning in the priority corridors [CEPF niche]	6.1 Analyze development policies, plans and programs; evaluate their impact on biodiversity and ecosystem services, and propose and actively support the application of alternative development scenarios, nature-based solutions and mitigation measures
	6.2 Develop demonstration projects for ecosystem restoration, with protocols suitable for replication
	6.3 Engage the media in order to increase awareness, inform public debate and influence decision making on mainstreaming biodiversity into development planning
	6.4 Pilot and scale-up models for biodiversity-friendly production, including certification and eco-labelling
7. Minimize the social and environmental impacts of agro-industrial plantations and hydropower dams in the priority corridors	7.1 Support land registration for local and indigenous communities at priority sites
	7.2 Upgrade the legal status of unprotected priority sites threatened by incompatible land uses
	7.3 Strengthen the voices of communities who are potentially or actually affected by agro-industrial plantations and hydropower dams
	7.4 Work with the private sector to ensure that agro-industrial plantations and hydropower dams are developed and operated in an environmentally and socially responsible manner
	7.5 Identify water, food and energy nexus models and develop policy options
	7.6 Support research and monitoring of the impacts of agro-industrial plantations and hydropower dams
COMPONENT IV: DEVELOPMENT OF A CONSERVATION CONSTITUENCY	
8. Strengthen the capacity of civil society to work on biodiversity, communities and livelihoods at regional, national, local and grassroots levels [CEPF niche]	8.1 Support networking mechanisms that enable collective civil society responses to priority and emerging threats
	8.2 Provide core support for the sustainable organizational and technical capacity development of domestic civil society organizations
	8.3 Establish mechanisms to match volunteers to civil society organizations' training needs

9. Conduct targeted education, training and awareness raising to build capacity and support for biodiversity conservation among all sections of society	9.1 Invest in the professional development of future conservation leaders through support to vocational, certificate, diploma and graduate programs at domestic academic institutions, and promote regional replication to each country
	9.2 Investigate the feasibility of establishing an Indo-Burma Conservation Field Studies Center
	9.3 Foster leadership for sustainable development by investing in professional development of key individuals
	9.4 Implement programs of experiential education to connect school children to nature in priority corridors and beyond
	9.5 Conduct targeted, effective outreach and awareness raising for behavioral change among rural and urban populations in regard to the values of natural ecosystems, with a focus on livelihoods, consumption patterns and lifestyle
	9.6 Conduct targeted training and awareness raising activities for decision makers in government and the private sector on biodiversity conservation, including impacts of development policies and projects on ecosystems
COMPONENT V: COORDINATION AND MONITORING OF CONSERVATION INVESTMENT	
10.Evaluate the impacts of conservation investment on biodiversity and human wellbeing through systematic monitoring	10.1 Develop common standards and systems for monitoring the impacts and effectiveness of conservation actions
	10.2 Develop common standards and systems for monitoring the negative impacts of development policies, plans and actions across multiple scales
	10.3 Support systematic efforts to build capacity for monitoring and data analysis among domestic organizations
	10.4 Develop and test mechanisms for ensuring that monitoring results inform national policy debates and local adaptive management
11.Provide strategic leadership and effective coordination of conservation investment through a regional implementation team [CEPF niche]	11.1 Build a broad constituency of civil society groups working across institutional and political boundaries towards achieving the shared conservation goals described in the ecosystem profile

Conclusion

In terms of species diversity and endemism, Indo-Burma is one of the most biologically important regions on the planet. Over the last five years, conservation investment from international sources averaged at least $160 million per year. In spite of the considerable sums invested, the overall level of support for conservation in the hotspot from governments, private sector and international donors has been insufficient to address the massive and accelerating threats to biodiversity, most significantly industrial agriculture, poaching, trade and consumption of wildlife, large infrastructure and logging. The root causes and enabling factors of biodiversity loss include population growth, urbanization and migration patterns, economic growth and increasing consumption, regional economic integration, weak regulatory and governance frameworks, and development models that prioritize large-scale projects with insufficient transparency or public participation. If these threats continue unabated, the natural ecosystems of the hotspot will continue to be degraded and lost, their capacity to deliver ecosystem services will erode, the resilience of the region to the effects of climate change will diminish, the rate of species extinctions will accelerate, and the risk of emergence of zoonotic diseases will increase. Civil society is well placed to address both immediate threats to biodiversity and their underlying causes. However, current investment does not always target the highest conservation priorities or promote the most effective approaches, and the potential to engage civil society in biodiversity conservation has yet to be fully realized. In this context, the opportunities for CEPF and other funders to support biodiversity conservation in the hotspot are almost limitless.

Over the period from 2020 to 2025, CEPF funding will concentrate on six strategic directions, containing 23 investment priorities. The geographic focus will be five priority corridors (the Chindwin River, the Mekong River and Major Tributaries, the Northern Plains Seasonally Inundated Forests, the Sino-Vietnamese Limestone, and the Tonle Sap Lake and Inundation Zone) plus a network of limestone karst sites in Myanmar. Moreover, CEPF investment will focus on 136 priority species that require species-focused action in addition to site-based and landscape-scale conservation. The overall objective of the investment will be to demonstrate effective, scalable approaches to major conservation issues that leverage the skills, experience and energy of civil society actors. Although ambitious, the CEPF investment strategy is realistic, and represents an important opportunity to realize the potential of civil society in the hotspot, and to make a lasting contribution to the conservation of Indo-Burma’s unique and irreplaceable biodiversity values.

1. INTRODUCTION

The Critical Ecosystem Partnership Fund (CEPF) is designed to safeguard the world's biologically richest and most threatened regions known as biodiversity hotspots. It is a joint initiative of l'Agence Française de Développement (AFD), Conservation International (CI), the European Union (EU), the Global Environment Facility (GEF), the Government of Japan, and the World Bank.

A fundamental purpose of CEPF is to engage civil society, such as community groups, nongovernmental organizations (NGOs), academic institutions and private enterprises, in biodiversity conservation in the hotspots. To guarantee their success, these efforts must complement existing strategies and programs of national governments and multilateral and bilateral donors. CEPF promotes working alliances among diverse groups, combining unique capacities and reducing duplication of efforts for a comprehensive, coordinated approach to conservation. CEPF focuses on biological areas rather than political boundaries and examines threats to biodiversity and their root causes on a hotspot-level basis. CEPF targets transboundary cooperation, in areas of high importance for biodiversity conservation that straddle national borders, or in areas where a regional approach will be more effective than a national approach. CEPF aims to provide civil society with an agile and flexible funding mechanism complementing funding available to government institutions.

The Indo-Burma Hotspot is ranked in the top 10 hotspots for irreplaceability and in the top five for threat, with only 5 percent of its natural habitat remaining and with more people than any other hotspot (Mittermeier *et al.* 2004, CI 2011).

The Indo-Burma Hotspot comprises all non-marine parts of Cambodia, Lao PDR, Myanmar, Thailand and Vietnam, plus those parts of southern China in Biounits 6 and 10 (i.e., Hainan Island, southern parts of Yunnan, Guangxi and Guangdong provinces, and Hong Kong and Macau Special Administrative Regions (SARs)) (Figure 1). As defined here, Indo-Burma covers a total land area of 2,308,815 square kilometers, making it larger than any other hotspot (Mittermeier *et al.* 2004). As originally defined by Mittermeier *et al.* (2004), the Indo-Burma Hotspot includes parts of northeastern India, Bangladesh and Malaysia. Northeastern India is included in a separate CEPF funding region (the Himalayas), while the hotspot only extends marginally into Bangladesh and Malaysia. For the purposes of the ecosystem profile, therefore, Bangladesh, India and Malaysia are considered extralimital to the hotspot.

CEPF began making grants to civil society groups in the Indo-Burma Hotspot in July 2008, since when there have been two phases of investment: phase I from 2008 to 2013; and phase II from 2013 to 2020. In each phase, CEPF grant making followed an investment strategy developed through an extensive stakeholder consultation process conducted in 2003, the results of which were documented in the original ecosystem profile, published in May 2007 (CEPF 2007); the strategy was then updated through further consultations, in 2011, which led to an updated ecosystem profile, published in October 2012 (CEPF 2012). The consultations that resulted in the original ecosystem profile involved more than 170 stakeholders, while those that led to the 2011 update involved more than 470, ensuring that the ecosystem profile is truly a collaborative product of many sections of civil society, government and the donor community.

Figure 1. Boundaries of the Indo-Burma Hotspot Followed by the Ecosystem Profile

Much has changed in the nine years since the ecosystem profile was last updated. There have been many changes to the global threat status of species on the IUCN Red List of Threatened Species (IUCN 2020b), due to both changes in knowledge about species and changes (usually deterioration) in their underlying status. There have been some changes in knowledge about the distribution of biodiversity elements of global significance, reflected in the documentation of new Key Biodiversity Areas (KBAs): sites that contribute significantly to the global persistence of biodiversity (IUCN 2016). There have been changes to the nature and relative importance of threats to biodiversity and their root causes, although there is considerable consistency between the main conservation issues identified in 2011 and those in 2019, indicating that, in spite of some local successes, the conservation movement is still some way from addressing these problems at the hotspot scale. The last nine years have also seen changes to the enabling environment for civil society organizations (CSOs) in the hotspot, including to the availability of funding for them, the regulations that govern them and the political space in which they operate. With regard to the former, several international donors that had been an important source of support to civil society have ended their programs in the region. These departures may be compensated for to some degree by the emergence of Asian philanthropic support for conservation, which is creating new opportunities. Finally, there is a growing body of evidence on the effectiveness (or otherwise) of different conservation approaches that have been tested in the hotspot since the emergence of the modern conservation movement in the early 1990s. A number of approaches with positive impacts on biodiversity and human wellbeing have been demonstrated in specific local contexts. These models can inform the next phase of investment by CEPF and other funders, where the onus will be on taking effective approaches to scale and adapting them to different contexts.

In light of these changes, there was a need to update the ecosystem profile and the investment strategy it contains, in order to inform the third phase of CEPF investment in the hotspot. This was done through a participatory process, with a view to developing a broad platform on which funders interested in supporting conservation efforts led by civil society groups could build shared goals and strategies that address the highest priorities, take advantage of emerging opportunities, and align well with existing investments by governments and other donors.

2. BACKGROUND

The ecosystem profile presents an overview of the Indo-Burma Hotspot in terms of its biodiversity conservation importance, major threats to and root causes of biodiversity loss, and the socioeconomic, policy and civil society context in which conservation takes place. The profile also presents assessments of the implications of climate change for biodiversity conservation in the hotspot, and of patterns of conservation investment over the last five years. It defines a comprehensive suite of measurable conservation outcomes at species, site and corridor scales, and identifies priorities for conservation investment within these.

The ecosystem profile concludes with a five-year investment strategy for donors interested in supporting civil-society-led conservation efforts in the hotspot. This strategy comprises a series of strategic funding opportunities, termed strategic directions, broken down into a number of investment priorities outlining the types of activities that will be eligible for funding. CSOs or individuals may propose projects that will help implement the strategy by addressing at least one of the investment priorities. The ecosystem profile does not include specific project concepts, as CSOs will develop these as part of their funding applications. Applicants are required to prepare detailed proposals identifying and describing the interventions and performance indicators that will be used to evaluate the success of their projects.

2.1 Previous Ecosystem Profiles

The original ecosystem profile was developed in 2003 through a process of consultation and desk study coordinated by BirdLife International in collaboration with the Bird Conservation Society of Thailand (BCST), Kadoorie Farm & Botanic Garden (KFBG), and the World Wide Fund for Nature (WWF) Cambodia Program, with the technical support of the Center for Applied Biodiversity Science at CI (CEPF 2007). In parallel to this process, a stand-alone investment strategy was developed for Myanmar during 2003 and 2004 (BirdLife International 2005).

The 2011 update to the ecosystem profile was developed through a consultation process coordinated by the CEPF Secretariat, in collaboration with BirdLife International *in Indochina*, the CI-China Program, KFBG, the Samdhana Institute and the Yunnan Green Environment Development Foundation (CEPF 2012). It incorporated and updated information from the two earlier documents.

2.2 First Investment Phase

The original ecosystem profile was approved by the CEPF Donor Council in April 2007, with a total budget allocation of $9.5 million. The Donor Council subsequently approved the appointment of BirdLife International as the Regional Implementation Team (RIT) for the hotspot in November 2007, and grant making began in July 2008, following the investment strategy set out in the profile.

Given the significant (albeit insufficient) investments already being made in biodiversity conservation by international donors and national governments, the CEPF investment strategy supported civil society initiatives that complemented and better targeted existing investments. In particular, resources were targeted at conservation efforts for freshwater biodiversity and trade-threatened species: two long-standing investment gaps. Investment also targeted efforts to mainstream biodiversity conservation goals into development policy and planning. The investment strategy had four strategic directions:

1. Safeguard priority globally threatened species by mitigating major threats.
2. Develop innovative, locally led approaches to site-based conservation at 28 key biodiversity areas.
3. Engage key actors in reconciling biodiversity conservation and development objectives.
4. Provide strategic leadership and effective coordination of CEPF investment through an RIT.

To maximize impact and enable synergies among individual projects, the first phase of CEPF investment focused on 67 priority species and 28 priority sites in two conservation corridors: the Mekong River and Major Tributaries; and the Northern Highlands Limestone (now renamed the Sino-Vietnamese Limestone). CEPF investment was restricted to four countries: Cambodia; Lao PDR; Thailand; and Vietnam.

During the five-and-a-half-year investment phase, between 2008 and 2013, CEPF and BirdLife International awarded 126 grants, totaling $9.7 million and engaging 66 CSOs (36 local and 30 international) in their implementation. The impacts of these grants were assessed at a final assessment workshop, held in Phnom Penh, Cambodia, in March 2013. The main impacts were summarized in the final assessment report (CEPF and BirdLife International 2014) as follows:

- Coherent and balanced grants portfolio developed, comprising 126 grants with a total value of $9.7 million.
- Nine civil society networks to coordinate conservation efforts established or strengthened.
- Global threat assessments completed for 3,122 species, as a basis for more effective and better targeted conservation planning and action, resulting in an almost 50 percent increase in the number of species in the hotspot officially assessed as globally threatened.
- Core populations of 32 globally threatened species made more secure from ongoing threats of overexploitation and illegal trade.
- New information generated on six species identified as being in great need of improved knowledge about their status and distribution.
- Demonstrated improvements to the protection and management of 15 CEPF priority sites.
- Innovative, local stakeholder-based conservation initiatives with potential for wider replication in the hotspot demonstrated in all four countries, including nest protection schemes, conservation incentives and community fisheries co-management.
- Tangible socioeconomic benefits conferred to 186 communities at project sites.
- Strengthened protection and management of 79 percent of targeted protected areas, as evidenced by increased SP1 Management Effectiveness Tracking Tool (METT) scores.
- Formal protection extended to more than 150,000 hectares through the creation and expansion of protected areas.

- Biodiversity conservation strengthened in nearly 1,6 million hectares within protected areas and more than 360,000 hectares in production landscapes outside protected areas.
- Seven development plans and policies analyzed for their impacts on biodiversity and ecosystem services, and alternative development scenarios proposed, particularly ones related to hydropower development in the Mekong Basin.
- Targeted outreach, training or awareness raising provided for more than 900 decision makers, journalists and lawyers.
- Sixty-six CSOs engaged directly as CEPF grantees or indirectly as sub-grantees; including 36 local organizations (55 percent).
- Strengthened capacity of 92 percent of local CSOs receiving CEPF grants, as evidenced by increased Civil Society Organizational Capacity Tracking Tool scores.
- Increased credibility of local CSOs in the eyes of government, donor and private sector partners, as evidenced by increased ability to influence development decision making.

Taken together, the achievements of CEPF phase I in Indo-Burma contributed to 12 of the 20 Aichi Biodiversity Targets of the Convention on Biological Diversity's (CBD's) Strategic Plan for Biodiversity 2011-2020.

2.3 Second Investment Phase

The updated ecosystem profile was approved by the CEPF Donor Council in October 2012, with a total spending authority of $10.4 million. The Donor Council subsequently approved the appointment of the International Union for Conservation of Nature (IUCN) as the RIT for the second investment phase. IUCN began work as the RIT in July 2013, thus beginning phase II of CEPF investment in the hotspot. The spending authority for Indo-Burma was subsequently raised to almost $15.8 million, thanks to additional commitments by CEPF's global and regional donors. These additional commitments allowed the investment phase to be extended to seven years, from July 2013 to June 2020.

In recognition of the fact that the investments during the first phase had delivered important results but that more time was needed, in many cases, to ensure lasting impacts (given the scale of the conservation issues addressed), the investment strategy for phase II built upon the strategy for phase I. The adoption of the ecosystem profile as a guide to investment by other funders, including the John D. and Catherine T. MacArthur Foundation, Margaret A. Cargill Philanthropies and the McKnight Foundation, allowed the investment strategy to be broadened beyond the original set of thematic, geographic and taxonomic priorities.

The number of strategic directions in the investment strategy was increased to 11, of which the following six were prioritized for CEPF investment:

1. Safeguard priority globally threatened species by mitigating major threats.
2. Demonstrate innovative responses to illegal trafficking and consumption of wildlife.
4. Empower local communities to engage in conservation and management of priority Key Biodiversity Areas.
6. Engage key actors in mainstreaming biodiversity, communities and livelihoods into development planning in the priority corridors.

8. Strengthen the capacity of civil society to work on biodiversity, communities and livelihoods at regional, national, local and grassroots levels.
11. Provide strategic leadership and effective coordination of conservation investment through a regional implementation team.

These strategies were focused on the sites and corridors where the top ranked threats (hunting and trade of wildlife, agro-industrial plantations, hydropower dams, and agricultural encroachment by smallholders) are most acutely felt: the Mekong River and its major tributaries; Tonle Sap Lake and its inundation zone; the limestone highlands along the Vietnam-China border; and the mountains of Hainan Island. The geographic priorities also included Myanmar, to take advantage of opportunities to strengthen capacity among CSOs in the country and enable them to address priority conservation actions in a rapidly changing political and development context. The list of priority species increased from 67 to 152, reflecting the gravity of the species extinction crisis in Southeast Asia (Duckworth *et al.* 2012).

Over the seven years of the investment phase, 84 large grants were awarded, including two to IUCN to serve as the RIT. These grants comprised 43 to international organizations and 41 to local organizations, with a total value of $13.7 million. Over the same period, 105 small grants were awarded, comprising 17 to international organizations and 88 to local organizations, with a total value of $1.8 million. The impacts of these grants were assessed at a final assessment workshop, held in Siem Reap, Cambodia, in May 2019. Highlights included the following:

- Long-term conservation programs put in place for core populations of 33 priority species.
- Initiatives to reduce wildlife trafficking across the Cambodia-Vietnam, Lao PDR-Vietnam, Vietnam-China and Myanmar-China borders piloted, resulting in intelligence-led seizures of major shipments of ivory, pangolin scales and other illegally traded products, and public commitments by private companies of zero tolerance towards illegal wildlife trade.
- Strengthened protection and management of 54 KBAs.
- Community-based conservation models piloted at 17 KBAs, including community forests, community fisheries and community-managed protected areas.
- Tangible wellbeing benefits gained by 123 local communities, including improved land tenure, food security and access to ecosystem services.
- Impacts on biodiversity and ecosystem services of 13 development policies, plans and programs analyzed and mitigating measures proposed.
- Public debate and awareness of 10 key environmental issues increased through coverage in domestic media.
- Five pilot models for biodiversity-friendly production established, including rice farming, medicinal plant collection and cement manufacture.
- Establishment or strengthening of 49 civil society networks, enabling collective responses to priority and emerging threats.
- Strengthened capacity of 134 CSOs working on conservation issues.

2.4 Updating Process

The ecosystem profile was updated through a consultative process coordinated by the CEPF Secretariat between May 2019 and August 2020. More than 170 stakeholders were consulted during the updating process, whether through the final assessment workshop, email correspondence or providing comments on the draft profile. Additional stakeholders were involved indirectly, by contributing to the main source documents that were drawn on to update the ecosystem profile: the situational analysis and the long-term vision (see below).

2.4.1 Source Documents

The 2019-2020 update to the ecosystem profile drew heavily on the 2011 update (CEPF 2012). In this regard, this document should not be considered a new analysis but, rather, an update of an earlier analysis, which was itself a living document. For instance, the investment strategy was updated at the mid-term assessment workshop in March 2015, resulting in changes to the lists of investment priorities, and priority species and sites. For the 2019-2020 update, each chapter of the 2011 ecosystem profile was reviewed, and information and analysis that was still current was retained, while information and analysis that was out of date was replaced. This exercise drew on peer-reviewed and grey literature published since 2011, as well as key conservation data sources, such as the IUCN Red List of Threatened Species (IUCN 2020b), the World Database on Protected Areas (WDPA) (IUCN and UNEP-WCMC 2020) and the World Database of KBAs (http://www.keybiodiversityareas.org).

Another key source document was a shared situational analysis prepared on behalf of the Lower Mekong Network by The Biodiversity Consultancy Ltd and its sub-consultants (Lower Mekong Network 2018). This analysis incorporated inputs from more than 30 organizations participating in the Lower Mekong Network, plus around 40 other stakeholders from civil society, government and the private sector. The purpose of the analysis was to assess the region’s social, economic and political context through the shared perspectives of the Lower Mekong Network: an emerging group of CSOs, donors and their intermediaries, with a common interest in biodiversity conservation, natural resource rights and sustainable livelihoods. Relevant sections of the shared situational analysis were incorporated into the ecosystem profile, to reflect current perspectives from actors likely to among the main users of the document.

The third key source document was the long-term vision for the Indo-Burma Hotspot, prepared by IUCN on behalf of CEPF (Mather *et al.* 2017). The long-term vision was prepared through review and synthesis of secondary information, as well as consultations with more than 100 key stakeholders. The purpose of the long-term vision is to inform decision making about the duration and types of investments that CEPF needs to make over the next 15 years, in order to reach a point at which it can withdraw from the hotspot with confidence that effective biodiversity conservation programs will continue in a self-sustaining manner.

To this end the long-term vision defines specific criteria and targets related to the following five conditions:

1. Global conservation priorities and best practices for their management are documented, disseminated and used by public and private sector, civil society and donor agencies to guide their support for conservation in the region.
2. Local civil society groups (i.e. national, sub-national and grassroots organizations) dedicated to global conservation priorities collectively possess sufficient organizational and technical capacity to be effective advocates for, and agents of, conservation and sustainable development, while being equal partners of private sector and government agencies influencing decision making in favor of sustainable societies and economies.
3. Adequate and continual financial resources are available to address conservation of global priorities.
4. Public policies, the capacity to implement them, and private sector business practices are supportive of the conservation of global biodiversity.
5. Mechanisms exist to identify and respond to emerging conservation challenges.

The ecosystem profile was aligned with these criteria and targets but, because it covers a shorter time period than the long-term vision (five years versus 15), it does not address them all. The long-term vision also makes a series of recommendations, related to priorities and modalities for CEPF grantmaking. These are incorporated into the ecosystem profile, in the CEPF niche (Chapter 12) and investment strategy (Chapter 13).

2.4.2 Thematic Studies

Thematic studies were undertaken to update the contextual chapters on climate change (Chapter 10) and conservation investment (Chapter 11). Each thematic study was led by a consultant, and involved some combination of desk study, one-to-one interviews and email correspondence. Due to the COVID-19 pandemic in 2020, no in-person interviews or small-group meetings were possible. The output of each thematic study was a report, which was modified and integrated into the draft ecosystem profile.

2.4.3 Final Assessment Workshop

A final assessment workshop was held in Siem Reap, Cambodia, in May 2019, attended by more than 130 representatives of CSOs, donors and government agencies (Figure 2). These included recent grantees of CEPF, the Chino Cienega Foundation, the MacArthur Foundation, Margaret A. Cargill Philanthropies, the McConnell Foundation and the McKnight Foundation. The objectives of the workshop were to: assess progress towards the investment strategy for the Indo-Burma Hotspot; enable exchange of good practice and lessons learned among participants; and create a space in which collaborations could emerge. Participants were asked to reexamine the investment strategy for the Indo-Burma Hotspot (Chapter 12) and propose revisions that respond to new needs and opportunities. Participants were also asked to revisit the ranking of threats to biodiversity in each of the hotspot countries and at the regional level, and to explore their root causes.

Figure 2. Participants at the Final Assessment Workshop, Siem Reap, Cambodia, May 2019

2.4.4 Drafting and Review of Ecosystem Profile

The source documents, the outputs of the thematic studies and the results of the final assessment workshop were integrated into a draft ecosystem profile, which was circulated for online review in July 2020. Comments received were integrated into a final draft, which was then reviewed internally by the CEPF Secretariat, prior to submission to the CEPF Working Group for additional review in August 2020.

3. LESSONS LEARNED FROM PREVIOUS CEPF INVESTMENT

As discussed in the previous chapters, there have been two previous phases of CEPF investment in the Indo-Burma Hotspot: phase I from 2008 to 2013; and phase II from 2013 to 2020. The proposed third phase, which will be guided by the investment strategy set out in the updated ecosystem profile, will follow on more-or-less directly from the second phase. It is important, therefore, that lessons are learned from the previous phases, so that effective approaches are reinforced, and pitfalls are avoided during the third phase.

There are three principle sources of information on lessons learned. First, a series of participatory assessments were conducted throughout phases I and II, bringing together CEPF grantees and other stakeholders to reflect collectively on experience, document good practice and capture lessons learned. During the first phase, the mid-term assessment was held in July 2010 (CEPF and BirdLife International in Indochina 2010) and the final assessment in March 2013 (CEPF and BirdLife International 2014). During the second phase, the mid-term assessment was held in March 2015 (CEPF 2015) and the final assessment in May 2019 (CEPF and IUCN in prep.). Second, the long-term vision for the Indo-Burma Hotspot was prepared during the second phase (Mather *et al.* 2017; see Section 2.4.1). This document incorporated feedback from more than 100 stakeholders across the six hotspot countries, who were consulted between July and November 2015, and formulated a series of recommendations informed by lessons learned from the first two CEPF investment phases, as well as initiatives supported by other donors. Third, an independent evaluation of lessons learned by the RIT was conducted between August 2019 and April 2020, through a combination of desk research and key informant interviews (Integrated Sustainability Solutions 2020). The purpose of the evaluation, which covered the Eastern Afromontane and Wallacea Hotspots in addition to Indo-Burma, was to assess RIT performance, inform future ecosystem profiles, and inform the selection of future RITs. The following sections consider the lessons documented in these three sources in turn.

3.1 Lessons Learned from Participatory Assessments

3.1.1 Lessons Learned from Phase I (2008-2013)

The first phase of CEPF investment in the Indo-Burma Hotspot established a solid platform, in terms of results, capacity and experience, on which to build further success. Lessons learned from the first phase were documented during the mid-term and final assessments and incorporated into the 2011 update of the ecosystem profile, with the aim of amplifying successful models, sustaining improvements in the enabling conditions for conservation, and enhancing the operations of CEPF grant making. The key lessons learned from the first phase relevant to future investment in the hotspot by CEPF and other funders were as follows:

- The conservation needs of many of the most highly threatened species are not adequately addressed by current approaches to ecosystem conservation, and they require targeted conservation interventions. The demand for funding for such species-focused conservation greatly outstrips supply, and CEPF funding has been critical in bridging this gap for many species (although a considerable shortfall remains).

- Conservation of viable populations of the most highly threatened, traded, species requires a combination of on-the-ground interventions for core populations, to reduce levels of offtake or displace them elsewhere, and actions to reduce the illegal trade that is driving unsustainable exploitation. Effective approaches to on-the-ground conservation have been piloted in various contexts, and now need to be amplified and turned into long-term programs. With regard to combatting the wildlife trade, however, there has been little proven success, and there is a need for further innovation and testing to identify approaches that work.
- Local communities can be active partners in conservation, both within and outside protected areas, but for their contributions to be effective and sustained they need to receive tangible, immediate benefits directly linked to their actions.
- Unless development planning and policy incorporates biodiversity conservation goals, site conservation efforts risk being rapidly undermined by incompatible developments, such as agro-industrial plantations or infrastructure projects. Civil society can play an important role in assessing the potential impacts of these developments on biodiversity and ecosystem services and proposing alternative development scenarios and appropriate mitigating measures.
- When responding to development-related threats, the agendas of conservation groups overlap with those of rural development and human-rights-based groups, as well as affected communities. Considerable potential exists to engage broad-based alliances of civil society in conservation of critical ecosystems, although this has yet to be fully realized.
- The political space available to civil society in most countries of the hotspot increased over the decade up to 2013, and domestic organizations had unprecedented influence on public debates of environmental issues. However, civil society continues to face a number of significant challenges, not least with regard to human and financial resources. As the need and potential to engage domestic organizations as grantees increase, CEPF needs to refine its strategies for doing this.
- Grants provide a context in which civil society capacity building can take place. However, facilitating the emergence of local conservation movements that can sustain the results of CEPF investment and respond to new conservation issues as they arise also requires direct investment in capacity building, at the individual, organizational and network levels.
- The scale of the conservation challenges facing the Indo-Burma Hotspot is far too great for any one organization to address alone. There is a need for coordinated action by government and civil society, towards common goals, and supported by well aligned donor funding. The CEPF ecosystem profile is a proven tool for facilitating such coordination, although it requires updating to reflect significant changes to the conservation context over the last decade.

3.1.2 Lessons Learned from Phase II (2013-2020)

The second phase of CEPF investment in the Indo-Burma Hotspot built on the platform established during Phase I, by reinforcing promising conservation interventions and replicating effective approaches in new contexts. At the same time, the scope of CEPF investment was greatly broadened during the second phase, in terms of geography (new countries and priority corridors), thematic focus (new strategic directions and investment priorities) and reach (a major increase in the number of grantee partners, especially among domestic CSOs). Also, CEPF collaborated more closely with other funders to provide coordinated support to grantees and intermediaries. Lessons learned from the first phase were documented during the mid-term and final assessments and incorporated this update of the ecosystem profile. The key lessons from the second phase are summarized below; any that substantively repeat lessons from the first phase (Section 3.1.1) are not repeated here:

- There should be stronger links among CEPF grantees at both national and regional levels. CSOs have developed, tested and refined many conservation approaches of demonstrated effectiveness but they tend not to be familiar with the work of other organizations grappling with similar challenges. This means that many organizations try to 'reinvent the wheel', rather than adopt good practice approaches developed by others. Another reason why strengthened linkages are needed is that conservation issues are increasingly trans-national in nature and require solutions that span international borders. Given the relative lack of regional CSOs, this calls for networks and alliances among organizations in different countries.
- More emphasis should be given to evidence-based conservation. Several conservation approaches supported by CEPF have strong anecdotal evidence for their efficacy but little empirical evidence of their impacts on either biodiversity conservation or human wellbeing. This is starting to improve, for example in regard to community fisheries, for which monitoring and evaluation protocols suitable for adoption by local CSOs have recently been developed. Also, for a growing-number of species-focused conservation initiatives, there is now a stronger evidence base, in terms of both reliable population estimates (and, even, Population Viability Assessments), as well as analysis of the factors contributing to population declines and/or impeding recovery.
- There is a need to do more to document traditional ecological knowledge and combine it with scientific knowledge. Throughout the hotspot, local and indigenous communities are at the forefront of efforts to conserve and sustainably manage biodiversity. Recognizing the value of their own knowledge systems and traditional management practices is a means of re-establishing their connections with nature and strengthening their voice in management and governance of natural resources.
- There is a need for greater integration of the CEPF portfolio into government plans and priorities. To this end, greater use should be made of National Advisory Committees: informal committees, established by the RIT, which bring together stakeholders from government, civil society and the donor community to oversee the development of the grant portfolio in each country. National Advisory Committees can help to align CEPF grant making with national priorities, as well as provide a platform for sharing experience and lessons learned from the portfolio, especially good practice models relevant to national conservation policy.
- There is a need for longer-term funding support to CSOs. Although CEPF grantees welcomed the grants they received, they noted that most had a duration of under two years, meaning that it was frequently difficult for organizations to retain institutional memory and staff capacity built during the period of support. It should be noted that, although individual grants may be short in duration, CEPF is able to award consecutive grants to the same organization, and thereby support multiple phases of a longer program of work. Going forward, it will be important to strike the right balance between providing longer-term support to a few organizations and making at least some funding available to a larger number.
- The maximum size for small grants of $20,000 does not necessarily match the capacity-building needs of many domestic CSOs that might have high potential to grow and do more impactful work but whose potential is constrained by limited

funding. The challenge here, of course, is to identify those organizations that have high potential for growth among the large pool of potential grantees, and to do so in a way that is transparent and fair.
- CEPF funding tends to be restricted to CSOs working on priority themes and in priority sites and corridors defined in the ecosystem profile. CSOs working in other areas should be given opportunities to apply, as many are doing important work that would benefit from CEPF support.
- In common with all donors, CEPF tends to have high expectations about what can be achieved with the size and duration of grants it awards. CSOs can deliver good value for money but it is important to be realistic about what is achievable, and to provide CSOs with sufficient time and resources.
- There exists an opportunity to transfer experience from CSOs working in the Mekong Basin to organizations working in the Ayeyarwady and Salween Basins. Conservation issues in the Mekong Basin, especially in relation to hydropower development, agro-industrial plantations and other major threats to biodiversity, are more severe but, at the same time, the response from civil society is more advanced. Given the relatively limited exposure of CSOs in Myanmar to international best practice, they could learn a lot from the experience of peer organizations active in the Mekong Basin.
- CEPF should not lose its unique focus on biodiversity. During the second phase, several donors that had hitherto been important sources of funding for CSOs announced decisions to end their support for biodiversity in the Indo-Burma Hotspot. Should CEPF also exit the hotspot or shift its attention to another programmatic focus, such as climate change, this could have serious implications for biodiversity conservation efforts in Indo-Burma, where CEPF has been at the forefront for the last 12 years.

3.2 Recommendations from the Long-term Vision Exercise

The long-term vision (Mather *et al.* 2017) recognizes that the overall conservation response from government, civil society and private sector actors in the Indo-Burma Hotspot is slowly improving but significant gaps remain. These gaps will need to be addressed in order for civil society in the hotspot to move away from CEPF support over the long term. The long-term vision makes 12 recommendations that CEPF and other funders should consider if they wish to accelerate progress towards transition:

- CEPF should support landscape-scale projects that clearly demonstrate linkages between conservation and development. Conservation challenges in the Indo-Burma Hotspot include overlapping ministerial jurisdictions, a failure to fully recognize the values of ecosystems and consider them in planning decisions, and low levels of public awareness. The best way to overcome these challenges is, perhaps, to demonstrate what is possible with sustainable development models at the landscape scale (which is easier to achieve than at the national level) and then amplifying best practices through incorporation into national policy and decision-making processes.
- CEPF should support processes to take learning from landscape-scale demonstration models into national policy and decision-making processes. This can be done through a variety of mechanisms, including an enhanced Monitoring, Evaluation and Learning approach, and by strengthening the platform provided by National Advisory Committees.

- CEPF should support strategic training for CSOs in the following areas: (i) governance and organizational capacity; (ii) project cycle management, including participatory situational analysis, proposal development and implementation; (iii) conservation management and research; (iv) community-based natural resource management and co-management; (v) communications and advocacy; and (vi) engagement with business, especially in the agriculture, energy and tourism sectors.
- CEPF should strengthen the fundraising capacity of local CSOs. This should include formal trainings, as well as dissemination of case studies of successful fund-raising using a wide variety of approaches, including non-traditional ones, such as crowd sourcing.
- CEPF should be realistic about what it can achieve with its forecast budget, focus on areas where it can make a difference, and build on that progressively, rather than use a countrywide, scattergun approach. Guidance for this should come from strengthened National Advisory Committees in each country (see Section 3.1.2).
- CEPF should support CSOs to engage constructively with key companies in critical sectors and geographic areas within the hotspot. There is a gap in incentives for industries with large ecological footprints to improve their contributions to biodiversity conservation. Addressing this gap in incentives is critical but difficult, and, initially, it may be best to focus on specific, market-leading companies within each hotspot country. CEPF could help support CSOs working to incentivize better environmental performance by businesses, for example by linking operating license issuance to environmental compliance.
- CEPF should support compilation of case studies of effective engagement with the private sector and disseminate them to CSOs in the hotspot, as part of capacity-building efforts.
- CEPF should support greater involvement of the mass media in its portfolio. It is important not just to view the media as a channel or conduit to convey conservation information and messages to other target groups but, rather, to engage with the media as a key target group in their own right. Important strategies include providing trainings and briefings for journalists on key conservation issues, training citizen journalists, and building specialist networks of environmental journalists.
- CEPF should support a review of the availability, content and quality of tertiary conservation education in the hotspot, and assess options for putting in place additional degree courses and/or integrating new modules in existing courses, with a particular focus on Lao PDR and Myanmar. The Masters of Science in Biodiversity Conservation offered by the Royal University of Phnom Penh in Cambodia is a good model.
- CEPF should identify possibilities for urban nature education centers, as well as protected area visitor education centers in national parks close to urban centers, across the Indo-Burma Hotspot and prioritize some of these opportunities for further feasibility study and eventual investments. People in the Indo-Burma Hotspot, like those elsewhere in the world, are increasingly living in towns and cities with limited exposure to nature in their daily lives. In this context, urban or peri-urban nature education centers located in remnant habitats in or close to towns and cities will become increasingly important, not only for the mental and physical health benefits that access to nature provides but also to educate urbanites to understand the demands that their lifestyles place on the natural environment and to promote more sustainable patterns of production and consumption.
- CEPF should support a feasibility study to look into the possibility of establishing an Indo-Burma Field Studies Center. The long-term vision for such a center would be a

self-financing center offering field-based training opportunities for both senior high school and undergraduate students, equipping them with practical skills for fieldwork in terrestrial, freshwater and coastal habitats, as well as with conservation and sustainable livelihood activities with farming and fishing communities in the hotspot countries. The goal of such a center would be to increase the number of young people who choose to pursue careers in practical field-based conservation and sustainable development related work, and to equip them with the necessary knowledge and skills to do so.

- CEPF should invest in the development and strengthening of the National Advisory Committee in each hotspot country. The long-term aim would be for the National Advisory Committee in each country to be formalized and strengthened and able to act as an independent advisory committee, as well as a forum for integrating lessons learned from the work of civil society into national policy.

3.3 Independent Evaluation of Lessons Learned by the RIT

The independent evaluation was carried out by Integrated Sustainability Solutions between August 2019 and April 2020. The purpose of the evaluation was to: (i) inform the selection of an RIT for the next phase of investment by evaluating the performance of the incumbent RIT (i.e., IUCN); (ii) benefit the design of future RIT proposals through the lessons learned from this evaluation regarding the programmatic and management approaches of the incumbent RIT; and (iii) inform the preparation of the update to the ecosystem profile by documenting the challenges and opportunities encountered by the RIT. The methodology adopted for the evaluation consisted of a virtual inception workshop, desk research, key informant interviews, post-research verification of initial conclusions, and triangulation of the various data sources. Nineteen key informant interviews were carried out in the Indo-Burma Hotspot, as well as four with staff of the CEPF Secretariat. The main findings of the evaluation with regard to Indo-Burma are presented in the following sections.

3.3.1 Relevance

IUCN reported that it used Facebook, its website, newsletters, a leading Thai civil society website (http://www.thaingo.org/) and the IUCN network, with country offices in all six countries, to connect to potential grantees and other stakeholders across the hotspot. The country offices also played a critical role for the grantees in each country. The RIT also worked through partners such as the Office of Natural Resources and Environmental Policy and Planning of the Ministry of Natural Resources and Environment (MoNRE) in Thailand to help circulate news of the calls for proposals. With regard to the creation and dissemination of lessons learned within a compendium of case studies and best practices, the first time this was done, IUCN asked grantees to self-select but it did not work very well. The next time, IUCN and the CEPF Secretariat chose the projects to disseminate.

Grantees generally reported good communication with the RIT, and clarity regarding when they should communicate with the RIT, national coordinators, or the CEPF Secretariat. One grantee felt that there should have been more exchange trips between different project areas. A grantee in Cambodia mostly communicated with the national coordinator there. Another grantee stated that they had a communications issue with IUCN that led to a year delay for the final payment.

IUCN facilitated the exchange of information between grantees through the mid-term and final assessment workshops, in which the grantees would present their work in different thematic groups. Donors and government representatives attended these workshops. The National Advisory Committees created by the RIT also played this information exchange role. The RIT's contribution to creating a community of conservation NGOs in the region was the Lower Mekong Network, created and initially supported by a group of donors including CEPF. It includes all countries in the hotspot except Myanmar and China.

The RIT was able to leverage additional funding in the region through multiple lines of funding, some directly through CEPF and some indirectly. These included the McConnell Foundation for a small grants program in Lao PDR, Save Our Species funding for gibbon conservation, and others for a total of $840,000. The CEPF Secretariat was able to leverage additional funding for the portfolio from Margaret A. Cargill Philanthropies and others. Large grantees were visited during supervision missions by the CEPF Secretariat accompanied by the national coordinators. During Monitoring, Learning, and Evaluation missions, the national coordinators visited grantees, occasionally together with the RIT Manager. Remote methods, such as communication apps and calls, were also employed. Among other events, to broaden awareness of the CEPF program, IUCN attended the Regional Conservation Forum associated with the World Conservation Congress.

3.3.2 Efficiency

The budget in the RIT’s proposal was reviewed, as well as the “Budget and Financial Management” section of all the Supervision Mission Reports. The following are the key takeaways:

- Initially, salary costs were being charged based on IUCN’s global time management policy, whereby staff are compensated per their category, and not based on the actual salary in the RIT budget and hours worked. In September 2016, IUCN and CEPF agreed that only actual budgeted salaries would be charged, as per CEPF policy, and shared costs allocated to other budget lines.
- The rate of expenditure under Meetings and Special Events was significantly more than the overall rate, attributable to the mid-term assessment workshop. The subsequent supervision report stated that this cost was credited back to the grant.
- Management Support Costs were initially found to be charged at a greater rate than overall expenditure, which was subsequently rectified.
- Significant balances remained in the Meetings and Special Events and Professional Services budget lines, but this was resolved by the end of 2017.
- National coordinators could have more of a role in the review of letters of inquiry (LOIs), beyond simply providing their opinions and then being out of the process.

The February 2019 supervision mission report noted that the CEPF Secretariat had suggested to the RIT and its partners to decentralize more information management tasks and decision making to the national coordinators, to remove some of the burden from the RIT Manager, as well as hiring a Deputy Manager. The Grant Director noted at that time that, as of 31 December 2017 (70 percent of the way through the RIT grants duration), only 62 percent of the funds budgeted for Salaries and Benefits had been spent. Per the October 2019 supervision report, the decentralization of tasks to national coordinators did not occur.

3.3.3 Effectiveness

Structure
The RIT role is being performed by a partnership of three organizations: IUCN; KFBG; and the Myanmar Environment Rehabilitation-conservation Network (MERN). IUCN has overall responsibility for ensuring delivery of the CEPF program in the hotspot, and leads implementation in Cambodia, Lao PDR, Thailand and Vietnam. KFBG leads implementation in the parts of the hotspot that lie within China, while MERN is responsible for implementation in Myanmar.

Capacities
The capacities of the RIT can be demonstrated by their performance along the different criteria used for the evaluation and the components of the RIT terms of reference. To capture a range of data from across the seven (2013-2020) years of implementation, a review of the project and supervision mission reports revealed the following highlights not already addressed in greater detail:

- The capacity of local groups to access CEPF funding was overestimated.
- Under the first funding round, international organizations received more than two-thirds of the awarded funds, so the third call was restricted to local CSOs.
- Over 10 calls, 1,056 LOIs were received, there were 83 large grants (for $13.7 million) and 105 small grants (for $1.9 million).
- Direct support was provided to 108 CSOs (84 of which were local), of which 76 percent showed increased capacity
- National coordinators and National Advisory Committees were established in all hotspot countries
- Several partnerships were created, facilitating international NGOs providing mentoring support to local groups, and the Lower Mekong Network.

3.3.4 Coverage

Per the CEPF Secretariat, IUCN implemented this component quite well, including the transition from the former grants management system (GEM) to the new system (ConservationGrants). IUCN managed the small grants using its own system and provided data to ConservationGrants. The day-to-day management was not through ConservationGrants, however. When a grant was awarded/closed, there was a standard list of documents that needed to be provided, which IUCN was aware of, and did on a rolling basis. The CEPF Secretariat would check on these items sporadically. Every quarter, the Secretariat would have to approve, and would have to sign off at the level of the small grant mechanism. Overall, the majority of grantees did not express any concern regarding contracting, technical or financial reporting. One grantee mentioned that they preferred the previous reporting portal (GEM) and another reported a delay with the initial payments but did not know why this occurred.

Per the CEPF Secretariat, IUCN was seen to have achieved a sensible balance between the different strategic priorities. The plan was followed, and spending done accordingly per the strategic directions. Per the October 2019 Supervision Mission report, the disbursements were as planned for all strategic directions, except Strategic Directions 2 and 8, which were at 88 and 94 percent, respectively, of the ecosystem profile allocation. Grantees and other stakeholders all felt that CEPF and IUCN were important regional actors in conservation.

Most grantees were unable to comment on the overall portfolio but those that did considered that there was a good diversity of projects. It was noted that Cambodia had approximately twice the average number of grantees in the other countries. One grantee in Cambodia felt that there should be a greater emphasis on national NGOs versus international ones.

3.3.5 Impact

The RIT indicated (as mentioned in Section 3.3.1) that it used Facebook, its website, newsletters, and the IUCN network to disseminate information on the availability of calls for proposals. The calls for all grants are obviously also disseminated via the CEPF website. The process used was as follows. Once LOIs were received in response to the calls for proposals, IUCN would request any needed clarification. There was an additional review for IUCN members to address conflict of interest. IUCN would then select the best LOIs, exclude the worst, and the remainder would be sent to the National Advisory Committee and outside experts. This would result in a list of applications recommended for funding. After award, the grantees would have to complete the civil society tracking tool. In general, it took three to four months from LOI to selection.

The grantees interviewed indicated that the calls for proposals and the process was clear. When, on smaller, unusual, one-off calls, they had questions, they received responses immediately. Grantees were satisfied with the proposal evaluation duration, which varied from two to four months. With respect to the portfolio, one key informant confirmed the importance of the KBA approach, and stated that, while small grants were good for single issue projects or a small initiative at a particular site, greater impact requires larger, multi-year grants.

The Cambodia portfolio of projects was described as being very interesting and the species focus noted as unique. The two-stage process of LOI and then full proposal was specifically praised by one key informant. IUCN generated over 1,000 applications over five years. One in four of the large grant applicants was successful and one in seven of the small grant applicants. Another positive aspect was the good use that was made of local languages for small grantee applications.

Per the CEPF Secretariat, of the 20 targets in the logical framework, IUCN was reported to have met 19 of them. Grantees and other stakeholders reported that CEPF was a leading actor in conservation in the region and its work was appreciated by the government. Government officials all stressed the importance of continuing CEPF and requested amplification.

As for mainstreaming through engagement with the government and the private sector, IUCN reported that it did not excel at this, and noted that this lapse often came up in the supervision missions. The outreach to government was through the National Advisory Committees and, opportunistically, at project level. In the south of Thailand, a local project stopped the aggressive corralling of dugong to plant radio-frequency identification tags. The RIT stated that it was hard to influence governments in the entire region. At grantee level, there were multiple examples, such as Vietnamese CSOs stopping a tourism development in the Son Tra peninsula in Danang city in Vietnam. With the private sector, IUCN indicated that not much was done. The BioDiversity Network Alliance, which is a private sector network (involving Toyota, Marriott, etc.) was mentioned as a forum where grantees could possibly present in the future.

The 2018 annual portfolio overview prepared by the CEPF Secretariat noted that the RIT's focus and success in soliciting and awarding grants took time away from its ability to communicate lessons learned from the portfolio to decision makers and conservation practitioners. This was described as having prevented mainstreaming the lessons from the most successful projects into public policy and private sector practice. The database provided by the Secretariat listed eight projects involving cooperation with corporate entities around traditional rice varieties, local conservation practices, and organic and FairWild products, among others.

At grantee level, one reported that mainstreaming had been a significant part of two of their large grants, per encouragement from the CEPF Secretariat. The focus was on a sustainable rice cultivation, working with farmers and the private sector. A grantee in Cambodia mentioned that it had 210 government counterparts seconded to it. Another illustration of grantee-level engagement involved giant ibis (*Thaumatibis gigantea*) conservation at Tmat Boeuy village in Kulen Promtep Wildlife Sanctuary, where a grantee and local communities identified nesting sites and informed the Cambodian Ministry of Environment, which drew up zoning and policies to protect them. A grantee stated that CEPF had the least influence in Thailand, and more influence in Cambodia and Vietnam.

3.3.6 Accessibility

IUCN reported that it determined grantees' capacity building needs using the civil society tracking tool, which involves self-assessment. It also conducted due diligence using an IUCN template and documents requested by template before disbursing grants. The civil society tracking tool is one of the first deliverables of the grantees' contracts. The mid-term assessment report indicated that, of the 11 self-assessments done at that time, financial and human resources were the biggest capacity gaps facing local CSOs in the hotspot. The 2019 annual portfolio overview provided more details on the capacity building conducted. It included supporting networking activities that enable collective civil society responses and core support for the organizational development of domestic CSOs. Under Strategic Direction 8 on capacity building, nine large grants and 58 small grants had been awarded at that point in time.

The grants awarded aimed to strengthen the capacity of 100 CSOs across the hotspot, and to establish or strengthen 21 civil society networks. Some key examples included: strengthening a network of CSOs and individuals to monitor Thailand's Important Bird Area network; official establishment of the Zhanjiang Bird Watching Society; and support to the Save Wildlife in Trade Coalition, which involved wildlife crime and enforcement agencies in China.

Grantees reported very positively on the assessment workshops held in Siem Reap, Cambodia. They found it useful to get to know the other grantees and working in the region, learn how the other grantees developed projects, and have networking opportunities. IUCN and (for large grants) the CEPF Secretariat provided useful feedback after the LOI stage. For small grantees, IUCN explained the environmental and social safeguards and the application of the ecosystem profile to the hotspot. One key indicator indicated that, while the RIT did a lot of capacity building in Myanmar where capacity was particularly low and in Thailand (where the RIT was based), less was done in other countries, where it was mainly in the form of mostly reactive implementation support.

Per the 2019 annual portfolio overview, 83 large grants were awarded, including two grants to IUCN to serve as the RIT. Of these, 42 were to international organizations and 41 to local organizations. As for small grants, 105 were awarded, 17 to international organizations and 88 to local organizations.

3.3.7 Adaptive Management

The Secretariat noted that the reporting of impacts (as opposed to progress and financial reporting) was done offline (outside ConservationGrants) via spreadsheets, because the necessary module was not ready at the time. With respect to supporting CEPF in monitoring programmatic performance of grantees, it was felt that this was done more reactively than proactively. The Secretariat would identify issues from reports or in-person issues and then ask IUCN to check up on them (in person) if needed. The review of financial spending of the grantees versus their achievements was satisfactory. The CEPF Secretariat reported no issues with the RIT regarding this component.

IUCN found the RIT training to be useful in understanding what the Secretariat required in terms of the program itself, safeguards, and gender. The RIT found the supervision missions to be very well structured and useful. Regarding financial reporting via ConservationGrants, they found the system to be slow and unresponsive, with the entry of too many variables requiring waiting until the system updated itself. The portal was seen as having too many steps. Besides the software challenges, everything went smoothly. Sometimes, the Secretariat asked for additional clarification outside the report. The procurement rules were in line with IUCN's own policies, so they were easy to implement and there were no issues.

Grantees indicated that they received clear information on how to report from the CEPF Secretariat and the RIT, and that they spent 15-20 percent of their time on reporting versus implementation. This was seen to be reasonable. The visits to the grantees by the grant director and/or IUCN were found to be very useful to update them on the progress of grantee work as well as the political trends of the country. The visits also provided many suggestions about connections, resolving issues with partners, etc. One grantee mentioned that the time needed for reporting for small grants was excessive relative to the $20,000 of funding.

The main security risk was regarding the security crisis in Rakhine state in Myanmar, where no projects were implemented. There are also other security issues with armed groups in parts of Myanmar. CEPF did not work in these areas, so they had no impact. The entire country was a priority, not specific areas. With the exception of southern Thailand, the other countries are secure. The McConnell funding for nine years was a good opportunity, as was working with the Lower Mekong Network, which was not planned but proved to be a useful network with which to work.

The overall rating given to the RIT by the independent evaluator was Highly Satisfactory.

4. BIOLOGICAL IMPORTANCE OF THE INDO-BURMA HOTSPOT

4.1 Geography, Climate, and History

Indo-Burma boasts an impressive geographic diversity. It spans nearly 6,000 meters in elevation, from the summit of Hkakaborazi in Myanmar, Southeast Asia's highest mountain, down to a coastline along the Bay of Bengal, Andaman Sea, Gulf of Thailand and South China Sea. The hotspot encompasses a number of complete mountain ranges, such as the Annamite Mountains, and includes parts of several others, including eastern extensions of the Himalayas. The hotspot features isolated massifs and plateaus, extensive areas of limestone karst and several of Asia's largest rivers: the Chindwin; Ayeyarwady (Irrawaddy); Salween (Nu/Thanlwin); Mekong (Lancang); Red (Yuan); and Pearl (Zhu). The hotspot's sweeping expanses of lowlands embrace several fertile floodplains and deltas and include the Great Lake of Tonle Sap, Southeast Asia's largest and most productive freshwater lake.

Reflecting its high diversity of landforms and climatic zones, Indo-Burma supports a wide variety of habitats and, thus, high overall biodiversity. This diversity is enriched by the development of areas of endemism as a result of the hotspot's geological and evolutionary history. Fluctuating Pleistocene sea levels and the resulting repeated isolation and reconnection of ecosystems and plant and animal populations have helped to promote speciation (van Dijk *et al.* 1999), while fluctuations in the relative extent of lowland evergreen forest during glacial episodes have allowed species to evolve in isolation, and further contributed to the high levels of endemism in the hotspot (Baltzer *et al.* 2001, van Dijk *et al.* 2004). Centers of endemism are concentrated in the Annamite Mountains, the northern highlands of southern China and northern Vietnam and, although probably to a lesser extent because of their connection with the Himalaya, Myanmar's northern highlands. Others may remain to be documented, given the patchiness of survey and of taxonomic review.

Within the hotspot, however, a complex array of microclimates exists, with mean annual precipitation varying from under 1,000 mm in the central dry zone of Myanmar and coastal areas of Vietnam to almost 8,000 mm in some parts of the northern highlands of Myanmar and the central Annamite Mountains (Figure 3). There are also pronounced temperature gradients within the hotspot, with higher latitudes and altitudes experiencing colder annual average temperatures than lowland areas and areas further south (Figure 4).

Most parts of the hotspot experience a strongly seasonal climate, with the climate of the south and west of the hotspot dominated by a southwest monsoon season of variable duration and the climate of the northeast of the hotspot dominated by the northeast monsoon in the northern summer. During the northern winter months, drier conditions prevail throughout much of the hotspot under the influence of stable continental Asian high-pressure systems (Figures 5 and 6).

Figure 3. Annual Mean Precipitation across the Indo-Burma Hotspot

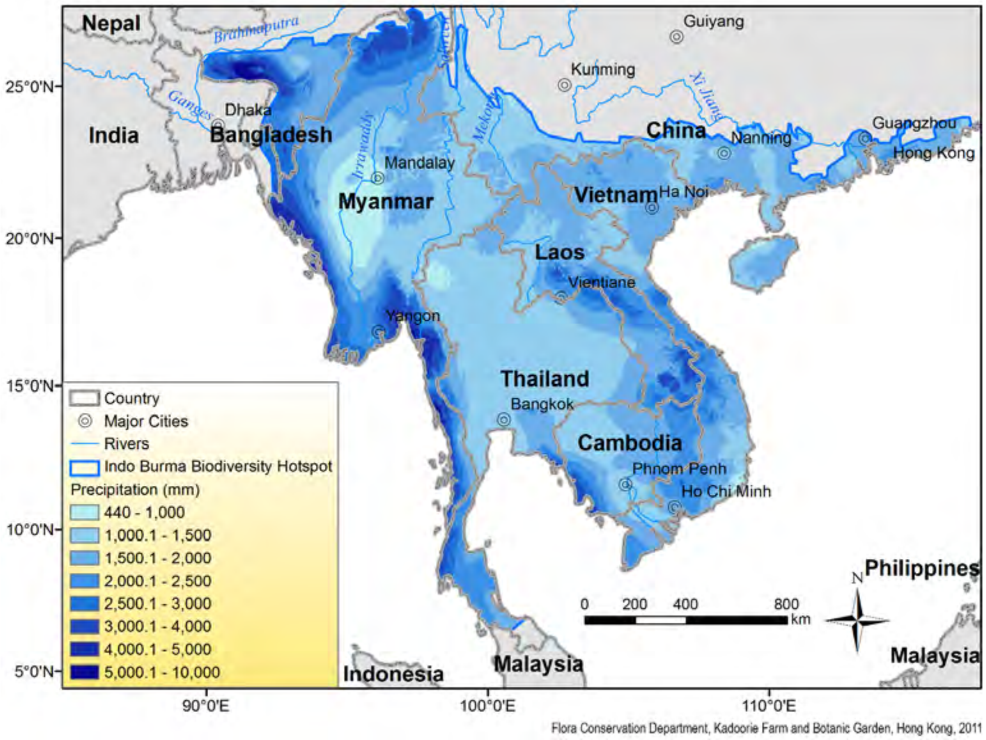


Figure 4. Annual Mean Temperature across the Indo-Burma Hotspot

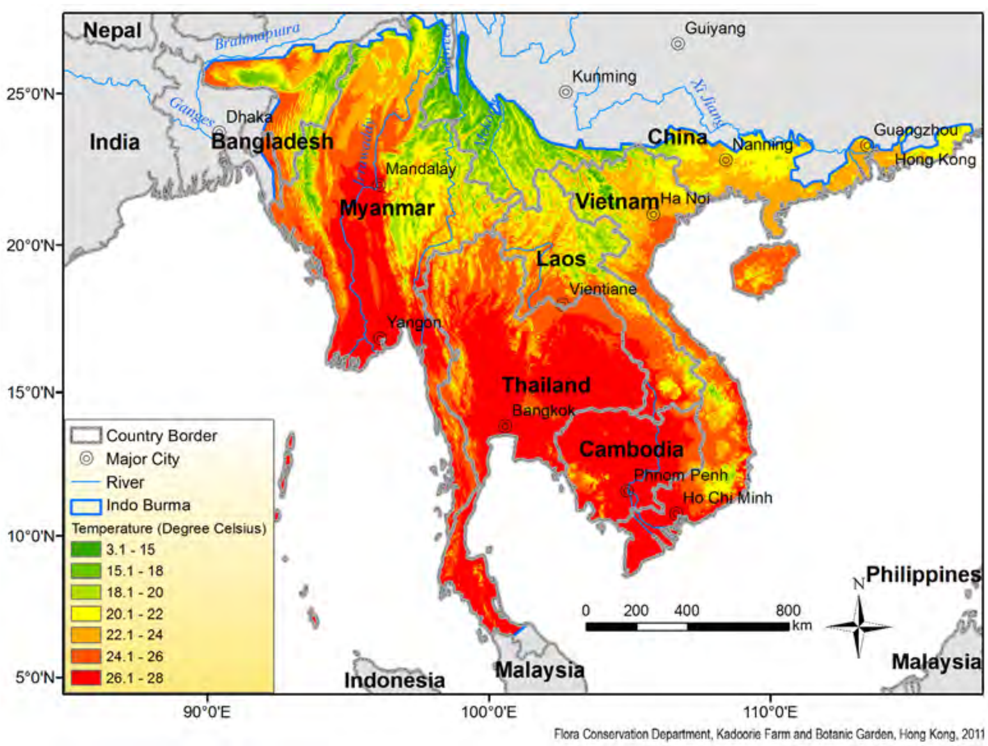


Figure 5. Monthly Mean Temperature across the Indo-Burma Hotspot

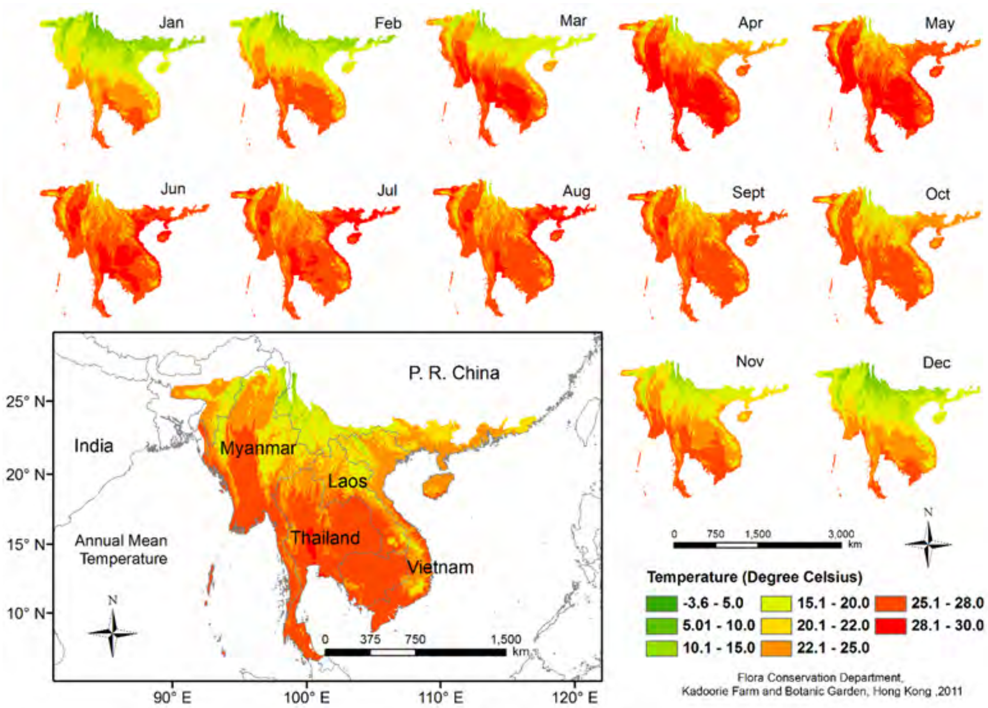
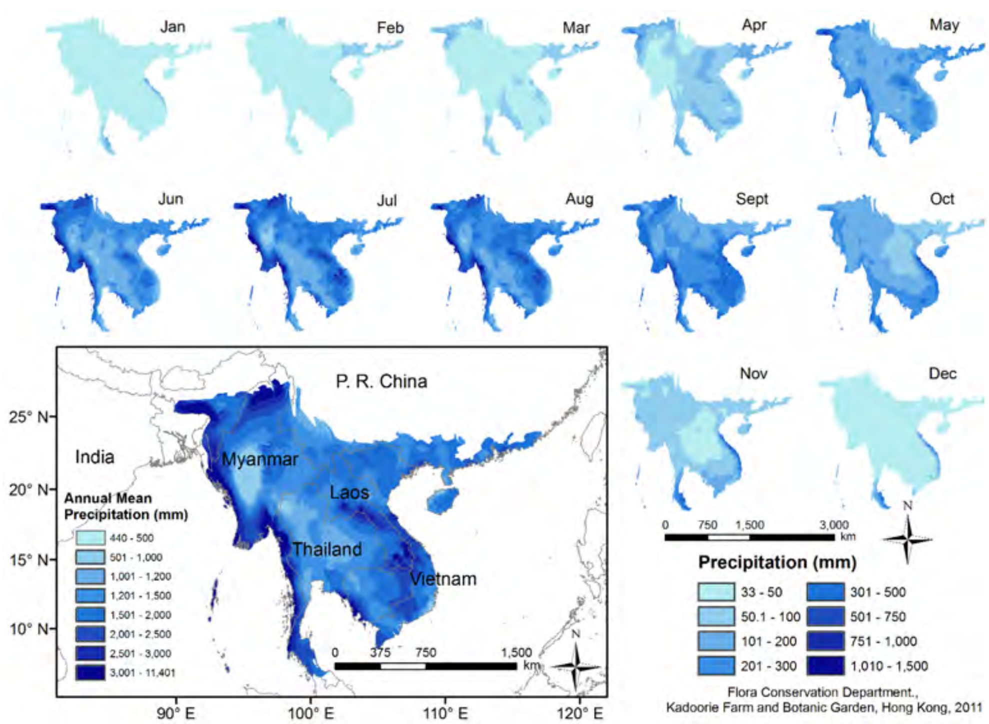


Figure 6. Monthly Mean Precipitation across the Indo-Burma Hotspot



4.2 Habitats and Ecosystems

Forests are among the most species-rich ecosystems in the hotspot; before major anthropogenic changes occurred, they covered the vast majority of its land area. The variety of forest types is immense, from evergreen forests with a high diversity of canopy tree species, through semi-evergreen and mixed deciduous forests, to relatively (tree) species-poor deciduous dipterocarp forests. Limestone karst supports distinctive vegetation formations, with high levels of very localized endemism, particularly among plants, reptiles and molluscs, with individual massifs frequently supporting unique species found nowhere else. Mono-dominant and mixed formations of conifers are distributed mostly in montane areas, while open, fire-climax coniferous formations are distributed on drier hills and plateaus subject to regular burning. Lowland floodplain swamp or flooded forests are a feature of the permanently and seasonally inundated lowlands, especially in Cambodia, and mangrove forests are distributed in coastal areas.

Lowland evergreen forests are among the most tree-species-rich in the whole hotspot, and many plants and animals are restricted to them. Lowland evergreen forests formerly covered large areas of peninsular Thailand and peninsular Myanmar, as well as smaller areas elsewhere in the hotspot, including the Annamese lowlands of Vietnam. However, due to the (former) abundance of commercially valuable timber species in these forests and their suitability for agriculture (especially oil palm), they have been among the most heavily exploited of all habitats. Large areas have been cleared and much of the remaining forest is threatened with conversion to agro-industrial plantations and smallholder agriculture.

Montane evergreen forests are distributed throughout the hotspot, including the Annamite Mountains of Lao PDR and Vietnam, the Cardamom Mountains of Cambodia, the Chin Hills, Bago Yoma, Rakhine Yoma and other ranges of Myanmar, and the vast and largely contiguous highland block across southern China, northern Vietnam, northern Lao PDR, northern Thailand and northern Myanmar. Turnover in species distribution with altitude is marked in many taxonomic groups of plants and animals in the hotspot (e.g., Whitmore 1999), and many species undertake seasonal altitudinal movements and are dependent upon habitats at different altitudes. Relative to most other habitats in the hotspot, montane evergreen forests support many restricted-range amphibians, birds and plants, although fewer such mammals (at least among the larger-bodied species), which seem to show less altitudinal stratification (Steinmetz *et al*. 2008). The hotspot's lower montane evergreen forests are believed to have plant species richness that is similar to nearby lowland evergreen forests, while upper montane evergreen forests are less species rich, and dominated by members of the families Fagaceae, Lauraceae and Magnoliaceae. At higher elevations, on summits and ridge crests, stunted, xerophytic formations dominated by *Rhododendron* spp. and other members of the family Ericaceae are found. Montane evergreen forests in Indo-Burma are generally less threatened by overexploitation than are the hotspot's lowland evergreen forests. However, conversion to cash crops and other land uses is leading to extensive clearance of lower montane evergreen forest in many areas.

Semi-evergreen and mixed deciduous forests are widely distributed in lowland and hill areas throughout the hotspot. These forests are less rich in plant species than are lowland evergreen forests and generally support lower levels of plant and animal endemism. These forests hold a number of commercially valuable timber species and are targeted for logging in many areas. The distinction between semi-evergreen and mixed deciduous forests is highly inconsistent depending on whether simple deciduousity is prioritized in definition (as would be implied by the habitats' names) or whether species and genus identity of the habitat-structuring species is considered of basic importance (Rundel 2009).

Deciduous dipterocarp forests are open forests mostly with grassy understory, which occur in areas with a prolonged dry season. These forests support relatively few tree species, although they support distinctive plant and animal communities, and there is a large variety of subtypes (Rundel 2009). Formerly these forests covered much of the center of the hotspot, notably in the Mekong Basin, but little-degraded tracts are now largely restricted to the plains of northern and northeastern Cambodia and adjacent areas of Lao PDR and Vietnam (Tordoff *et al*. 2005), and small tracts in western Thailand. In these areas, deciduous dipterocarp forests frequently occur in mosaics with patches of semi-evergreen forest, grassland and wetlands, many of which are subject to seasonal monsoon inundation, and the mosaic nature is itself probably vital to a large number of specialist deciduous dipterocarp animal species. As recently as the 1950s, these landscapes supported such impressive herds of large ungulates that they were considered one of the "great gamelands of the world" (Wharton 1957). The Ayeyarwady floodplain, sheltered from southwest and northeast monsoons by a horseshoe of mountain ranges, has an extremely dry and seasonal climate, which has given rise to specialized vegetation types, including deciduous dipterocarp forest similar to that of the Mekong Basin, as well as the only thorn scrub in the hotspot. Myanmar's dry scrub and forest landscapes have been isolated from similar landscapes in Southeast Asia and the Indian Subcontinent for significant periods of geological history. As a result, the area, termed the Central Dry Zone, supports a number of endemic species additional to many of the deciduous dipterocarp specialists of lands further east.

The limestone karst formations that are distributed throughout the hotspot (in some places as extensive belts and in other places as isolated outcrops) support highly distinctive ecosystems rich in endemic species (Clements *et al*. 2006). Although, to date, taxonomic groups such as primates, birds and orchids have received the greatest amount of conservation investment and scientific study, limestone ecosystems are of equal, if not greater, significance for other, generally less well known groups, including geckos, cave fish, land snails and deep-soil invertebrates (e.g., Grismer *et al.* 2018a,b). While the unsuitability of limestone karst for agriculture means that wholesale habitat conversion is generally less of a threat than it is to other forest types in the hotspot, tall forest on limestone is localized, often heavily harvested for firewood, and of unknown but possibly high importance to some, perhaps many, of the karst endemics. Animal and plant species of limestone ecosystems are often threatened by overharvest for the pet and horticulture trades. The karst formations themselves are, in places, heavily quarried, which has the potential to cause or contribute to the loss of plant and animal populations. Where quarrying takes place on a small scale within extensive, contiguous belts of karst, its overall effects may be predominantly local. However, destruction of isolated karst formations poses a significant risk of extinctions for many hyperendemic invertebrates and certain fish, plant and reptile species, and may already have resulted in global extinctions (e.g., Deharveng and Bedos 2016).

Seasonally inundated swamp forest ecosystems surround the Great Lake of Tonle Sap in Cambodia. Formerly, these ecosystems were also extensive in the deltas and lower floodplains of the Mekong and Chao Phraya Rivers but are now restricted to isolated fragments. Freshwater swamp forest in Myanmar is distributed in the Ayeyarwady Delta and in the floodplains of the Chindwin and other rivers. Because of its coincidence with areas of high human population and suitability for conversion to agricultural land, freshwater swamp forest has been extensively cleared throughout mainland Southeast Asia. These ecosystems are important for a number of globally threatened species, notably large waterbirds.

Mangrove forests were once distributed widely in coastal areas, particularly within and near estuaries, but are now greatly reduced, as a result of fuelwood extraction and conversion to aquaculture. Other important coastal habitats in the hotspot include intertidal mudflats and sandflats, which are a key habitat for many migratory shorebirds. The largest and ecologically most important intertidal ecosystems are found near large river mouths, most importantly in the Red River and Mekong Deltas of Vietnam, the Inner Gulf of Thailand, the Gulf of Mottama in Myanmar, and the Pearl River Delta in southern China.

Grassland ecosystems range from small, seasonally wet meadows within dry forest landscapes to the extensive, seasonally inundated grasslands that characterize the inundation zone of Tonle Sap Lake. Seasonally inundated grasslands support distinctive assemblages of species, including several that are globally threatened. They are one of the most threatened ecosystems in the hotspot. Formerly well distributed in central Thailand and the Mekong Delta, and occurring as smaller expanses on the floodplains of all the major rivers and their tributaries, they have almost disappeared through conversion to agriculture, aquaculture and forestry.

Freshwater ecosystems range from fast-flowing rocky mountain streams to wide, slow-flowing lowland rivers braided by large, partly vegetated sand and rock bars. Prime examples of the latter are: the Mekong and its complex of major tributaries, the Sekong, Sesan and Srepok; and the Ayeyarwady and its tributary, the Chindwin. The Great Lake of Tonle Sap in Cambodia dwarfs all other lotic bodies in the hotspot, although Myanmar has several large, open, freshwater lakes, such as Inle and Indawgyi. Freshwater ecosystems support many globally threatened species, including some of those most threatened in the hotspot, and provide the livelihoods of a substantial proportion of the hotspot’s human population. However, these areas are often of high subsistence importance for some of the region’s most economically marginalized people, and the frequently high levels of human use have many negative effects on biodiversity (e.g., Meusch *et al*. 2003, Mollot *et al*. 2006, Bezuijen *et al*. 2008). Specific threats to freshwater ecosystems include: unsustainable fishing; changes to river flow patterns, such as blasting of rapids for navigation channels; hydropower dam construction; and, increasingly, pollution.

4.3 Species Diversity and Endemism

Indo-Burma encompasses all or part of seven Endemic Bird Areas defined by BirdLife International (Stattersfield *et al*. 1998, as updated by http://www.birdlife.org/datazone/), 12 of the Global 200 Ecoregions defined by WWF (Olson *et al*. 2000) and 28 Centers of Plant Diversity defined by IUCN (Davis *et al*. 1995). Endemism is generally associated with offshore islands (e.g., Hainan), montane isolates, limestone karst, and areas of lowland evergreen forest that were isolated during glacial episodes.

The Indo-Burma Hotspot has extraordinarily high plant species richness (Davis *et al*. 1995). Preliminary estimates suggest that the hotspot may support 15,000 to 25,000 species of vascular plant, and that as many as half the angiosperms and gymnosperms are endemic to the hotspot (Davis *et al*. 1986, Campbell and Hammond 1989, Davis *et al*. 1995, van Dijk *et* *al*. 1999, Kress *et al.* 2003). The complex merging of floras in the highlands of Southeast Asia (most of which is encompassed within the Indo-Burma Hotspot) has no parallel in any other part of the world (de Laubenfels 1975). It represents the convergence of several distinctive temperate, tropical and subtropical floristic regions: the Indian, Malesian (Sundaic), Sino-Himalayan and Indochinese (Schmid 1989). Forest ecosystems support the highest plant species richness, among which montane forests and lowland evergreen forests are apparently the most species rich. Plant families particularly notable for their high species richness in the hotspot include the Orchidaceae and Dipterocarpaceae.

On the basis of current knowledge, the Indo-Burma Hotspot harbors more than 470 mammal species and 1,330 bird species (IUCN 2020b). Most of the latter are resident within the hotspot but a significant number are highly migratory, most being species that spend the northern winter in the hotspot and breed further north. Reptiles number more than 670 species, of which more than a quarter are endemic (IUCN 2020b). Of the more than 380 amphibian species known so far to occur in the hotspot, more than half are endemic (IUCN 2020b), and new species are regularly being discovered (e.g., Stuart *et al.* 2020).

Freshwater biodiversity in Indo-Burma is still very poorly known: for example, Kottelat (2011a) estimated that 11 percent of fish species so far found in the Sekong catchment in Lao PDR were certainly or potentially unnamed. The hotspot as a whole supports at least 1,440 species of fish (IUCN 2020b). The Lower Mekong Basin alone supports at least 850 freshwater fish species, with a total estimate of 1,100 species if possible coastal or marine visitors are included (Hortle 2009). The basin may be exceeded in species richness only by the Amazon and Congo Basins (Dudgeon 2000a). Overall, knowledge of freshwater biodiversity in Indo-Burma is still at the exploratory stage, with numerous taxonomic uncertainties, large areas unsurveyed, and many species known only from a single locality (Kottelat and Whitten 1996, Baltzer *et al*. 2001). The high rate at which fish species were newly described during the 1990s and 2000s (often more than a dozen at a time, e.g., Freyhof and Serov 2001) shows no sign of abating. For example, Bolotov *et al.* (2019) recently described four new species and four new sub-species of freshwater mollusc from Myanmar.

Rapids are particularly notable as sites of high species richness, endemism and periodic congregations of fish, as are some headwaters areas (e.g., more than a quarter of fishes recorded from the Dakchung Plateau in Lao PDR are apparently endemic to it; Kottelat 2011a). In addition, Inle Lake in Myanmar has been isolated for significant periods of geological history, resulting in the evolution of endemic taxa. This indicates that many more fish species may await discovery and description. In general, other freshwater taxa remain even less studied than fish. One exception is the Pomatiopsidae, a family of aquatic gastropods, for which the Mekong Basin represents a remarkable center of radiation, with at least 121 species (Davis 1979); this suggests that similarly high diversities might be found in other aquatic invertebrate taxa.

While it is abundantly clear that Indo-Burma supports extraordinary vertebrate species richness, detailed comparable data for most plant and invertebrate groups are lacking. Even among mammals, birds and turtles, new species for science are still being regularly discovered in the hotspot, including, in recent decades, saola (*Pseudoryx nghetinhensis*) (Vu Van Dung *et al*. 1993), large-antlered muntjac (*Muntiacus vuquangensis*) (Do Tuoc *et al*. 1994, Timmins *et al*. 1998), skywalker hoolock (*Hoolock tianxing*) (Fan *et al.* 2017), grey-shanked douc (*Pygathrix cinerea*) (Nadler 1997), leaf muntjac (*Muntiacus putaoensis*)

(Amato *et al*. 1999), Annamite striped rabbit (*Nesolagus timminsi*) (Averianov *et al.* 2000), long-eared gymnure (*Hylomys megalotis*) (Jenkins and Robinson 2002), shield-nosed leaf-nosed bat (*Hipposideros scutinares*) (Robinson *et al*. 2003), Kachin woolly bat (*Kerivoula kachinensis*) (Bates *et al.* 2004), kha-nyou (*Laonastes aenigmamus*) (Jenkins *et al.* 2005), Paulina's limestone rat (*Saxatilomys paulinae*) (Musser *et al*. 2005), various *Crocidura* shrews (e.g., Jenkins *et al*. 2009), Myanmar snub-nosed monkey (*Rhinopithecus strykeri*) (Geissmann *et al*. 2010), Lao giant flying squirrel (*Biswamoyopterus laoensis*) (Sanamxay *et al*. 2013), bare-faced bulbul (*Pycnonotus hualon*) (Woxvold *et al*. 2009), black-crowned barwing (*Actinodura sodangorum*) (Eames *et al*. 1999b), chestnut-eared laughingthrush (*Garrulax konkakinhensis*) (Eames and Eames 2001), golden-winged laughingthrush (*Trochalopteron ngoclinhensis*) (Eames *et al*. 1999a), Naung Maung wren babbler (*Rimator naungmungensis*) (Rappole *et al*. 2005), Nonggang babbler (*Stachyris nonggangensis*) (Zhou and Jiang 2008), Cambodian tailorbird (*Orthotomus chaktomuk*) (Mahood *et al.* 2013), limestone leaf warbler (*Phylloscopus calciatilis*) (Alström *et al*. 2009), Mekong wagtail (*Motacilla samvaesnae*) (Duckworth *et al*. 2001) and Zhou's box turtle (*Cuora zhoui*) (Zhao *et al.* 1990).

Although some of these new species are so similar to already-named species that they are known or likely to have been previously overlooked, a number are so startlingly distinctive as to help set this part of the world apart: saola and kha-nyou look unlike any other species, even coarsely, and have no close relatives (indeed kha-nyou is a startling survival from a rodent lineage thought long extinct; Dawson *et al*. 2006); bare-faced bulbul (a species of bird) is the world's only bulbul with a mainly bald head (Woxvold *et al*. 2009), and while Annamite striped rabbit looks extremely similar to its close relative Sumatran striped rabbit (*Nesolagus netscheri*), there was no previous suspicion that such a dramatic-looking animal inhabited mainland Southeast Asia (Surridge *et al*. 1999). There are also a number of newly proposed species in these groups that require taxonomic confirmation, such as Annamite muntjac (*Muntiacus truongsonensis*) (Nguyen An Quang Ha 1997, P[ham] M[ong] Giao *et al*. 1998), Puhoat muntjac (*M. puhoatensis*) (Binh Chau 1997) and Cuc Phuong ferret badger (*Melogale cucphuongensis*) (Nadler *et al*. 2011).

The continued naming of new species for the world in the hotspot, and discovery within it of species previously thought extralimital to it (e.g., beech marten (*Martes foina*); Rabinowitz and Saw Tun Khaing 1998), are combined with a recent upsurge of taxonomic revision that is resulting in many widespread "species" being segregated into several different species (e.g., Groves 2001, Meijaard and Groves 2004, Stuart and Parham 2004, Stuart *et al*. 2006, Leader *et al*. 2010, Spinks *et al.* 2012). These three factors are leading to continued increases in known species richness and endemism.

4.4 Globally Threatened Species

Species listed on the IUCN Red List of Threatened Species (IUCN 2020b) as Critically Endangered, Endangered or Vulnerable (i.e., "globally threatened"), form the principal basis for the identification of conservation outcomes for Indo-Burma and, consequently, the determination of priorities for CEPF investment (see Sections 5.1 and 12.1). A significant proportion of the vertebrate species in Indo-Burma have been assessed as globally threatened. For many groups of plants in the hotspot, global threat assessments are not comprehensive, while the hotspot's invertebrates and fungi have barely been assessed, with the exception of a few invertebrate groups, such as odonates and molluscs. These groups may include many species meeting the criteria for globally threatened, despite not yet being classified as such on the Red List.

4.4.1 Mammals

One-fifth of mammal species in the hotspot are considered globally threatened (IUCN 2020b). This is in line with the overall pattern for South and Southeast Asia, which hold concentrations of threatened species (Schipper *et al*. 2008). Most mammals inhabit forest ecosystems, and this is particularly true for threatened mammals of Southeast Asia (Schipper *et al*. 2008). Overexploitation and habitat loss, the two principal threats to mammal survival globally, are also the major threats in Southeast Asia, where 90 percent of large mammals are threatened by overhunting (Schipper *et al*. 2008).

Indo-Burma is noteworthy for its concentration of globally threatened primates, of which 20 are endemic to the hotspot (based on the boundaries followed for the ecosystem profile; Figure 1): pygmy loris (*Nycticebus pygmaeus*); Delacour's leaf monkey (*Trachypithecus delacouri*); François's leaf monkey (*T. francoisi*); white-headed leaf monkey (*T. poliocephalus*); Lao leaf monkey (*T. laotum*); Hatinh leaf monkey (*T. hatinhensis*); Indochinese silvered leaf monkey (*T. germaini*); Shortridge's leaf monkey (*T. shortridgei*); red-shanked douc (*Pygathrix nemaeus*); black-shanked douc (*P. nigripes*); grey-shanked douc; Tonkin snub-nosed monkey (*Rhinopithecus avunculus*); Myanmar snub-nosed monkey; skywalker hoolock; Hainan gibbon (*Nomascus hainanus*); cao vit crested gibbon (*N. nasutus*); black crested gibbon (*N. concolor*); northern white-cheeked gibbon (*N. leucogenys*); southern white-cheeked gibbon (*N. siki*); and yellow-cheeked gibbon (*N. gabriellae*). Various other globally threatened primate species inhabit the hotspot but also occur elsewhere. Unresolved taxonomy, especially in the genera *Nomascus* and *Trachypithecus*, makes the figures quoted here preliminary; additional species recognized are likely to qualify as globally threatened (e.g., Duckworth *et al*. 2010). For instance, the recently named yellow-cheeked gibbon (*N. annamensis*) (Van Ngoc Thinh *et al*. 2010; formerly included by the Red List within *N. gabriellae*) will surely meet criteria for globally threatened.

Other globally threatened mammals endemic to the hotspot include the recently described saola and large-antlered muntjac. Both are confined to evergreen forests of the Annamite Mountains of Lao PDR and Vietnam and, for the muntjac, a small part of Cambodia (Timmins *et al*. 1998, Saola Working Group 2009). Other globally threatened mammal species are endemic to the hotspot; as with primates, ongoing taxonomic review of bats and rodents is liable to increase the number, perhaps substantially.

Two Endangered deer have races endemic to the hotspot (Mattioli 2011). Eld's deer (*Rucervus eldii*) has three subspecies, of which two are endemic to Indo-Burma: *R. e. siamensis*; and *R. e. thamin*. The former underwent a massive decline in the second half of the 20th century and only tiny numbers remain outside Cambodia, where declines continue apace. Hog deer (*Axis porcinus*) is probably reduced, in terms of native populations in the hotspot, to five small populations in Cambodia, the last remnants of the race *A. p. annamiticus* (Brook *et. al* 2015), and an unknown number of animals in Myanmar, presumed to be of the nominate race, which also occurs in the Indian subcontinent but is also in steep decline (Biswas *et al*. 2002).

Many globally threatened mammals with more widespread global distributions inhabit the hotspot, including tiger (*Panthera tigris*), Asian elephant (*Elephas maximus*), banteng (*Bos javanicus*), gaur (*B. gaurus*), two species of pangolin (*Manis* spp.) and four species of otter. These are all severely threatened by overexploitation and require species-focused conservation interventions (IUCN 2020b). Several, notably tiger, the wild cattle and Asian elephant, remain mostly as small, isolated groups or individuals, and only some of the larger, less encroached blocks of natural habitat support potentially viable populations (e.g., Walston *et al*. 2010).

High mountains in northern Myanmar support mammal species characteristic of the Eastern Himalayas, including red panda (*Ailurus fulgens*), takin (*Budorcas taxicolor*) and red goral (*Naemorhedus baileyi*), which occur nowhere else in the hotspot.

At least one mammal species endemic to the hotspot is already extinct globally, Schomburgk's deer (*Rucervus schomburgki*), which inhabited the lowland plains and swamps of central Thailand, dying out in 1938 (Lekagul and McNeely 1977). Also, there are no recent records of kouprey (*Bos sauveli*), although survey effort has been inadequate to be sure that the species is extinct (Timmins 2011). Javan rhinoceros (*Rhinoceros sondaicus*) recently disappeared from the hotspot (Brook *et al*. 2011) and survives globally only in one location in Java.

Recent taxonomic revisions have recognized several species too poorly known to be categorized on the Red List other than as Data Deficient. Several have very small known ranges and may well be globally threatened, such as the chevrotains ("mousedeer") *Tragulus versicolor* and *T. williamsoni* (Meijaard and Groves 2004) and the leaf monkey *Trachypithecus barbei* (Geissmann *et al*. 2004).

4.4.2 Birds

Eight percent of the bird species occurring in the hotspot are classified as globally threatened: the lowest proportion of any vertebrate class (IUCN 2020b). However, given the very high richness of birds in the hotspot, this still amounts to over 100 species.

Each major ecosystem in Indo-Burma supports a suite of globally threatened bird species; except where stated, the following information about the species is drawn from the species accounts in BirdLife International (2001) and IUCN (2020b). Of these ecosystems, montane forests are the best represented within protected area networks and, generally, under the lowest threat. However, montane forest ecosystems support many restricted-range species, some of which are threatened by habitat loss, for example white-throated wren-babbler (*Rimator pasquieri*), the forest understory habitat of which is being greatly encroached by expansion of cardamom cultivation in the Hoang Lien Mountains of Vietnam. Lowland forest, coastal, freshwater wetland, riverine and grassland ecosystems generally receive less conservation effort than hill and montane forest ecosystems yet are under higher levels of threat. It is these ecosystems that support the greatest numbers of Endangered and Critically Endangered bird species.

The hotspot's most enigmatic bird, and probably its rarest, if still extant, is white-eyed river-martin (*Eurychelidon sirintarae*) known from wetlands in central Thailand. There are no confirmed records since 1978; the species is categorized as Critically Endangered but may well already be extinct. Many floodplain species, particularly larger ones of open habitats, and including endemics to the hotspot like giant ibis and the biggest breeding colony of large waterbirds in the whole of Asia, in the flooded forests of Prek Toal in the northwestern corner of the Great Lake of Tonle Sap (Goes 2005, Campbell *et al*. 2006), are severely threatened. This avian megafauna requires species-focused interventions at the landscape scale (not confined to pristine habitat) to conserve viable populations (e.g., He *et al*. 2007a,b, Gray *et al*. 2009, Pilgrim *et al*. 2009). Perhaps the most threatened large waterbird of the hotspot is white-bellied heron (*Ardea insignis*). Now restricted in the hotspot to northern Myanmar (which probably supports a substantial portion of the global population), conservation of this species is impeded by multiple factors (White-bellied Heron Working Group 2019).

White-winged duck (*Asarcornis scutulata*) and masked finfoot (*Heliopais personata*), of the forest/wetland interface, are extremely depleted and, without targeted action, face inevitable global extinction soon. Even rarer and possibly extinct, is pink-headed duck (*Rhodonessa caryophyllacea*), of which there are no confirmed records from the hotspot since 1910 (Tordoff *et al.* 2008). Tied to large rivers, Indian skimmer (*Rynchops albicollis*) is probably extinct in the hotspot except as an occasional visitor, leading the way for a suite of other river-channel breeders; the next casualty is likely to be black-bellied tern (*Sterna acuticauda*), which has recently disappeared from the Mekong system (Goes *et al*. 2010).

The hotspot's coastal ecosystems are particularly important for several globally threatened migratory waterbirds: black-faced spoonbill (*Platalea minor*), spotted greenshank (*Tringa guttifer*), great knot (*Calidris tenuirostris*), far-eastern curlew (*Numenius madagascarensis*) and the rapidly declining spoon-billed sandpiper (*Calidris pygmeus*) (e.g., Round 2008, Zöckler *et al*. 2010a,b).

Population crashes of vultures in the Indian Subcontinent resulted in the global threat status of the three species resident in the hotspot being revised to Critically Endangered. The hotspot populations of the three species are now of high conservation significance, as the veterinary drugs that caused the precipitous declines in the Indian Subcontinent have never been widely available in Indo-Burma (e.g., Pain *et al*. 2003, 2008, Htin Hla *et al*. 2011).

Among threatened forest passerines, lowland forest specialists, typified by Gurney's pitta (*Hydrornis gurneyi*) are chiefly distributed in the evergreen forests of peninsular Thailand and Myanmar, where the Sundaic biogeographic influence in the hotspot is at its strongest (Hughes *et al*. 2003, Donald *et al*. 2009). Globally threatened montane passerines threatened by habitat loss and fragmentation include collared laughingthrush (*Trochalopteron yersini*) and grey-crowned crocias (*Laniellus langbianis*), endemic to the southern Annamite Mountains of Vietnam, and golden-winged laughingthrush, chestnut-eared laughingthrush and black-crowned barwing endemic to the central Annamite Mountains of Lao PDR and Vietnam. Their extremely restricted ranges compound these threats.

4.4.3 Reptiles

Almost one-fifth of the reptile species in the hotspot are assessed as globally threatened (IUCN 2020b). However, species continue to be discovered at a rapid pace, making meaningful statistics evasive. For example, until 1997, only three species of *Cyrtodactylus* gecko had been recorded for Vietnam, whereas currently 38 species are known from the country (IUCN 2020b); the increase coming mostly from new discoveries rather than taxonomic reassessment (Luu Quang Vinh *et al*. 2011). Similarly, during 2009–2011, six new *Gekko* gecko species were discovered in Vietnam, whereas only eight had previously been found there (Phung My Trung and Ziegler 2011). Some newly described species were first found in trade, and detective-style investigation was required to find wild populations (e.g., southern Vietnam box turtle (*Cuora picturata*); Ly Tri *et al*. 2011).

Some broad patterns in Indo-Burmese reptiles, relevant to conservation, are clear. Montane forest, wet evergreen forest and limestone karst are all richer in restricted-range species than the more seasonal, mostly lower-lying habitats of the hotspot. Limestone karst is particularly prone to hold species with very small geographic ranges, such as *Cyrtodactylus* geckos (e.g., Grismer *et al.* 2018a). Such species are susceptible to relatively localized habitat perturbation, from direct human activity or perhaps climate change. There is also a suite of large-bodied, mostly slowly reproducing species (i.e., turtles, crocodiles, *Varanus* lizards and various big snakes) that are in steep decline through overharvest. Some of these also have restricted ranges but others are widespread in tropical Asia. These large species tend to be better known but conservation efforts for them still lag behind those for many mammals and birds.

Siamese crocodile (*Crocodylus siamensis)*, formerly widespread in the Mekong, Chao Phraya and Mae Klong Basins, is now Critically Endangered and restricted to a few, widely scattered, localities. Although it is abundant in captivity, where it is farmed for its hide, it has been extensively hybridized with other crocodile species, severely limiting the potential of most captive populations for reintroduction programs. Escapes from captivity occur, and the few remnant wild populations require careful management to ensure genetic purity (van Dijk *et al*. 1999, FitzSimmons *et al*. 2002).

The hotspot supports the richest non-marine turtle fauna in the world. In 1999, a re-evaluation of the global threat status of Asia's turtles concluded that 75 percent were globally threatened, with more than 50 percent meeting the criteria for Endangered or Critically Endangered. The distributions and habitat requirements of most species in Indo-Burma remain imperfectly understood, in part because many recent records stem from wildlife markets (van Dijk *et al*. 2000, Stuart *et al*. 2001, Stuart and Platt 2004, Turtle Conservation Coalition 2011). Overexploitation to supply the wildlife trade is clearly the major factor driving the decline of most turtle species in the hotspot, with some species fetching thousands of US dollars for a single animal. The naturally slow reproductive rates of many turtle species mean that wild populations cannot sustain exploitation on this scale. Conservation action is urgently needed to prevent a wave of extinctions among the hotspot's turtles (Turtle Conservation Coalition 2011).

Reptiles make up a significant proportion of traded wildlife entering China from Southeast Asia, and a number of snake and lizard species with a high value in trade qualify as globally threatened, for instance Burmese python (*Python bivittatus*). Also of concern are species with highly restricted ranges, such as Chinese crocodile lizard (*Shinisaurus crocodilurus*), a large lizard known only from a few sites in southern China and northern Vietnam, and which is threatened by over-collection for the pet trade. The conservation of most globally threatened reptile species requires strategic, coordinated regional and global initiatives to combat the over-riding threat to their populations: overexploitation for trade.

4.4.4 Amphibians

Most of the hotspot's amphibian species have been described only in the last 30 years. For example, 31 percent of amphibian species known from Vietnam, Lao PDR and Cambodia in 2005 had been described since 1997 (Bain *et al*. 2007). This indicates that many more remain to be described. Collecting has been uneven over the hotspot but, as with reptiles, and perhaps even more so, permanently humid areas (montane forest, wet evergreen forest and certain microhabitats within limestone karst) support concentrations of restricted-range species, whereas non-forest habitats and forests with a harsh dry season hold fewer such species. Many of the amphibians occurring in the hotspot occur nowhere else in the world (Stuart *et al*. 2008, IUCN 2020b).

In the 1996 IUCN Red List of Threatened Animals (IUCN 1996), only a single amphibian species in Indo-Burma was assessed as globally threatened. Following the Global Amphibian Assessment (IUCN-SSC and CI-CABS 2003; final presentation in Stuart *et al*. 2008) and subsequent Red Listing work, the group has now been comprehensively assessed. Of the more than 380 amphibian species currently known from the hotspot, one-quarter are listed as globally threatened and a further one-fifth are listed as Data Deficient (IUCN 2020b). Many amphibian species are considered highly threatened by habitat loss due to their highly restricted ranges, such as the Endangered Hoang Lien moustached toad (*Leptobrachium echinatum*) known only from the Hoang Lien Mountains of Vietnam. Other species with highly restricted ranges include Hainan knobby newt (*Tylototriton hainanensis*), Hainan stream frog (*Buergeria oxycephala*), Hainan torrent frog (*Amolops hainanensis*) (all three of which are restricted to forested streams on Hainan Island), Yunnan Asian frog (*Nanorana unculuanus*), endemic to Yunnan, Laos warty newt (*Laotriton laoensis*), endemic at the genus level to a small part of Lao PDR's northern highlands, Vietnamese knobby newt (*Tylototriton vietnamensis*), endemic to northern Vietnam, and Guangxi warty newt (*Paramesotriton guangxiensis*), endemic to southern China. Threat levels to all the hotspot's salamanders are of rapidly increasing concern (Rowley *et al*. 2010). Several large-bodied stream frogs, such as Yunnan spiny frog (*Nanorana yunnanensis*), are assessed as Endangered because they are harvested in vast quantities for food. As well as new discoveries, improved taxonomic knowledge reveals localized taxa hitherto included in widespread 'species' that should be treated as full species (e.g., Stuart *et al*. 2006, Weisrock *et al*. 2006); some are likely to qualify as being globally threatened.

While the need for conservation action for Southeast Asian amphibians is becoming increasingly apparent (Rowley *et al*. 2010), information is often insufficient to allow specific action to be taken. Even the most obvious action, habitat protection, is hampered by a lack of information on distribution of key sites for most species. The most pervasive threats affecting the hotspot's amphibians (including even some presently considered common) may comprise: habitat loss for highly restricted-range species; localized declines of some common species due to over-collection (mostly for food); pollution (a potential risk to hyperendemic species) possibly the fungal disease chytridiomycosis (Woodhams *et al*. 2011) or the inadvertent introduction of amphibian viruses through farmed frogs; and, in the long term, climate change.

4.4.5 Freshwater Fish

Since the last update of the ecosystem profile, in 2011, there has been a significant increase in the number of fish species assessed as globally threatened, thanks in part to a major Red List assessment of freshwater taxa led by IUCN with support from CEPF (Allen *et al.* 2012). Nine percent of the fish species found in the hotspot are assessed as globally threatened (IUCN 2020b), although this might be an underestimate of the proportion of species threatened with extinction, given that a further 39 percent are assessed as Data Deficient.

Mekong giant catfish (*Pangasianodon gigas*) is perhaps the best-known globally threatened fish in Indo-Burma. Despite being abundant in the Mekong River a century ago, and being legally protected for several decades, the species is at risk of extinction due to overharvesting, habitat loss and pollution (Baltzer *et al*. 2001; WWF 2010). Mekong giant catfish is, however, just one of a suite of giant freshwater fish threatened by overexploitation and infrastructure developments that may disrupt their migratory patterns (WWF 2010). Other globally threatened giant freshwater fish in the hotspot include giant freshwater stingray (*Urogymnus polylepis*), giant dog-eating catfish (*Pangasius sanitwongsei*), giant carp (*Catlocarpio siamensis*) and Jullien's golden carp (*Probarbus jullieni*). Most of these large species are migratory, and require the maintenance of little-changed, large-scale aquatic systems. Long-distance migrations are also made by many smaller-bodied species; and many such species are endemic to a single catchment, making them particularly vulnerable to dams, which may obstruct their migrations.

Many fish species, particularly those of lowland waterbodies and watercourses, have populations that are very depleted and fragmented from intensive agriculture, pollution and problems of urbanization, notably channelization (Dudgeon 2000a,b). Hill and mountain fishes, including many species with very small ranges endemic to rapids in such streams, are threatened by dam construction (which often obliterates the precise stretches of rapid to which the species are hyperendemic) and destructive fishing practices, such as electrofishing, poisoning and dynamiting (Roberts 1995, KFBG 2002, Chen 2003, Dugan *et al*. 2010). Invasive non-native species threaten some fish species, such as the suite of fishes endemic to Myanmar's Inle Lake. Smaller-bodied, less commercially valuable species, especially those occurring outside the Mekong mainstream, also include many species at high risk of extinction.

4.4.6 Invertebrates

In the absence of comprehensive global threat assessments of invertebrates occurring in Indo-Burma, it is difficult to identify taxonomic priorities for global invertebrate conservation in the hotspot. Considerable progress has been made with some groups (notably, dragonflies and various aquatic molluscs) thanks to the freshwater Red List assessment led by IUCN (Allen *et al.* 2012) but some other groups likely to contain species under rapid decline have not yet been assessed. These include large specimen beetles, which attract high prices in the pet and specimen trades in countries such as Japan (New 2005, 2010). Nor has any assessment been made of dung beetles or other coprophagous invertebrates, which are dependent on large mammals for adult and larval food resources and could therefore be affected by population collapses of large herbivores (Nichols *et al.* 2009). For the majority of invertebrate groups, however, habitat degradation and loss is likely to represent the major threat. For instance, a study of carabid beetles in southern Yunnan province shed light on the negative impacts of expansion of rubber plantations on native forest assemblages, with the strongest effects being felt by forest specialists and rare species (Meng *et al.* 2011).

Even broad patterns of richness, endemism and threat remain unclear among invertebrates. It has sometimes been assumed that the richest forest communities are in the evergreen lowlands. However, a study of crane flies at protected areas across Thailand found a correlation between diversity and landscape topology, with mountainous areas in the north supporting the highest species richness (Petersen and Courtney 2010). Regarding endemism, it is assumed that restricted-range species are particularly prevalent in montane habitats and, especially, limestone karst formations, and that species adapted to year-round humidity are more sensitive to habitat perturbation than those of areas with a harsh dry season. None of these patterns is well supported by basic data, however, with the exception of the high richness of endemic species in limestone karst (Clements *et al.* 2006), which is one of the top priorities for invertebrate conservation in the hotspot. This is particularly the case for endemism in land snails, which peaks on karst because of their low dispersal capabilities and isolation effects, both of which facilitate speciation (Schilthuizen *et al.* 1999).

There can be no quick solution to filling this enormous information gap for invertebrates. In the inevitably very long interim, the best strategy for invertebrate conservation in the region is probably based around ensuring the conservation of little-degraded blocks of at least 10,000 hectares and preferably much more, of all identifiable habitat types, represented across the region. This needs to be supplemented with targeted conservation actions for smaller limestone karst formations threatened in their entirety by quarrying, as well as species-specific action in the relatively limited number of cases where overharvesting may be a threat. There is little solid information available even on this, however, either on trade volumes or on effects on source populations.

4.4.7 Plants

There are 589 globally threatened plant species in Indo-Burma (IUCN 2020b), comprising 45 percent of the hotspot's globally threatened species (Table 1). However, this figure probably represents only a fraction of the plant species in the hotspot that would meet the Red List criteria for globally threatened categories should they be assessed, because comprehensive global threat assessments have only been conducted for certain groups. Gymnosperms are generally better assessed than angiosperms. Within angiosperms, tree species (in particular, commercially valuable timber species) are generally better assessed than other groups.

One family of angiosperms with a large number of globally threatened species in the hotspot is the orchids (Orchidaceae), with over 50. These include 33 species of slipper-orchid (*Paphiopedilum* spp.), which have very restricted known distributions and are targeted by collectors for the horticultural trade. This, combined with destruction of their primary forest habitat, places some species in the genus at an imminent risk of extinction. Meanwhile, the illegal collection of plants for the medicinal plants trade continues to place unsustainable pressure on wild populations of orchids, including *Dendrobium* spp., especially in northern Myanmar, northern Laos and southern China. Although generally more widespread than *Paphiopedilum* species, the collection pressure is so extreme that local extirpations have already been witnessed. Comprehensive global threat assessments are a priority for these groups, and for pteridophytes and non-vascular plants (S. Gale *in litt*. 2012).

Of the plant species already assessed as globally threatened, many are high-value timber species threatened by overexploitation. The family with the highest number of globally threatened species is the Dipterocarpaceae, which includes four threatened species of *Anisoptera*, 14 of *Dipterocarpus*, 18 of *Hopea*, three of *Parashorea*, 17 of *Shorea,* and nine of *Vatica*. Other globally threatened plant species in the hotspot include seven species of *Aquilaria*, which are threatened by overexploitation of agarwood, an aromatic non-timber forest product formed when *Aquilaria* trees are infected by one or more specific fungi.

5. CONSERVATION OUTCOMES DEFINED FOR THE HOTSPOT

Biological diversity cannot be saved by *ad hoc* actions (Pressey 1994). In order to support the delivery of coordinated conservation action, CEPF invests effort in defining conservation outcomes: the quantifiable set of species, sites, and corridors that must be conserved to maximize the long-term persistence of global biodiversity. By presenting quantitative and justifiable targets against which the success of investments can be measured, conservation outcomes allow the limited resources available for conservation to be targeted more effectively, and their impacts to be monitored at the global scale. Therefore, conservation outcomes form the basis for identifying biological priorities for CEPF investment in Indo-Burma.

Biodiversity cannot be measured in any single unit because it is distributed across a hierarchical continuum of ecological scales (Wilson 1992). This continuum can be condensed into three levels: species; sites; and corridors (inter-connected landscapes of sites). These three levels interlock geographically, through the occurrence of species at sites and of species and sites in corridors but are nonetheless identifiable. Given threats to biodiversity at each of the three levels, quantifiable targets for conservation can be set in terms of extinctions avoided (species outcomes), areas protected (site outcomes) and corridors created (corridor outcomes).

Conservation outcomes are defined sequentially, with species outcomes defined first, then site outcomes and, finally, corridor outcomes. Since species outcomes are extinctions avoided at the global level, they relate to globally threatened species (in the IUCN categories Critically Endangered, Endangered and Vulnerable). This definition excludes species categorized as Data Deficient, which are considered to be priorities for further research, because any might be globally threatened, but not yet to be priorities for conservation action *per se*, because many will not be globally threatened. Also excluded are species threatened locally but not globally, which may be national or regional conservation priorities but are not high global priorities. Species outcomes are met when a species' global threat status improves, particularly when it is categorized on the Red List as Least Concern.

Because of CEPF's focus on global biodiversity hotspots, the process to set conservation targets is based on global standards. The principal basis for defining species outcomes for this document is the global threat assessments contained within the IUCN Red List as of 1 June 2020 (IUCN 2020b). Thanks to a considerable amount of Red Listing activity over the last decade, these assessments are close to comprehensive for all classes of vertebrate, and extensive for some invertebrate and plant taxa; they are also variably current. For 44 percent of species, the most recent assessment was conducted within the last five years (2016-2020). For a further 31 percent of species, the most recent assessment was conducted five to 10 years ago (2011-2020); meaning that three-quarters of species have been either re-assessed or newly assessed since the last update of the ecosystem profile in 2011. Regarding species with older assessments, 11 percent had their most recent assessment between 2006 and 2010, and 2 percent between 2001 and 2005. Only 12 percent of species had their most recent assessment more than 20 years ago; most of these species are plants, and these assessments can be considered significantly out of date, given the rapid changes to environmental conditions that have taken place in the intervening period.

Many species are best conserved through the protection of a network of sites at which they occur, so the next stage is to define a set of Key Biodiversity Areas (KBAs): sites that contribute significantly to the global persistence of biodiversity. KBAs are identified for individual elements of biodiversity, such as globally threatened species or ecosystems. Multiple approaches have been used by conservation organizations to identify such sites. These were consolidated into a single methodology by the IUCN Species Survival Commission and IUCN World Commission on Protected Areas in association with the IUCN Global Species Programme, resulting in the *Global Standard for the Identification of Key Biodiversity Areas* (IUCN 2016). The KBA Standard includes a total of five criteria and 11 sub-criteria under which a site can be identified as a KBA:

- Criterion A: Threatened biodiversity.
- Criterion B: Geographically restricted biodiversity.
- Criterion C: Ecological integrity.
- Criterion D: Biological processes.
- Criterion E: Irreplaceability through quantitative analysis.

The site outcomes in the Indo-Burma Hotspot were (with some exceptions, see Section 5.2) identified prior to the adoption of the new KBA Standard. Most of them were identified in 2003, using an earlier KBA methodology, which was subsequently published by IUCN as part of its Best Practice Protected Area Guidelines Series (Langhammer *et al.* 2007). This methodology depended heavily on the importance of sites for globally threatened species (Criteria A1a-e in the new standard), individually geographically restricted species (Criterion B1 in the new standard), and demographic aggregations (Criterion D1 in the new standard), with the latter two criteria being applied in Indo-Burma for birds only.

Significant additional work is required to update the KBA analysis for the Indo-Burma Hotspot to meet the KBA Standard. In particular, the thresholds and documentation standards of the KBA Standard are more stringent than those used in 2003, and there are additional steps of expert review and confirmation by the KBA Secretariat. In addition, global threat assessments are available for hundreds of additional species, while, as discussed above, most of the species assessed as globally threatened in 2003 have since been reassessed. Furthermore, the adoption of new criteria, for example Criterion A2 on threatened ecosystem types, creates opportunities for KBA identification at sites important for elements of biodiversity other than globally threatened species. Due to time and resource constraints, plus the restrictions on international travel and in-person meetings due to the COVID-19 pandemic, it was not possible to update the KBA analysis as part of the update of the ecosystem profile. Thus, while all of the site outcomes in the Indo-Burma Hotspot qualify as KBAs, the global/regional status of each awaits confirmation.

The most important criterion used to identify KBAs in the Indo-Burma Hotspot was the regular occurrence of significant numbers of one or more globally threatened species. The major challenge was to determine whether a given threatened species recorded at a given site was likely to occur both regularly and in numbers significant to its conservation prospects. In most cases, in the absence of detailed data on population size and minimum area requirements, it was necessary to make a provisional assessment, based on a necessarily somewhat speculative consideration of the ecological requirements, density and home-range size of the species in question (parameters that are often themselves poorly understood, or for some species, entirely unknown), the availability of suitable habitat at the site, and the number of records relative to the appropriate survey effort expended there.

In addition to the occurrence of globally threatened species, KBAs were also defined based on the occurrence of restricted-range species and congregations (i.e. demographic aggregations). Sites regularly supporting significant populations of restricted-range species are global conservation priorities, because there are few or no other sites in the world for which conservation action for these species can be taken. This criterion was used to define KBAs only for birds, because this was the only group for which the concept of restricted-range species had been quantified: species with a global breeding range of less than 50,000 square kilometers (Stattersfield *et al.* 1998). Sites supporting a high proportion of the total population of one or more congregatory species at a particular time of year (e.g., breeding; wintering; post-breeding moulting; staging sites for migratory waterbirds) are conservation priorities because these species are particularly susceptible to threats at these sites. Again, this criterion was only used to define KBAs for birds, as these were the only group with comprehensive population estimates for congregatory species (Wetlands International 2002); a threshold of 1 percent of the Asian biogeographic population was used.

Site outcomes are met when a KBA is protected, through improved management or expansion of an existing conservation area, or creation of an effective new conservation area. Improved management of an existing conservation area will involve changing management practices for a KBA in order to improve the long-term conservation of species' populations and the ecosystem as a whole. Expansion of an existing conservation area will involve increasing the proportion of a KBA under conservation management to meet species' area requirements or include other previously excluded species or habitats. Creation of an effective new conservation area will involve designating all or part of a KBA as a conservation area, and initiating effective long-term management. Conservation areas are not limited to actual or potential protected areas but also include what has been defined as Other Effective Area-based Conservation Measures (OECMs, Jonas *et al.* 2014), which includes sites that are managed for conservation by local communities, private landowners or other stakeholders.

The starting point for defining KBAs in Indo-Burma was the Important Bird Area networks in each country, identified by BirdLife International and collaborating organizations (Tordoff 2002, Ounekham and Inthapatha 2003, Seng Kim Hout *et al.* 2003, BCST 2004, Chan *et al*. 2004, preparatory work for BirdLife International 2009). As the IBA networks included most key sites for the conservation of globally threatened, restricted-range and congregatory bird species, it was only necessary to supplement them through the definition of additional KBAs for other taxonomic groups. This was done through consultation with surveyors, biologists and others with information on recent wildlife status in each country, complemented by literature review.

While the protection of a network of sites would probably be sufficient to conserve most elements of biodiversity in the medium term, the long-term conservation of all elements of biodiversity requires the protection of inter-connected landscapes of sites, or conservation corridors. This is particularly important for the conservation of broad-scale ecological and evolutionary processes (Schwartz 1999), and also for the conservation of species with wide home ranges, low natural densities, migratory behavior or other characteristics that make them unlikely to be conserved by site-based interventions alone. Such species can be termed "landscape species" (Sanderson *et al.* 2001). In addition, conservation corridors can support the integration of habitat management consistent with conservation objectives (ranging from strict protection to sustainable use) into local, regional, and national land-use planning processes. Consequently, corridor outcomes are defined (based on conservation corridors), in addition to site and species outcomes.

Corridor outcomes are met when a conservation corridor maintains little-changed biotic assemblages and natural processes. Maintaining little-changed biotic assemblages requires the maintenance of little-changed ecological communities, a prerequisite for which is the conservation of landscape species. Maintaining natural processes involves achieving the long-term sustainability of little-changed ecological and evolutionary processes that are species-driven and essential for the long-term viability of natural ecosystems.

In order to allow the persistence of biodiversity, inter-connected landscapes of sites must be anchored on core areas, embedded in a matrix of natural and/or anthropogenic habitats (Soulé and Terborgh 1999). Therefore, conservation corridors are anchored on KBAs (core areas), with the rest of the conservation corridor comprising either areas that have the potential to become KBAs in their own right (through management or restoration) or areas that contribute to the ability of the conservation corridor to support all elements of biodiversity in the long term.

Therefore, KBAs were the starting point for defining conservation corridors. First, conservation corridors were defined wherever it is considered necessary that connectivity be maintained between two or more KBAs in order to meet the long-term conservation needs of landscape species. Then, additional conservation corridors were defined wherever it was considered necessary to increase the area of actual or potential natural habitat in order to maintain evolutionary and ecological processes. In the latter case, the definition of conservation corridors was largely subjective, due to limitations of time, paucity of relevant data, and absence of detailed criteria. Given these limitations, emphasis was placed on maintaining continuums of natural habitat across environmental gradients, particularly altitudinal gradients, in order to maintain such ecological processes as seasonal altitudinal migration and to provide a safeguard against the potential impacts of climate change.

Conservation corridors were defined through consultation with local experts, complemented by analysis of spatial data on land cover, elevation and human population distribution, and consideration of the results of previous landscape-scale conservation planning exercises. In Indo-Burma, the key sources of information for defining conservation corridors were (1) the results of an ecoregion-based conservation assessment covering most of Cambodia, Lao PDR and Vietnam and convened by WWF (Baltzer *et al.* 2001), (2) an analysis of forest complexes in Thailand conducted by the Royal Forest Department (1999), and (3) an overview for southern China provided by J. Fellowes (pers. comm.) resulting from a series of discussions with relevant specialists. Corridors for the remainder of the hotspot (i.e. Myanmar, northern Lao PDR and northern Vietnam) were defined during stakeholder consultation workshops held in 2003 and 2004, during the preparation of the original ecosystem profile. Because natural habitats are more fragmented in Indo-Burma than in many other hotspots, the average conservation corridor size was relatively small. One consequence of this was that a relatively large number of conservation corridors were defined, with the benefit that CEPF funding could be more precisely targeted geographically.

In theory, within any given region, or, ultimately, for the whole world, conservation outcomes can and should be defined for all taxonomic groups. However, this requires data on the global threat status of each species, and on the distribution of globally threatened species among sites and across corridors. Many of these data were incomplete or lacking when the conservation outcomes for the Indo-Burma Hotspot were originally identified in 2003-2004. Over the following years, global threat assessments have been completed for all vertebrates, as well as some plant and invertebrate taxa (although many gaps remain in these groups), while surveys have generated additional data on the distribution and status of many species, allowing the identification of new KBAs, especially in the freshwater realm. Ultimately, the definition of conservation outcomes is an adaptive process: as more data are generated, additional conservation outcomes can be defined.

5.1 Species Outcomes

The 2011 ecosystem profile listed 754 species outcomes in the Indo-Burma Hotspot. Based on the IUCN Red List (IUCN 2020b), there are now 1,298 globally threatened species that occur (or occurred until recently) in the Indo-Burma Hotspot (Table 1 and Appendix 1). Fifty-three species outcomes from the 2011 ecosystem profile are no longer assessed as globally threatened. In most cases, this is because new information on the status of the species has led to a reassessment of its global threat status from globally threatened to a lower threat category. For example, the newly described kha-nyou was assessed as Endangered in 2008 but this assessment was "downlisted" to Least Concern in 2016, based on an improved understanding of the species' range and the threats facing it. In no case has a species found in the hotspot formerly assessed as globally threatened been downlisted due to an actual improvement in its conservation status, which is a sobering fact. More worryingly, since 2011, 597 species have been added to the list of species outcomes, comprising species assessed for the first time, and species that were previously assessed as either non-threatened (a grouping that includes the category Near Threatened) or Data Deficient.

This net change of 544 species represents a net increase of 72 percent over nine years. The magnitude of the increase varies among taxonomic groups, with the number of globally threatened mammals and birds (groups for which comprehensive threat assessments were available in 2011) increasing by only 10 and 27 percent, respectively, while the number of globally threatened plants, amphibians and invertebrates roughly doubled over the same period (increases of 91, 104 and 124 percent, respectively). The biggest increases were seen among reptiles and fishes, for which comprehensive Red List assessments were completed in the interim period. The number of globally threatened species in these groups increased by 164 and 344 percent, respectively.

Changes in knowledge, taxonomy and species' status notwithstanding, the list of species outcomes in the Indo-Burma Hotspot can be considered largely complete for vertebrates. Major gaps remain, however, with regard to plants and, in particular, invertebrates. Certain invertebrate groups, for instance those containing many cave-dwelling taxa, are characterized by high levels of endemism and of threat, and, although there have been great increases in knowledge on such species (Deharveng 2002), many narrowly endemic species remain not evaluated on the Red List. This is a particular problem in the case of limestone karst ecosystems, where loss of comparatively tiny areas of habitat due to limestone quarrying for cement manufacture can result in global species extinctions.

Table 1. Summary of Globally Threatened Species in the Indo-Burma Hotspot

Taxonomic Group	Global Threat Status				Distribution by Country					
	Critically Endangered	Endangered	Vulnerable	Total	Cambodia	China	Lao PDR	Myanmar	Thailand	Vietnam
Mammals	18	37	42	**97**	38	50	48	47	58	58
Birds	18	32	58	**108**	35	59	32	63	70	56
Reptiles	28	42	54	**124**	24	36	30	34	38	75
Amphibians	3	42	53	**98**	11	41	17	9	8	52
Fish	25	43	66	**134**	30	27	60	21	61	38
Invertebrates	19	41	88	**148**	6	26	25	9	44	60
Plants	116	234	239	**589**	48	253	69	90	189	269
Total	**227**	**471**	**600**	**1,298**	**192**	**492**	**281**	**273**	**468**	**608**

Of the 1,298 globally threatened species in Indo-Burma: 608 (47 percent) occur in Vietnam, including 263 that are not found elsewhere in the hotspot; 492 (38 percent) occur in China, including 225 that are not found elsewhere in the hotspot; 468 (36 percent) occur in Thailand, including 207 that are not found elsewhere in the hotspot; 281 (22 percent) occur in Lao PDR, including 55 that are not found elsewhere in the hotspot; 273 (21 percent) occur in Myanmar, including 67 that are not found elsewhere in the hotspot; and 192 (15 percent) occur in Cambodia, including eight that are not found elsewhere in the hotspot. Vietnam supports the most globally threatened species and the most globally threatened species not found elsewhere in the hotspot. Vietnam's importance for the conservation of globally threatened species is emphasized even more when one considers that many of the species found "only" in China, Myanmar and Thailand are also found outside the hotspot boundaries, in neighboring parts of China, India and/or Malaysia. Although Cambodia supports the fewest globally threatened species and has very few species found only within its borders, it is, nevertheless, a high priority for species conservation. This is because, for many species, Cambodia supports the populations with the greatest potential to be viable in the long term.

Indo-Burma is on the frontlines of the species extinction crisis currently facing the planet, with 227 Critically Endangered, 471 Endangered and 600 Vulnerable species. Critically Endangered species are, by definition those most at risk of imminent extinction and, when other factors are accounted for, warrant greater per-species attention than the species in the lower threat categories of Endangered and Vulnerable.

The 18 Critically Endangered mammal species in the region comprise nine primate species (four *Nomascus* gibbons and five colobine leaf-eating monkeys: Delacour's leaf monkey, white-headed leaf monkey, grey-shanked douc, Tonkin snub-nosed monkey and Myanmar snub-nosed monkey), five ungulates, two pangolins and two bats. Seven of the nine primates have naturally small ranges: six in the densely settled regions of Vietnam and southeastern China; and one in the more sparsely populated highlands of northern Myanmar. The other two primates have wider ranges (both in some combination of China, Lao PDR and Vietnam), but even so have suffered massive hunting-driven reductions. They include one of the 25 species chosen to illustrate the variety among the most threatened primates of the world (a second species on this list, skywalker hoolock, is currently assessed as Endangered; Schwitzer *et al.* 2019). The primate list is large partly as a result of recent research indicating the merits of increasingly narrow species limits. For example, the four Critically Endangered gibbons were once considered conspecific, forming a single species (*Nomascus* [then considered a subgenus of *Hylobates*] *concolor*), together with other taxa still today a good deal less threatened, while two of the colobines were considered one species (*Trachypithecus francoisi*), again combined with other, less threatened, taxa.

The same cannot be said of the five ungulates, which include two species in monospecific genera, i.e. with no close living relatives anywhere in the world. The five comprise: two rhinoceroses with formerly huge ranges (but now believed to be restricted to Indonesia); kouprey, which occurred rather widely in the deciduous landscapes of southern Indochina; and large-antlered muntjac and saola, two species with a narrow range in the humid evergreen forests of the Annamite Mountains. There are only a handful of credible post-2000 records of saola, the rhinoceroses' continued occurrence within the region is unconfirmed, and the situation is even worse with kouprey, which may be globally extinct not having been recorded reliably for several decades. Large-antlered muntjac is the only one of the five species to have a confirmed viable population in the hotspot.

The two pangolins have both undergone massive declines in the hotspot and throughout their global ranges. Throughout the last decade, demand for pangolins and their parts from consumers in East and Southeast Asia has skyrocketed, to the point that they have become the world's most trafficked mammal species (Aisher 2016). There are initial signs that demand for pangolins has dropped following reports linking the species to the origin of the COVID-19 (e.g., Cyranoski 2020). However, this may come too late for pangolin populations in the hotspot, to which, despite a concerted response by conservation and animal welfare organizations, the damage has already been done.

The final two Critically Endangered mammal species are both bat species found in Thailand's Hala Bala Wildlife Sanctuary. Both have extremely small known ranges and are threatened by habitat loss due to agricultural expansion. Hala Bala is located at the extreme southern boundary of the Indo-Burma Hotspot, adjacent to Malaysia, where it is possible that additional populations of both species may be found. This has not been demonstrated, despite a series of intensive surveys over 15 years (Soisook 2017).

Perhaps surprisingly, the list of Critically Endangered mammals includes no carnivores, a group often considered to have heightened extinction risk. Carnivore numbers have been severely reduced in parts of the hotspot (Lau *et al.* 2010) and without effective action these declines are likely to be replicated over the remainder. Yet the pattern of extinctions to date in the hotspots demonstrates that it is the ungulates, not their predators, that are disappearing first.

The 18 Critically Endangered bird species in Indo-Burma include five large ground-dwelling birds associated with wetlands of various forms: giant ibis and white-shouldered ibis (*Pseudibis davisoni*), the former being endemic to the region and the latter being only otherwise known from a small population on Borneo; pink-headed duck and white-bellied heron, of northeastern India and adjacent countries, including Myanmar in the hotspot; and Bengal florican (*Houbaropsis bengalensis*), which has two disjunct populations, one in Cambodia, and the other in the Himalayan foothills. Two other ground-dwelling birds have been reassessed as Critically Endangered since the 2011 ecosystem profile: Gurney's pitta; and Edwards's pheasant (*Lophura edwardsi*). They are threatened by degradation and loss of their lowland evergreen forest habitats and, at least in the latter case, by snaring.

The Critically Endangered birds include three species of vulture, the hotspot populations of which are of increasing significance as they are not affected by the drug-induced precipitous declines undergone by the Indian Subcontinent populations over the last 30 years (Pain *et al.* 2003, Oaks *et al*. 2004, Cuthbert *et al*. 2006). They also include three species highly threatened by over-exploitation: yellow-breasted bunting (*Emberiza aureola*), which is threatened by trapping for food; straw-headed bulbul (*Pycnonotus zeylanicus*), which is trapped for the caged bird trade; and helmeted hornbill (*Rhinoplax vigil*), which is killed for its casques, used for carving. For all three species, the majority of their remaining population is found outside the hotspot (all of it, in the case of straw-headed bulbul).

The Critically Endangered birds also include four species of seabird and waterbird that breed outside the hotspot: spoon-billed sandpiper, for which the hotspot's estuaries support the majority of its fast-decreasing population during the winter; Baer's pochard (*Aythya baeri*), which occurs as a very rare non-breeding visitor to inland and coastal wetlands; Christmas Island frigatebird (*Fregata andrewsi*), which occurs in significant numbers as a non-breeding visitor to shallow seas in the region, chiefly off the west coast of peninsular Thailand; and Chinese crested tern (*Thalasseus bernsteini*), which occurs only as a vagrant. Finally, the list of Critically Endangered birds includes white-eyed river-martin, one of the most enigmatic bird species in the world, of which there are no confirmed records since the 1970s (BirdLife International 2016).

The 28 Critically Endangered reptile species comprise 18 species of turtle, eight geckos, Hong Kong blind snake (*Indotyphlops lazelli*; a species known only from two specimens, which has not been rediscovered despite intensive efforts) and Siamese crocodile (the only inland crocodilian extant in the hotspot). That so many species of turtle in the region are assessed as globally Critically Endangered is a strong indication of the extreme levels of threat faced by turtles as a group, particularly from overexploitation (Turtle Conservation Coalition 2011). Although, between them, these species occur almost throughout the hotspot (or did, before their recent major reductions), they are concentrated in Vietnam (10 species) and adjacent southern China (eight species). This probably reflects the fact that this part of the hotspot has many species with small distribution ranges, combined with the very heavy harvesting pressure that has been going on longer here (as a result, in part, of the area's proximity to the main markets in China); some of the species with comparably small ranges elsewhere in the hotspot are not yet categorized as Critically Endangered.

The eight Critically Endangered gecko species were all assessed (and, in some cases, described) since the 2011 update of the ecosystem profile. These species all have highly restricted ranges in limestone karst formations in Lao PDR, Thailand and Vietnam, where they are highly susceptible to habitat loss, especially due to limestone quarrying. The list of globally threatened geckos is anticipated to increase in future Red List updates, as surveys of limestone karst lead to the discovery of new species, for example in Myanmar (Grismer *et al.* 2020).

In the 2011 ecosystem profile, no amphibian species in Indo-Burma was listed as Critically Endangered. Over the intervening period, three species have been assessed as Critically Endangered: Botsford's leaf-litter toad (*Leptobrachella botsfordi*) and Sterling's toothed toad (*Oreolalax sterlingae*), which are known only from the Hoang Lien mountains in Vietnam; and Bokor Horned Toad (*Megophrys damrei*), which is known only from Cambodia's Bokor plateau. All three species have highly restricted ranges and are, thus, susceptible to habitat loss and degradation, including pollution.

There are 25 fish species that are listed as Critically Endangered. Some of these are large and/or slow-breeding long-distance migrant species, heavily depleted by overfishing, and for which the construction of dams on large rivers are likely to inhibit or entirely prevent migration between spawning, feeding and nursery areas. Examples include Mekong giant salmon carp (*Aaptosyax grypus*), Mekong giant catfish and Jullien's golden carp. Others are a varied mix of single-location species facing a several threats, restricted-range migrants threatened by specific dams, and species highly sought in the aquarium trade. Many of these species are priorities for research to better understand their current status. For example, Nam Leuk loach (*Schistura leukensis*), which has not been recorded since a hydropower dam was built upstream of its only known locality (Kottelat 2011c).

Nineteen invertebrate species in Indo-Burma are currently listed as Critically Endangered: an increase of 10 over the number in the 2011 ecosystem profile. They comprise seven bivalves (Unionoida), five snails (Architaenioglossa, Littorinimorpha and Stylommatophora), three dragonflies (Odonata), two springtails (Collembola), one shrimp (Decapoda) and one millipede (Stemmiulida). This list is likely to be a considerable under-estimate of the true number of invertebrates at the highest risk of global extinction, considering current rates of habitat loss in the hotspot and the proportion of species with extremely restricted ranges, especially in limestone karst ecosystems.

Finally, 116 Critically Endangered plant species are known to occur in Indo-Burma, which is a significant increase on the 69 species in the 2011 ecosystem profile. A number of plant genera and families have been reassessed or assessed for the first time in the intervening period. In some cases, this has led to species being downlisted, as their threat status has been reassessed using more recent global threat categories and criteria. The most notable example is within the family Dipterocarpaceae, where the number of Critically Endangered species has reduced from 33 to seven. In other cases, (re)assessments have revealed families and genera with high concentrations of Critically Endangered species. The genera with the greatest number of Critically Endangered species are: *Camellia* (19 species), a genus of small trees and bushes that includes many species with highly restricted ranges in the mountains of northern Vietnam and southern China; *Paphiopedilum* (14 species), a genus of slipper-orchids with many highly restricted range species in northern Myanmar, Vietnam and southern China, especially in limestone karst ecosystems, which are threatened by over-exploitation and habitat loss; *Magnolia* (six species), a genus of tree species with many representatives in northern Vietnam and southern China, which are threatened by habitat loss and over-exploitation; and *Cycas* (five species), a genus of cycad found throughout the hotspot, which are slow-growing plants widely poached for the horticulture trade.

5.2 Site Outcomes

A total of 555 KBAs have been identified in Indo-Burma, covering a combined area of approximately 390,000 square kilometers or 16 percent of the total area of the hotspot (Appendix 2 and Figures 7 to 12). Of these, 274 sites (49 percent of the total) were defined for globally threatened mammals, 322 (58 percent) were defined for globally threatened, geographically restricted or congregatory birds, 215 (39 percent) were defined for globally threatened reptiles, 41 (seven percent) were defined for globally threatened amphibians, 39 (seven percent) were defined for globally threatened fishes, 25 (five percent) were defined for globally threatened or geographically restricted invertebrates, and 203 (37 percent) were defined for globally threatened plants (Table 2). The figures add to well over 100 percent because most KBAs are triggered by species from more than one taxonomic group.

The number of KBAs defined for globally threatened plant and invertebrate species would undoubtedly be considerably higher if more detailed information was available on the distribution of plant and invertebrate species at the site level, and if comprehensive Red List assessments reflecting global conservation priorities within these groups were conducted.

Table 2. Summary of Key Biodiversity Areas in the Indo-Burma Hotspot

Taxonomic Group	Cambodia	China	Lao PDR	Myanmar	Thailand	Vietnam	Total
Mammals	21	25	32	59	59	78	**274**
Birds	39	55	24	82	63	59	**322**
Reptiles	24	18	20	100	32	21	**215**
Amphibians	2	20	1	0	5	13	**41**
Fish	8	2	13	2	9	5	**39**
Invertebrates	1	0	2	16	3	3	**25**
Plants	8	48	8	28	75	36	**203**
All KBAs	**43**	**90**	**47**	**142**	**117**	**116**	**555**

The total of 555 KBAs compares with 509 identified in 2011, and 438 identified in 2003-2004. This expansion reflects the inclusion of an additional 26 sites on the World Database of KBAs (http://www.keybiodiversityareas.org) since 2011: 10 in China; six in Vietnam; four in Lao PDR; three in Cambodia; and three in Thailand. Fifteen of these sites were identified during an analysis of freshwater KBAs in the Lower Mekong Basin conducted by the IUCN Freshwater Biodiversity Unit in 2018 (Máiz-Tomé 2019). Nine are IBAs identified in China in 2009 but overlooked during the 2011 update of the ecosystem profile (BirdLife International 2020a). The remaining two are Alliance for Zero Extinction (AZE) sites identified during a major reassessment in 2018 (Alliance for Zero Extinction 2020). It also reflects the identification of 24 KBAs in limestone karst ecosystems in Myanmar (Komerički *et al.* in prep.), which are in the process of being included on the World Database of KBAs. Four of these sites overlap with existing KBAs, meaning that only 20 additional KBAs were added to the list of site outcomes.

Figure 7. Site and Corridor Outcomes for Cambodia

Code	Key Biodiversity Area	Code	Key Biodiversity Area
KMH1	Ang Tropeang Thmor	KMH23	Phnom Bokor
KMH2	Bakan	KMH24	Phnom Samkos
KMH3	Bassac Marsh	KMH25	Preah Net Preah/Kra Lanh/Pourk
KMH4	Boeung Chhmar/Moat Khla	KMH26	Prek Chhlong
KMH5	Boeung Prek Lapouv	KMH27	Prek Toal
KMH6	Central Cambodia Lowlands	KMH28	Sekong River
KMH7	Central Cardamoms	KMH29	Sesan River
KMH8	Central Oddar Meanchey	KMH30	Snoul/Keo Sema/O Reang
KMH9	Chhep	KMH31	Southern Cardamoms
KMH10	Chhnuck Tru	KMH32	Sre Ambel
KMH11	Dei Roneat	KMH33	Srepok River
KMH12	Kampong Laeng	KMH34	Stung Kampong Smach
KMH13	Kampong Trach	KMH35	Stung Sen/Santuk/Baray
KMH14	Kirirom	KMH36	Stung/Chi Kreng/Kampong Svay
KMH15	Koh Kapik	KMH37	Stung/Prasat Balang
KMH16	Koh Tang Archipelago	KMH38	Thala Stueng Treng
KMH17	Lomphat	KMH39	Upper Srepok Catchment
KMH18	Lower Stung Sen	KMH40	Upper Stung Sen Catchment
KMH19	Mekong River from Kratie to Lao PDR	KMH41	Veal Srongae
KMH20	Mondulkiri-Kratie Lowlands	KMH42	Virachey
KMH21	O Skach	KMH43	Western Siem Pang
KMH22	Phnom Aural		

Figure 8a. Site and Corridor Outcomes for China (Yunnan)

Figure 8b. Site and Corridor Outcomes for China (Guangxi)

Figure 8c. Site and Corridor Outcomes for China (Guangdong)

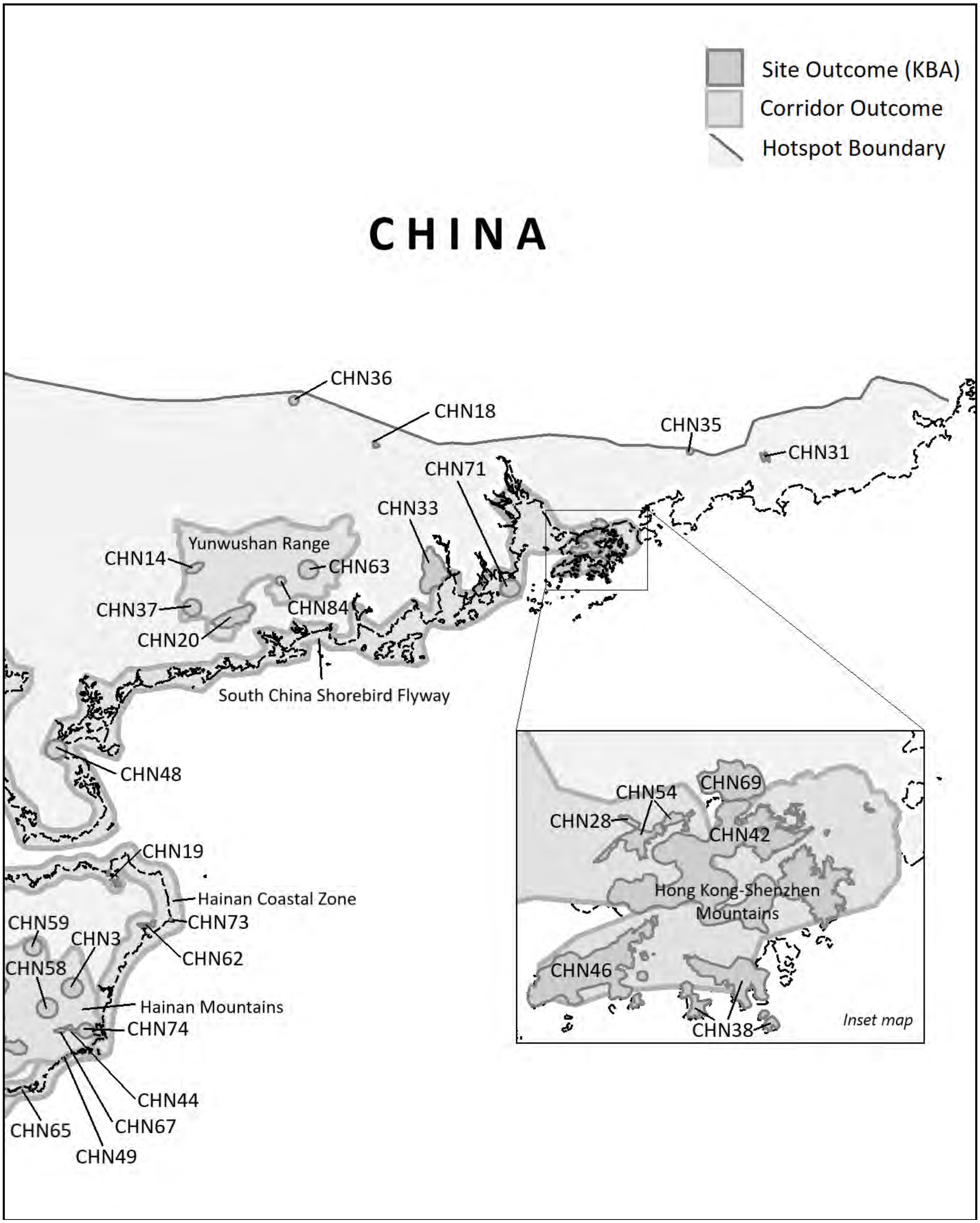
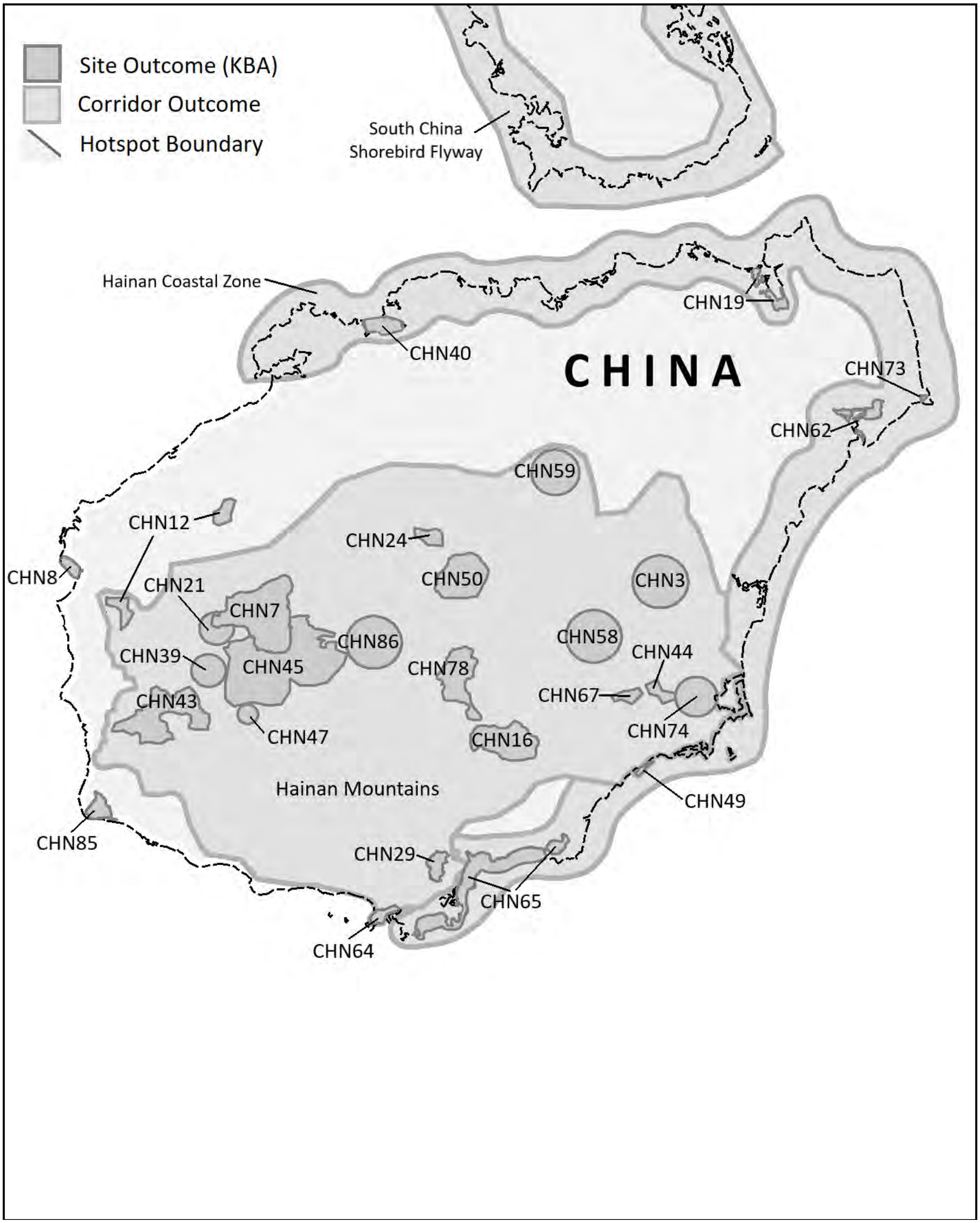


Figure 8d. Site and Corridor Outcomes for China (Hainan)



Code	Key Biodiversity Area	Code	Key Biodiversity Area
CHN1	Ailaoshan	CHN46	Lantau Island and Associated Islands
CHN2	Babianjiang	CHN47	Ledong
CHN3	Baimaling-Huishan	CHN48	Leizhou Peninsula
CHN4	Baixu-Qinpai	CHN49	Liji
CHN5	Bajianjing	CHN50	Limushan
CHN6	Bangliang	CHN51	Longhua
CHN7	Bawangling	CHN52	Longhushan
CHN8	Beili Wan Sigeng	CHN53	Longshan section of Nonggang
CHN9	Caiyanghe	CHN54	Mai Po and Inner Deep Bay
CHN10	Chongzuo	CHN55	Malipo
CHN11	Damingshan	CHN56	Nangunhe
CHN12	Datian	CHN57	Nangliujiang Hekou
CHN13	Daweishan	CHN58	Nanmaoling
CHN14	Dawuling	CHN59	Nanweiling
CHN15	Dehong Zizhizhou	CHN60	Nonggang
CHN16	Diaoluoshan	CHN61	Paiyangshan
CHN17	Diding	CHN62	Qinglangang
CHN18	Dinghushan	CHN63	Qixingkeng
CHN19	Dongzhaigang	CHN64	Sanya
CHN20	Ehuangzhang	CHN65	Sanya Seagrass Beds
CHN21	Exianling and Changhuajiang	CHN66	Shangsi-Biannian
CHN22	Fangcheng	CHN67	Shangxi
CHN23	Fangcheng Shangyue	CHN68	Shankou
CHN24	Fanjia	CHN69	Shenzhen Wutongshan
CHN25	Fenshuiling	CHN70	Shiwandashan
CHN26	Funing Niaowangshan	CHN71	Taipa-Coloane
CHN27	Fuping-Gula-Dingye	CHN72	Tongbiguan
CHN28	Futian	CHN73	Tongguling
CHN29	Ganshiling	CHN74	Tongtieling
CHN30	Gaoligongshan	CHN75	Weiyuanjiang
CHN31	Gongping Dahu	CHN76	Weizhou Dao
CHN32	Guangtouling	CHN77	Wuliangshan
CHN33	Gudoushan	CHN78	Wuzhishan
CHN34	Gulongshan	CHN79	Xianhu Reservoir
CHN35	Gutian	CHN80	Xidamingshan
CHN36	Heishiding	CHN81	Xieyang Dao
CHN37	Heweishan	CHN82	Xijin Reservoir
CHN38	Hong Kong Island and Associated Islands	CHN83	Xishuangbanna
CHN39	Houmiling	CHN84	Yangchun Baiyong
CHN40	Houshui Wan	CHN85	Yinggehai Salt Pans
CHN41	Huanglianshan	CHN86	Yinggeling
CHN42	Inland New Territories	CHN87	Yiwa
CHN43	Jianfengling	CHN88	Yongde Daxueshan
CHN44	Jianling	CHN89	Youluoshan
CHN45	Jiaxi	CHN90	Yunlong Tianchi

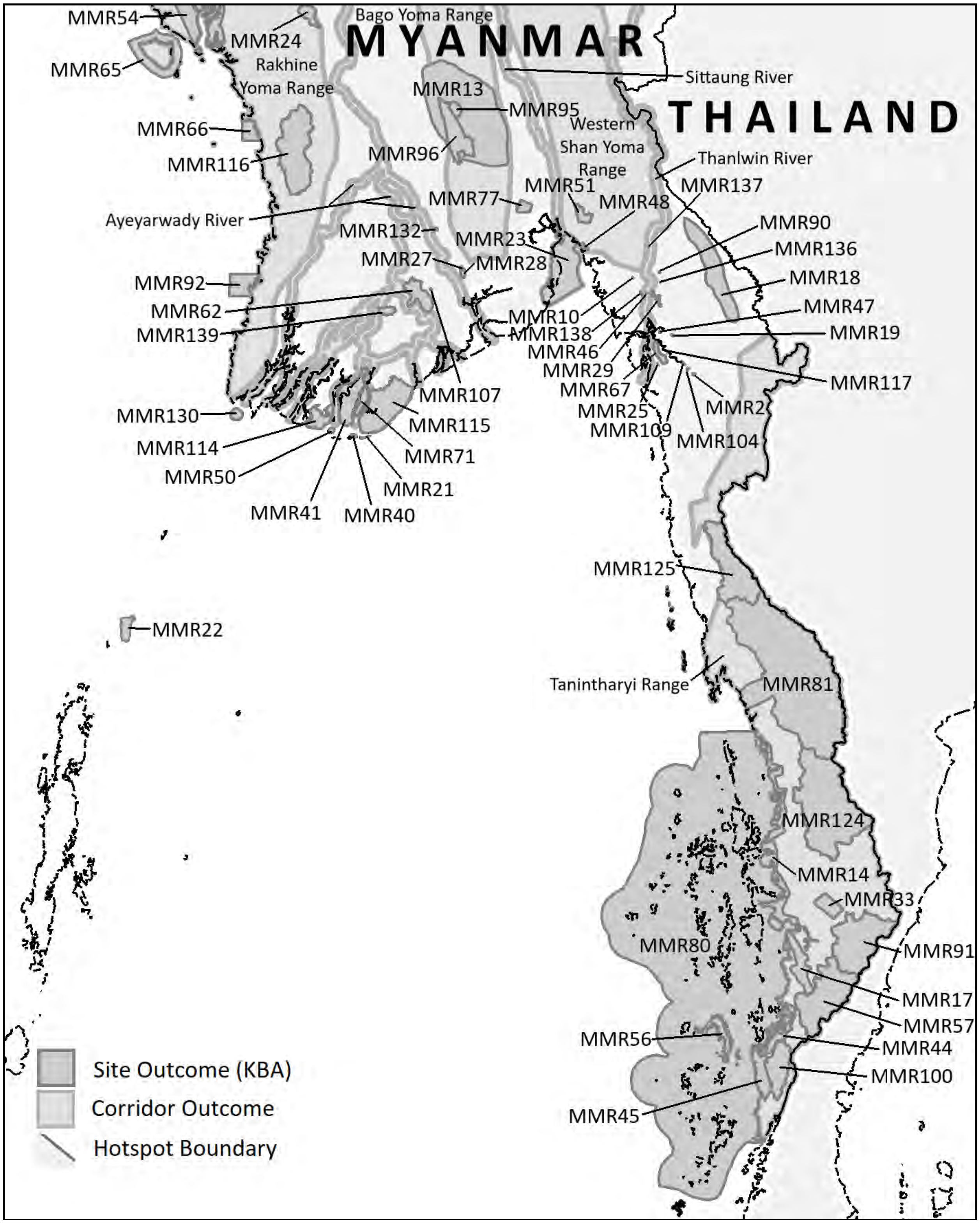
Figure 9a. Site and Corridor Outcomes for Lao PDR (North)

Figure 9b. Site and Corridor Outcomes for Lao PDR (South)

Code	Key Biodiversity Area	Code	Key Biodiversity Area
LAO1	Bolaven Northeast	LAO25	Nam Noa
LAO2	Chonabuly	LAO26	Nam Ou Headwaters
LAO3	Dakchung Plateau	LAO27	Nam Phoun
LAO4	Dong Ampham	LAO28	Nam Xam
LAO5	Dong Hua Sao	LAO29	Nong Khe Wetlands
LAO6	Dong Khanthung	LAO30	Pakxan Wetlands
LAO7	Dong Phou Vieng	LAO31	Phou Ahyon
LAO8	Eastern Bolikhamxay Mountains	LAO32	Phou Dendin
LAO9	Hin Namno	LAO33	Phou Kathong
LAO10	Khammouan Limestone	LAO34	Phou Khaokhoay
LAO11	Laving-Laveun	LAO35	Phou Loeuy
LAO12	Lower Nam Ou	LAO36	Phou Xang He
LAO13	Mekong Confluence with Nam Kading	LAO37	Phou Xiang Thong
LAO14	Mekong Confluence with Xe Bangfai	LAO38	Siphandon
LAO15	Mekong River from Louangphabang to Vientiane	LAO39	Upper Lao Mekong
LAO16	Mekong River from Phou Xiang Thong to Siphandon	LAO40	Upper Xe Bangfai
LAO17	Nakai Plateau	LAO41	Upper Xe Kaman
LAO18	Nakai-Nam Theun	LAO42	Xe Bang-Nouan
LAO19	Nam Et	LAO43	Xe Bangfai Cave System
LAO20	Nam Ghong	LAO44	Xe Champhon
LAO21	Nam Ha	LAO45	Xe Khampho-Xe Pian
LAO22	Nam Kading	LAO46	Xe Pian
LAO23	Nam Kan	LAO47	Xe Sap
LAO24	Nam Ngum Reservoir		

Figure 10a. Site and Corridor Outcomes for Myanmar (North)

Figure 10b. Site and Corridor Outcomes for Myanmar (South)



Code	Key Biodiversity Area	Code	Key Biodiversity Area
MMR1	Alaungdaw Kathapa	MMR72	Minzontaung
MMR2	Ataran Taung Karst	MMR73	Momeik-Mabein
MMR3	Ayeyarwady River: Bagan Section	MMR74	Mone Chaung
MMR4	Ayeyarwady River: Bhamo Section	MMR75	Montawa Cave
MMR5	Ayeyarwady River: Myitkyina to Sinbo Section	MMR76	Moscos Kyun
MMR6	Ayeyarwady River: Shwegu Section	MMR77	Moyingyi
MMR7	Ayeyarwady River: Sinbyugyun to Minbu Section	MMR78	Myaleik Taung
MMR8	Ayeyarwady River: Singu Section	MMR79	Myebon
MMR9	Babulon Htan	MMR80	Myeik Archipelago
MMR10	Bayin Nyi Karst	MMR81	Myinmoletkhat
MMR11	Bumphabum	MMR82	Myitkyina-Nandebad-Talawgyi
MMR12	Bwe Pa	MMR83	Myittha Lakes
MMR13	Central Bago Yoma	MMR84	Nadi Kan
MMR14	Central Tanintharyi Coast	MMR85	Nam Sam Chaung
MMR15	Chatthin	MMR86	Nam San Valley
MMR16	Chaungmagyi Reservoir	MMR87	Nantha Island
MMR17	Chaungmon-Wachaung	MMR88	Nat-yekan
MMR18	Dawna Range	MMR89	Natmataung (Mount Victoria)
MMR19	Dhammata Karst	MMR90	Naung Ka Myaing Karst
MMR20	Fen-shui-ling Valley	MMR91	Ngawun (Lenya extension)
MMR21	Gayetgyi Island	MMR92	Ngwe Saung
MMR22	Great Coco Island	MMR93	Ngwe Taung
MMR23	Gulf of Mottama	MMR94	Ninety-six Inns
MMR24	Gyobin	MMR95	North Zarmayi
MMR25	Himeinkanein Karst	MMR96	North Zarmayi Elephant Range
MMR26	Hkakaborazi	MMR97	Northern Rakhine Yoma
MMR27	Hlawga Park	MMR98	Nyaung Kan-Minhla Kan
MMR28	Hlawga Reservoir	MMR99	Oyster Island
MMR29	Hpa-an	MMR100	Pachan
MMR30	Hponkanrazi	MMR101	Padamyar Karst
MMR31	Hpruso Karst	MMR102	Panlaung-Pyadalin Cave
MMR32	Htamanthi	MMR103	Parpant Caves
MMR33	Htaung Pru	MMR104	Pathein Karst
MMR34	Hukaung Valley	MMR105	Pauk Area
MMR35	Hukaung Valley extension	MMR106	Paunglaung Catchment Area
MMR36	Indawgyi Grassland & Indaw Chaung Wetland	MMR107	Payagyi
MMR37	Indawgyi Wildlife Sanctuary	MMR108	Peleik Inn
MMR38	Inle Lake	MMR109	Pharbaung Karst
MMR39	Irrawaddy Dolphin	MMR110	Phokyar Elephant Camp
MMR40	Kadongalay Island	MMR111	Pidaung
MMR41	Kadonkani	MMR112	Popa
MMR42	Kaladan River	MMR113	Pyaungbya River
MMR43	Kamaing	MMR114	Pyin-ah-lan
MMR44	Karathuri	MMR115	Pyindaye
MMR45	Kawthaung District Lowlands	MMR116	Rakhine Yoma Elephant Range

Code	Key Biodiversity Area	Code	Key Biodiversity Area
MMR46	Kayin Linno Karst	MMR117	Sabel Karst
MMR47	Kayon Karst	MMR118	Saramati Taung
MMR48	Kelatha	MMR119	Sheinmaga Tawyagyi
MMR49	Kennedy Peak	MMR120	Shinmataung
MMR50	Khaing Thaung Island	MMR121	Shwe U Daung
MMR51	Kyaikhtiyoe	MMR122	Shwesettaw
MMR52	Kyauk Nagar	MMR123	Tanai River
MMR53	Kyauk Pan Taung	MMR124	Tanintharyi National Park
MMR54	Kyaukphyu (Wunbike)	MMR125	Tanintharyi Nature Reserve
MMR55	Kyee-ni Inn	MMR126	Tar Tar Karst
MMR56	Lampi Island	MMR127	Taung Kan at Sedawgyi
MMR57	Lenya	MMR128	Taunggyi
MMR58	Loimwe	MMR129	Taungtaman Inn
MMR59	Lwoilin/Ginga Mountain	MMR130	Thamihla Kyun
MMR60	Mahamyaing	MMR131	Thaungdut
MMR61	Mahanandar Kan	MMR132	U-do
MMR62	Maletto Inn	MMR133	Upper Chindwin River: Kaunghein to Padumone Section
MMR63	Mali Hka Area	MMR134	Upper Mogaung Chaung Basin
MMR64	Man Chaung	MMR135	Uyu River
MMR65	Manaung Kyun	MMR136	Waiponla Karst
MMR66	Maw She	MMR137	Weibyan Karst
MMR67	Mawlamyine	MMR138	Yathae Pyan Karst
MMR68	May Hka Area	MMR139	Yelegale
MMR69	May Yu	MMR140	Yemyet Inn
MMR70	Mehon (Doke-hta Wady River)	MMR141	Ywangan Karst
MMR71	Meinmahla Kyun	MMR142	Zeihmu Range

Figure 11a. Site and Corridor Outcomes for Thailand (North)

Figure 11b. Site and Corridor Outcomes for Thailand (South)

Code	Key Biodiversity Area	Code	Key Biodiversity Area
THA1	Ao Bandon	THA60	Mae Wong
THA2	Ao Pattani	THA61	Mae Yom
THA3	Ao Phang-nga	THA62	Mekong Channel near Pakchom
THA4	Ban Khlong Marakor Tai	THA63	Mu Ko Chang
THA5	Bang Lang	THA64	Mu Ko Similan
THA6	Bu Do-Sungai Padi	THA65	Mu Ko Surin
THA7	Bung Boraphet	THA66	Na Muang Krabi
THA8	Bung Khong Lhong	THA67	Nam Nao
THA9	Chaloem Pra Kiet (Pa Phru To Daeng)	THA68	Nam River
THA10	Chao Phraya River from Nonthaburi to Nakon Sawan	THA69	Namtok Huai Yang
THA11	Doi Chiang Dao	THA70	Namtok Khlong Kaew
THA12	Doi Inthanon	THA71	Namtok Sai Khao
THA13	Doi Pha Chang	THA72	Namtok Yong
THA14	Doi Phu Nang	THA73	Nanthaburi
THA15	Doi Phukha	THA74	Nong Bong Kai
THA16	Doi Suthep-Pui	THA75	Om Koi
THA17	Erawan	THA76	Pak Nam Prasae
THA18	Hala-Bala	THA77	Palian Lang-ngu
THA19	Hat Chao Mai	THA78	Pang Sida
THA20	Hat Nopharat Thara-Mu Ko Phi Phi	THA79	Phu Jong Na Yoi
THA21	Huai Kha Khaeng	THA80	Phu Khieo
THA22	Huai Nam Dang	THA81	Phu Kradung
THA23	Inner Gulf of Thailand	THA82	Phu Luang
THA24	Kaeng Krachan	THA83	Phu Miang-Phu Thong
THA25	Kaeng Krung	THA84	Phu Phan
THA26	Khao Ang Ru Nai	THA85	Phu Rua
THA27	Khao Banthad	THA86	Prince Chumphon Park
THA28	Khao Chamao-Khao Wong	THA87	Sai Yok
THA29	Khao Chong	THA88	Sakaerat
THA30	Khao Khitchakut	THA89	Salak Phra
THA31	Khao Laem	THA90	Salawin
THA32	Khao Lak-Lam Ru	THA91	San Kala Khiri
THA33	Khao Luang	THA92	Sanambin
THA34	Khao Nam Khang	THA93	Sri Lanna
THA35	Khao Nor Chuchi	THA94	Sri Nakarin
THA36	Khao Phanom Bencha	THA95	Sri Nan
THA37	Khao Pu-Khao Ya	THA96	Sri Phang-nga
THA38	Khao Sabab-Namtok Phlew	THA97	Sub Langkha
THA39	Khao Sam Roi Yot	THA98	Tai Rom Yen
THA40	Khao Soi Dao	THA99	Tarutao
THA41	Khao Sok	THA100	Tha Tum Nam Mun
THA42	Khao Yai	THA101	Tha Yang
THA43	Khlong Lan	THA102	Thab Lan
THA44	Khlong Nakha	THA103	Thale Noi
THA45	Khlong Saeng	THA104	Thale Sap Songkhla
THA46	Ko Li Bong	THA105	Thaleban
THA47	Ko Phra Tong	THA106	Tham Ba Dan

THA48	Kuiburi	THA107	Thung Kha
THA49	Laem Pakarang	THA108	Thung Salaeng Luang
THA50	Lam Khlong Ngu	THA109	Thung Tha Laad
THA51	Lower Central Basin	THA110	Thung Yai-Naresuan
THA52	Lum Nam Pai	THA111	Ton Nga Chang
THA53	Mae Fang	THA112	Tonpariwat
THA54	Mae Jarim NP	THA113	Trat Wetlands
THA55	Mae Jarim WS	THA114	Ubon Nam Mun
THA56	Mae Klong Basin	THA115	Umphang
THA57	Mae Lao-Mae Sae	THA116	Wiang Lo
THA58	Mae Ping	THA117	Yot Dom
THA59	Mae Tuen		

Figure 12a. Site and Corridor Outcomes for Vietnam (North)

Figure 12b. Site and Corridor Outcomes for Vietnam (Center)

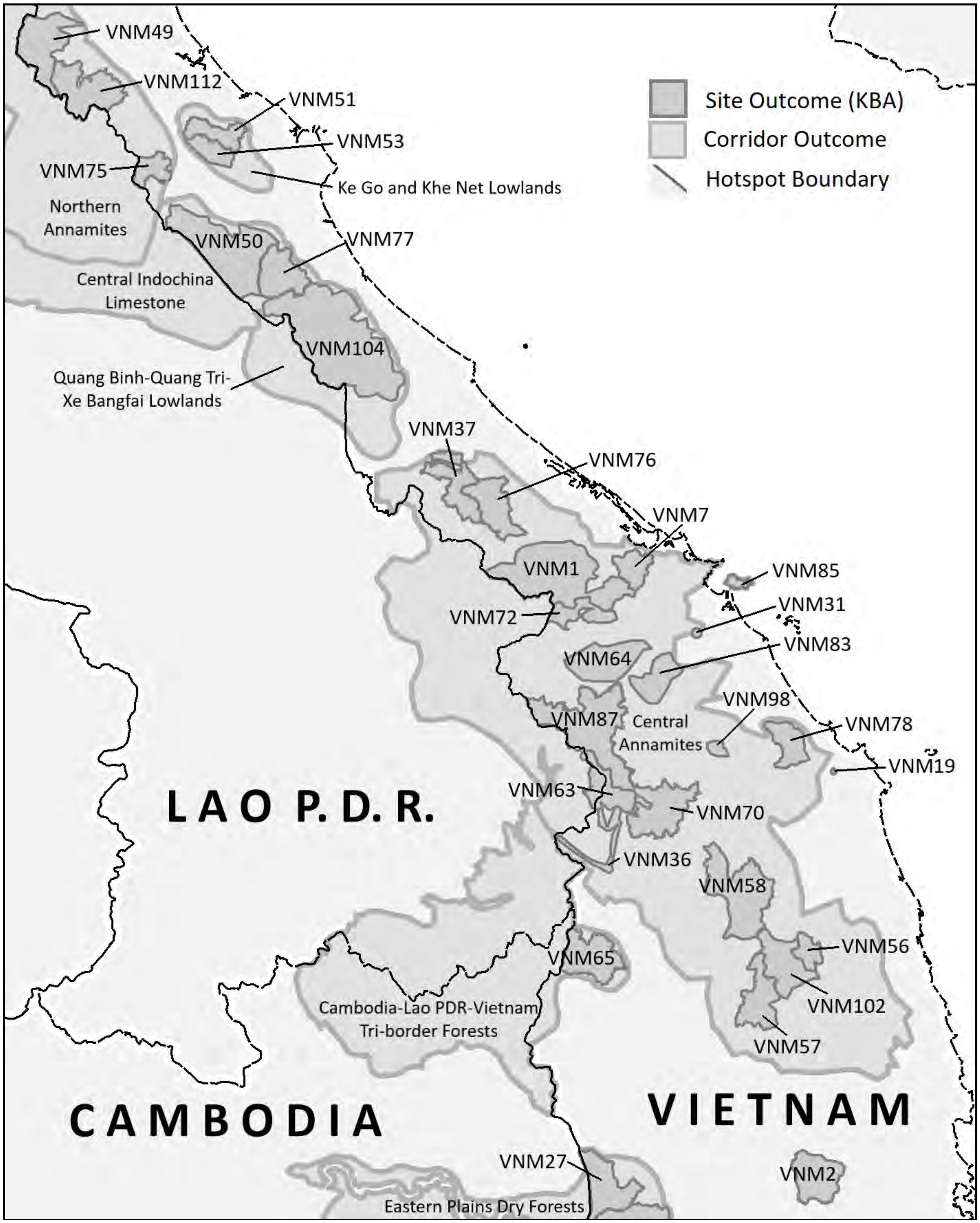


Figure 12c. Site and Corridor Outcomes for Vietnam (South)

Code	Key Biodiversity Area	Code	Key Biodiversity Area
VNM1	A Luoi-Nam Dong	VNM59	Lac Thuy-Kim Bang
VNM2	A Yun Pa	VNM60	Lam Binh
VNM3	An Hai	VNM61	Lang Sen
VNM4	Ba Be	VNM62	Lo Go-Xa Mat
VNM5	Ba Tri	VNM63	Lo Xo Pass
VNM6	Bac Lieu	VNM64	Macooih
VNM7	Bach Ma	VNM65	Mom Ray
VNM8	Bai Boi	VNM66	Na Chi
VNM9	Ban Bung	VNM67	Nam Cat Tien
VNM10	Ban Thi-Xuan Lac	VNM68	Nam He
VNM11	Bao Loc-Loc Bac	VNM69	Nghia Hung
VNM12	Bat Dai Son	VNM70	Ngoc Linh
VNM13	Ben En	VNM71	Ngoc Son
VNM14	Bi Dup-Nui Ba	VNM72	Northern Hien
VNM15	Bien Lac-Nui Ong	VNM73	Nui Boi Yao
VNM16	Bim Son	VNM74	Nui Chua
VNM17	Binh An	VNM75	Nui Giang Man
VNM18	Binh Dai	VNM76	Phong Dien
VNM19	Binh Khuong	VNM77	Phong Nha
VNM20	Bu Gia Map	VNM78	Phu Ninh
VNM21	Ca Mau	VNM79	Phuoc Binh
VNM22	Can Gio	VNM80	Pu Huong
VNM23	Cat Ba	VNM81	Pu Luong
VNM24	Cat Loc	VNM82	Pu Mat
VNM25	Cham Chu	VNM83	Que Son
VNM26	Che Tao	VNM84	Sinh Long
VNM27	Chu Prong	VNM85	Son Tra
VNM28	Chu Yang Sin	VNM86	Song Hinh
VNM29	Chua Hang	VNM87	Song Thanh
VNM30	Chua Huong	VNM88	Ta Dung
VNM31	Co Nhi River	VNM89	Tam Dao
VNM32	Cong Troi	VNM90	Tat Ke
VNM33	Cu Jut	VNM91	Tay Con Linh
VNM34	Cuc Phuong	VNM92	Tay Yen Tu
VNM35	Dak Dam	VNM93	Thai Thuy
VNM36	Dak Poko Headwaters	VNM94	Than Xa
VNM37	Dakrong	VNM95	Thiet Ong
VNM38	Dat Mui	VNM96	Tien Hai
VNM39	Deo Ca-Hon Nua	VNM97	Tien Lang
VNM40	Deo Nui San	VNM98	Tien Phuoc
VNM41	Dong Mo Lake	VNM99	Tra Co
VNM42	Du Gia	VNM100	Tra Cu
VNM43	Ea So	VNM101	Tram Chim
VNM44	Fan Si Pan	VNM102	Tram Lap-Dakrong
VNM45	Ha Nam	VNM103	Trung Khanh
VNM46	Ha Tien	VNM104	Truong Son
VNM47	Ho Earal	VNM105	Tung Vai
VNM48	Hoa Lu-Tam Coc-Bich Dong	VNM106	Tuyen Lam

VNM49	Huong Son	VNM107	U Minh Thuong
VNM50	Ke Bang	VNM108	Vam Nao Confluence
VNM51	Ke Go	VNM109	Van Ban
VNM52	Khau Ca	VNM110	Van Long
VNM53	Khe Net	VNM111	Vinh Cuu
VNM54	Kien Giang	VNM112	Vu Quang
VNM55	Kien Luong	VNM113	Xuan Lien
VNM56	Kon Cha Rang-An Toan	VNM114	Xuan Thuy
VNM57	Kon Ka Kinh	VNM115	Ya Lop
VNM58	Kon Plong	VNM116	Yok Don

Of the 555 KBAs in Indo-Burma, only 310 (56 percent) are wholly or partly included within gazetted protected areas. This indicates that, while protected area-based approaches could form an important component of any conservation strategy for the region, there also exists great potential (indeed, necessity) for OECMs, such as indigenous and community conserved areas (ICCAs), fish conservation zones, and conservation concessions. The proportion of KBAs wholly or partly included within gazetted protected areas varies significantly among countries, from only 21 percent in Myanmar to 82 percent in Thailand; thus, the opportunity for conservation action outside formal protected areas may be greater in some countries than in others.

Several KBAs are known to support large numbers of globally threatened species. Areas known to support at least 30 globally threatened species include: Htamanthi in Myanmar; Hala-Bala, Huai Kha Khaeng and Khao Banthad in Thailand; and Phong Nha and Pu Mat in Vietnam. These sites are not necessarily the highest priorities for conservation action in the hotspot, for two reasons. First, they may not be the most important for the conservation of any particular highly threatened species. Second, they might not be particularly preferentially threatened, so would not be priorities for conservation action as much as for surveillance, in case threat levels increased and stepped-up action was needed. Third, other sites less surveyed to date may support similar or even greater numbers of globally threatened species.

As the comprehensiveness of available data on the distribution of globally threatened species among KBAs varies significantly among taxonomic groups, KBAs identified as being important for the conservation of one taxonomic group may also be important for other groups for which data are not yet available. In addition, there are likely to be other important sites for the conservation of species assessed as globally threatened since the original KBA analysis, which, in many cases, dates back to the early 2000s. As discussed earlier, there is a need to re-evaluate the KBAs in the Indo-Burma Hotspot, drawing on current information about the population, distribution and global threat status of species, incorporating information about threatened and intact ecosystems, and applying the new KBA Standard (IUCN 2016).

5.3 Corridor Outcomes

Sixty-five conservation corridors were defined in Indo-Burma (Table 3 and Appendix 3). The corridors cover a total area of 1,063,134 square kilometers, equivalent to 46 percent of the total area of the hotspot. They range in size from around 1,000 square kilometers (Ke Go and Khe Net Lowlands) to a little over 100,000 square kilometers (Ayeyarwady Catchment). The full list of KBAs within each conservation corridor is presented in Appendix 3.

Table 3. Summary of Conservation Corridors in the Indo-Burma Hotspot

Conservation Corridor	Countries	Area (km^2)	# of KBAs
Ailaoshan/Hoang Lien Mountains	China and Vietnam	28,076	7
Ayeyarwady Catchment	Myanmar	101,382	17
Ayeyarwady River	Myanmar	19,758	9
Bago Yoma Range	Myanmar	16,119	4
Bolaven Plateau	Lao PDR	4,411	2
Cambodia-Lao PDR-Vietnam Tri-border Forests	Cambodia, Lao PDR and Vietnam	10,617	4
Cardamom and Elephant Mountains	Cambodia	17,660	6
Central Annamites	Lao PDR and Vietnam	32,873	20
Central Indochina Limestone	Lao PDR and Vietnam	7,990	5
Chin Hills Complex	Myanmar	36,013	5
Chindwin Catchment	Myanmar	50,072	6
Chindwin River	Myanmar	5,281	1
Chumphon	Thailand	1,740	2
Damingshan Range	China	5,685	3
Di Linh	Vietnam	5,166	2
Doi Phuka-Mae Yom	Lao PDR and Thailand	17,053	10
Eastern Plains Dry Forests	Cambodia and Vietnam	21,160	8
Hainan Coastal Zone	China	8,311	5
Hainan Mountains	China	17,452	21
Hala-Bala	Thailand	7,423	7
Hong Kong-Shenzhen Mountains	China	1,337	3
Inner Gulf of Thailand	Thailand	1,408	2
Kaeng Krachan	Thailand	5,479	2
Ke Go and Khe Net Lowlands	Vietnam	1,011	2
Khao Banthad	Thailand	4,064	4
Khao Luang	Thailand	2,439	3
Khlong Saeng-Khao Sok	Thailand	8,132	8
Lower Chindwin Forest	Myanmar	39,926	6
Lower Eastern Forest Complex	Thailand	4,139	5
Lowland Dong Nai Watershed	Vietnam	8,293	5

Conservation Corridor	Countries	Area (km^2)	# of KBAs
Lum Nam Pai-Salawin	Thailand	24,333	7
Mae Ping-Om Koi	Thailand	8,666	3
Mekong Delta Coastal Zone	Vietnam	3,933	8
Mekong River and Major Tributaries	Cambodia, Lao PDR and Thailand	19,435	18
Mu Ko Similan-Phi Phi-Andaman	Thailand	26,317	11
Nam Et-Phou Louey	Lao PDR	4,391	2
Nam Ha-Xishuangbanna-Phou Dendin	China and Lao PDR	21,523	9
Nangunhe-Yongde Daxueshan	China	2,588	2
North-western Mekong Delta Wetlands	Cambodia and Vietnam	7,854	7
Northern Annamites	Lao PDR and Vietnam	21,112	7
Northern Indochina Limestone	Vietnam	6,793	10
Northern Plains Seasonally Inundated Forests	Cambodia and Lao PDR	19,322	4
Phanom Dongrak-Pha Tam	Thailand	3,510	2
Phu Khieo-Nam Nao	Thailand	13,395	6
Phu Miang-Phu Thong	Thailand	9,944	2
Quang Binh-Quang Tri-Xe Bangfai Lowlands	Lao PDR and Vietnam	3,819	3
Rakhine Yoma Range	Myanmar	47,614	12
Red River Delta Coastal Zone	Vietnam	2,255	7
Shiwandashan Range	China	2,458	2
Sino-Vietnamese Limestone	China and Vietnam	58,502	31
Sittaung River	Myanmar	47,614	1
South China Shorebird Flyway	China	22,665	8
Southern Annamites Main Montane Block	Vietnam	11,976	7
Southern Annamites Western Slopes	Cambodia and Vietnam	3,945	2
Sri Lanna-Khun Tan	Thailand	20,164	1
Tanintharyi Range	Myanmar	42,912	12
Thanlwin River	Myanmar	7,696	2
Tongbiguan-Gaoligongshan	China	11,216	3
Tonle Sap Lake and Inundation Zone	Cambodia	17,547	12
Upper Chu River Watershed	Vietnam	4,505	2
Upper Eastern Forest Complex	Thailand	9,685	4
Western Forest Complex	Thailand	24,112	12
Western Shan Yoma Range	Myanmar	27,732	5
Xe Khampho-Xe Pian	Lao PDR	4,723	3
Yunwushan Range	China	8,408	5

Many of the conservation corridors were defined for the conservation of landscape species. In Indo-Burma, these species were taken to comprise Asian elephant, takin, tiger, Irrawaddy dolphin (*Orcaella brevirostris*), rufous-necked hornbill (*Aceros nipalensis*), plain-pouched hornbill (*Rhyticeros subruficollis*), great hornbill (*Buceros bicornis*), rhinoceros hornbill (*B. rhinoceros*), sandbar-nesting birds, vultures, large waterbirds (including the long-distance migrant black-faced spoonbill, white-bellied heron, which is restricted to the northwest of the hotspot, and the clutch of species typical of lowland deciduous landscapes in the southern half of the hotspot) and migratory freshwater fish. For all these species, conservation of individual sites in isolation is unlikely to meet their long-term conservation needs. Other conservation corridors were defined on the basis of their importance for maintaining ecological and evolutionary processes, including shorebird migration, annual flooding cycles and altitudinal migration.

The 65 conservation corridors contain 416 KBAs (equivalent to 75 percent of the total). Moreover, the coverage of globally threatened species within the conservation corridors is very good: more than 95 percent are known to occur in one or more conservation corridor, and at least some of the species presently not known to inhabit at least one conservation corridor may, with better information, be found to do so.

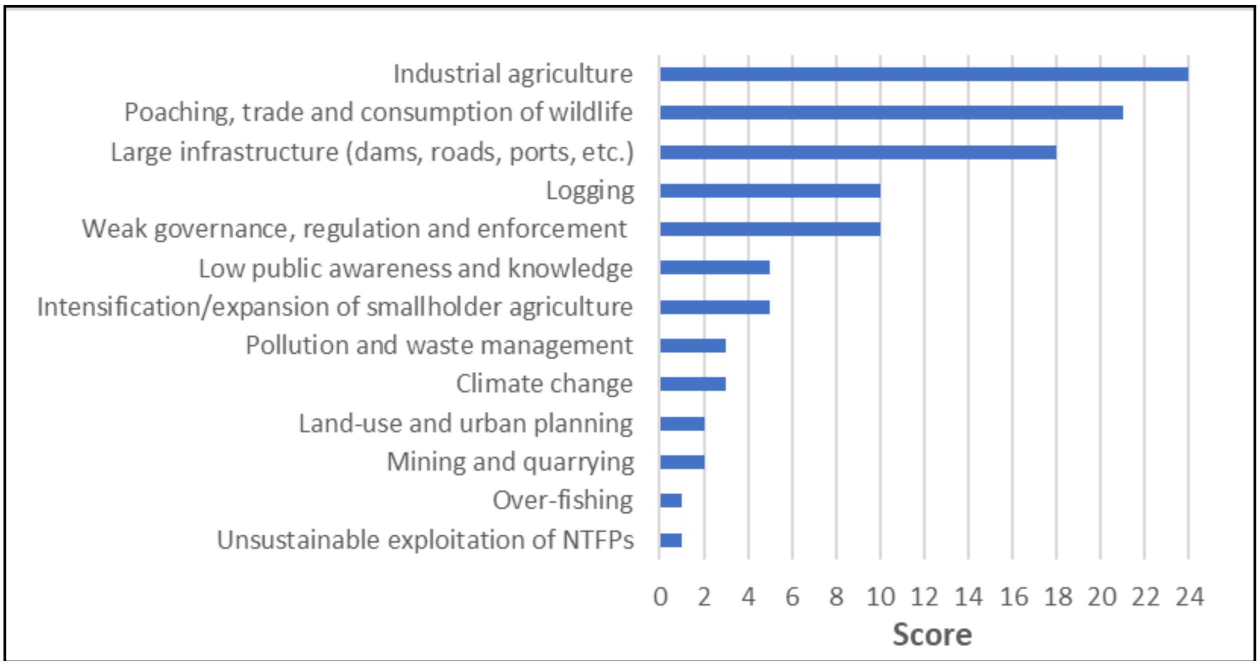
6. THREAT ASSESSMENT

6.1 Overview

The Indo-Burma Hotspot is one of the top five most threatened hotspots, based on the proportion of original habitat remaining (CI 2011). Threats to many species, sites and even landscapes are immediate and severe (e.g., Duckworth *et al*. 1999, Baltzer *et al*. 2001, Nooren and Claridge 2001, Tordoff 2002, IUCN 2020b). The combination of economic development and an increasing human population is exerting enormous pressure on the region's natural resources, and overexploitation has extirpated an increasing number of species from many, and ever more, areas. Existing planning and management systems are inadequate to control these pressures. The government institutions responsible for the management of natural resources and biodiversity often lack the financial resources, technical expertise and incentives to fulfill their mandates effectively.

This chapter updates the analysis from the 2011 ecosystem profile (which is still broadly relevant) with the results on the stakeholder consultations conducted during the final assessment workshop in May 2019 (Figure 13 and Table 4), and a review of relevant literature. Unless otherwise stated, the species-specific threat information in this chapter is drawn from the relevant page of the 2020 IUCN Red List (IUCN 2020b).

Figure 13. Prioritized Threats to Biodiversity in the Indo-Burma Hotspot, Based on Stakeholder Consultations during the May 2019 Final Assessment Workshop



Note: Participants were asked to rank threats in order of priority, based on criteria of extent, severity and immediacy.

Overall, there was broad agreement about the top threats to biodiversity in the region among the participants at the final assessment workshop, although there were differences among groups and countries with regard to the relative ranking of different threats (Table 4). Some of these differences can be attributed to different perspectives among diverse groups of stakeholders but they also reflect genuine variation across the hotspot with regard to the extent, severity and immediacy of different threats. It should also be noted that the conclusions of the participants reflect a very broad range in level of understanding of the identified threats among the individual participants within each country and across the hotspot as a whole.

Table 4. Top Ranked Threats to Biodiversity in Each Country, Based on Stakeholder Consultations during the May 2019 Final Assessment Workshop

Threat	**Cambodia**	**China**	**Lao PDR**	**Myanmar**	**Thailand**	**Vietnam**	**Regional**	**Overall Score**	**Overall Rank**
Industrial agriculture	1	2		3	2	1	3	24	**1**
Poaching, trade and consumption of wildlife	2	4	3	2		2	2	21	**2**
Large infrastructure (dams, roads, ports, etc.)		5	1	4	1		1	18	**3**
Logging	3		5	1			5	10	**4=**
Weak governance, regulation and enforcement*	4	1				3		10	**4=**
Intensification and expansion of smallholder agriculture	5		2					5	**6=**
Low public awareness and knowledge*		3				4		5	**6=**
Climate change			4	5				3	**8=**
Pollution and waste management					3			3	**8=**
Land-use and urban planning					4			2	**10=**
Mining and quarrying							4	2	**10=**
Over-fishing						5		1	**12=**
Unsustainable exploitation of NTFPs					5			1	**12=**

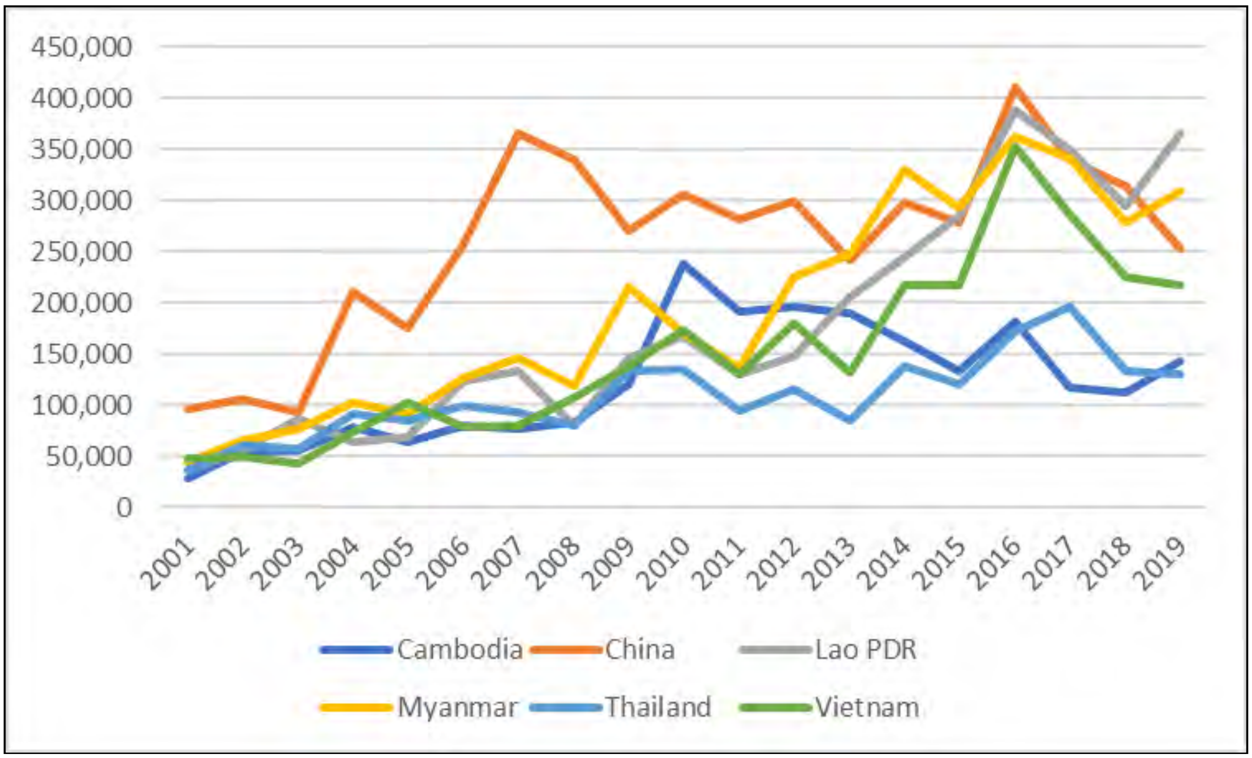
Notes: Overall score equals the sum of the scores for each country, based on 5 for the top ranked threat, 4 for the second ranked, 3 for the third ranked, 2 for the fourth ranked and 1 for the fifth ranked. A standard set of threat categories was not used across the workshops but, rather, the suggestions of participants were grouped together under similar themes. * = these two themes are not direct threats *per se* but were given high priority by participants; they are considered in the discussion of root causes and enabling factors (Section 6.8).

Comparing the results of the May 2019 consultations with the stakeholder consultations during the 2011 update of the ecosystem profile, the overall ranking of threats is similar. Given the degree of variation among the rankings of different groups of stakeholders, even those from the same country, it is plausible that the small differences in ranking can be attributed to the different composition of stakeholders in the two exercises rather than any underlying change in the relative priority of different threats. In both exercises, the top-ranked threats were poaching, trade and consumption of wildlife (referred to as hunting and trade of wildlife in 2011) and industrial agriculture (referred to as agro-industrial plantations in 2011).

Large infrastructure was the third-ranked threat in both exercises. In 2011, the threat was defined narrowly as hydropower dams; this definition was broadened to large infrastructure (dams, roads, ports, etc.) in 2019, reflecting the impacts of large hydropower projects are not limited to the dams themselves but include access roads, river engineering for navigation, transmission lines, and other ancillary infrastructure.

In both exercises, the next five highest ranked threats included logging, intensification and expansion of smallholder agriculture (referred to as agricultural encroachment by smallholders in 2011), and climate change. These can be considered the next suite of threats in terms of overall priority. Other conservation issues highly ranked by stakeholders are not direct threats to biodiversity *per se* but can be better thought of as enabling factors of biodiversity loss: weak governance, regulation and enforcement; and low public awareness and knowledge.

Figure 14. Annual Tree Cover Loss in Countries in the Indo-Burma Hotspot, 2001-2019



Source: Global Forest Watch (2020). Notes: chart shows annual loss of tree cover (>30% canopy cover) in hectares. Tree cover includes both natural forest cover (which accounted for 93% of the total in 2001) and plantations. Figures for China are based on the four provinces that overlap with the hotspot: Guangdong; Guangxi; Hainan; and Yunnan.

Forest landscapes continue to face many pressures in Indo-Burma. Based on Global Forest Watch (2020) data from the University of Maryland and the World Resources Institute, there has been an increase in annual forest loss in all six hotspot countries since 2001. Although the rate of forest loss in Cambodia has begun to decrease since a peak in 2010, overall it continued to climb in the other countries (Figure 14).

Although commercial timber extraction accounts for much of the past deforestation in Indo-Burma, it is now the second highest cause, accounting for 28 percent of forest destruction in the hotspot outside of China between 2001 and 2019 (Global Forest Watch 2020). The main cause of forest loss over this period was commodity-driven deforestation (i.e. industrial agriculture), which accounted for 54 percent (Global Forest Watch 2020). It is important to note, however, that these two issues are inter-linked, because much timber extraction takes place within economic land concessions under the pretext of clearing land for cash crop cultivation. Shifting agriculture accounted for 18 percent of tree cover loss during 2001-2019, and urbanization for less than 1 percent (Global Forest Watch 2020). Forests have not been the only landscapes affected by habitat loss, freshwater floodplain swamps and wetlands have been converted to paddy rice cultivation and other uses, many rivers have been dammed and modified, and large areas of mangrove have been enclosed within aquacultural ponds; in point of fact, most of these in most of the hotspot's countries have had more of their original area converted, and, overall, non-anthropogenic grasslands have probably seen the highest proportionate loss of habitat from their original extent.

Another grouping of threats identified during the stakeholder consultations (Figure 13) were ones related to overexploitation of natural resources, including poaching, trade and consumption of wildlife, logging, and unsustainable exploitation of non-timber forest products (NTFPs). Many species face extinction due to these threats, with knock-on effects on wider ecosystems. Red List assessments of many ungulate, primate and turtle species point to the priority of this threat and highlight the gravity of their plight (IUCN 2020b).

Ecosystem integrity is also deteriorating due to a variety of other threats, notably the proliferation of pollution, mining, invasive species and climate change. The broad consensus among stakeholders is that most of these threats are set to become higher priorities, at least in the short-term. For instance, while climate change is currently ranked as the eighth highest priority, because its effects on species and ecosystem have only started to be observed, it has the potential to become one of the top threats in coming decades.

6.2 Overexploitation of Natural Resources

Direct use of biological resources is one of the greatest threats to conservation outcomes in Indo-Burma, and it is the threat affecting the largest number of globally threatened species in the hotspot (IUCN 2020b). Overexploitation takes many forms, which stakeholders classified in various ways in 2011 and 2019. This section distinguishes poaching, trade and consumption of wildlife (which relates to overexploitation of wild (i.e., non-domesticated) animal species) from unsustainable exploitation of NTFPs (which relates to overexploitation of wild plant (and fungus) species, excluding timber trees), because the two threats require different, albeit overlapping, sets of strategies. Logging (which relates to overexploitation of timber trees) is treated separately, again because of the need for a different set of strategies.

6.2.1 Logging

Logging was ranked among the top five threats in Cambodia, Lao PDR and Myanmar, and equal-fourth overall. The clear-felling of natural forests and other destructive forestry practices that blighted China, Thailand and Vietnam in the 1980s and 1990s have since diminished, as these countries introduced logging bans in natural forests, and looked to plantations and forests beyond their borders to meet their timber and pulp needs. Nevertheless, illegal logging of high value species, on a range of scales, continues to have massive impacts on the condition and composition of forests throughout the hotspot. The direct impacts of logging on ecosystem health can be significant, through the selective removal of large trees that provide food, roosting and nesting habitat for other species, such as hornbills, vultures and large waterbirds, and changes to forest structure that affect arboreal species, such as gibbons. However, the indirect impacts can be equally, if not more, significant, as the construction of logging roads opens up forest areas to subsequent settlement, conversion to other land uses, and offtake of a wide range of other species.

During the latter part of the 20th century, commercial logging in lowland evergreen and semi-evergreen forests was devastating. On Hainan Island, natural forest cover fell from 26 percent in 1956 to 7 percent in 1983 (NEPA 1994), while in Thailand, less than 5 percent of the level lowlands retained forest cover by 1995 (Stewart-Cox and Cubitt 1995). Net annual forest loss between 1990 and 2000 was 0.2 to 0.3 percent in Myanmar (Leimgruber *et al.* 2004), and even higher in neighboring Thailand (Lynam 2003). Loss of natural forest cover in China, Thailand and Vietnam since the 1950s put the forestry industries there into substantial decline. Floods, including those in Nakhon Si Thammarat province in Thailand and the Yangtze Basin in China, prompted national logging bans in Thailand, Vietnam and China in 1989, 1997 and 1998, respectively (Carew-Reid 2002, BirdLife International 2003). Some of the timber shortfall from rapid economic growth in these countries was then met by exploitation of forests in Lao PDR and Myanmar (Carew-Reid 2002, BirdLife International 2003). Western and northwestern Lao PDR lost over 5 percent of its humid tropical forest between 2000 and 2005 (Hansen *et al.* 2008), while Myanmar lost an estimated 74,400 square kilometers (19 percent) of forest between 1990 and 2010, including 15,500 square kilometers (4.7 percent) between 2005 and 2010 (Blaser *et al.* 2011).

Because demand for wood products in each country continued to increase, and was not fully met by commercial timber plantations, the national logging bans in China, Thailand and Vietnam heightened logging pressure on natural forests in Cambodia, Lao PDR and Myanmar (Sadoff 1992; Durst *et al*. 2001). Although a nationwide logging ban was introduced in Cambodia in 2002, commercial logging was replaced by illegal logging (Global Witness 2007). In Lao PDR, a nationwide ban on exports of logs and sawn wood introduced in 2016 appears to have been more successful, at least in stemming exports of these products to China and Vietnam (To Xuan Phuc *et al.* 2017). Nevertheless, China remains the dominant importer of unprocessed wood (logs and sawn wood) exported illegally from the other countries of the Indo-Burma Hotspot (Foley 2020).

Often, implementation of forest-protection law falls down when it requires coordinated action between departments, notably the agency responsible for forest protection, the police and the public prosecutor’s office. Timber species with high economic value are at greatest risk, such as ironwood (*Erythrophleum fordii*), rosewoods (*Dalbergia* spp.), dipterocarps (such as *Dipterocarpus* spp., *Shorea* spp. and *Hopea* spp.), and various conifers (such as

Chamaecyparis hodginsii). Stocks of most of these species have declined significantly over recent decades.

Research from the National Resource Protection Group in Cambodia indicates that enforcement of regulations protecting valuable timber trees has been lax, leading to drastic declines there (Weinland and Vong 2011). The group reported that, in 2008, the Cambodia retained more than 30 percent of its pre-Khmer-Rouge-era luxury-wood resources but that this number had fallen to a staggering 3 percent by 2011; it is now effectively zero following two decades of rampant logging of the highest value species. Criminal networks that traffic timber are increasingly sophisticated and the demand for *Afzelia xylocarpa* and rosewood (*Dalbergia* spp.) has increased, to supply Cambodia's proliferating hotels, mansions and boardrooms.

Myanmar's forests, which support a great diversity of commercially valuable timber species, including teak and various dipterocarps and rosewoods, have also been heavily impacted by commercial logging (e.g., Brunner *et al.* 1998, Blaser *et al.* 2011).

6.2.2 Unsustainable Exploitation of Non-timber Forest Products

Trees are not the only plants affected by unsustainable harvesting. Thousands of plant species in the region have documented uses in human societies, from decoration to construction, and from food to traditional medicine. Some two-thirds of plant species in the forests on Hainan Island, for instance, are used locally for timber, medicines, fiber and fruit (Davis *et al*. 1995). Thus, overexploitation of non-timber plant (and fungus) species has implications not only for biodiversity but also for rural livelihoods. For instance, surveys in Cambodia found that NTFPs provide 0 to 20 percent of the livelihood value for better-off households, and 10 to 40 percent for poor households (Hansen 2006), while, in parts of the northeast, they provide up to 90 percent of farmers' income (Lund 2006).

Lack of data constrains evaluation of the severity of this threat, as does the fact that many of the species most affected by it have not been assessed by IUCN. Nonetheless, its effects on many groups of plants, for instance orchids, as well as on certain medicinal plants, ornamental plants and rattans, are potentially devastating, and local extirpations are already evident. Demand from the traditional medicine trade is known to be a significant factor contributing to the depletion of Himalayan yew (*Taxus wallichiana*) in Yunnan, and to the bulk removal of *Dendrobium* spp. and other wild orchids from Lao PDR and Myanmar to China (S. Gale *in litt.* 2012). Horticultural uses place huge pressure on cycads, a group that includes many threatened species in the hotspot, while slipper-orchids (*Paphiopedilum* spp.) are removed *en masse* for the horticulture trade from forests in northern Myanmar, southern China and northern Vietnam (S. Gale *in litt.* 2012). Very little information is available on the status of fungi in the hotspot (Boa 2004) but it is likely that many species are over-exploited.

6.2.3 Poaching, Trade and Consumption of Wildlife

Unregulated, unsustainable and unreported hunting and trade has driven many animal species in the hotspot to (and, in some cases, over) the verge of extinction, and severely suppressed populations of others (e.g., Nash 1997, Nooren and Claridge 2001, Oldfield 2003, Lau *et al.* 2010). This was ranked among the top five threats for all countries apart from Thailand, and as the number two threat overall. There are several causes that arise locally, among the people responsible, including subsistence needs, recreation, and opportunistic exploitation. However, trade demand, from both domestic and international markets, is the major factor driving overexploitation (e.g., Corlett 2007, Nijman 2010). A 2008 study by TRAFFIC found that pangolins and turtles (both used for meat and in traditional Chinese medicine) were the vertebrates most frequently seized from illegal traders in Southeast Asia (TRAFFIC 2008), while pangolins are recognized as the most trafficked mammals on Earth (Challender *et al.* 2014). Also targeted are a wide range of other animal species, including tiger, bears, snakes, geckos, monitor lizards and primates, resulting in many species in these groups being assessed as globally threatened (IUCN 2020b).

Prior to the 1990s, the greatest declines were in China, which is the major market for wildlife products in the region. During the 1990s, the focus of pressure shifted to populations in Vietnam, then Cambodia, Lao PDR and Myanmar, as the economies of these countries opened to international trade, infrastructure developments linked previously remote areas to outside markets, supplies of wildlife products in China became depleted, and domestic demand for wildlife products increased. For example, demand for wildlife products from a growing wealthy population has made Vietnam a major destination and transit point for illegal wildlife trade (De Queiroz *et al.* 2013).

The values of some species have risen to the point that even formerly secure populations in more affluent areas are heavily trapped, as with the population of Chinese three-striped box turtle (*Cuora trifasciata*) in Hong Kong (Lau 2003). Many target species have been reduced to such low levels that traders now acquire wildlife and wildlife products from outside the region. Most pangolins found in trade in Vietnam in the late 2000s were in shipments from Malaysia and Indonesia (Shepherd 2009); a decade later, pangolin products were being sourced from as far afield as West Africa (The Pangolin Reports 2020). The illegal wildlife trade is becoming ever more globalized. For instance, Vietnamese traders have been implicated in the wave of poaching that saw more than 9,000 rhinoceroses killed in Africa in the decade up to 2019 (Milliken *et al.* 2009, International Rhino Foundation 2019).

Infrastructure development (see Section 6.3.4) is one of the biggest drivers of overall poaching, trade and consumption of wildlife. For example, construction camps have a stimulus effect on offtake of wildlife in and around project areas. This illustrates the interconnectedness of the different threats discussed here and the challenges inherent in placing them in neat categories.

Limited resources, manpower, capacity, motivation and coordination among enforcement agencies mean that hunting, trapping and poisoning of animal species continues largely unabated. Trade networks are pervasive, and financial incentives to hunt these species are often high for rural people, particularly where there are few such easy alternative sources of income. A study in northern Myanmar found hunting to be the highest source of income among 24 percent of respondents, after NTFP collection (31 percent) and farming (45 percent) (Rao *et al*. 2010), although this is not, *a priori*, an indication that people had few alternative sources of income but merely suggests that, of the sources available to them, a quarter of people considered hunting to be the best option.

The combination of wide traditional uses, accelerating and poorly regulated trade, and growing consumer demand, has devastated many species. Hunting has extirpated Javan rhinoceros from mainland Asia (Brook *et al.* 2011) and threatens to drive many other species to local or global extinction. High value species, such as pangolins and turtles, are hunted in a targeted manner, using trained dogs or other special techniques. However, many vertebrate species with little or no premium value in trade are not spared, as they may become victim to opportunistic exploitation by hunting parties or fall prey to snare lines set to capture other species. Snaring occurs on an industrial scale in many parts of the hotspot. For example, more than 200,000 snares were removed from just five protected areas in Cambodia, Lao PDR and Vietnam between 2010 and 2015 (Gray *et al.* 2018), while a recent report by WWF estimated that there are more than 12 million snares set in the protected areas of Cambodia, Lao PDR and Vietnam (Belecky and Gray 2020). Indiscriminate snaring is the major threat to Indo-Burma's terrestrial flagship species, saola, which, ironically, has no premium value in the trade, perhaps in part because it was unknown in Chinese traditional medicine (Hance 2011).

Another way in which species are affected indirectly by trade-driven hunting is through declines in species to which they are ecologically linked. For instance, overharvesting of prey animals threatens the survival of carnivores, including all the otter species. Tiger, in particular, requires a large ungulate prey base, now rarely to be found, and this is considered the second-greatest barrier to tiger conservation after the lack of law enforcement (Sanderson *et al.* 2006). In birds, declines in wild ungulate populations have contributed to those of scavengers, such as three Critically Endangered vulture species. While almost unstudied in the hotspot, declines in populations of wild ungulates (and other vertebrate species) can also be presumed to have caused declines in specialized coprophagous invertebrates, ecto- and endo-parasites, and stenotopic inhabitants of wallows and other microhabitats created or maintained by them.

Many of the animal species being traded at highest volumes in the illegal wildlife trade are reptiles. Many turtle species command high values in the trade, as pets and, especially, for food and traditional medicine, including Vietnamese pond turtle (*Mauremys annamensis*), impressed tortoise (*Manouria impressa*) and box turtles (*Cuora* spp.). Monitor lizards (*Varanus* spp.), tokay gecko (*Gekko gecko*) and various species of snake are particularly targeted by trade, because of their perceived medicinal benefits.

A large number of mammal species are threatened by hunting and trade, as either direct targets or incidental by-catch, and the trade is very dynamic. Hence, this section does not attempt to present a comprehensive list. Primates are targeted throughout the hotspot, for food, traditional medicine (such as bone 'glue') and pets. Many of the primates endemic to Indo-Burma, such as cao vit crested gibbon, Delacour's leaf monkey and Tonkin snub-nosed monkey persist only as one or a handful of relict populations. Other species, previously thought to be relatively little threatened, such as macaques, are now coming under increasing hunting pressure to supply demand from the biomedical industry. Other mammal species highly impacted by hunting include: cats, such as tiger, mainland clouded leopard (*Neofelis nebulosa*) and marbled cat (*Pardofelis marmorata*), targeted for their skins, teeth and claws and bones used in traditional medicine; bears, targeted for their skins, bears and bile (extracted from captive animals held in 'farms'); otters, targeted for their meat, pelts and body parts for traditional medicine; pangolins, targeted for their skin, meat and scales; and large ungulates, sought for meat, medicine and horns/antlers to be displayed as prestige-enhancing ornaments.

In comparison with mammals and reptiles, as of 2020, very few birds are of sufficiently high commercial value to be specifically targeted by hunters. The main exceptions of global concern include helmeted hornbill, which is targeted for its solid casque, used for carving ornaments, and straw-headed bulbul, which is targeted for the caged bird trade and has already been driven to extinction within the hotspot. Its relative, red-whiskered Bulbul (*Pycnonotus jocosus*) is heavily sought for the cagebird trade, particularly in Thailand, where it is becoming increasingly rare. Parakeets and mynas have also undergone large declines across substantial parts of the hotspot, driven by overharvesting for the cagebird trade. Nevertheless, incidental hunting, indiscriminate snaring and egg collection have been major factors in the declines of many of the hotspot's most threatened bird species, including Bengal florican, white-shouldered ibis, giant ibis, white-winged duck, Edwards's pheasant and green peafowl (*Pavo muticus*).

As human populations and levels of consumption increase, overfishing presents a growing threat to the region's freshwater fish diversity, with potentially significant indirect impacts on other species through, for example, depletion of prey species. The hotspot's most productive freshwater fishery, Tonle Sap Lake, has witnessed the disappearance from catches of some of the larger, more valuable species, an overall decrease in average fish size, and lower catches per unit effort (Baran *et al*. 2001). Overfishing is not restricted to industrial-scale fisheries. The increasing incidence of poison, electric and even bomb fishing on a local scale (e.g., Chen 2003) can, in conjunction with other threats, cause drastic reduction in whole fish communities (Baltzer *et al*. 2001). At Myanmar's Alaungdaw Kathapa National Park and Htamanthi Wildlife Sanctuary, for example, liquid pesticides are poured into pools in seasonal streams; as well as affecting aquatic fauna, such practices can result in the poisoning of wild animals that drink from the pools, and harm people and livestock (CARE Myanmar 2003). Use of poison and explosives for fishing is frequently associated with intensified infrastructure development, particularly as road workers often have access to dynamite (S. Kullander, C. Ferraris, Jr. and Fang Fang *in litt.* 2004).

The list of fish species threatened with extinction by overfishing is a long one. The most threatened species include Mekong giant salmon carp, giant carp, Jullien's golden carp, and the hotspot's freshwater flagship, Mekong giant catfish. For these and other large-bodied species, over-exploitation typically takes the form of commercial fishing to meet domestic market demand. Other species are not captured for consumption but to supply the (mainly international) aquarium trade. Collection for the aquarium trade has been identified as a major factor in the declines of several globally threatened fish species, including red fin shark minnow (*Epalzeorhynchos munense*), emerald dwarf rasbora (*Danio erythromicron*), Siamese fighting fish (*Betta splendens*) and Asian arowana (*Scleropages formosus*), which has been traded since at least the 1970s and has disappeared from many locations where it formerly occurred.

6.3 Habitat Loss, Degradation and Fragmentation

The recent stakeholder consultations point to the overriding threat posed by habitat loss, degradation and fragmentation. Besides the better-known vertebrate species that constitute the targets of much conservation action, habitat loss threatens a vast array of lesser-known and undescribed species especially of plants, invertebrates and fungi. Between 2000 and 2017, 120,000 square kilometers of forest ecosystems in Cambodia, Lao PDR, Myanmar, Thailand and Vietnam (i.e., the Indo-Burma Hotspot excluding China) were destroyed (Foley 2020). Apart from the immense scale of the losses, what is concerning is the rate of increase. Between 2000 and 2010, the rate of forest destruction increased from around

5,000 square kilometers per year to 8,000 square kilometers per year, reaching 13,000 square kilometers per year by 2017 (Foley 2020).

According to Global Forest Watch, Cambodia lost more than 14,000 square kilometers of forest between 2001 and 2014 (NASA Earth Observatory 2017). In the early 2000s, the most significant losses were in the northwest, notably Battambang, Oddar Meanchey and Pailin provinces; by 2012-2014, the wave of deforestation had spread eastwards, especially to Kampong Thom, Stung Treng and Ratankiri provinces (NASA Earth Observatory 2017). Cambodia's accelerating rate of deforestation during this period has been linked to changes in global rubber prices and a growth in economic land concessions (Davis *et al.* 2015, Grogan *et al.* 2015). Since 2006, one of the biggest threats to Myanmar's northern frontier forests has been deforestation to make way for sugarcane, tapioca, castor oil and rubber plantations (Global Witness 2009). Habitat conversion to agriculture takes two main forms: conversion of forest to industrial agriculture; and agricultural encroachment by smallholders. Although both have similar impacts, the two forms are considered separately below because their socioeconomic and political drivers are distinct, and hence they require different responses. Other causes of habitat loss, degradation and fragmentation include development of hydropower dams, linear infrastructure, and mines and quarries.

6.3.1 Industrial Agriculture

Conversion to agro-industrial plantations, often through the granting of economic land concessions, is one of the most significant causes of forest loss in the region: a fact repeatedly and explicitly highlighted during consultations with stakeholders. Stakeholders considered this to be the top-ranked threat overall and one of the top three threats in every country except Lao PDR (this partly reflects the unsuitability of Lao PDR's predominantly mountainous topography for industrial agriculture, which remains a major threat to the limited area of remaining forest on level lowlands). While natural forests are mostly now confined to lands less suited to arable farming, they continue to be replaced by perennial cash crops, including: rubber in Cambodia; tea in China, Myanmar and Vietnam; coffee in China, Lao PDR and Vietnam; oil palm in southern Myanmar and peninsular Thailand; teak in Myanmar; cashew in Vietnam; and eucalypts, acacias, pines, and fruit trees throughout the hotspot (Eames 1995, MacKinnon *et al.* 1996, Duckworth *et al.* 1999, Wells 1999, Das 2000, BirdLife International 2003, Clay 2004, Leimgruber *et al.* 2004, Eames *et al.* 2005, Manivong and Cramb 2008).

In Cambodia, for example, the last two decades have witnessed a surge in industrial agriculture, with more than 20,000 square kilometers of economic land concessions being granted to foreign and domestic investors on long-term leases (Davis *et al.* 2015). More than half of the land within these concessions was forested in 2000 but the annual rate of deforestation within these concessions was up to double that of comparable areas outside, in the period from 2000 to 2012 (Davis *et al.* 2015). The principal crop grown in these concessions was rubber.

Rubber plantations, originally planted for latex but increasingly harvested for timber (Blaser *et al.* 2011), are rapidly encroaching into protected areas in southern Thailand (The Nation 2011), Cambodia (Global Witness 2013) and China (Liu *et al.* 2006). In Vietnam, where there has been a significant expansion in rubber plantations, research in five Central Highland provinces revealed that about 79 percent of rubber plantation was established in areas that were originally natural forest, and not necessarily classified as degraded forest

(To Xuan Phuc and Tran Huu Nghi 2014). Besides the growth of market economies and investment from firms in China and Vietnam, this is driven by increasing rural populations in some areas (see Section 7.2.2).

In general, conversion of forest to plantations implies wholesale loss of forest-adapted species (e.g., Aratrakorn *et al.* 2006). Globally threatened species affected by conversion include Eld's deer, sarus crane (*Antigone antigone*) and white-shouldered ibis in Cambodia, which are threatened by expansion of rubber, cassava and fruit crops, and Gurney's pitta in southern Myanmar, which is threatened by expansion of oil palm. In Vietnam, the post-war human demographic explosion and extensive clearing for coffee, rubber, and cashew across the south of the country have reduced the available habitat for yellow-cheeked gibbon, black-shanked douc and other globally threatened species.

One documented case of the effect of plantations on a globally threatened species is that of Hainan gibbon. The area of forest on Hainan Island considered able to support the species fell by 58 percent between 1991 and 2008, with plantations the main factor below 760 meters (Zhang *et al.* 2010). At the gibbon's Bawangling refuge, KFBG worked with the nature reserve authorities to freeze plantation expansion and implement active restoration between remaining habitat fragments. By contrast most 'reforestation' programs underway in southern China and Vietnam adopt monocultures of eucalypts or pines, which are fire-prone, nutrient-depleting and ecologically sterile (MacKinnon *et al*. 1996, 2001). Some widely introduced tree crops, such as eucalypts, actually have allelopathic impacts on native biota (Fang *et al.* 2009). At best, plantations of non-native trees provide some habitat structure and ground cover, as well as an alternative source of timber to natural forest. However, the biodiversity and ecosystem service values of such plantations are very substantially lower than those of natural forests, and almost invariably even of the 'degraded', non-forest habitats they replace.

6.3.2 Intensification and Expansion of Smallholder Agriculture

Throughout Indo-Burma, rural communities in upland areas have long practiced various forms of shifting cultivation, typically involving rotational systems of swidden fields and regenerating fallows. This can have negative effects on forest integrity and continuity (MOPE 2002, Leimgruber *et al.* 2004), as in the case of Myanmar's Natmataung National Park (J. C. Eames verbally 2004). The replacement of forest by permanent arable agriculture has a long history in the hotspot, of which vast areas now lie under rice, maize, tobacco, cassava and sugarcane, along with the patchier occurrence of other crops, such as cotton, soybean, sorghum, cassava, wheat and peanuts (Clay 2004, Pollard and Evans 2008). Globally, tropical forests were the main source of new agricultural land in the 1980s and 1990s (Gibbs *et al.* 2010). Besides the expansion of cash crops, farmers still need new land for subsistence agriculture, especially the increasing rural populations in Cambodia and Lao PDR (see Chapter 7). Agricultural expansion is taking place along the edges of large forested regions, such as the northern edge of the Central Dry Zone and in the Ayeyarwady and Myitha River valleys in Myanmar (Leimgruber *et al.* 2004), as well as around Tonle Sap lake and along major lowland rivers in Cambodia (Bou Vorsak *in litt.* 2020). Intensification and expansion of smallholder agriculture was identified as one of the top five threats in Cambodia and Lao PDR, and the joint sixth ranked threat overall.

Not all forms of shifting cultivation are detrimental to forest biodiversity (Pye-Smith 1997), especially when compared with the alternative of conversion to permanent agricultural estate (including plantations). For example, a landscape maintaining traditional swidden practices in Yunnan's Xishuangbanna prefecture retained high bird richness and diversity relative to a nearby landscape undergoing rapid agricultural change (Wang and Young 2003). Some forms of low-intensity agroforestry (e.g., in Lao PDR) have existed for centuries without major deleterious impacts. There is a need to maintain or reassert such systems, which are able to sustain a rich tapestry of landscape, tradition and culture supporting biodiversity of global importance is being fragmented as a result of agricultural intensification (P. D. Round *in litt*. 2002). There is a need to review the compatibility of such systems with forest conservation and safeguard against unsustainable practices. Cardamom is one crop that may be compatible with conserving semi-natural forest, if the economic context (Ducourtieux *et al.* 2006) and ecological impacts (Feng and Li 2007) are conducive. However, experience from the Hoang Lien mountains of northern Vietnam demonstrates the potential of this crop to destroy habitat for montane birds through changes to understory structure (Eames and Mahood 2011).

While there are limits on the amount of new land suitable for arable farming, there will continue to be escalating demand for land to meet the food, fiber and fuel demands of the burgeoning human population, exacerbated by depletion of soil nutrients and fossil-fuel-derived fertilizers, and increasingly unpredictable climates (van Vuuren *et al.* 2008, Smith *et al.* 2010). Natural forest continues to retreat in the face of this demand (e.g., Forest Carbon Asia 2011a), and loss of species richness, abundance and population size inevitably follows across taxa (Sodhi *et al.* 2009). Expansion of smallholder agriculture threatens a range of globally threatened species, such as cao vit crested gibbon, Tonkin snub-nosed monkey, François's leaf monkey and white-eared night-heron (*Gorsachius magnificus*) in the Sino-Vietnamese Limestone Corridor, where this threat is particularly pervasive. In many cases, fire, over-grazing and over-harvesting of firewood are additional threats, inhibiting the recovery of fallow or abandoned fields.

Floodplain swamps and wetlands, notably seasonally inundated grasslands, have suffered immense historical losses to agricultural and aquacultural expansion. This has impacted many species, such as Bengal florican. In the Mekong Delta of Vietnam, almost all natural grasslands have been converted for intensive rice cultivation (Buckton *et al*. 1999), as have the formerly extensive wetlands in the Chao Phraya Basin of central Thailand (P. D. Round *in litt*. 2002).

6.3.3 Conversion of Coastal Habitats

Throughout the coastal zones of the hotspot, mangroves, lagoons, marshes and other wetlands, including some Ramsar sites, have undergone widespread conversion to shrimp- and fish-farms (Ong 2003), or been cleared for charcoal and fuelwood (Yan 2019). In Myanmar, where rates of loss have been quantified, mangroves are one of the ecosystems most severely threatened by habitat loss (Leimgruber *et al.* 2004, Yan 2019). Impacts include not only habitat loss but also interference with ecosystem hydrology, loss of storm barriers, and the demand for associated roads and other infrastructure (Clay 2004). Aquacultural expansion into mangrove threatens individual species, such as the Critically Endangered mangrove tree *Sonneratia griffithii*, as well as the critical services provided by these ecosystems, such as provision of nursery areas for fish and other marine species that support local incomes and food security.

Aquaculture is not necessarily incompatible with the conservation of coastal biodiversity. Traditionally managed, or extensive aquaculture, as practiced at the fishponds and tidal shrimp ponds in the Mai Po Marshes and Inner Deep Bay Ramsar Site in Hong Kong (WWF Hong Kong 2006, HKBWS 2020), can provide valuable habitat for many waterbirds including a number of globally threatened species (BirdLife International 2003). However, various forces, including the need for aquacultural pond owners to generate rapid financial returns in order to repay loans for the construction and lease of ponds, are driving a shift to unsustainable forms of intensive aquaculture, leading to die-back of mangrove and loss of habitat for many waterbirds.

Intertidal mudflats in the Indo-Burma Hotspot are the feeding areas of hundreds of thousands of migratory and resident shorebirds. At least 20 shorebird species, including the Critically Endangered spoon-billed sandpiper, occur in internationally significant numbers, and several areas qualify for Ramsar designation (Round 2000, Wetlands International 2002). Piecemeal afforestation of intertidal areas with mangrove is a threat to the most important areas for migratory shorebirds, including the Inner Gulf of Thailand and the Red River Delta of Vietnam (Pedersen and Nguyen Huy Thang 1996, Erftermeijer and Lewis 1999). Mangrove afforestation changes the nature of the substrate, making intertidal mudflats unsuitable for dependent bird species such as the Endangered black-faced spoonbill (Yu and Swennen 2001). The forces driving afforestation of mudflats include the coastal protection, land reclamation, and aquaculture development agendas of national and local governments, and financial incentives from national forestry programs.

6.3.4 Large Infrastructure (Dams, Roads, Ports, etc.)

Hydropower dams and associated infrastructure (access roads, ports, high voltage transmission lines, etc.) were identified by stakeholders as one of the top five threats in China, Lao PDR, Myanmar and Thailand, and the third ranked threat overall. Increasing regional demand for flood control, irrigation, and, especially, electricity generation is fueling a wave of dam construction on large rivers (see Section 7.3.2). The reservoirs created often flood important terrestrial habitats, and fundamentally alter aquatic habitats. The dams withhold water, which can create drought-like conditions and severely stress downstream habitats. Artificially managed discharges can cause major alterations to seasonal flow regimes and natural sedimentation processes both upstream and downstream of each dam. Existing and planned hydropower developments on the Mekong River and its tributaries are predicted to lead to substantial reductions in the amount of sediment carried by the river, with knock-on effects on aquatic biodiversity (Piman and Shrestha 2017), and potentially significant changes in flow patterns downstream (Räsänen *et al.* 2017, Olson and Morton 2018). Indeed, the impacts of hydropower dam construction on the Mekong mainstream since 2010 can already be observed, including reduced flooding around Tonle Sap Lake and less sediment deposition on the Mekong floodplain (Hecht *et al.* 2019). Such changes have serious impacts on species and their habitats, for instance reduced flooding around Tonle Sap Lake is exposing flooded forest (a critical nursery for fishes) to an increased risk of fire (Lovgren 2020).

Dams also directly impact fish migration routes and access to spawning grounds. Most lack fish passes or strategies to maintain aquatic communities upstream and downstream (e.g., Dudgeon 2000b). Even when fish passes have been incorporated into dam design, the first such experiments have been ineffectual (Roberts 2001), and the sheer volume of fish and diversity of species involved invalidate comparisons to temperate areas, where these techniques may have been effective. Water regimes influence aquatic biodiversity via several inter-related mechanisms (Dudgeon *et al.* 2006), while displaced human communities are often relocated in areas where they convert or place additional pressure on natural habitats.

The hotspot's freshwater flagship, Mekong giant catfish, is threatened by a cascade of up to 11 large-scale dams that could be operating on the lower Mekong mainstream by 2040 (International Rivers 2019). The Xayabouri dam has already been constructed, blocking the mainstream of the river downstream of Louangphabang in northern Lao PDR, while the Don Sahong dam has blocked the Hou Sahong, the main channel used for upstream migration of fishes through the Siphandon region in southern Lao PDR. Other proposed mainstream dams could have even more devastating impacts, especially the proposed Stung Treng and Sambor dams in Cambodia, which would block access to a greater proportion of the river's headwaters. Fortunately, development of these dams does not appear to be imminent, following an announcement by the Cambodian government in March 2020 that hydropower dam construction on the Mekong mainstream would be halted until at least 2030 (Kijewski 2020). Other highly threatened fish species potentially affected by dams in the lower Mekong Basin include Mekong giant salmon carp, giant carp, Siamese tiger perch (*Datnioides pulcher*), Mekong freshwater stingray, flying minnow (*Laubuka caeruleostigmata*) and Mekong herring (*Tenualosa thibaudeaui*).

Long-distance migrants, such as Krempf's catfish (*Pangasius krempfi*), which migrates upstream from the Mekong Delta at least as far as the Khone falls (Hogan *et al.* 2007), are particularly vulnerable, because their migration routes cross the sites of multiple proposed dams. Eighty-seven percent of mainstream Mekong fish species for which data are available are migratory (Baran 2006), and around 70 percent of the Mekong's commercial fish catch is composed of long-distance migrants (Dugan 2008). In terms of volume, between 700,000 and 1.6 million tonnes of the annual Mekong fish catch (up to 62 percent of the total) is at risk from the proposed Mekong mainstream dams (Baran 2010 cited in Peterson and Middleton 2010). The MRC Council Study concluded that planned hydropower construction would cause fish biomass to decline by between 40 and 80 percent by 2040 (International Rivers 2019). The potential implications of this for fisheries and food security are clear when one considers that the Mekong supports the world's largest inland fishery, accounting for 15 percent of the global inland fish catch (FAO 2020), with an estimated annual economic value of $11.2 billion (MRC 2019a). Indeed, the economic losses in terms of lost capture fisheries as a result of planned Mekong hydropower projects are predicted to greatly exceed the economic benefits from hydropower generation (Intralawan *et al.* 2017, 2018).

While dam developments on the mainstream of the lower Mekong River have justifiably attracted a huge amount of attention from civil society, media and policy makers within and outside the region, the potential impacts of dam development on Mekong tributaries and rivers in other basins are hardly less significant for biodiversity. The Yali Falls dam on the Sesan River in Vietnam, for example, has had serious deleterious effects on the river's fish and sandbar-nesting bird communities downstream in Cambodia (Baird *et al.* 2002, Seng Kim Hout *et al*. 2003). In Lao PDR, the population of Nam Theun barb (*Scaphognathops theunensis*) has declined dramatically following the construction of the Nam Theun II and other dams in the Nam Kading Basin (Kottelat 2011b), while Nam Leuk loach and slender-tailed loach (*Schistura tenura*) are now considered Critically Endangered following completion of the Nam Leuk dam at their only known locality (Kottelat 2011c,d). Outside the Mekong Basin, a recent Strategic Environmental Assessment (SEA) of the hydropower sector in Myanmar predicted that planned development of mainstream dams along the Salween (Nu/Thanlwin) River, “would lead to the direct loss of an estimated 1,030 km^2 of aquatic and terrestrial habitat, and indirectly affect an estimated 12,000 km^2 of KBA... ...and 3,500 km^2 of intact forest” in the basin (IFC 2018, p38).

Impacts of dam construction on species other than fishes are less known. The Critically Endangered damselfly *Cryptophaea saukra* is known only from streams in Doi Suthep-Pui National Park in northern Thailand, which have been adversely affected by the building of a small dam (Hämäläinen 2003, Dow 2009). Another Critically Endangered invertebrate, the bivalve mollusc *Cuneopsis demangei*, known only from the Da River near Viet Tri city, Vietnam, may already be extinct following construction of a large hydropower dam upstream. Hydropower dam projects can also have serious indirect impacts on terrestrial biodiversity, including forest destruction and increased hunting pressure, as affected Tonkin snub-nosed monkey following construction of the Na Hang dam on the Gam River in Vietnam (Le Xuan Canh *et al.* 2008).

Hydropower development is not the only form of large infrastructure development to have severe direct and indirect impacts on biodiversity in the Indo-Burma Hotspot. Extension of transport networks (road, rail and river navigation) has the potential for direct and indirect adverse impacts on natural ecosystems. At the regional level, major road networks are being created that link capital cities and major ports, such as the North-South Corridor Project, financed by the Asian Development Bank (ADB), which now links all the hotspot countries with two-lane highways, and the East-West Corridor, linking the port of Da Nang in Vietnam with Bangkok, via southern Lao PDR. In Vietnam, a second major north-south highway linking Hanoi with Ho Chi Minh City through the Annamite Mountains now runs through the hearts of several protected areas, compounding threats to endemic and threatened species, such as saola, southern white-cheeked gibbon and red-shanked douc, fragmenting subpopulations and increasing human access for hunting and forest clearance. Research has shown that some of Vietnam’s major routes for wildlife trafficking are along new roads linking Vietnamese provinces to China and Lao PDR (ENV 2016). In Myanmar the impacts of roads, powerlines and other infrastructure was relatively localized until recently (Lynam 2003), for instance, only around 25 percent of protected areas contained roads in 2002 (Rao *et al.* 2002), but this is changing. Power and telephone lines have been implicated in habitat fragmentation for saola, Tonkin snub-nosed monkey and Hainan gibbon.

Road building has damaged aquatic ecosystems, diverting water courses, reducing canopy cover and depositing large volumes of sediment. In addition to its direct impacts, construction of roads facilitates human settlement, and makes agro-industrial plantations more economically viable. Another major indirect impact of new roads is that they strengthen economic links between remote rural areas and urban centers, facilitating the expansion of wildlife trade networks and placing increased pressure on plant and animal populations.

6.3.5 Land-use and Urban Planning

Globally, over 50 percent of the population lives in urban areas and, by 2045, the world’s urban population is projected to increase by 1.5 times, to 6 billion (World Bank 2020a). Because the expansion of urban land consumption outpaces population growth by as much as 50 percent, this growth is expected to add 1.2 million square kilometers of new urban area worldwide in the three decades (World Bank 2020a). Within the Indo-Burma Hotspot, urban expansion has been especially rapid in parts of coastal China, where the rate reached 13 percent per year (Seto *et al.* 2011). While not one of the top threats, land-use and urban planning was ranked by stakeholders as one of the top five threats in Thailand and the joint tenth overall. Urban expansion has impacted Critically Endangered plants, such as *Cycas fugax* in Vietnam and *Diospyros vaccinioides* in southern China. The loss of aquatic vegetation to urbanization threatens fish species, such as the Critically Endangered Somphongs's rasbora (*Trigonostigma somphongsi*) in the lowland Mae Khlong basin near Ratchaburi, central Thailand (Vidthayanon 2011b). Urbanization is also a major contributor to pollution in the hotspot, which is treated in a later section, as well as to the growth in demand for wildlife, timber and energy. In this sense, it is both a direct cause and a driver of biodiversity loss.

6.3.6 Mining and Quarrying

Mining and quarrying for ores, gems and construction materials are causing localized but significant habitat loss in the hotspot. Mining/quarrying was identified as a threat in most of the stakeholder consultations but was only ranked in the top five threats by the group looking at regional issues, leading to it being ranked joint tenth overall. In Cambodia, for example, 23 licenses for industrial mining, 61 licenses for mineral exploration and 401 licenses for mining construction materials (pits and quarries) were current at the end of 2016 (Transparency International 2017). These licenses overlap with a number of KBAs and conservation corridors. For instance, Indochine Mining Limited (Boeung Nging Kang) has an exploration license for gold and copper within Virachey National Park, Gold Metal Group Co. Ltd. 1 has an exploration license for gold within Phnom Prich Wildlife Sanctuary, and Allumina (Cambodia Vietnam) Co. Ltd. has an exploration license for bauxite that overlaps with Seima and Phnom Nam Lyr Wildlife Sanctuaries (ODC 2019).

Quarrying of limestone for cement manufacture is a particular threat to limestone karst. Limestone quarrying threatens a number of globally threatened species, and may already have caused the extinction of some. For example, the springtail *Delamarephorura tami* was discovered in 2004 but its only known site (in the Kien Luong limestone of southern Vietnam) has since been destroyed by quarrying; the species is therefore assessed as Critically Endangered (Possibly Extinct) (Deharveng and Bedos 2016).

Mine access roads and temporary settlement by mine workers can also have serious indirect impacts, including increased levels of offtake of wildlife to meet demand from mine workers living in temporary camps in remote forest areas. Moreover, several mining techniques can lead to pollution of aquatic systems by sediment or toxic chemicals, with negative impacts on freshwater biodiversity. Gold panning releases mercury into the upper reaches of the Ayeyarwady and Chindwin Rivers in Myanmar (Eberhardt 2003), although there have been government efforts to control this. Mining is implicated in the collapse in populations of several Critically Endangered bivalves in the Sino-Vietnamese Limestone Corridor, including *Lamprotula liedtkei* and *Lanceolaria bilirata* (Do 2011a,b). Gold, sand and gravel mining are causing major changes to the geomorphologic and hydraulic features of rivers and marine-appended lakes that support important aquatic biodiversity. For example, in the Sre Ambel River of Cambodia, sand mining is a major threat to the Critically Endangered southern river terrapin (*Batagur affinis*), which nests on riverine sandbanks (Moll *et al.* 2015).

6.4 Pollution

Urbanization, industrialization and agricultural intensification are leading to increased levels of pollution throughout the hotspot. Discharge of industrial waste into major waterways is a widespread problem, as is run-off of agrochemicals from agricultural land and agro-industrial plantations. Pollutants entering aquatic systems may have direct effects on sensitive animal and plant species, through toxicity or indirect effects, particularly through eutrophication. Sewage treatment is scarce in the region, and mass dumping of raw sewage is frequent (BirdLife International 2003). Microplastic and nanosilver pollution are rising fast with consumption (Sutherland *et al.* 2009), while pollution by mining is a particular concern (see Section 6.3.6).

There has been little research into the impacts of pollution on biodiversity in the hotspot, and, as a threat to lesser-known ecosystems and organisms, it may be under-appreciated. This is consistent with the stakeholder consultations in May 2019, where pollution was only ranked in the top five threats in Thailand. With the intensification of agriculture as a major socioeconomic strategy, the extensive use of agrochemicals will continue to pose many problems for species and ecosystems. Algal blooms in lakes are one consequence, to which vehicle emissions also contribute (Stone 2011). As well as the direct impacts on species through toxicity, the severe decline in invertebrate abundance associated with high levels of pesticide use is one of the major factors contributing to the collapse of open-country and peri-urban bird populations in agricultural landscapes throughout the region.

Impacts on coastal and marine ecosystems are significant. Nitrogen levels in waters off China have risen sharply in recent decades due to industrial (e.g., coal power plants) and agricultural (e.g., nitrogen oxide) pollution (Kim *et al.* 2011), increasing the threat of algal blooms and dead zones with low oxygen levels. Pollution is a threat to many globally threatened fish species, including club-barbel sheatfish (*Ceratoglanis pachynema*), ornate barb (*Pethia ornata*) and spot-finned loach (*Schistura spiloptera*) (IUCN 2020b). Also believed to be threatened by pollution are various molluscs, such as *Gabbia alticola* and *Lanceolaria bilirata*, and aquatic plants, such as *Terniopsis ubonensis* (IUCN 2020b).

6.5 Invasive Species, Disease and Genetic Contamination

Deliberate and accidental introduction of invasive alien species has occurred at many sites in Indo-Burma (e.g., Dudgeon and Corlett 1994, Fellowes 1999, Li and Xie 2002), although the impacts on biodiversity have been little studied to date and are, thus, poorly understood. It is often unclear whether the spread of invasive alien species has driven or followed the depletion of native species; the latter is generally suspected, at least in terrestrial ecosystems. Aquatic ecosystems may be more at risk from displacement of native species by aliens. Two large introduced species, grass carp (*Ctenopharyngodon idellus*) and rohu (*Labeo rohita*), are found in Myanmar's Inle Lake, and the former poses a clear threat to the lake's ecosystem (Kullander *et al.* 2004). Water hyacinth (*Eichhornia crassipes*) and giant mimosa (*Mimosa pigra*) are threats to Tonle Sap Lake and its inundation zone (MacDonald *et al*. 1997) the Mekong Delta in Cambodia (Bou Vorsak *in litt.* 2020), and to an increasing number of wetlands, large to small, in the hotspot's plains. Prickly pear (*Opuntia* sp.) is a threat to Khao Sam Roi Yot National Park in Thailand (J. Parr verbally 2003), as is mile-a-minute (*Mikania micrantha*) to the New Territories of Hong Kong (Liu *et al.* 1997) and substantial areas of northern Myanmar (J. W. Duckworth pers. obs.). Vegetation in some areas of Myanmar's Central Dry Zone is dominated by introduced species such as *Prosopis juliflora* and *Euphorbia* spp. Globally threatened fish species threatened by invasive species include Inle danio (*Devario auropurpureus*), red dwarf rasbora (*Microrasbora rubescens*) and Burmese rammy nose (*Sawbwa resplendens*), which are all endemic to Myanmar's Inle Lake (IUCN 2020b).

Given the ongoing modification of most ecosystems, the expansion of tropical taxa into higher latitudes and altitudes, and climate variability favoring adaptable generalists over specialists, the economic and ecological impacts of invasive alien species look set to increase unless, as advocated by the CBD, there is proactive and adaptive management with emphasis on prevention and early detection rather than on control. Of particular concern are ecologically dominant plants and ants, which have the potential to restrict the persistence of forest taxa (Corlett 2010). One potentially huge threat to ecosystems comes from aggressive invasive insects, such as the red imported fire ant (*Solenopsis invicta*), now expanding in many parts of South China (Zhang *et al.* 2007) including the Mai Po Marshes and Inner Deep Bay Ramsar site in Hong Kong (WWF Hong Kong 2006). A threat to invertebrates, plants and even medium-sized vertebrates (Taber 2000), this ant looks set to invade other countries of the region unless there are rapid improvements in biosecurity, guided by more systematic assessment of risk and probability of success: as practiced in New Zealand, the one country that has eliminated *S. invicta*. A strong biosecurity system requires coordination and information portals.

Disease may be another underappreciated threat to biodiversity. Coral disease has emerged as a serious threat to coral reefs worldwide and is a major cause of reef deterioration. Diseases and parasites from domestic and/or free-ranging livestock could also have disastrous impacts on wild ungulate species, particularly banteng, which appears to be particularly susceptible to a number of cattle diseases (Gardner *et al.* 2016). The impact of chytridiomycosis, a fungal disease caused by the pathogen *Batrachochytrium dendrobatidis (Bd),* which has been implicated in the decline and extinction of many amphibian species in other regions of the world (Skerratt *et al.* 2007), does not appear to be as great in the Indo-Burma Hotspot. Recent research from Vietnam has revealed the pathogen to be prevalent in amphibian populations, with no evidence of population declines (Le Thi Thuy Duong *et al.* 2017), and the hypothesis that chytridiomycosis is causing widespread amphibian declines globally has been questioned (Heard *et al.* 2011). Another disease that poses a potential threat to biodiversity in the region is avian malaria, which could become a greater problem with climate change (Garamszegi 2011).

The misdirected release of animals (for example, following confiscation of illegally trafficked wildlife or to earn spiritual merit) risks introducing diseases, as well as alien genotypes, to native populations (Karesh *et al.* 2007). Released captive animals can interbreed with wild populations of the same or related species, leading to genetic contamination. For example, release of confiscated long-tailed macaques is at least a localized threat to rhesus macaque (*Macaca mulatta*) in parts of the latter species's range in Vietnam (Timmins *et al.* 2008).

6.6 Climate Change

The potential impacts of climate change on the species populations and ecosystems of the Indo-Burma Hotspot are reviewed in Chapter 10. These impacts are anticipated to be severe, particularly for freshwater and coastal ecosystems, which are considered to be among the most sensitive to climate change and sea-level rise. Global effects of climate change are predicted to include temperature increases, sea level rise, increase in CO_2 concentrations, and altered patterns of precipitation (Gitay *et al.* 2002). Although temperature increases are forecast to be greatest towards the poles, climate sensitivity is highest in the tropics, since species there are not adapted to high variability and are close to their upper limits of temperature tolerance, hence many tropical species are at risk of extinction from temperature change (Deutsch *et al.* 2008). Species that persist within isolated or fragmented habitat patches are at elevated risk, because they are less able to undergo altitudinal or latitudinal range shifts in response to movement in climate 'envelopes' of suitable conditions. One of the few studies that has looked specifically at the impacts of climate change on biodiversity in the Indo-Burma Hotspot estimated that between 1.9 and 40.5 percent of endemic plant and vertebrate species may become extinct due to the climate change over the next century, depending on different modeling scenarios (Malcolm *et al.* 2006).

The specific effects of climate change on biodiversity are difficult to predict. However, Chapter 10 goes some way towards identifying the most sensitive ecosystems and species. Ecosystems that are particularly vulnerable to climate change include: inland freshwater wetlands, due to predicted impacts on hydrodynamics (Bates *et al.* 2008); coastal wetlands and deltas, due to sea level rise, saltwater intrusion and increased severe weather events (Cruz *et al.* 2007, Rao *et al.* 2013); lowland forests, due to changes in temperature and rainfall patterns (Blate 2010, Rao *et al.* 2013); and montane forests, due to changes in temperature and rainfall, compounded by limited dispersal ability of species assemblages (Rao *et al.* 2013; see Section 10.3.1). Species and groups of species that are particularly likely to be negatively affected by climate change include turtles, Siamese crocodile, amphibians, fishes and migratory birds (Rao *et al.* 2013, Howard *et al.* 2018; see Section 10.3.2).

Indirect impacts of climate change on biodiversity could be no less important than direct ones. In particular, the responses of human populations to climate change will almost certainly place greater pressure on the hotspot's biodiversity (see Section 10.3.4), including through changing agricultural patterns, realignment of infrastructure, resettlement of people and civil engineering responses to water-availability problems (Dudgeon 2007, Palmer *et al*. 2008). For example, serious consideration is being given to water-diversion projects, such as the Kong-Loei-Chi-Mun project to divert water from four major Mekong tributaries to irrigate agriculture in north-eastern Thailand; such schemes have the potential for catastrophic impacts on freshwater ecosystems (Lower Mekong Network 2018). Another indirect impact from climate change is expected to be internal displacement of people, as people move away from areas affected by climate change (and other environmental changes) and create knock-on impacts in other areas.

6.7 Other Threats

6.7.1 Harmful Human Behavior

Besides infrastructure and agricultural expansion, human activity can itself be harmful to threatened species. This threat is sometimes referred to as 'disturbance' but harmful human behavior as discussed here also encompasses deliberate persecution of living things. Tourism and recreational activity can disturb or kill coastal species, such as corals, sea turtles and dolphins; vessel strikes can kill or injure aquatic species, such as Irrawaddy dolphin, which are also accidentally entangled in gillnets, killed by electrofishing or restricted by fishing gear, as in Songkhla Lake, Thailand (Minton *et al.* 2017). Cave visiting is a threat to bats and other species, such as the Critically Endangered blind cave loach (*Nemacheilus troglocataractus*), known only from one subterranean stream in western Thailand (Vidthayanon 2011a). Direct human-animal conflict is a major conservation issue for certain globally threatened species, such as Asian elephant, which can destroy crops and even kill or injure people, and tiger, which is seen as a threat to people and livestock.

6.7.2 Extinction Cascades through Degradation

Many of the threats to particular species or groups of species are having knock-on effects on ecosystems. In general, these are little studied but examples include the effects of ungulate depletion on predator, scavenger, coprophage and parasite populations, the effects of disappearing seed-dispersing mammals and large birds on large-seeded trees and any folivorous insects strongly associated with them, and the effects of declining pollinator insects on flowering plants. The declines of large ungulates across the hotspot may underlie those of threatened vulture species. The loss of large apex predators from ecosystems, exemplified by the depletion of mammals in the order Carnivora from southern China (Lau *et al.* 2010) and elsewhere in the hotspot, could be among humankind's most pervasive influences on nature due to extensive cascading effects of their disappearance on a range of processes, including the dynamics of disease, wildfire, carbon sequestration, invasive species and biogeochemical cycles (Estes *et al.* 2011). Climate change will certainly compound these disruptions.

6.7.3 Small Population Effects

The survival of many of Indo-Burma's globally threatened species is in doubt even if active threats can be mitigated, due to their now only small remaining populations, such that breeding is uncommon and inbreeding is likely. Populations of Hainan gibbon, white-headed leaf monkey, Irrawaddy dolphin and white-winged duck, among other species, are likely to be threatened by inbreeding effects, limited mate-choice, and risk of human or natural disaster. The smallest populations of Delacour's leaf monkey are extremely unlikely to survive without population management, because the number of reproductively active males is often reduced to a single individual. The Hainan population of Eld's deer has low genetic diversity following a population bottleneck, and this may inhibit recovery efforts. Several of the hotspot's most threatened tree species are reduced to under 100 mature individuals, and it seems likely that many will require active population management to recover.

6.8 Root Causes and Enabling Factors

The root causes and enabling factors of biodiversity loss are often deep-rooted and complex. This section does not attempt a comprehensive review of the underlying societal, socioeconomic, technological or institutional causes of biodiversity loss in the Indo-Burma Hotspot, which would be outside the scope of this document. Rather, it expounds the various root causes and enabling factors identified by participants at the consultations in 2011 and 2019.

6.8.1 Population Growth, Urbanization and Migration Patterns

Humans (*Homo sapiens*) are one of the few large mammal species in Indo-Burma whose population is increasing not decreasing. The human population of the hotspot increased by about 8 percent per year from 2008 to 2018 and population density now averages 150 people per square kilometer (World Bank 2020c; Section 7.2.1). Within this trend, there has been considerable internal migration since the 1990s, especially from rural to economically vibrant urban areas, although sometimes the converse, as in the movement of people from the Cambodian rice belt to more sparsely populated regions, including protected areas (see Section 7.2.2). Migration in rural areas can have huge impacts on the ability of upland populations to live sustainably (Eberhardt 2003); drivers include natural disasters and conflict, which had left around 500,000 people internally displaced within Myanmar as of 31 December 2019 (IMDC 2000), and, increasingly, climate change (FAO 2011b).

Migration towards urban centers, in the region or overseas, can reduce local pressure on land (Asia Pacific Forestry Commission 2011b), but this may be outweighed by the direct and indirect impacts of urban expansion. For instance, urban areas create disproportionate demand for cement and concrete, which is driving mining of limestone karst ecosystems in the hotspot (IUCN 2014, Wallace 2017). Individual limestone outcrops often hold plant, reptile, fish and invertebrate species with extremely restricted ranges, so quarrying of this ecosystem may be causing more species extinctions than any other economic activity in the hotspot. Furthermore, urban lifestyles are typically more resource-intensive, particularly where markets are highly liberal. The dramatic worldwide increases in urban population (from 732 million in 1950 to 4.4 billion in 2020) and consumption have been enabled, in turn, by the energy subsidy of fossil fuels (i.e. the products of past photosynthesis), whose contribution to the human energy economy currently exceeds global net primary production. As we pass the peak in global oil supply, the development of alternatives to support humankind's huge population is itself a major threat to biodiversity in the hotspot, in the shape of hydropower and biofuel expansion (Lee *et al.* 2011), and the dependence of the current global food system on declining fossil fuels is bringing food-security concerns center stage.

6.8.2 Economic Growth and Regional Economic Integration

Economic growth and regional economic integration are major underlying causes of habitat loss and degradation, and the overexploitation of plant and animal species. While the pace of economic development varies greatly within the hotspot, being higher in Thailand and southern China, and lower in Myanmar and Lao PDR (Williams 2011), all countries are pursuing market-oriented economic policies and export-led development strategies, on the promise of strong economic growth and with the encouragement and support of external donors. This is especially notable in three critical sectors for biodiversity conservation (forestry, fisheries and agriculture), where natural ecosystems are often sacrificed for hard currency (Eberhardt 2003), generated through production of timber, pulp, palm oil and other commodities. Regional economic integration and the associated increases in cross-border trade and transnational infrastructure pose significant new challenges to biodiversity conservation, as the increased volumes of goods crossing borders make it hard to detect both illegally traded wildlife and invasive alien species, and the developing road networks expose previously remote areas to outside market pressures.

While increased economic growth can result in more resources being made available for biodiversity conservation, it does not necessarily translate into increased overall wealth. Measures like GDP, GNP and HDI fail to represent a country's productive base (i.e., its stock of capital assets, including institutions and natural capital) or the wellbeing of future generations (Dasgupta 2010). At the same time, global carbon dioxide emissions continue to rise (more than doubling in the 50 years between 2007 and 2020; C2ES 2020) as a result of this mode of development, which is arguably now diminishing overall global wealth by any comprehensive definition.

Many analysts question whether economic growth can be sustained for long after the peak in global oil supply, calling for an alternative economic pathway that meets qualitative goals within energy constraints (Daly 2007, Jackson 2009, Aleklett *et al.* 2010). While economic projections become unreliable from this point onwards, there is a strong need for sustainable development policies backed up by studies that evaluate, document and promote the economic case for investing in natural capital (see Section 6.8.6). This will require interdisciplinary collaboration and dialogue between policymakers and researchers.

6.8.3 Changes in Consumption Patterns

Changes in consumption patterns for food and non-food goods are exacerbating pressure on land, particularly an increase in consumption of livestock proteins, which make less efficient use of land and energy than plants (Smith *et al.* 2010). From the mid-late 1960s to the late 1990s, per-capita dietary fat supply in East and Southeast Asia rose by 86 percent; in East Asia annual consumption of meat rose by 333 percent and milk by 177 percent (WHO 2011). Total global meat production is projected to increase by 66 percent between 2008 and 2050 (Halweil 2008), and meat and dairy increases have dramatic implications for land use (e.g., Sutherland *et al.* 2010). There is cultural variation within this trend, and scope for influencing habits through environmental education. Consumption in developed countries is also contributing to loss of natural habitats in the region. For example, the major export markets for shrimp farmed in the region's coastal zones are the EU, Japan and the United States.

Intensification is expected to be the main means of increasing agricultural production in Asia (Gregory *et al.* 2002, Bruinsma 2003) to meet the gathering food security challenge (Godfray *et al.* 2010). Some 24 percent of children in the hotspot are malnourished (Mittermeier *et al.* 2011), and this figure could rise if the challenge is not met. There is a clear need to develop approaches to natural resource management that deliver significant benefits to local communities while meeting biodiversity conservation objectives. In many cases, such approaches will need to address issues of institutional capacity and land-use policy and planning simultaneously. Both governments and producers have an interest in siting agriculture in optimal locations and strengthening zoning to optimize ecosystem services and minimize societal costs (Clay 2004). Diverse and productive faunal communities can persist in an agricultural landscape provided that there is sufficient ecological integrity, including natural forest (Ranganathan *et al.* 2010). Productivity can rise, and environmental costs decrease, when agriculture is abandoned on marginal lands (Clay 2004). In Thailand, for instance, forests are regrowing on former agricultural land, allowing forest recovery (FAO 2011b). The global land area dedicated to fiber crops actually declined between 1961 and 2007, due to increased productivity per unit area (Smith *et al.* 2010). Improved research and practice are needed on rehabilitating degraded lands for agriculture (Clay 2004), on more innovative ecological farming methods that nurture soil biodiversity, and on the overall resource efficiency of farm management practices. These can be incorporated into efforts by protected areas to improve synergy between conservation and community development, as demonstrated by the joint work of KFBG and Yinggeling Nature Reserve on Hainan Island (Padilla and Fellowes 2010).

Environmental education, improved recycling and restoration of degraded lands may influence the pressure on forest land for pulp. Continued progress in curbing biomass demand cannot be assumed given rising fuel costs. In some cases, e.g., in western Guangxi, the fuelwood-saving benefits of biogas have been compromised by the collection of fuelwood to cook pig feed (J. R. Fellowes, pers. obs.), calling for the use of alternative feeds. While a relatively low proportion of forested land in Indo-Burma is considered suitable for conversion to biofuels, such as sugarcane (5.6 percent), soybean (2.7 percent) or oil palm (0.8 percent), the absolute area involved amounts to over 70,000 square kilometers (Lee *et al.* 2011), making this a serious threat to biodiversity. These figures relate to current cultivars; selective breeding of varieties of these crops better suited to the region's climates and soils would allow much greater areas to be economically productive for them.

6.8.4 Relationships between Humans and Nature

Culture influences all aspects of threats to biodiversity. Cultural drivers include increasing disconnection from nature and preference for consuming rare wildlife. Conversely, there are trends in some more educated populations to appreciate the non-utilitarian values of nature and pursue associated pastimes, such as birdwatching or nature photography. Indeed, some common presumptions, such as that most people in China are unwilling to sacrifice economic gains for nature conservation (McBeath and Leng 2006), need to be tested, as attitudes and values are dynamic. The growing separation of people from nature, with symptoms such as 'biophobia' and the denial of biodiversity loss (Sutherland *et al.* 2010), threaten engagement with conservation. Several initiatives, including those of the Gaia School, KFBG, WWF and others in Hong Kong, Partnerships for Community Development in mainland China, and the Traidhos Three Generation Barge Program in Thailand, are actively trying to reconnect urban people with nature. Experiential nature-education activities can be effective, and there is scope for synergy with governments' health and wellbeing agendas, as well as traditional Asian practices of mindfulness and spiritual enquiry.

Rural people living in close proximity to protected areas may not necessarily be supportive of conservation management (Clarke 1999), and this challenge can be compounded by poor communication about conservation aims, lack of mechanisms for local communities to benefit from protected areas, and lack of opportunities for grassroots participation in conservation. NGOs and academic institutions can build grassroots support by addressing these issues.

Unless responsible authorities have the political will to implement conservation, there is little potential to succeed. The extinction of the Vietnamese population of Javan rhinoceros, like other less heralded losses, ultimately reflects a lack of political support to secure adequate habitat, prevent encroachment, and control hunting (Brook *et al.* 2011). For protected areas, the ever-present possibility of downgrading, downsizing and de-gazettal, the lack of long-term funding security, and the lack of constant political support underlie institutional limitations (Blaser *et al.* 2011). Changing the culture of indifference among decision-makers is a top priority, therefore.

6.8.5 Technological Innovation

Powerful new technologies can speed up rates of biodiversity loss, as has been noted for fishing, farming, logging, trade and pollution in the hotspot. Many industries have developed technologies that have failed to complete resource-flow cycles and, hence, fail to internalize costs, leading to pollution and its effects, including climate change. Such technologies may be aggressively advertised by industry, with no comparable agency able adequately to present or even investigate the costs to ecosystems and society until the damage is done. An emerging example is the genetic modification of crops, which is often held up by industry as a solution to food insecurity, despite the fact that it raises threats to food sovereignty, inherent risks to native biodiversity, and diversion of investment from ecologically resilient and sustainable agriculture (Altieri and Rosset 1999).

If applied differently, technology could help to enable more sustainable resource use. For example, while the internet can open up new pathways for illegal wildlife trade and invasive species, it can also empower civil society responses and cohesion. Field survey methods are improving due to use of Global Positioning System, camera traps, weather recorders, and automated recognition of animal calls and images (Sutherland *et al.* 2009). Surveillance can take advantage of the ubiquity of mobile phones with cameras and internet access. For example, the Spatial Monitoring and Reporting Tool (SMART), which is being adopted by a growing number of protected area managers and community conservation teams across the hotspot, takes advantage of GPS-enabled mobile devices fitted with the CyberTracker data collection application. The overall challenge is to improve the application of technology in support of biodiversity, while curbing its negative impacts.

6.8.6 Narrow Measures of Economic Development

Although biodiversity has important cultural, spiritual, recreational and personal values, government policies frequently recognize natural resources only for their market value. Throughout the world, market prices tend to reflect only the direct-use values of natural resources, ignoring indirect use, option use and existence values (e.g., SCBD 2001). Dispersed services, such as carbon sequestration, are undervalued by national governments, which tend to focus on the immediate gains from exploiting a natural resource rather than long-term benefits from its maintenance; the devastating delayed impacts of climate change are one consequence of this market failure (Stern 2006). Yet, quality of life depends on a complex range of ecological functions that provide clean air, pure water, fertile soils and other ecosystem services. Grasslands and wetlands are particularly undervalued.

More systematic attention to natural capital would help reinforce such policies as moratoria on the further expansion of agro-industrial plantations into natural forests, as was applied in 2010 to the six largest foreign plantation projects in Vietnam, implemented by the Hong Kong-backed InnovGreen (Forest Carbon Asia 2011b). Correcting the many market failures behind the biodiversity crisis will involve the costs of conservation being met by society as a whole, notably its wealthier sections (Whitten and Balmford 2006). Payments for ecosystem services can be effective tools for this (Goldman *et al.* 2008; Wunder *et al.* 2008). There has also been pioneering work under China's Natural Forest Conservation and Grain to Green Programs, as well as under national reforestation programs in Lao PDR and Vietnam (McNeely 2007). In future, such schemes need to address loopholes, such as the lack of additionality (Corlett 2009) and perverse incentives, not to mention ingrained corruption.

Governments responsible for long-term wellbeing clearly need to rise above 'economism' (i.e., the reduction of progress to narrow economic measures) but also to refine these measures. Among the many improvements needed for a sustainable economics are the improved definition of 'shadow prices' (i.e., the values to be imputed to assets without current market value), and better representation of economies' comprehensive wealth, including all capital assets (Dasgupta 2010). Improving the ecological literacy of finance officials and economics students is an obvious and pressing need. Another is the improved valuation of ecosystem services. The combined value of 17 different ecosystem services, including climate regulation, water supply, and food production, has been estimated at between $16 and $54 trillion per year (Costanza *et al*. 1997), or twice global GNP. A number of projects, including a review of the roles of natural vegetation in China (MacKinnon *et al.* 2001) and an economic review of protected areas undertaken for the lower Mekong countries (ICEM 2003), have aimed at demonstrating the economic values of biodiversity. Such studies may help ensure that investors compensate more fully for the full economic costs of their investments, for instance through a natural-resources tax or appropriate mitigation measures. Financial mechanisms could be developed that enable the beneficiaries of dispersed ecosystem services to contribute to their conservation, such as carbon offset payments and debt-for-nature swaps. However, the declining role of international donors, with standardized practices of transparency and safeguards (see Section 7.3.1), may make developing these more difficult.

Possible economic policy instruments to promote sustainability include: agricultural prices and subsidies; trade policies; user fees; payments for ecosystem services; tax exemptions for sustainable behavior; high levels of taxes on unsustainable practices; fines; and environmental performance bonds and deposits. To date, subsidies within the forestry and agriculture sectors have promoted increased production of a number of commodities linked to forest loss, including timber, NTFPs and cash crops, as well as promoting agricultural intensification and the large-scale use of agrochemicals. Subsidies for tree planting have led to the afforestation of intertidal mudflats, grasslands and other natural non-forest habitats. Such perverse incentives may be direct, for example tax write-offs, grants or low-interest loans, or indirect, for example low land rents, low labor costs, construction of access roads and other infrastructure, or weak environmental protection regulations. Realigning subsidies and compensation schemes in support of environmental services is a key priority (Clay 2004) and signatories to the CBD committed to eliminate or reform incentives harmful to biodiversity by 2020 (Aichi Biodiversity Target 3; SCBD 2010).

Biodiversity offset and compensation schemes are at an early stage of development in Asia. China has various 'eco-compensation' schemes, mainly government-mediated payments for water quality and flood mitigation (Madsen *et al.* 2010). One national regulatory program, based in the Forest Law (1998), requires developers impacting forestry lands to avoid, minimize, and then pay a Forest Vegetation Restoration Fee, used for reforestation. This program collected RMB 8 billion (about $393 million) in 2003-2005. Constraints on payment for ecosystem services projects in Asia include high population density (escalating the transaction costs of contracting potential service suppliers), state control over most forest land (Huang *et al.* 2009), and the extremely low profile of other, mostly more threatened, natural habitats.

The private sector is seen as increasingly important in resolving problems of biodiversity conservation, which are often core to industry viability (TEEB 2009). Cross-sector partnerships, such as the Roundtable for Sustainable Palm Oil, have potential for integrating biodiversity concerns into business practices. Certification is another way of promoting environmentally benign practices, such as sustainable forest management. Tropical plywood exports have declined dramatically since the 1990s, in part due to consumer concern about environmental and social impacts, and legislation in the United States (the 2008 Lacey Act) and EU (the 2013 EU Timber Regulation), plus public purchasing policy in Japan, which are driving moves towards the production of certified, higher-value products to secure a viable future for the natural-forest-based tropical timber sector (Blaser *et al.* 2011).

To assist such moves, the EU provides technical assistance through its Forest Law Enforcement, Governance and Trade (FLEGT) Action Plan. Under the EU FLEGT Action Plan, hotspot countries are currently negotiating or implementing Voluntary Partnership Agreements (VPAs), which impose requirements to export only legally sourced timber to EU member countries. The first VPA in the hotspot, between the EU and Vietnam, entered force in June 2019, while VPAs between the EU and Lao PDR, Myanmar and Thailand are still being negotiated (EU FLEGT Facility 2020). All four of these countries are receiving support from the EU FLEGT Facility for the participation of small and micro timber enterprises in legal supply chains. In addition to the EU FLEGT initiative, the International Tropical Timber Organization assists its member countries through several national-level projects and through its Tropical Forest Law Enforcement and Trade thematic program.

In addition to legally binding agreements, such as VPAs, there also exist a number of voluntary schemes to certify (typically using third party verification) that a given area of forest is being managed sustainably, according to agreed standards. One of the most widespread voluntary certification schemes is that of the Forest Stewardship Council (FSC), which has certified 1,127,804 hectares of forest in China (whole country; hotspot-specific figures are unavailable), 215,400 hectares in Vietnam, 88,826 hectares in Thailand, 85,984 square kilometers in Lao PDR, 7,896 hectares in Cambodia and none to date in Myanmar (FSC 2020). While forest certification needs to pay attention to ecological quality-control, such trade measures could help strengthen forest law enforcement, governance and management. By value, 75 percent of the Greater Mekong Subregion's wooden furniture exports went to markets in the United States in 2007, and Vietnam exported wooden furniture worth over $2 billion to the EU and United States (Asia Pacific Forestry Commission 2011a). At present, there is little positive pressure from consumer countries within Asia. Indeed, China and Vietnam have invested in a number of poorly planned and regulated agro-industrial plantation, logging and extractive ventures in hotspot countries, to supply raw materials to manufacturers in their countries (see Chapter 7).

As discussed in greater detail in Chapter 10, the carbon market is poised to be a major influence on forest conservation in Indo-Burma. Under the UNFCCC, policy approaches and positive incentives known as "REDD+" aim at reducing emissions from deforestation and forest degradation, and promoting conservation, sustainable forest management and enhancement of forest carbon stocks, in developing countries. REDD+ could provide substantial new funding for the sustainable management of tropical forests.

Tourism is another sector of key importance. For example, national parks are of growing importance to Thailand's economically important tourism industry (Blaser *et al.* 2011), and areas such as Hainan in China have been targeted for rapid tourism development. This raises major risks to biodiversity. For example, in 2017, the Son Tra peninsula, which is home to Vietnam's largest population of red-shanked douc, was threatened by an explosion of tourism development (Nhan Dan 2017). However, tourism also creates opportunities, if the industry can learn from practices elsewhere of investing in biodiversity conservation (TEEB 2009) and pursue true ecotourism (Fellowes *et al.* 2008). For example, Sam Veasna Conservation Tours (2020) has developed a series of birdwatching and wildlife tours to KBAs in Cambodia, which bring benefits to local communities linked to conservation.

6.8.7 Inappropriate Land Distribution, Land Tenure and Land-use Policies

Inappropriate systems of land ownership, particularly lack of land tenure and opportunities to become involved in management for local communities, are a key underlying cause of biodiversity loss. Large tracts of natural habitat under the nominal ownership of the state have frequently failed to retain their biological and ecological values. Indeed the excision or downgrading of protected-area status is predictable where its value to society has not been demonstrated (Mascia and Pailler 2010; Sutherland *et al.* 2010). Land tenure is an important consideration in people's attitudes toward land use, and significant in terms of habitat loss, especially deforestation. Unresolved land tenure arrangements can facilitate spontaneous settlement and conversion of forested areas. Loss of land can force local communities to shorten fallow cycles, or cultivate steeper, less productive slopes, which are more susceptible to environmental degradation (Eberhardt 2003).

Since the 1990s, most countries in the hotspot have undertaken major reforms to their land policies, including allocation of land to private owners. Unclear policies and lack of technical capacity within the government institutions involved have often meant that the land reform and allocation processes have further marginalized the poorer sections of rural communities, and exacerbated threats to biodiversity. Land-tenure systems in most upland areas of Myanmar, for example, are based on customary rights under local institutions (Eberhardt 2003), which are not upheld under national law. As a result, rural communities are vulnerable to losing access to land through such processes as establishment of commercial plantations by agribusinesses. This is further compounded by a lack of a specific land-use policy to settle disputes over land tenure (Eberhardt 2003). In Lao PDR, where rural communities do not always have legally recognized tenure over land they depend upon for food security (and where legal rights are not always respected in any case), land-grabbing for development is leading directly to malnutrition (Kenney-Lazar 2016).

In Thailand, local communities have no formal use rights in protected areas but can collect some basic forest products, such as dry fuelwood and NTFPs, for household use, with permission from the relevant authorities (Blaser *et al.* 2011). The establishment of community forests is currently permitted in national forest reserves under formal management by the Royal Forest Department and in other forests that are not yet occupied or developed for use. However, less than 1 percent of the forest estate has been brought under community management. Barriers include a lack of confidence in local communities as forest custodians, fear of exploitation by a rising number of illegal immigrants especially in border areas, transfer of land to households (rather than communities) through individual land-grant programs, and a lack of perceived benefits to villagers of formal registration (Blaser *et al*. 2011).

In Cambodia, the Land Law (2001) recognizes the rights of indigenous communities to engage in their land and natural resource management systems, and a form of collective land title that accords with systems of local governance and traditional authority is available. Nevertheless, the process towards indigenous land titling is tedious and lengthy compared to the processes for land concessions and acquisitions, and many indigenous communities have already lost their lands and associated livelihoods (Lower Mekong Network 2018).

6.8.8 Weak Regulatory and Governance Frameworks

Most countries are making progress with regard to stronger legislation in support of conservation (see Section 8.5; Blaser *et al.* 2011). At the same time, actual implementation of this legislation is often weak or readily circumvented by vested interests (Lower Mekong Network 2018). Grassroots political pressure to hold governments to account and to secure land and forest rights, is limited by intrinsic capacity, legal/policy restrictions on grassroots organizations, and the limited ability of administrative-political systems to respond to grassroots demands (Lower Mekong Network 2018).

Globally, protected areas are generally quite effective in protecting vegetation and fauna. Within the Indo-Burma Hotspot, however, protected area status has also demonstrably failed to safeguard areas from rampant, trade-driven overexploitation of animal and plant species, hydropower projects, road construction, economic land concessions and mineral exploration. Some argue that standards of forest governance have actually fallen across much of the subregion (Asia Pacific Forestry Commission 2011a), mirroring overall trends in these countries (see Section 8.4). Certainly, despite increased attention to forest law enforcement and governance, significant improvements on the ground have been slow to emerge due to conflicting priorities, lack of resources and the reluctance of vested interests to stem the flow of forest products.

Taking Cambodia as an example, various guidelines and codes serve to regulate forest management. In 2001, for example, the government mandated long-term strategic forest management plans consistent with international standards, and cancelled or suspended concessions covering some 70,000 square kilometers of forest. There was no legal logging in the period 2004 to 2007, though allegedly a lot of illegal logging took place, involving various arms of the state (Global Witness 2007). From 2007, MAFF created the Cambodian Forestry Stamp to mark legal and illegal logs. Despite this tightening of forest policy, consumers still could not determine the legality of luxury furniture produced in Cambodia, because no certification system was in place (CI cited in Weinland and Vong 2011). By 2020, 7,896 hectares in Cambodia had been certified under the voluntary FSC standard (FSC 2020) but this represents only 0.1 percent of the national forest estate. Illegal logging of high-value tree species, such as rosewoods (*Dalbergia* spp.) remains rampant, to the point that mature trees are now considered rare outside strictly protected areas (EIA 2014).

All countries in the hotspot have introduced legislation aimed at mitigating biodiversity loss. Each country has developed environmental impact assessment (EIA) regulations, laws or policies that require mitigation of adverse environmental impacts, and some, but not all, countries have specific biodiversity laws (see Section 8.5). Overall, however, there is a need for better integration of biodiversity considerations into government decision making at all levels, particularly in the agriculture, forestry, fisheries, mining and energy sectors. There are systemic weaknesses to the environmental planning process in all countries, including poor or faulty EIAs, lack of effective public participation, little or no opportunity to challenge planning decisions in court on environmental grounds, and little or no use of SEA to consider cumulative impacts of development projects and inform upstream decision making.

The biosecurity outlook suffers from a lack of relevant international and national legislation, with heavy reliance on plant protection legislation to keep out invasive alien species. Authorities find it difficult to take a precautionary approach, as befits biodiversity conservation, when urged, as they invariably are, to take a proportionate response by commerce.

6.8.9 Institutional Capacity Limitations

Many threats to biodiversity arise from situations where government agencies mandated to manage natural resources face limitations of personnel, resources, training, and motivation. Capacity limitations are especially pronounced in sub-national and local institutions, and they are one of the major reasons why protected area systems in the hotspot generally function so inefficiently. Specifically, protected areas are plagued by a suite of management problems, ranging from low staff morale, lack of accountability and incentives for good performance, limited technical capacity and legal knowledge to inappropriate budget allocations, and overemphasis on infrastructure development. Inadequate regulation of private businesses, illegal land clearance and encroachment of protected areas are other symptoms of capacity limitations.

In some respects, national technical capacity is increasing. For example, the GIS and Remote Sensing Unit of Cambodia's Forestry Administration produces national forest-cover maps and local maps supporting forest demarcation, the evaluation of forest function and forest management plans (Blaser *et al.* 2011). On the whole, however, the lack of firm political support for conservation makes it difficult to maintain a motivated and well-trained staff.

Improving protected area effectiveness remains a top priority in the hotspot, although sustained financial support and engagement over many years is required to build and maintain capacity and motivation among protected area staff, and this can be difficult to secure funding for. For example, a support program for Chatthin Wildlife Sanctuary, the main site in Myanmar for the conservation of Eld's deer, had an encouraging start. However, deer numbers dropped when external funding stopped (Gray *et al.* 2015). Similarly, the WWF-implemented Cat Tien National Park Conservation Project, funded by the Netherlands government, improved standards of patrolling and enforcement but these fell following the end of the project in 2004, and the last Javan rhinoceros there was killed in 2010 (Brook *et al.* 2011).

Within each country, there is a need for improved coordination among policies and government institutions. A project to mainstream biodiversity responsibilities in the Southwest Guangxi Limestone Area, funded by the EU-China Biodiversity Programme, was one attempt to improve this. Some broad threats, which are growing in significance, such as biosecurity and climate change, need inter-institutional horizon-scanning, strategizing and coordination mechanisms. However, even basic cooperation and information on day-to-day issues is a challenge for institutions within the environment sector, let alone between the environment sector and other sectors. This weak coordination plays out in various ways, including failure to convert arrests for wildlife crimes into prosecutions due to poor coordination among wildlife protection, police, prosecution and court officials, and conflicting land-use objectives for the same areas due to poor coordination in planning processes for protected areas, mineral exploration licenses, economic land concessions, etc.

Building local civil society constituencies for conservation is a particularly high priority in Indo-Burma. Student organizations have some potential, for example there are a growing number of environmental clubs and birdwatching societies established by university students in China, to address local environmental problems, or even just expose young people to nature. There may be a lot of scope for building the understanding and long-term perspective of community forest organizations through regional networks, such as the Indigenous Knowledge and Peoples Network throughout mainland Southeast Asia and the Northern Farmers' Network in northern Thailand (Blaser *et al.* 2011).

The specialist knowledge base for conservation requires strengthening in a great many areas, including taxonomy, survey and monitoring techniques, ecological restoration, river hydrology and ecology, and biosecurity. Ecology and conservation science (natural and social) also need to be integrated into a wide range of other educational disciplines, including agriculture and agricultural extension, forestry and planning.

There is a recognized need to improve networking between experts and practitioners in all aspects of conservation. New opportunities to use and inform the rising numbers of amateur naturalists should be creatively pursued. Invariably, a feature of successful conservation efforts is the dedicated involvement of individuals who care about the work and can innovate when problems arise. Creative means are needed to encourage and sustain such dedication and innovation in the face of great challenges.

6.8.10 Global Climate Change

Global climate change is a rapidly emerging threat, which is compounding the other pressures on biodiversity described here. Climate change scenarios for the Indo-Burma Hotspot and their implications for biodiversity conservation are reviewed in detail in Chapter 10. As that chapter recommends, the essential action to help species adapt to climate change is to mitigate other pressures on them, particularly from over-exploitation and habitat loss, and thereby enhance their resilience to new pressures.

6.8.11 Agricultural Productivity Limits and Nitrogen Imbalance

Decades of agriculture focused on short-term yield at the expense of wider and longer-term ecosystem services have created further challenges, by depleting soils, wild fisheries and other resources, and polluting aquatic ecosystems. This calls for greater investment in sustainable agriculture. Conservation projects at the interface between farming communities and nature conservation need to help integrate ecological sustainability into production activity. Only with investment in forward-looking measures, such as restoring degraded agricultural land, promoting sustainable intensification and incorporating the true environmental costs into different production systems (see Foresight 2011), can the ecological deficit be reversed, and natural capital be rebuilt.

Refined ecological techniques are needed to improve the efficiency, biodiversity and ecosystem-service value of existing production lands, building on and strengthening evidence for high productivity in intercropping systems, such as tea and rubber (Guo *et al.* 2006). To improve the nitrogen efficiency of farming, systems research is needed at various scales, from single crops to diverse cropping and farming systems (Spiertz 2010). There is a strong need for quantitative systems research, including interdisciplinary research, along with the development of best practices and legislation.

7. SOCIOECONOMIC CONTEXT OF THE INDO-BURMA HOTSPOT

This chapter provides a broad overview of the socioeconomic context for biodiversity conservation in the hotspot. The chapter reviews the main trends in socioeconomic development over recent decades, the principal economic sectors operating in the region and evaluates how they impact biodiversity and the enabling environment for conservation actions. In addition, this chapter assesses the broad changes in land cover that have occurred in the hotspot.

7.1 Historical Context

The hotspot has a long history of human occupation, forest clearance and cultivation. The region has been home to some of Asia's most successful civilizations and empires. These have included successive Vietnamese imperial dynasties, the Cham empire (7^{th} to 10^{th} centuries), and the Angkorian empire (9^{th} to 15^{th} centuries). At its height (12^{th} century), the latter extended over much of the hotspot. The power of the Angkorian empire was built on intensive irrigated rice cultivation and probably led to the clearance of large areas of forest. Recent analysis (Clements 2005) indicates that, although much of the area has returned to forest, remains of this agricultural system now form grasslands and wetlands that are of high importance for waterbirds and ungulates in the deciduous dipterocarp forests of northern Cambodia.

Significant European influences on the region began in the 16^{th} century, through trading posts, such as that of the Portuguese in Macau. By the 19^{th} and early 20^{th} century, trading posts had evolved into colonial regimes: the British in Hong Kong and present-day Myanmar, and the French in present-day Cambodia, Lao PDR and Vietnam. During this period, Siam (present-day Thailand) and China remained independent states. Agricultural expansion and intensification increased during this time, notably with the introduction by the French of large-scale rubber plantations in eastern Cambodia and southern Vietnam. Expansion of commercial rice production for export in the Chao Phraya floodplain of central Thailand, in the late 19^{th} century and 20^{th} century, possibly contributed to the extinction of Schomburgk's deer (Duckworth *et al.* 2015).

Independence movements that emerged in each colonized country came to prominence following the end of Japanese occupation during World War Two. Myanmar gained independence from Britain in 1948, while Cambodia became independent in 1953, and Lao PDR and Vietnam in 1954, following several years of conflict with France. The conflicts sparked during the independence period continued in various forms across these countries for several decades, with profound effects on the socioeconomics, politics and biodiversity of the hotspot. To cite one example, widespread use of defoliants by US forces impacted forests throughout southern Vietnam (Dudley *et al.* 2002). Deprivation following years of conflict in Lao PDR and Vietnam, as well as the extreme policies of the Khmer Rouge and the 15-year civil war that followed its downfall in Cambodia, drove a high demand for wildlife and forest products for food and basic needs. It was during this period that the once-huge herds of wild ungulates in Cambodia, famously described as 'the Serengeti of Asia' (Wharton 1957), were decimated, leading to the probable extinction of kouprey and the likely extirpation of wild water buffalo (*Bubalus arnee*).

Overall, the region has enjoyed greater political stability since the early 1990s. Communist governments in China, Lao PDR and Vietnam have liberalized their economies and experienced rapid growth. Post-civil-war Cambodia became a democratic constitutional monarchy in 1993. Post-independence Myanmar has been marked by long periods of military rule, and prolonged conflict between the government and ethnic armed groups. A civilian-led government came to power in 2016, following openly contested elections the previous year. Ending conflict with ethnic armed groups is a priority for the new government, and the peace process is ongoing.

In contrast, Thailand has remained a constitutional monarchy, and, despite decades of political instability with frequent periods of military rule, has experienced rapid economic and social development. Since 2006, Thailand has experienced heightened political instability, with increasing tensions between the poorer rural population and the urban middle class. Following a coup in 2014, Thailand was under the rule of the National Council for Peace and Order until the resumption of democratic elections in 2019.

Over the same period, Cambodia has seen a retreat from multiparty democracy, with the main opposition party being dissolved in 2017 and the 2018 general election being widely condemned by the international community. Despite a general stabilization and global integration of the region's countries, the regulatory and operating environments for civil society have remained challenging throughout the region, and recent years have seen some serious setbacks.

7.2 Key Social and Demographic Trends

7.2.1 Regional and National Demographics

Indo-Burma is the most populous of all the biodiversity hotspots. The total population is estimated as at least 346 million people (Table 5). This is almost certainly an underestimate, because the population calculation for the Mainland China part of the hotspot is based on data from 2000. Since 2010, for example, the total population of Guangdong province has grown from approximately 73 million (about 60 percent of them in the hotspot) to over 113 million people (National Bureau of Statistics of China 2018).

Population density averages 150 people per square kilometer across the hotspot but varies greatly among countries (Table 5) and within each country. Lao PDR, for example, has one of the lowest population densities in the world at only 31 people per square kilometer, while Macau SAR and Hong Kong SAR have the highest, at 20,778 and 7,096 respectively (World Bank 2020c). Vietnam's population shows marked concentrations in the Red River (approximately 1,150 people per square kilometer) and Mekong Deltas (approximately 530 people per square kilometer), with mountainous parts of the country being much more sparsely populated. Southern China shows even more extreme variations.

Table 5. Basic Population Statistics for the Indo-Burma Hotspot

Country	Population in the Hotspot (2018)	Population Density (people per km² 2018)	% Annual Population Growth (2018)	% Population Increase 2008-2018	Rural Population as % of Total (2018)
Cambodia	16,249,798	92	1.49	17	77
China	104,219,416**	269**	0.46*	5*	41*
Lao PDR	7,061,507	31	1.55	17	65
Myanmar	53,708,395	82	0.61	8	69
Thailand	69,428,524	136	0.32	4	50
Vietnam	95,540,395	308	0.99	11	64
Total	**346,208,080**	**150**			

Source: World Bank (2020c). Notes: * = figures for the whole country; ** = The population for the Chinese part of the hotspot was calculated from detailed population statistics for individual counties (HUCE 1999). The total population of a county was included if more than 50 percent of its area was in the hotspot. For Hong Kong SAR and Macau SAR, the most recent available data were for 2018; for Guangdong, Guangxi, Hainan and Yunnan, they were for 2000.

There is, similarly, great variation in population growth between the countries. The application of the one child policy in Mainland China has kept its national population growth at only around 0.5 percent per annum (World Bank 2020c). This policy does not apply to some ethnic minority groups that live in the hotspot, however, so it is likely that there is some local variation to the natural population growth rate in the Chinese part of the hotspot. This figure also hides patterns of migration, which have impacted on the hotspot. For example, the population of Shenzhen in Guangdong province grew from 2.4 million in 1995 to 11.9 million in 2018, making it one of the fastest growing cities in China (Statista 2020).

In contrast with the slow growth rates in China, both Cambodia and Lao PDR had a population growth rate of around 1.5 percent in 2018, and both countries have seen their populations grow by 17 percent over the last decade (World Bank 2020c). It is important to note, however, that population growth rates are decreasing in all hotspot countries. For the period of 1990-1995, for example, Cambodia experienced annual population growth of 3.2 percent and Lao PDR 2.7 percent (UNDP 2011). It is also of important to note that the region's population is young and still growing (ODM 2015), with particularly young populations in Cambodia and Lao PDR, where more than 30 percent of the population is aged under 15.

Although the hotspot contains some major urban population centers, such as Guangzhou (13.0 million people), Shenzhen (11.9 million), Ho Chi Minh City (9.0 million), Bangkok (8.3 million), Hanoi (8.1 million), Hong Kong (7.5 million) and Nanning (7.3 million), the population is still predominately rural (Table 5). A large part of this rural population depends on agriculture for their livelihoods, which has direct impacts on biodiversity through use of agrichemicals and the expansion of the agricultural lands into forests and wetlands. In addition, a great many are also still dependent on wild resources for their basic needs and income. Foremost among these, for many communities, are freshwater fisheries. Other products widely harvested by rural communities include firewood, building materials (timber, rattan, bamboo, etc.), wild fruits and vegetables (Ashwell and Walston 2008), medicines and wild animals (for domestic consumption or sale).

Increasing rural populations are putting greater pressures on biodiversity and natural resources. In some countries, these pressures are being exacerbated by national policies promoting the expansion of agro-industrial plantations which not only clear large areas of natural habitats but can also lead the displacement of human populations and new clearance for subsistence agriculture. Since the 2011 update of the ecosystem profile, rapid and increasingly large-scale development, based significantly on exploitation of natural resources, accelerated by considerable investment from China and within the Lower Mekong region, has had substantial impacts on the region's environment and its natural resource-dependent communities (Lower Mekong Network 2018).

7.2.2 Migration and Urbanization

Since the 1990s, there has been a notable trend for rural-to-urban migration in the hotspot (Guest 2003). This has been most notable in southern China, where the Pearl River Delta region has seen massive levels of in-migration from other parts of China to work in the industrial complexes of China's south coast. The pattern is repeated in other countries. For instance, in Cambodia, people have moved to Phnom Penh to find employment, chiefly in the garment factories (World Bank 2007), and in Vietnam there has been a movement from the northern highlands to the industrial heartland in the Red River Delta (AAG 2011). Another significant pattern has been rural-to-rural migration. In Cambodia, there has been significant movement of people from the more densely populated regions around Phnom Penh and the Tonle Sap great lake 'rice belt' to more sparsely populated regions including protected areas (Pollard and Evans 2008). In Vietnam, an estimated 6 million people resettled or migrated during the second half of the 20th century (UNDP 1998), and migration policies played an important role in government plans for agricultural expansion (particularly of tea, coffee and other commodities) in the south of the country and mountainous areas (World Bank 2009).

The increases in urban populations do not necessarily decrease pressures on natural resources and biodiversity, however. Booming urban centers need building supplies, including timber and charcoal for brick kilns, and fuel often from firewood, and may provide a large demand for wild meat and fish. Research in Cambodia (for example Blackett 2008) has revealed the huge demand for charcoal for bricks, and fuelwood for garment factories in the relatively small city of Phnom Penh. The NGO GERES (reported in Blackett 2008) reports that a single brick and tile factory requires around 500 cubic meters of charcoal per month. There are dozens of such factories surrounding Phnom Penh.

7.2.3 Ethnicity, Language and Religion

Patterns of ethnicity are similar in each of the main hotspot countries. Broadly speaking, each country has a lowland, rice-farming, ethnic group that makes up the majority of the population and dominates the cultural and political elite. The hotspot is also, however, home to many minority ethnic groups, with unique culture, language and heritage (Table 6). Most of these groups live in the more remote, mountainous parts of the region, and are, on average, more economically and politically marginalized than the majority ethnic group.

Table 6. Ethnic Groups, Religions and Languages in the Indo-Burma Hotspot

Country	Majority Ethnic Group	Total No. of Ethnic Groups	Significant other Ethnicities	Majority Religion	Other Religions	Majority Language
Cambodia	Khmer	Approx. 25	Brao, Bunong, Cham, Chinese, Kui, Jarai, Lao, Tampuon	Buddhism	Christianity, Islam, Animism	Khmer
China	Han	Hotspot figure unavailable	Cantonese, Zhuang, Dai, Yi, Li, Hmong	none	Buddhism, Confucianism, Christianity	Mandarin
Lao PDR	Lao	149	Hmong, Chinese, Vietnamese,	Buddhism	Christianity, Animism	Lao
Myanmar	Bamar	135	Kachin, Kayah, Karen (Kayin), Chin, Shan, Chinese, Rakhine	Buddhism	Christianity, Islam, Animism	Burmese
Thailand	Thai	62	Chinese, Akha, Hmong, Yao, Karen, Lahu, Lisu	Buddhism	Christianity, Islam, Animism	Thai
Vietnam	Kinh	54	Tay, Thai, Muong, Khmer, Chinese, Hmong	Buddhism	Christianity	Vietnamese

Many of the most important protected areas in the hotspot are located in remote and upland areas. Therefore, although they may be minority groups nationally, some ethnic groups form the majority in and around protected areas. The largest ethnic group around Mondulkiri Protected Forest in eastern Cambodia, for example, is Bunong (WWF 2008). Similarly, in Thung Yai Wildlife Sanctuary in western Thailand, the population in and around the park is almost entirely Karen (Emphandhu 2003). Minority groups, therefore, have a disproportionate influence on protected areas and biodiversity. In addition, many minority groups follow animist belief systems with very close links to the forest. Traditional taboos exist that form complex resource management systems (Degan *et al.* 2004) and many groups have networks of spirit groves and pools that protect culturally important forest and river sites, leading to the maintenance of biodiversity values. Improving infrastructure and the extension of market economies into remote areas is impacting on minority cultures, however. Many of these traditional systems are being eroded and the values lost. Supporting the maintenance of minority cultures not only has important social benefits, but may also have secondary benefits for biodiversity conservation.

Each country in the hotspot has its own national language, in each case the language of the majority ethnic group. Among minority ethnic groups, the national language may at best be a second language for many people. Knowledge of English among the educated urban middle and upper classes is fairly widespread, especially in Myanmar and Thailand, but English language skills are generally lacking in rural populations, in lower levels of government institutions and in grassroots CSOs.

7.2.4 Poverty and Human Development

As with many other socioeconomic metrics, the hotspot exhibits great disparities in wealth and human wellbeing. Settlements in the hotspot range from the international financial center of Hong Kong to isolated subsistence farming communities in Lao PDR.

Fisher and Christopher (2007) assessed various measures of poverty among the 34 hotspots across the globe. Their study ranked the Indo-Burma Hotspot third for total area affected by poor socioeconomic conditions. In addition, countries in the hotspot appeared in four of the five lists of poverty indicators.

In 2011, all countries in the hotspot ranked in the bottom half of the United Nations Development Programme (UNDP) Human Development Index. Economic growth over the last decade has helped to bring many people out of poverty in the region. As a result, China and Thailand have now moved into the top half of the rankings, while all six countries have seen improvements in key development indicators (Table 7). Nevertheless, Cambodia, Lao PDR and Myanmar remain some of the least developed countries in the world, outside Africa, and all have high levels of extreme poverty. It is perhaps not a coincidence that they are also ranked in the bottom half of the UNDP Gender Inequality Index (Table 7).

Table 7. Poverty Indicators for the Indo-Burma Hotspot

Country	Human Development Index Rank (out of 189)	Life Expectancy (Years)	% Earning <$1.90 per Day	% Earning <$3.10 per Day	Adult Literacy Rate (%)	Gender Inequality Rank (out of 187)
Cambodia	146	69.6	n.a	60	80.5	114
China	85	76.7	0.7	5.9	95.1	39
Lao PDR	140	67.6	22.7	42.5	85	110
Myanmar	145	66.9	6.2	19.6	75.6	106
Thailand	77	76.9	0.0	0.1	93	84
Vietnam	118	75.3	2.0	7.4	93.5	68

Source: UNDP (2019).

Although absolute poverty remains in each hotspot country, dramatic transitions out of extreme poverty have taken place over the past decade, with major gains in education and healthcare, and increased employment opportunities for young professionals. Rapid economic growth has dramatically reduced levels of poverty; Vietnam saw a decrease from 60 percent in 1993 to 10 percent in 2016, for example (World Bank 2018). Nonetheless, a significant proportion of rural people, particularly in Cambodia and Lao PDR, still live on the brink of poverty. Despite them having little cash income, living standards for rural households, particularly ones in upland areas, can be good, owing to access to abundant natural resources. This fact can be obscured by economic indicators of household income that do not include monetary valuations of natural resource extraction and/or nature-based livelihoods (Chamberlain 2001, 2007).

Reduction in poverty has been accompanied by a reduction in economic inequality in Thailand but this trend is not uniform across the region. Growing urban areas, including a growing middle class, reap many of the benefits of economic development, while more remote rural and, in particular, ethnic minority communities risk being left behing (e.g., Baulch *et al.* 2008, General Statistics Office of Vietnam 2012). Such disparities have contributed to considerable political tensions in Thailand, and repeated protests elsewhere (e.g., Clement and Amazega 2013). The commodification of land and insecure land rights in the region are also leading to economic inequality, through accumulation of land by weathlier individuals or outright land grabs by the political/economic elite where land rights are weak or unclear (Lower Mekong Network 2018).

Sub-national patterns are harder to determine, because fewer comparative data are available. Nonetheless, it is likely that rural populations, and particularly ethnic minorities, rate worse than national averages. Development indicators, such as income and literacy rates, are typically lower in remote rural areas, which often have concentrations of biodiversity and protected areas.

7.2.5 Gender Issues

At a national level, political and economic elites are dominated by men, as are senior levels of government and legislature. Although Thailand elected a female Prime Minister in 2011, the first in the region, and Aung San Suu Kyi became Myanmar's first State Counsellor in 2016, as part of the country's transition to democracy, the voice of women is generally under-represented. With the exception of Thailand, each hotspot country is ranked higher on the Gender Inequality Index than on the Human Development Index (UNDP 2019) higher than its overall rank, indicating the countries perform better against this than against other conventional development indicators (Table 7), there remains gender disparity in poverty and livelihood indicators. Many of these disparities are exaggerated further in rural areas. Women's access to basic services, resources and infrastructure is more limited than men's, and their voice in decision making is more limited. Throughout the region, there are general patterns of women carrying the burden of working on household farms, while men carry out wage labor (for example in plantations or construction). In rural communities, such as in Cambodia, women are typically responsible for collecting firewood and water and for cooking, whereas activities such as logging, hunting and collection of certain non-timber forest products (e.g., tree resins) are carried out by men. Where community-based natural resource management groups exist, these patterns of male dominance tend to be repeated. There is a need, therefore, for conservation initiatives to recognize that gender relations exercise an important influence on women and men's access to and control over environmental resources and the goods and services they provide, and to integrate gender considerations into the design and implementation of projects. Opportunities exist to build on achievements to date of initiatives that give attention to strengthening women's participation and leadership in conservation, such as the case studies presented in a recent status review of knowledge on women and rivers in the Mekong Region (Delfau and Yeophantong 2020).

National and international conservation NGOs tend to show a gender imbalance. The majority of management and field staff are male, with most female staff tending to be in administrative and support roles. There is variation among countries with regard to gender imbalances, and there are notable individual exceptions, with several successful and influential female researchers and conservation practitioners working in the region. Moreover, this pattern is not unique to Indo-Burma and perhaps reflects broader gender imbalances in the conservation sector. Nevertheless, capacity building and support for the development of female conservation practitioners and leaders in the hotspot needs greater investment.

7.3 Key Economic Context

7.3.1 Key Recent Economic Trends

Until very recently, all nations had predominantly rural, natural resource/agriculture-based economies. This is essentially still the case in Cambodia, Lao PDR and Myanmar, as well as significant parts of Thailand, Vietnam and southern China, despite rapid industrialization elsewhere in these countries. Thailand achieved double-digit economic growth in the late 1980s, marking its gradual shift to an export-driven, industrialized economy (ADB 2000). During the 1990s, Vietnam has gradually shed its centrally planned economic policies for market-oriented policies. China went through a similar transition, starting in 1978, and is now the world's second-largest economy by nominal GDP (IMF 2018). A large part of this growth has occurred within the hotspot, in the heavily industrialized Pearl River Delta. All countries in the region were affected by the Asian economic crisis and global economic slump in the late 1990s, Thailand most severely. The region recovered well during the 2000s and continued to see fast economic growth until the COVID-19 pandemic of 2020; whose long-term economic impacts are too early to see. Over the first two decades of the 21st century as a whole, however, economic growth rates in the Indo-Burma Hotspot were the highest of any hotspot, with all countries reaching at least lower middle income status by 2018 (Table 8).

Table 8. Main Economic Statistics for Countries in the Indo-Burma Hotspot

Country	Income Group	GDP per Capita (2018)	GDP Growth (%) (2018)	Net ODA Received (2018; $ Thousands)	Net ODA Received as % of GNI (2018)
Cambodia	Lower Middle	$1,510	5.9	$744	3.4
China*	Upper Middle	$9,771	6.1	- $745	0.0
Lao PDR	Lower Middle	$2,543	4.6	$545	3.3
Myanmar	Lower Middle	$1,326	5.6	$1,637	2.4
Thailand	Upper Middle	$7,274	3.8	- $420	-0.1
Vietnam	Lower Middle	$2,567	6.0	$1,573	0.7

Source: World Bank (2020c). Note: * = figures for the whole country.

The global economic problems manifest since the 2008/2009 credit crunch slowed this growth, principally through a decline in exports to Europe and North America, but the impact of these problems was far less severe in Asia than in Europe or the USA (FAO

2011a). In terms of absolute gain, China has seen by far the largest economic growth since 2000, however Cambodia, Lao PDR, Myanmar and Vietnam have all recorded similar rates of GDP growth to China over the same period (World Bank 2020c). With the COVID-19 pandemic, the macroeconomic outlook for the hotspot countries is now uncertain, although it is doubtful whether the extraordinary GDP growth rates of the last two decades could have been sustained in any case.

Official development assistance (ODA) has formed a significant part of the gross national income (GNI) of Cambodia and Lao PDR since the 1990s; and, in 2009, stood at about 7 percent of these countries GNI (World Bank 2011); it has since declined to around 3 percent (Table 8). Although the absolute amount of aid to these countries has remained approximately constant over this period, growth in their economies has meant that ODA has declined as a percentage of GNI. Overall, aid budgets to the hotspot continue to shrink (see Chapter 11) and, as GNI increases (particularly with potential oil and gas revenues in Cambodia, see below), the contribution of ODA will continue to decline further, and the influence of international donors over national policy will continue to wane (Seiff 2011). The declining role of international donors in major development projects may have some significant impacts. Private sector investment, particularly from regional economies, may lack the transparency and safeguards that are now standard in many bilateral and multilateral donor investments. The lack of safeguards and conditions increases the risk of inappropriate and environmentally damaging developments. Guidelines and standards related to intra-regional investment are emerging, however, and creating opportunities to safeguard against environment and social risks. For example, voluntary guidelines on overseas investment have been developed for a number of sectors in China and Vietnam, while the Thai Bankers Association has adopted responsible lending guidelines.

The rapid economic growth described above has brought much of the population of the hotspot countries out of poverty, and seen many of the cities transformed into major metropolises. Development priorities have also influenced rural areas. Most countries have seen a rapid increase in the road network (often paid for with aid from neighboring economies). Thus, previously remote areas have, in recent years, been opened up. Market economies have become more established and agricultural economies have tended towards cash crops (Pollard and Evans 2008), such as cashew, cassava, coffee and rubber smallholdings.

Throughout the hotspot, there is considerable variation in how changes in the national economic context affect different geographic, ethnic, and rural/urban groups. On the one hand, as industrial agriculture has increased, it has led to large-scale land-grabbing, with negative impacts on biodiversity and forest-dependent communities. On the other hand, growth of the industrial and service sectors has created off-farm employment, which has diminished agriculture’s proportional contribution to the economy and, in combination with mechanization and technological advances, has led to dramatic declines in the workforce employed in the agriculture sector. For example, 32 percent of Thailand’s workforce was employed in agriculture in 2015, compared with 64 percent in 1990 (NESDB 2017).

Regional Patterns of Investment
Intra-regional investment has rapidly evolved in the Indo-Burma Hotspot in recent years. New regional initiatives, such as China’s Belt and Road Initiative, established in 2013, the Association of Southeast Asian Nations (ASEAN) Economic Community, established in 2015, and the Lancang-Mekong Cooperation (LMC) mechanism, established in 2016, are

increasing regional economic integration. The larger economies of Thailand, Vietnam and, in particular, China are investing in the smaller economies of Cambodia, Lao PDR and Myanmar. This investment is both from the state and the private sector, as well as in the form of ODA (principally loans). Chinese, Thai and Vietnamese investment firms are investing in large-scale infrastructure, agro-industrial plantations, timber extraction and extractive industries to supply raw materials to manufacturers in their countries. As outlined below, these rapid and generally poorly planned and regulated developments are having significant impacts on biodiversity in many parts of the hotspot, including priority sites and corridors (see Section 13.1.5).

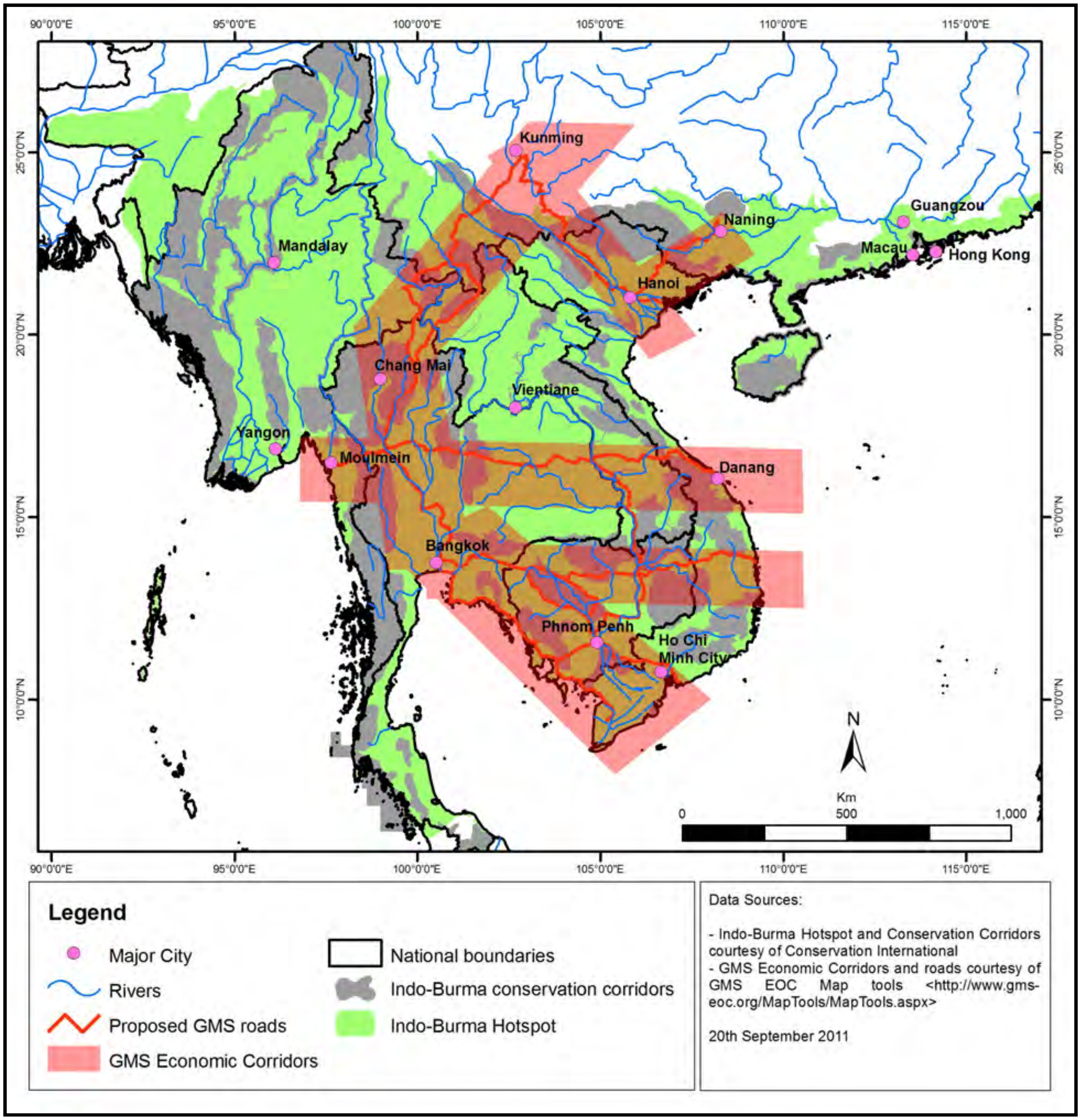
One framework for regional economic integration is the ADB's Greater Mekong Subregion (GMS) Regional Cooperation Program Strategic Framework 2012-2022, which seeks to advance the goals of GMS cooperation of fulfilling the region's vast potential, lifting people from poverty, and promoting sustainable development for all (ADB 2011e). This program has identified three broad corridors based around improved road networks that will promote regional economic cooperation (ADB 2011c). The corridors are:

- North-South Corridor: Kunming to Hanoi/Hai Phong and Nanning; and Kunming to Bangkok.
- East-West Corridor: Mawlamyine-Myawaddy across Thailand and Lao PDR to Hue in Vietnam.
- Southern Corridor : Bangkok to Phnom Penh and Ho Chi Minh City; Bangkok across northern Cambodia to Quy Nhon in Vietnam; Bangkok along the coast to Nam Can in the Mekong Delta; and a corridor link from the Cambodian coast to the East West Corridor at Savannakhet.

The economic corridors will influence several KBAs, and conservation corridors, including the Central Annamites in Vietnam and Lao PDR, the Shiwandashan Range in China, and parts of Thailand's Western Forest Complex (Figures 15 and 16). Improving access and promoting investment in previously remote areas has significant impacts on biodiversity. In addition to direct land conversion, new road networks can lead to the spread of frontier agricultural expansion, facilitate the illegal wildlife and timber trade, and enable the increased expansion of agro-industrial plantations, leading to further forest loss. These impacts are addressed by the GMS Core Environment Program of the ADB, which is covered in more detail in Chapter 8.

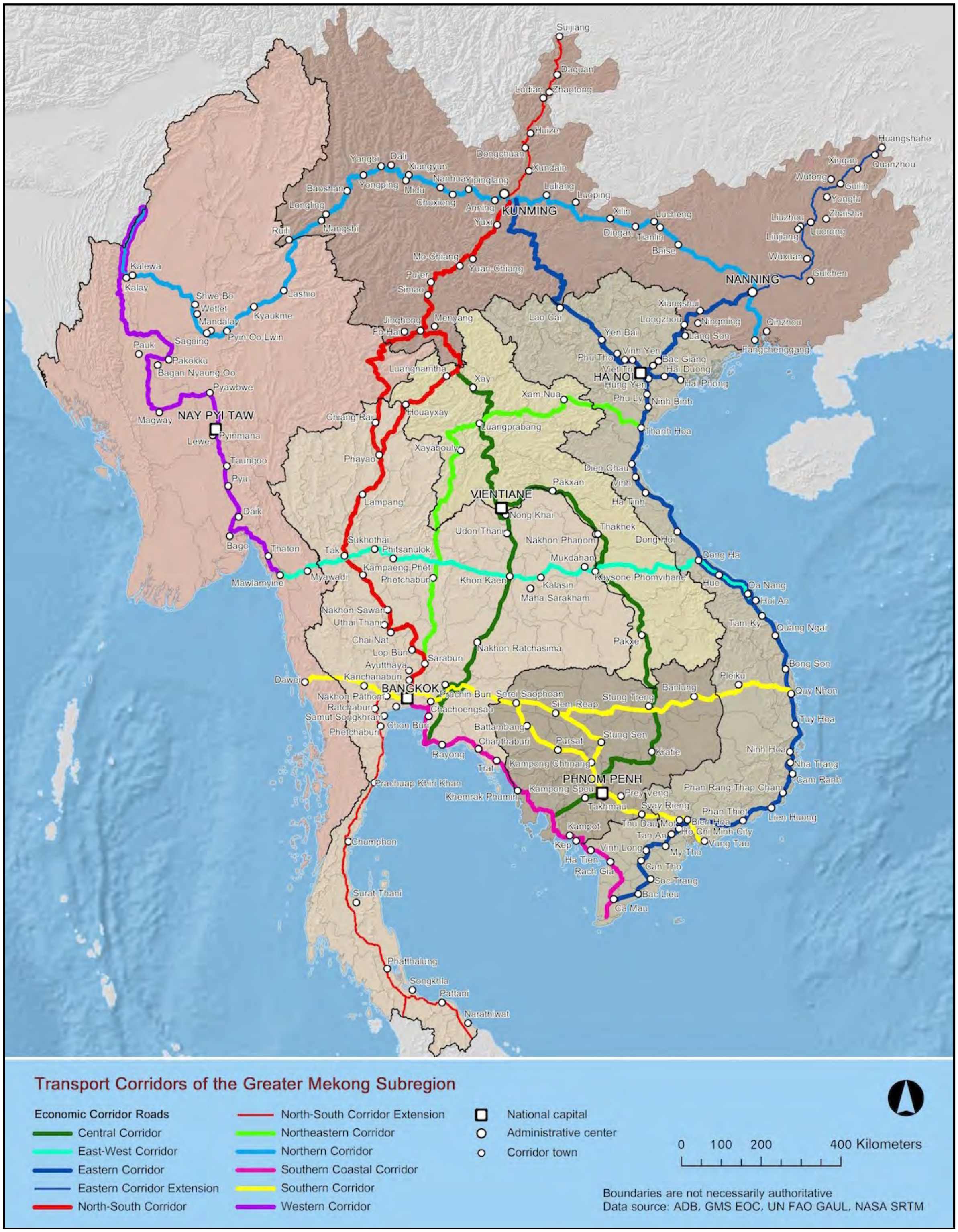
Outside the framework of the GMS Regional Cooperation Strategy and Program, China is promoting and financing several economic corridors with its southern neighbors. These include: the China-Myanmar Economic Corridor, which will link Yunnan province to Khaukphyu port on the Andaman Sea, via a railway and gas and oil pipelines (the latter were completed in 2013 and 2017); the Kunming to Vientiane Railway, which will connect Yunnan province to Vientiane and, eventually, Singapore, and the Lancang-Mekong Development Plan, which involves river engineering to facilitate navigation along the Mekong River in northern Lao PDR and Thailand. The latter initiative has been halted, following a decision by Thailand's cabinet in February 2020 (Bangkok Post 2020). The scale of borrowing from China for regional infrastructure projects is so large that there are real concerns some countries, particularly Lao PDR, could default on their sovereign debt (Hurley *et al*. 2018).

Figure 15. Overlap between GMS Economic Corridors and Conservation Corridors in the Indo-Burma Hotspot



Source: ADB (2011b); CI (unpublished data).

Figure 16. Overview of GMS Transport Corridors



Source: Greater Mekong Subregion Atlas of the Environment (2nd ed). Licensed under CC-BY-SA-4.0.

In addition to investment in economic corridors, the hotspot is witnessing the emergence of Special Economic Zones (SEZs), which are areas set aside for targeted economic development, often in border areas. Although SEZs are as yet little-developed in Thailand and Vietnam, Cambodia already has more than 30 SEZs (ODC 2015a) and Lao PDR has 12 (Yap 2018). At least 10 new SEZs are planned for each country (Lower Mekong Network 2018). Preferential tax and legal frameworks encourage outside investment in SEZs but loose controls can result in these areas becoming hubs for illegal wildlife trade (e.g., Krishnasamy *et al.* 2018). The economic draw of SEZs can also lead to in-migration and associated additional impacts on any nearby natural areas.

Investment from other Asian and Middle Eastern economies is also increasing, notably from South Korea, India (mostly in Myanmar) and the United Arab Emirates, who have interests in agricultural commodities, principally rice, in Thailand, Cambodia and Lao PDR (McCarten 2008). As described below, there is also significant regional investment in the energy sector, with Chinese, Indian, Thai and Vietnamese companies heavily involved in oil and gas, and hydropower development across the hotspot.

7.3.2 Main Economic Sectors

Key economic sectors that have an impact on or are dependent on natural ecosystems in the hotspot are agriculture, forestry, tourism, fisheries, mining and energy (particularly the hydropower sub-sector). Historically, and continuing to the present day, agriculture has been the prime economic activity in the many of hotspot countries. Although, as their economies grow, the countries of the hotspot are becoming increasingly industrialized, the agriculture sector remains the largest employer.

Agriculture
Agriculture is a major part of the economy in all hotspot countries, making a significant contribution to gross domestic product (GDP), and being a major employer. It is still the most important economic sector in Cambodia, Lao PDR and Myanmar, where is contributes to over 22 percent of GDP (World Bank 2020c). However, the overall trend among the hotspot countries shows a decline in agriculture, as education and economic development continue to diversify the regional economy.

By far and away the most important crop is rice. The majority of rice production is from permanent wet rice cultivation, which has a large land-use footprint, especially in floodplain and delta regions. It is also a major source of pollution of freshwater systems, due to pesticide and fertilizer run-off. For example, Vietnam, the world’s third biggest exporter of rice, has become one of the largest global users of fertilizer, with resultant impacts in terms of land and water pollution (IMF 2017, Nguyen Thi Phuong 2017). In addition, shifting cultivation of rice, maize and cassava is widespread in upland areas, and has contributed to significant forest loss and land-use change in some mountainous parts of the hotspot.

Data on land area dedicated to agriculture are available up until 2018 (World Bank 2020c). These show that agricultural land area stayed roughly stable since 2010, with slight increases in Cambodia, Myanmar and Lao PDR, and a more significant increase in Vietnam. The recent increase in large-scale agro-industrial plantations in Cambodia and Lao PDR, since 2008, may result in an increase in the agricultural area, which is not yet represented by these figures. Another trend that is not recognized in these data is moves towards increased productivity. For example, industrialized irrigated dry-season rice farming in the floodplain of Tonle Sap Lake in Cambodia , which has increased dramatically since 2007, has resulted in the loss of large areas of a unique grassland agro-ecosystem, which is home to several threatened species, including the Critically Endangered Bengal florican (Eames 2010, Sophakchakrya 2010).

One trend over the past 15 years has been the increase in large-scale agro-industrial plantations of several different crops. Such developments can have some socioeconomic benefits. For instance, they can potentially provide significant employment in rural areas, could (for some crops) improve food security, and may increase export earnings and provide important contributions to national budgets through tax contributions. On the other hand, poorly planned and unregulated developments, combined with low levels of transparency, mean that these potential benefits have not always been realized in the hotspot (Oxfam 2011). The expansion of these plantations is having a significant impact on forest cover and biodiversity throughout the hotspot, and is currently a major driver of forest loss in the region.

During the 1990s and 2000s, large coffee plantations were established in the central highlands of Vietnam, to such an extent that the country is now the second largest coffee producer and exporter in the world (ICO 2019). Southern Vietnam and Cambodia have also seen the establishment of rubber, cashew and cassava cultivation, in plantations and by smallholders.

For instance, Vietnam's rubber plantations doubled in size between 2004 and 2012 (Häuser *et al.* 2015). Oil palm and rubber plantations have expanded in the lowlands of southern Thailand clearing much of the remnant lowland forest of the areas (Aratrakorn *et al.* 2006). One impact of this has been the decline in the population of the Critically Endangered Gurney's pitta. Once believed extinct, it was re-discovered in 1986, when the population was estimated at 44-45 pairs (BirdLife International 2020b). Since then however forest loss, principally conversion to oil palm, led to a decline in the Thai population, which is now believed to be functionally extinct (BirdLife International 2020b). The majority of the global population is now found in neighboring areas of Myanmar but the forests there are also highly threatened with conversion to oil palm (Donald *et al.* 2009, Woods 2011).

Cambodia, Lao PDR, Vietnam, and Yunnan province's Xishuangbanna prefecture have seen a rapid growth in rubber plantations (Qiu 2009, FAO 2011a). This has been particularly dramatic in Cambodia, where a large number of 'economic land concessions' (ELCs) for a range of commodities (including rubber, cassava, teak and acacia) have been granted across the country. ELCs in Cambodia cover at least 20,000 square kilometers, making them a leading cause of forest loss throughout the country (LICADHO undated, ODC 2015b, Ironside 2017). One trend of particular concern is the placement of plantations in protected areas. Large areas of several protected areas, including Snuol and Boung Per Wildlife Sanctuaries and Virachey National Park, have been de-gazetted or zoned to allow plantation development (Reoun and Vrieze 2011). Plantation development is also expanding in Myanmar (FAO 2011a) where it is also impacting on protected areas, and hotspot corridors. Large-scale sugar plantations in northern Myanmar have severely fragmented the Hukaung Valley (Woods 2011).

This rapid expansion of agro-industrial plantations is being driven by a range of macro-economic factors, and is facilitated by socio-political conditions in the hotspot nations (Oxfam 2011). Global commodity prices have risen dramatically in recent years. The price of natural rubber increased four-fold between 2009 and 2011, because of increased demand for natural rubber in vehicle tires, but has since dropped back to its earlier level, as a result of oversupply from producers in Southeast Asia. Demands for bio-fuels driven by policies aimed at reducing the use of fossil fuels as an attempt to reduce greenhouse gas emissions, have increased demands for sugar, oil palm, cassava and jatropha, and may have impacted on food prices such as for rice. China and Thailand have limited areas of land available for agriculture but are experiencing increased demands and rising production costs. Production is shifting therefore to neighboring countries with greater land availability, and cheaper costs (particularly labor). China's opium substitution program provides incentives to Chinese companies to develop agriculture in poppy-producing regions of northern Lao PDR and Myanmar. Conditions in countries that are expanding their agro-industry encourage the trend further. For example, Cambodia is promoting actively the development of agro-industry as a foreign currency earner (McCarten 2008, Chung 2011). Weak and unclear legal frameworks (see Chapter 8), which leave loopholes that developers can exploit to get access to cheap land (Oxfam 2011), combined with a lack of transparency, create conditions under which development agreements can be obtained extra-legally. Remote areas with uncertain land tenure, often populated by ethnic minorities, are also exploited by developers.

Agro-industrial expansion has increasingly become a transnational environmental issue. For example, there has been massive expansion of banana plantations in northern Lao PDR, stimulated by Chinese investment to supply market demand in China (Anon. 2016b). As regards the expansion of ELCs in discussed above, a particular driver has been rubber, led by Vietnamese companies with investment stemming mainly from Vietnamese banks. For instance, Vietnam Rubber Group, Vietnam's top rubber exporter, established 392,000 hectares of rubber plantations in 2013, of which 100,000 hectares were in Cambodia and Lao PDR. This expansion of rubber plantations and other commercial crops is achieved at the expense of natural forests (Global Witness 2013, Pardomuan and Ho 2014, Baird and Fox 2015, Baird 2017, Ingalls et al. 2018). There have also been accusations of forced evictions from rubber plantations (e.g., Melta and Baliga 2018).

Industry and Manufacturing

As mentioned above, many of the hotspot's countries have undergone a period of rapid industrialization since the 1970s. The Pearl River Delta in the Chinese part of the hotspot is one of the great industrial centers of the world, with factories manufacturing goods for export around the globe. The other hotspot countries also also rapidly industrializing, with the industrial sector providing around one-third of the GDP of each country in 2018 (World Bank 2020c).

The impacts of industry on the environment are diverse. There have been direct impacts in the development of industrial zones, often in coastal areas to ease logistics, leading to the widespread loss of wetlands, particularly along the Chinese coast, and around Bangkok. Heavy industry is poorly regulated in the region, and levels of air and water pollution are high. The most important indirect impacts of industry come from energy demands. Energy supply and hydropower are covered in greater detail below. However, other energy demands are also made. For example garment factories around Phnom Penh use significant volumes of firewood (Blackett 2008). For much of the 2000s, this demand was met by wood from senescent rubber plantations. As demand outstrips supply, the shortfall is believed to be coming from natural forest areas, including forests cleared for ELCs.

Tourism

Tourism is an important source of foreign income in many hotspot countries and has grown dramatically as an economic sector in the region in the last decade. For example, in Thailand, where tourism has long been a key part of the economy, it contributed 20.6 percent of GDP in 2016; this is forecast to rise to 31.7 percent by 2027 (World Travel and Tourism Council 2017). Cambodia has followed this model, with tourism now the third largest economic sector after agriculture and the garment industry. Growth in tourism in Lao PDR and Vietnam has shown similar rapid advances.

Most of this international tourism is focused on beach holidays in Thailand, visits to major cities, and trips to cultural heritage sites, such as the temples of Angkor Wat in Cambodia, and the town of Louangphabang in Lao PDR. There is, however, a small but significant market for nature-based tourism. The largest contributor to this sub-sector is dive tourism in Thailand (and to a lesser extent Cambodia and Vietnam), visiting the well established network of marine protected areas on both coasts. Specialist ecotourism operations currently contribute relatively little to national income but can have significant positive impacts on rural communities and wildlife. Examples of successful ventures include bird-based tourism packages provided by the Sam Veasna Center in Cambodia, and the award-winning Nam Nern Night Safari at Lao PDR's Nam Et-Phou Louey National Park, supported by WCS. In the short term, nature-based tourism enterprises may be hard hit by the drop in international visitor arrivals due to the COVID-19 pandemic. In the medium-term, these enterprises may provide models for small-scale, pro-poor, sustainable economic recovery following the crisis, as alternatives to mass tourism models with their negative impacts on local communities and the environment.

Domestic tourism is an increasingly important sector, although data are harder to obtain. The urban middle classes in China, Thailand and Vietnam are travelling more, including to protected areas. Heavily visited protected areas in the hotspot include Khao Yai National Park in Thailand, Phong Nha-Ke Bang National Park in Vietnam and Angkor Wat in Cambodia.

Fisheries

Marine and freshwater fisheries are an incredibly important component of the economy of the hotspot. Fisheries are a major employer, provide significant contributions to national income, and are a vitally important source of protein and fatty acids for millions of people. The hotspot includes productive coastal waters in the Bay of Bengal, Andaman Sea, Gulf of Thailand and South China Sea, as well as highly productive freshwater fisheries in the Mekong and Ayeyarwady basins. The Tonle Sap Great Lake is one of the most productive freshwater fisheries in the world, and it is estimated that 80 percent of Cambodia's population obtains its protein from its waters (Poole and Briggs 2005).

The hotspot has seen major growth in fisheries since the mid-1980s, in large part through the expansion of aquaculture. This has provided significant economic gains but at a high environmental cost, including through loss of mangroves (see below). Overall production levels are now high in the region (FAO 2010b). In 2016, Vietnam's fisheries (capture and aquaculture) produced 6.4 million metric tons, Myanmar's 3.1 million metric tons, Thailand's 2.5 million metric tons, Cambodia's 0.8 million metric tons and landlocked Lao PDR's 0.2 million metric tons (World Bank 2020c). Aquaculture production in Vietnam has grown from 0.5 million metric tons in 2000 to 3.6 million metric tons in 2016: a seven-fold increase in just 16 years (World Bank 2020c). Similar increases have been seen in Myanmar and

Thailand, although in Thailand, aquaculture production has declined by 50 percent from its peak in 2009 (World Bank 2020c). In Cambodia and Lao PDR, aquacultural production remains relatively modest, although both countries have important wild-capture freshwater fisheries.

Forestry

With the exception of Myanmar, exploitation of natural forests has declined in importance across the hotspot since the 1990s. This has happened as the resource base declined, and countries have become more industrialized. Natural-forest logging bans are now in place in Cambodia, China, Thailand and Vietnam, with some exceptions for local communities. Official production figures have declined slightly in Lao PDR (FAO 2011a) but this may be a consequence of under-reporting (EIA 2008, 2011) because large volumes are exported to Vietnam illegally (EIA 2017). Unsustainable forestry practices persist throughout the region, and the impacts on biodiversity of exploitation of natural forest (most of it illegal) are high. Production in Myanmar increased between 1997 and 2007, primarily as the area of forest available for timber production increased (FAO 2011a).

Reductions in production from natural forest in the hotspot countries have been compensated for by increased production from plantations: chiefly teak (*Tectona grandis*) for timber, and Australasian exotics (*Acacia* spp. and *Eucalyptus* spp.) for pulp and timber. For instance, roundwood production tripled in Thailand between 1997 and 2007 (FAO 2011a), while, in Vietnam, export earnings from wood products ranked fifth compared to other exports in 2015 (Ingalls *et al.* 2018), with proposed agreements to export to the EU setting the stage for a dramatic change of the country's forests.

Although the contribution of forestry to national development may be decreasing, forests of the hotspot still have considerable value as a source of non-wood products. Forest communities throughout the hotspot are still reliant to some extent on products such as bamboo, rattan, and fuelwood. The value of this local use has not been comprehensively calculated but, across the hotspot, it is probably quite considerable. Forest products are increasingly important as an income source rather than for subsistence use. Large-scale trade has exhausted economically viable stocks of rattan across large parts Cambodia, Lao PDR and Vietnam (Evans 2002). Bamboo is heavily harvested for construction materials and for use in incense sticks (Mann 2009). Wildlife is heavily hunted for local subsistence and trade throughout the hotspot. This widespread and indiscriminate hunting is one of the main threats to wildlife in the hotspot (Chapter 6).

Extractive Industries

Mining and the oil and gas industries are growing rapidly in the hotspot. Large-scale mining operations are now operating in Lao PDR and Vietnam (principally for copper, gold and bauxite), and unregulated 'artisanal' mining is taking place widely, sometimes on a large scale, including within conservation corridors and protected areas (e.g., Cambodia's Phnom Prich Wildlife Sanctuary, and Myanmar's Hukaung Valley). Improving investment conditions, rising commodity prices and high demand for minerals from China and India have sparked something of a boom in exploration throughout the region. Australian, Chinese and Vietnamese companies are exploring for mineral deposits in many parts of Cambodia, Lao PDR and Vietnam. Data on these exploration activities are often hard to obtain but it is believed that exploration is taking place in several hotspot corridors. Commercial exploitation of mineral deposits remains relatively rare, and the presence of exploration does not necessarily mean that a commercially viable resource will be found. Nevertheless, where such resources are found, the impacts for biodiversity could be highly significant, not only from the direct impact of mining operations but also from the potential secondary impacts from opening up remote areas, infrastructure development, and influx of migrant labor.

Myanmar, Thailand, Vietnam and southern China all have active oil and gas fields, although their relative importance as a source of foreign exchange is diminishing, as other industries develop. For example crude oil has gone from being Vietnam's leading export earner to a relatively minor one, after production peaked in 2004 (Worldometer 2020). The environmental impacts of many these operations are not known, but the impact of oil extraction on the environment globally is well known. Potentially significant oil and gas reserves have been found in Cambodia, both offshore and inland; exploration is still continuing but offshore production is getting closer (ODC 2016). The impact of oil revenue could be enormous, potentially dwarfing all other sources of income (UNDP 2005). Since 2008, oil and gas exploration has begun onshore. Six of the onshore blocks are located around Tonle Sap Lake, including Block XV, where PetroVietnam Exploration Production Corporation has an exploration license. It is not yet known whether there are commercially viable deposits but, should production go ahead, this could have severe impacts on the ecologically sensitive flooded forests of Tonle Sap Lake, and their associated fisheries and wildlife populations.

Energy

Across the Ayeyarwady, Mekong, Nu/Salween/Thanlwin, and Red River Basins, there are currently 212 commissioned dams with a capacity of 15 MW or above, and a further 44 under construction (WLE Greater Mekong 2020). This is an under-estimate of the total number of large and medium hydropower dams in the Indo-Burma Hotspot, because it does not include rivers outside these basins, which are also extensively dammed, especially in China and Vietnam. These figures also do not take into account the many planned dams. In the lower Mekong basin alone, up to 11 large and medium capacity dams could be operating on the Mekong mainstream by 2040, together with 120 tributary dams (International Rivers 2019). This is likely to have profound impacts on riverine ecosystems and the people who depend on them. The amount of sediment reaching the Mekong Delta could reduce by up to 97 percent (MRC 2017). Such severe loss of sediment could threaten the very existence of the Mekong Delta itself (Nguyen Van Manh *et al.* 2015, Rubin *et al.* 2015). Mainstream dam construction would also have dramatic impacts on aquatic ecosystems, the hydrology of the river and sediment flow, and would block the migration of several endemic fish species, including the iconic Mekong giant catfish.

The so-called Mekong River Commission (MRC) 'Council Study', which assessed, among other issues, the positive and negative impacts of existing and planned hydropower development in the lower Mekong Basin to date, found that proposed hydropower developments "are likely to reduce resilience and increase vulnerability of rural communities in the Mekong impact corridor, with the main benefits going to power companies and consumers mainly outside the corridor at the expense of fishing and rural households", that "the connectivity related impacts of mainstream and tributary hydropower dams, such as trapping of sediment, disruption of fish migration paths and alteration of flow regimes, are substantial and far-reaching, and overshadow those of all other planned water resource developments" in the lower Mekong Basin, and that "reservoirs created by mainstream hydropower dams, the construction of bank and flood protection structures, and barriers to fish migration have wide-ranging ecosystem impacts, especially on Mekong fish species" (MRC 2019b, p4).

Many of these impacts are already starting to be observed, due to dam construction that has already taken place, including a cascade of 11 dams along the upper Mekong (Lancang) River in China, the Xayabouri and Don Sahong dams on the lower Mekong mainstream in Lao PDR, and major tributary dams, such as the Lower Sesan II dam in Cambodia. For instance, a comprehensive review of the hydrological impacts of hydropower dam construction in the Mekong Basin by Hecht *et al.* (2019) found that the increase in mainstream dams since 2010 is already reducing and delaying maximum flows (and, thus, the extent of flooding in the Tonle Sap floodplain) in the wet season and increasing flows in the dry season, while reducing the overall delivery of sediment to the Mekong floodplain.

One reason behind this surge in dam construction is increased demand for electricity in China, Vietnam and Thailand. There is a strong correlation between power consumption by shopping malls in Bangkok and power generation in Lao PDR (Marks 2014). Indeed, an MRC SEA estimated that 96 percent of the power demand for dam construction on the lower Mekong mainstream came from Thailand and Vietnam. If all planned lower mainstream dams were constructed, they would provide an increase in power generation, although they would only meet around 11 percent of predicted power demands (ICEM 2010).

Yet, the need for further dam construction is not inevitable. The energy landscape in the hotspot is changing rapidly, and questions are being raised about the need for large-scale hydropower to meet the region's power needs. For example, the MRC's Council Study recommends replacing hydropower projects with high adverse impacts with more sustainable power generation options, such as solar and wind (MRC 2019b). There is also significant potential for demand-side management and energy efficiency measures to reduce rates of growth in electricity consumption to below current projections. These are essential in any case, given declining oil and gas availability and the need to curb greenhouse gas emissions.

Major hydro-power developments exist or are planned in many other river systems in the hotspot. Six dams are currently under construction in the Cardamom and Elephant Mountains, which will inundate large areas of forest, including areas holding some of the last remaining wild populations of Siamese crocodile, create more access roads in previously inaccessible forest areas, and bring thousands of workers into the forest (L. Perlman *in litt.* 2012). Most major Vietnamese river systems draining from the Annamite Mountains to the South China Sea are now dammed, or have plans for dams, and many of these developments have impacted areas supporting high levels of localized endemism.

Together with the Ayeyarwady, the Salween remains the last major river in the hotspot yet to be dammed. Plans exist however for seven dams in Myanmar and at least 13 in China, funded by a mix of Chinese, Thai and Myanmar investment (Salween Watch Coalition 2016). Elsewhere in Myanmar, the 1,200 MW Htamanthi dam on the Chindwin River has been proposed for development in cooperation with India's National Hydroelectric Power Corporation, with a plan to export 80 percent of the electricity generated to India. It is estimated the 6 percent of Htamanthi Wildlife Sanctuary would be inundated if the project were to go ahead. This proposed dam is dwarfed by the 6,000 MW Myitsone Dam, proposed for the confluence of the N'Mai Hka and Mali Hka, at the source of the Ayerarwady River. This project, which would have devastating impacts on the ecosystems of the Ayeyarwady

River and the human communities who depend on them, was suspended in 2017, although its Chinese backers are pushing for its resumption (Zhou 2019). The SEA of the hydropower sector in Myanmar recommends excluding the Ayerarwady River, together with sections of the Chindwin, Mekong, Salween (Nu/Thanlwin) and Sittaung Rivers, from mainstream hydropower dam development (IFC 2018).

Hydrocarbons (mainly imported) still represent the main source of power generation in the Indo-Burma Hotspot, although this proportion is decreasing, year-on-year, due to the expansion of hydropower outlined above, combined with new investments in other renewable energies, especially solar. In Vietnam, for example, the last few years have seen a rapid expansion in solar power. By June 2019, 82 solar power plants with a cumulative capacity of 4.46 GW had been connected to the national grid, accounting for 8 percent of Vietnam’s electricity generating capacity (GlobalData Energy 2019). This trend is anticipated to continue across the hotspot, as the cost per kilowatt-hour of solar power falls below that of both fossil fuels and large-scale hydropower. Solar power provides a realistic alternative to investments in more environmentally damaging energy sources, either as power plants, distributed generation or retrofitted to existing hydropower reservoirs, although it may have environmental impacts of its own, which have yet to be studied in detail.

Transportation

As described above, the rapid development of the region’s economies has been accompanied by an expanding road network. Roads have been improved and upgraded across the region with clear socioeconomic benefits from improved access to markets, healthcare and education. Many of the roads have been built in environmentally sensitive areas, however, including KBAs and conservation corridors, with significant adverse impacts. For example, until 2008, Cambodia’s National Route 76, which runs through the Seima Protection Forest, was a dirt road, often impassible during the wet season. With assistance from a Chinese loan, the road was upgraded to an all-season sealed highway. The improved access contributed to increased land prices around the protected area, and increased threats from encroachment and land grabs. At the same time, improved access to markets facilitated a shift away from small-scale shifting agriculture and towards larger-scale permanent agriculture (Pollard and Evans 2008). Timber and wildlife which are harvested illegally from the forest could now be moved quicker and easier to the nearby Vietnamese border, or to Phnom Penh in less than five hours. These changes combined to greatly increase pressures on the protected area. Similar trends followed the construction Vietnam’s Highway 14, the “Ho Chi Minh Highway”, which was constructed during the 2000s and runs the length of the Annamite Mountains, greatly improving access to previously isolated forested areas. These impacts were compounded by the upgrading of a network of transboundary roads linking Vietnam with Cambodia and Lao PDR.

The last decade has seen the implementation of plans to improve the regional rail network. Major ongoing projects include the railway from Ruili in China’s Yunnan province to Khaukphyu port on Myanmar’s Andaman Sea coast, and the railway from Kunming, Yunnan province, to Vientiane in Lao PDR (see Section 7.3.1). The latter project will massively improve transport links for this landlocked country, facilitating further the movement of natural resources and agricultural products to Chinese markets, and eventually opening up access to Thailand, Malaysia and Singapore. Recently completed projects include the railway from Phnom Penh to the port of Sihanoukville in Cambodia, renovated with support from the ADB, which opened to freight traffic in February 2013.

7.4 Land Cover and Land Use

7.4.1 Deforestation

Table 9 shows the recent rates of tree cover change for hotspot countries based upon the Global Forest Watch (2020) dataset. It should be noted that deciduous dipterocarp forests, which tend to have canopy cover of less than 30 percent, are not captured by the definition of forest used in Table 9. Therefore, these figures may under-estimate the total forest cover in hotspot countries, while under-estimating deforestation rates, which tend to be high in these ecologically important forests. All the hotspot countries continue to see high and accelerating rates of degradation and loss of natural forest.

Table 9. Tree Cover and Deforestation Rates in Indo-Burma Hotspot Countries

Country	Natural Forest Cover (km^2)	Plantations (km^2)	Total Tree Cover (km^2)	Percentage Decrease in Tree Cover 2000-2010	Percentage Decrease in Tree Cover 2010-2019
Cambodia	82,200	5,940	88,140	10.0	18.0
China	341,800	63,370	405,170	5.5	7.1
Lao PDR	191,000	0	191,000	5.0	13.3
Myanmar	418,000	10,600	428,600	2.7	6.1
Thailand	198,000	1,400	199,400	4.4	6.2
Vietnam	147,000	18,300	165,300	5.4	12.5
Total	**1,378,000**	**99,610**	**1,477,610**	**4.7**	**8.7**

Source: Global Forest Watch (2020). Notes: tree cover = land with >30% canopy cover. Figures for China are based on the four provinces that overlap with the hotspot: Guangdong; Guangxi; Hainan; and Yunnan. Figures are for the entirety of these provinces. Apart from Hainan, only a portion of each province is included in the Indo-Burma Hotspot. However, these figures are considered to be reasonable approximations of tree cover and deforestation rates for the Chinese portion the hotspot, because forest cover in these provinces is concentrated within the hotspot.

Deforestation, together with unsustainable levels of hunting, and dam construction, remains one of the greatest threats to biodiversity in the Indo-Burma Hotspot. The six hotspot countries still retain large areas of natural forest but, in the two decades from 2000 to 2019, lost a combined total of 192,226 square kilometers of tree cover (Global Forest Watch 2020), equivalent to 8 percent of the total area of the hotspot.

Cambodia, Lao PDR and Myanmar still support significant areas of lowland forest, although much of this is open deciduous and mixed deciduous forest. Forest cover in Thailand and Vietnam is generally restricted to upland and hilly areas; most of the forest area is fragmented and few large blocks remain. The most significant exception to this is the Western Forest Complex along the Thai-Myanmar border. At 18,000 square kilometers, this remains one of the largest unfragmented forest blocks in Southeast Asia, retains an almost complete suite of species and is one of the most important sites for biodiversity in the hotspot. Other important relatively un-fragmented forest blocks in the hotspot include the Cardamom Mountains and the northern and eastern plains of Cambodia, the Annamite Mountains of Lao PDR and Vietnam, and the Sundaic forests of Myanmar's Tanintharyi Region.

According to the Global Forest Resources Assessment (FAO 2015a), Thailand and Vietnam reported net increases in forest cover between 2005 and 2015. Closer examination of the data reveals that the reported increases were largely due to increases in planted forest. One-quarter of the forest cover in each country is now planted forest (FAO 2015a), a large proportion of which is exotics such as *Acacia* spp., *Eucalyptus* spp. and *Pinus* spp. The biodiversity value of plantation forest is significantly lower than that of natural forest, even heavily disturbed natural forest (Aratrakorn *et al.* 2006, Fitzherbert *et al.* 2008), and so forest cover statistics for Thailand and Vietnam belie a trend of natural forest loss, which has had significant impacts on biodiversity. Lowland forests in Thailand and Vietnam, which typically are the most species rich, have been most heavily impacted. These are now among the most highly threatened ecosystems in the hotspot.

Generally, deforestation is taking place in two direct forms, both driven by a suite of socioeconomic drivers: large-scale clearance of forest for forest plantations and agro-industry; and small-scale clearance by households for farmland. Both of these are significant factors in Cambodia, Lao PD, and Myanmar (see above), and this trend is likely to continue. Further clearance of large areas of natural forest for plantations is now less likely in China, Thailand and Vietnam but encroachment of natural forest (often protected areas) by farming communities continues to be a problem (FAO 2011a).

7.4.2 Degradation

Even where forest cover is retained, increasing levels of illegal logging, hunting and high levels of non-timber forest product collection mean that large areas of forest are increasingly degraded. Forest structure is affected, and species composition is altered, favoring pioneer species and generalists. Disturbed forest is more prone to fire, which may become an increasing problem considering predicted climate models (FAO 2011a). Wildlife densities are well below natural levels throughout the hotspot, and many areas (including protected areas) exhibit the 'empty forests syndrome', with tree cover but virtually no wildlife aside from the most resilient species.

7.4.3 Wetlands

Wetlands and coastal ecosystems have been particularly heavily impacted by human activities. Wetlands throughout the hotspot have been converted to agriculture and now cover a tiny fragment of their historical extent. Much of this conversion took place in the last century but the trend continues. As mentioned above, wetlands are also threatened by pollution from industrial expansion, inundation following dam construction, and also from over-exploitation of resources, principally over-fishing.

Mangrove forests along the coasts of the hotspot are a critically important ecosystem providing vital spawning grounds for many fish species, as well as coastal protection. However, they have also suffered from high levels of disturbance and clearance. Thailand and Vietnam lost one third of their mangrove area between 1960 and 2000. The trend has continued, and the coastal countries in the hotspot lost between 1 and 4 percent per year in the decade up to 2015, apart from Vietnam, which reported a 16 percent annual increase over this period (FAO 2015a). The main driver of mangrove destruction has been the creation of ponds for shrimp aquaculture, mainly for export. In Myanmar, which has seen the highest rates of net loss (FAO 2015a), charcoal production has been a major driver of mangrove destruction.

7.5 Conclusions

The Indo-Burma Hotspot has witnessed extraordinary economic growth since the 1990s but remains a region of contrasts. It includes global cities like Bangkok and Hong Kong, and one of the world's great centers of manufacturing in southern China. It also includes isolated forest communities, little changed for hundreds of years, and some of the poorest parts of Asia. This rapid growth and extremes of wealth and development present many challenges for biodiversity conservation. Poverty alleviation remains a key development strategy and national priorities focus on continuing the rapid growth, often at the expense of natural ecosystems and biodiversity, which remain undervalued and under-appreciated. During this period of growth and industrialization, biodiversity conservation could be seen as in a phase of triage. All efforts should be made to maintain as much of the most critically important areas as possible but in the knowledge that some areas will be lost. While national (and most donor) priorities focus on poverty alleviation, economic development and, increasingly, climate change (see Chapter 10), opportunities exist to focus investments on biodiversity conservation. At the same time, it is important to understand more fully the socioeconomic context for conservation in the region. Key topics that need deeper understanding include:

- Impacts of hydropower developments outside the lower Mekong Basin.
- The potential growth and environmental impacts of extractive industries, especially oil and gas extraction, mining, and limestone quarrying.
- The potential for payments for ecosystem services linked to extractive industries and hydropower.
- Opportunities to strengthen environmental and social safeguards in relation to intra-regional investment.
- Options for engaging owners of ELC in more sustainable, accountable development of these areas, which preserves their key biodiversity values and respects the rights of local communities.
- Status of mangroves throughout the hotspot, and likely future trends.
- The links between traditional belief systems and biodiversity conservation, including the potential for Indigenous and Community Conserved Areas (ICCAs).

8. POLICY CONTEXT OF THE INDO-BURMA HOTSPOT

8.1 Introduction

This chapter presents a review of the main environment-related national, regional and global policies and agreements being applied in the Indo-Burma Hotspot. It illustrates how development strategies of hotspot countries can hinder or benefit biodiversity conservation. As shown in Chapter 7, the region has gone through a period of unprecedented economic growth in the past two decades. This has been facilitated by a shift towards more market-oriented policies by governments in the hotspot. This push for more liberalized economies and a concerted effort to reduce poverty has had short-term environmental costs. At the same time, however, some of the political and institutional changes that have taken place create opportunities for long-term improvements in environmental management.

8.2 Overview of the Regional and National Political Situation

8.2.1 General Overview

The current policy and institutional context has been greatly influenced by the recent history of the region and individual nations. At the same time, older, deeper cultural aspects still influence policy and its implementation. The past two decades have been a period of relative political stability in the region. This era of stability follows a long period of political instability and armed conflict following the end of the Second World War and the withdrawal of the colonial powers. One notable exception to this is Thailand, which, despite frequent changes of government and periods of military rule, has remained a constitutional monarchy with most of the trappings of a liberal democracy. The other notable exception is Myanmar, where many of the ethnic conflicts that erupted following independence in 1948 continue to this day, despite the signing of a National Ceasefire Agreement in 2015 and an ongoing peace process.

The hotspot includes three of the world's five remaining communist states in the People's Republic of China, Lao People's Democratic Republic, and the Socialist Republic of Vietnam. All three of these states have been opening up and introducing reforms since the 1990s, particularly with regard to liberalization of the economy. Political changes have been slower and all three states still maintain strong, one-party control of government, limited political space for civil society, regulated media and limited democratic accountability. Hong Kong and Macau (both in the Indo-Burma Hotspot) have the status of SARs in China. This affords them a degree of autonomy and they have control over all issues except diplomacy and national defense.

After nearly 30 years of armed conflict, including a genocide under the despotic Khmer Rouge regime, Cambodia has been a constitutional monarchy and democracy since 1993, although there is no effective opposition to the current ruling party, which has been in power since the mid-1980s and dominates the political scene. Myanmar was under direct military rule from 1962 to 2015, when the first openly contested elections returned a civil government to power. The military still retains considerable influence over many aspects of public life and sectors of the economy.

A general pattern exists across the hotspot where political power in each country is held by an elite that has dominated for several decades. Only in Thailand (and, to some extent, Myanmar) have there been major swings in political power in the last quarter of a century. There have been some moves towards decentralization (see below) but political power tends to be centralized and top-down. The political elites also hold great economic power, which fuels patronage networks and encourages cronyism. With the partial exception of Thailand, the media are under state control across the region, and efforts at wider citizen participation in the political process have been sporadic. There are also constraints on civil society and political space with respect to development decision-making. This tight state control has fostered rapid industrialization, massive state investment in infrastructure, and brought millions out of poverty. This rush for economic growth has, however, taken priority over other issues, such as the environment.

8.2.2 Conflicts and Insecurity

Past conflicts and insecurity have had significant impacts on the biodiversity of the Indo-Burma Hotspot. Areas of insecurity still exist in parts of the hotspot, with localized consequences for conservation.

The three Indochina Wars in the latter half of the 20th century had multiple impacts. Human populations were displaced, often to forest areas, where they relied more heavily on wild meat. Periods of famine followed the conflicts increasing further the reliance on wild foods. The Khmer Rouge regime in Cambodia had a policy of actively hunting wildlife as a source of foreign income and supplies (Loucks *et al.* 2009). The effects of the Khmer Rouge regime and the decades of insecurity and civil war that followed are still felt in Cambodia. The wars had another direct impact on forest and wildlife. The widespread use of defoliants by US forces over Cambodia, Lao PDR and Vietnam destroyed thousands of square kilometers of forest (Dudley *et al.* 2002). In addition, Asian elephants were directly targeted by the US military, who believed they may be used for transporting supplies (Dudley *et al.* 2002).

Several notable areas of conflict still exist today, including in southern Thailand and in various parts of Myanmar. Each of these conflicts is occurring in remote, predominately forested locations, and is likely having an impact on the biodiversity of those areas. In many areas of Myanmar, there is conflict between the military and ethnic armed groups, eight of which signed the National Ceasefire Agreement in October 2015. The national elections of 2015 introduced democratic reforms and returned a civilian government, led by Aung San Suu Kyi, ending decades of direct military rule. While this transition has garnered much international attention and increased investment in the country significantly, several armed conflicts have continued, or intensified, particularly in Rakhine Region and Shan State. Moreover, the complex interplay of competing interests, with a nexus of exploitation of natural resources (jade, timber, etc.), has created very challenging conditions for internationally supported conservation efforts (Fishbein 2020, Lindsay 2020).

Another major implication of the armed conflicts in Myanmar is that development has become entwined with militarization, as securing resource rich lands for development projects increases military and police presence, with serious consequences for local populations (BEWG 2011). There have been accusations of conservation projects (for instance the declaration of a Tiger Reserve within the Hukaung Valley) having similar effects (BEWG 2011), and this calls for high levels of vigilance on the part of conservation groups to ensure that their actions do not affect local people’s rights and wellbeing.

A low-level insurgency persists in southern Thailand, which has resulted in a strong response from the Thai military. Insecurity in the region is no doubt impacting management of the protected areas south of the Isthmus of Kra (A. Lynam pers. comm. 2010). A short conflict between Cambodia and Thailand over sovereignty of the region around the Prasat Preah Vihear temples along their shared border flared up in 2008, following its declaration as a World Heritage Site. Subsequent militarization of the border area resulted in the Cambodian military being granted permission to develop bases within Kulen Promtep Wildlife Sanctuary and Preah Vihear Protected Forest (Fox 2009), leading to clearance of forest in these areas for the bases, barracks and farm land. There are also reports of increased hunting in these protected area, and other neighboring forests.

8.3 Global and Regional Agreements

All nations in the Indo-Burma Hotspot are signatories to a range of global and regional agreements designed to promote environmental protection and sustainable development. The impact of these agreements on national policy is variable, as economic development generally has primacy over environmental concerns. They have, however, probably mitigated some of the more severe possible impacts of rapid economic development.

8.3.1 Hotspot Parties to Global Agreements

Hotspot countries are signatories to various multilateral environmental agreements. Apart from those in Table 10, all nations are signatories to the Convention on International Trade in Endangered Species (CITES), the United Nations Convention to Combat Desertification, the United Nations Forum on Forests, the United Nations Framework Convention on Climate Change (UNFCCC), and the Cartagena Protocol on Biosafety.

Table 10. Number of Sites in the Hotspot Designated under Multilateral Environmental Agreements

Country	Ramsar Sites	Natural World Heritage Sites	Man and Biosphere Reserves	ASEAN Heritage Parks
Cambodia	5	0	1	2
China*	11	1	3	0
Lao PDR	2	0	0	1
Myanmar	6	0	2	7
Thailand	15	2	4	4
Vietnam	9	3	9	6
Total	**48**	**6**	**19**	**20**

Note: * = figures for the Indo-Burma Hotspot only.

Convention on Biological Diversity (CBD)
This convention, effective since 1993, has 193 member countries. Its objectives are the conservation of biological diversity, the sustainable use of its components, and the fair and

equitable sharing of the benefits arising out of the utilization of genetic resources. It seeks to promote conservation of biological diversity in the wild, through requesting signatories to identify regions of biodiversity importance, establish a system of protected areas, restore degraded ecosystems, maintain viable populations of species in natural surroundings, and develop or maintain necessary legislation and/or other regulatory provisions for the protection of threatened species and populations. All hotspot countries have an official National Biodiversity Strategy and Action Plan (NBSAP), which acts as an over-arching guide to biodiversity conservation in the country. Unfortunately, overlapping jurisdiction combined with the limited resources and political power of many of the implementing agencies has limited the impact of these action plans.

Ramsar Convention

Effective since 1975, the Ramsar Convention, also known as the Convention on Wetlands of International Importance especially as Waterfowl Habitat, has 160 member countries. It is an intergovernmental treaty that embodies the commitments of its member countries to maintain the ecological character of their Wetlands of International Importance and to plan for the 'wise use' of all wetlands in their territories (Ramsar 2011). All hotspot countries are contracting parties, and they have designated a total of 48 'Ramsar sites', or wetlands of international importance (Ramsar 2020). Generally, however, wetlands are under-represented in national protected area networks, which is of great consequence because they include some of the most threatened ecosystems in the hotspot. Designation of Ramsar sites is probably not indicative of the actual number of wetlands of international importance in the hotspot. For example, Myanmar, which includes many of the least disturbed wetland ecosystems in the region, has declared only six Ramsar sites, whereas the United Kingdom, a far less biodiverse country, has 175. Many KBAs in the hotspot qualify as Ramsar sites based on multiple criteria; promoting their recognition as Ramsar sites would give them global recognition and might lead to increased protection.

World Heritage Convention

Effective since 1975, this convention has 193 member countries. Its aim is to identify and conserve cultural and natural monuments and sites of outstanding universal value, through the nomination of World Heritage Sites by national governments and their recognition by the United Nations Educational, Scientific and Cultural Organization (UNESCO). As of June 2020, only six natural heritage sites had been nominated in the hotspot (compared to 21 cultural sites). Given the global importance of many sites in the hotspot, it is highly likely that other areas would qualify. Some hotspot nations have stated that they will not nominate some areas as they fear that World Heritage status would restrict development opportunities.

UNESCO's Man and Biosphere Program

This program operates through national committees and focal points among UNESCO member states. It aims to develop a basis, within the natural and the social sciences, for the conservation and sustainable use of biological diversity and for the improvement of the relationship between people and their environment, encouraging interdisciplinary research, demonstration and training in natural resource management. An essential tool for the Man and Biosphere Program is the network of Biosphere Reserves, which are areas of terrestrial and coastal ecosystems where solutions are promoted to reconcile biodiversity conservation with its sustainable use. To date, 19 biosphere reserves have been declared in the hotspot, nearly half of which are in Vietnam. Some of these sites have been very successful at combining biodiversity conservation and natural resource management. For example, until

August 2011, the Prek Toal Core Area of the Tonle Sap Biosphere Reserve was in an active commercial fishing lot. At the same time, it supported a waterbird colony of international importance. Wise management of the area saw the numbers of waterbirds breeding at the site increase significantly since 2000 (Sun Visal and Allebone-Webb 2009).

Convention on Migratory Species of Wild Animals (Bonn Convention)
The Bonn Convention has been implemented since 1983 and has 129 parties. Its objective is to protect migratory species that cross international borders. To date, no hotspot country is party to the convention. However, all except Lao PDR are signatories to a memorandum of understanding (MoU) that "aims to protect, conserve, replenish and recover marine turtles and their habitats of the Indian Ocean and Southeast Asian region" (IOSEA 2011). Myanmar and Thailand are signatories to a similar MoU, which aims to protect dugong (*Dugong dugon*).

8.3.2 Hotspot Parties to Regional Agreements

In addition to the global environmental agreements outlined above, the hotspot countries are also members or partners of three significant regional organizations (Table 11). Although no one organization covers the whole of the hotspot they all have influence on parts of it.

Table 11. Membership of Regional Organizations and Initiatives

Country	ASEAN	MRC	LMC	ADB-GMS
Cambodia	✓	✓	✓	✓
China	a	a	✓	b
Lao PDR	✓	✓	✓	✓
Myanmar	✓	a	✓	✓
Thailand	✓	✓	✓	✓
Vietnam	✓	✓	✓	✓

Notes: a = dialogue partner; b = Guangxi and Yunnan provinces only.

Association of Southeast Asian Nations (ASEAN)
ASEAN is a network of Southeast Asian countries with the aim of promoting peace and stability, and accelerating economic growth and social progress in Southeast Asia. All hotspot countries are members, apart from China, which is a 'dialogue partner'. ASEAN includes countries outside the hotspot and, so, influence on environmental issues in the hotspot is often diluted. It is also considered rather bureaucratic and may not have much power (Habito and Antonio 2007). It does, however, acknowledge the importance of the environment, the high biodiversity value of Southeast Asia, and the potential impacts of rapid economic growth (ASEAN 2010). It has identified 10 priority issues of regional importance as mentioned in the *ASEAN Socio-Cultural Community (ASCC Blueprint) 2009-2015* (ASEAN 2009). These include environmental education, harmonizing environmental policies, promoting the sustainable use of coastal and marine environment, of natural resources and biodiversity, and of freshwater resources. Also, the *ASEAN Human Rights*

Declaration recognizes that every person has the right to a clean, safe and sustainable environment (ASEAN 2013).

In addition to these broad policy statements, ASEAN has established three focused programs related to biodiversity conservation. The ASEAN Wildlife Enforcement Network (ASEAN WEN) is "the world's largest wildlife law enforcement network that involves police, customs and environment agencies of all 10 ASEAN countries" (ASEAN WEN 2009). It is designed to provide training and capacity building to agencies across the region and improve collaboration and coordination between member states. To date, this program has been relatively successful in raising awareness of wildlife trade among member governments but the international trade in wildlife remains a huge problem in the ASEAN region, and increased efforts and support are needed. The ASEAN Centre for Biodiversity, based in the Philippines, aims to support national governments to meet their commitments to international agreements and commitments (ACB 2010). The center acts as a clearing house for regional biodiversity data, including online databases and policy briefs. In recognition of their importance, ASEAN states have also created a system of ASEAN Heritage Parks, 20 of which are found in the hotspot countries (Table 10). This status is not as well known as World Heritage status, and it is unclear whether it provides any additional protection against incompatible development (or, even, may encourage it). For example, although Vietnam's Hoang Lien National Park is designated as an ASEAN Heritage Park, a cable car to the summit of the mountain was developed in 2016, causing significant disturbance to sensitive montane habitats.

Mekong River Commission (MRC)

The MRC was established in 1995 by the governments of Cambodia, Lao PDR, Thailand and Vietnam. It is a forum "to cooperate in all fields of sustainable development, utilization, management and conservation of the water and related resources of the Mekong River Basin" (MRC 2005) . Although the source and headwaters of the river are in China, and part of its basin is in Myanmar, the two countries are not full members of the organization but 'dialogue partners'. The main guiding documents of the MRC relating to the sustainable use of the river are the Basin Development Strategies. The current strategy, which covers the period 2016 to 2020, focuses on "how the sustainable development of the LMB can be achieved and national plans adapted to address longer term needs and provide a comprehensive response to climate change and other challenges" (MRC 2016, pvi). An updated strategy, covering the period 2021 to 2025, is currently under development.

The MRC has not proven to be an especially powerful institution. It acts only as an advisory body and forum for discussion and agreement. In relation to hydropower, it provides processes for share information and solicit input in relation to projects with potential transboundary impacts, such as the Procedures for Notification, Prior Consultation and Agreement, but it does not provide for dispute resolution or ensure public participation in decision-making. It has been effective within its mandate but is inherently limited (Lee and Scurrah 2008). For example, the MRC SEA provided valuable information on the impact of mainstream dams and made clear recommendations, including that decisions on mainstream dams should be deferred for a period of 10 years (ICEM 2010), while the Council Study makes clear recommendations, including that only low impact and high return hydropower projects proceed to implementation, and that a levy on hydropower be used to fund conservation, management and monitoring of fisheries and ecosystems (MRC 2019b). However, the MRC has no authority to enforce implementation of any of these recommendations. Fundamentally, it is highly unlikely that any member states would surrender sovereignty over development decisions within their borders (even ones with regional implications) to a regional body.

Lancang-Mekong Cooperation (LMC) Mechanism
The LCM was established in 2016 as a sub-regional cooperation mechanism to promote development among the six countries that share the Mekong (Lancang) River. The LMC focuses on practical cooperation in three areas: political and security issues; economic and sustainable development; and social, cultural and people-to-people exchange. Although environmental protection is not a primary goal of the mechanism, in the Sanya Declaration, announced at the launch of the LMC, the heads of state of the participating countries agreed to "encourage sustainable and green development, enhance environmental protection and natural resources management; develop and utilize sustainably and efficiently clean energy sources, develop regional power market, and enhance exchange and transfer of clean energy technologies" (LMC 2016). In addition, the five-year action plan for the LMC includes actions related to forests, water resources and environmental protection (LMC 2018).

Asian Development Bank Greater Mekong Sub-region (ADB-GMS) Economic Cooperation Program
The ADB-GMS program was set up in 1992 to enhance economic cooperation among the six member nations (Habito and Antonio 2007). It has a sectoral approach, which initially focused on cross-border infrastructure support. This remains the principal focus of some elements of the program, such as the economic corridors (see Chapter 7), although the program has also begun to take a more holistic approach to sustainable development. For instance, it has an environmental component, which is run through an Environmental Operations Center in Bangkok (GMS EOC 2008). The initiative's main purpose, however, remains the economic development of the region and it is, therefore, helping promote development activities, increasingly through private sector development, which can have major adverse impacts on biodiversity.

The program is currently being guided by the *Greater Mekong Subregion Economic Cooperation Program Strategic Framework 2012-2022*, which has five strategic thrusts: strengthening infrastructure linkages; facilitating cross-border trade, investment and tourism; enhancing private sector participation and competitiveness; developing human resources; and protection the environment and promoting sustainable use of shared natural resources (ADB 2011e). The flagship programs for advancing the fifth strategic thrust, on environment and biodiversity, are Core Environment Program and Biodiversity Conservation Corridors Initiative, which respond to "infrastructure and other development being major drivers of ecosystem fragmentation and destruction" (ADB 2011e, p17).

8.4 Development Strategies and Policy Interactions with Natural Resources

National development strategies for all countries in the hotspot have many similarities. They are principally based on an aggressive drive for economic development and industrialization, aimed at reducing the proportion of the population living in poverty. As shown in Chapter 7, this approach has been broadly successful, at least in the short term. National development strategies mostly operate on five-year cycles. Although their goals may align with the United Nations Sustainable Goals, they are primarily a response to national policy imperatives.

The national development strategy for Cambodia is based around the government's 'rectangular strategy' philosophy: to promote growth, employment, equity and efficiency. At the heart of this is economic development, through the enhancement of the agricultural sector, infrastructure improvement, private-sector investment and capacity building. A major component of the development strategy has been a process of decentralization and deconcentration, with increased planning powers being devolved to provincial governments (NCDD 2010). However, low levels of capacity and weak governance have led to many problems of overlapping business developments, and an almost total lack of consideration for environmental issues. Moreover, decentralization and deconcentration has also, ironically, weakened the voice of ethnic minorities over natural resource management, through, for example, literacy requirements for local official positions that few minority people can meet (J. Ironside *in litt.* 2012).

Development of the Chinese portion of the Indo-Burma Hotspot is dominated by the 'China Western Development' strategy. This aims to improve the economic situation of western China, including Yunnan and Guangxi, through capital investment. It was first proposed in 1999 and began supporting activities in 2000. It has supported infrastructure development, including dams on the upper Mekong River (see Section 7.3.2). China's rapid development in the 1980s and 1990s came at a high environmental and social cost. In recognition of the potential impacts of infrastructure development, the China Western Development Strategy also includes environmental protection activities. To date, these have focused on reforestation, aimed primarily at water catchment protection. The biodiversity benefits of this reforestation program are yet to be evaluated but it is highly unlikely that either the biodiversity or environmental protection values of these plantations will be comparable to those of natural forests. Protection of remaining natural forest in this region remains a very high priority for biodiversity conservation. Acknowledgement of the importance of limiting the environmental damage of development is becoming increasingly widespread in China.

Lao PDR's eighth National Socioeconomic Development Plan runs from 2016-2020. Unlike other development plans in the region, this plan pays little attention to environmental sustainability and gives clear primacy to economic growth. Although there is little acknowledgement in the plan that there may be environmental risks in the future, there have recently been some encouraging developments at the national policy level in Lao PDR. For example, Prime Ministerial orders have recently been issued to halt illegal logging and wildlife trade, while changes are being made to introduce a Division of Conservation and Protected Areas within the Department of Forestry (Lower Mekong Network 2018). Lao PDR has also adopted a National Green Growth Strategy 2019-2030, which prioritizes nature-based tourism and sustainable forestry as key drivers of economic growth.

Ongoing armed conflicts in parts of the country and low levels of ODA and foreign direct investment have slowed development in Myanmar compared to its neighbors. This has not hindered the country's ambition, however. The National Comprehensive Development plan for 2011-2031 aims to triple the country's GDP from $60 billion in 2011 to $180 billion by 2031. As with other countries in the hotspot, this is based on a strategy of improving agricultural productivity, enhancing power supply to support industrial expansion, and human capacity development.

Thailand is currently on its 12th National Economic and Social Development Plan, running from 2017 to 2021. Like other plans, it is anchored in increased industrialization and a move away from subsistence agriculture. It also follows the King's philosophy of 'Sufficient Economy', implying an emphasis on environmental and human wellbeing goals.

The guiding aim of Vietnam's development plans has been for the country to attain the status of an industrialized nation. A review of development strategies carried out for the ADB (Habito and Antonio 2007) concluded, however, that Vietnam may succeed in this economic ambition but at significant expense to the environment.

The same report noted several issues that were common to the implementation of sustainable development in the Greater Mekong Sub-region (Habito and Antonio 2007). Some of these have important implications when attempting to improve the conservation of biodiversity in the Indo-Burma Hotspot:

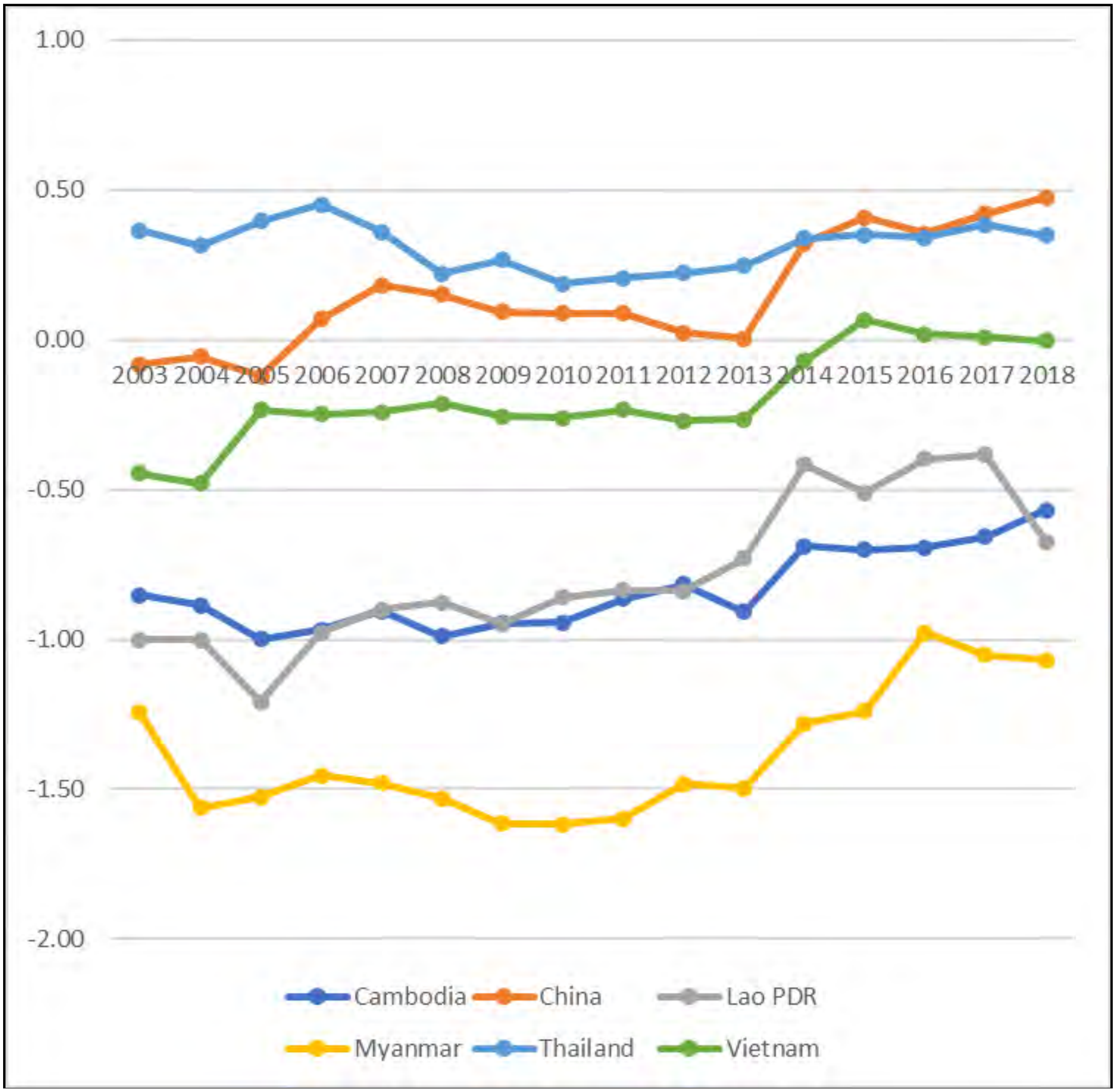
- Policy integration is generally weak (but improving) with development priorities stressing economic development over social and environmental dimensions.
- Although all countries have at least one long-term document, most planning cycles are short-term. This tends to underestimate environmental costs, which occur on a longer timescale.
- There is very poor institutional coordination within countries. Individual ministries and agencies develop their own plans, which often clash with those of others. This is an especially significant problem in the environment sector, where the relevant ministries are often politically weak and the priorities of other departments are given precedence.
- Although most countries maintain central control, there has been a trend for increased decentralization in several countries. However, the capacity of local institutions often remains low and this undermines the effectiveness of decentralization policies.
- Funding for the implementation of sustainable development plans is restricted.

These issues with governance are having huge impacts on biodiversity conservation. Government staff capacity is a key challenge (Thomas 2015). Government staff mandated to protect biodiversity are often poorly paid and operate in environments where corruption is normalized. As outlined below, hotspot countries generally have good legal basis for biodiversity conservation. Limited budgets and poor governance, however, mean that these laws are often not implemented adequately.

The Environmental Performance Index (Yale University 2020) ranks 180 countries around the world on environmental health and ecosystem vitality, against 32 performance indicators in 11 categories. These indicators provide a measure of how close countries are to established environmental policy targets. In the 2020 rankings, five of the six hotspot countries were ranked 120th or below, with only Thailand (78th) being ranked in the top half of the world's countries.

While there are concerns about governance and transparency in all of the hotspot countries, there are also some positive signs. The World Bank Governance Indicators are aggregates of six dimensions of governance, scored by interviews with citizens and experts in each country (World Bank 2019b). The government effectiveness indicator captures perceptions of the quality of public services, the quality of the civil service, the quality of policy formulation and implementation, and the government's commitment to such policies. Encouragingly, over the 15 years between 2003 and 2018, the government effectiveness indicator increased in five of the six hotspot countries, and remained broadly stable in the sixth (Figure 17).

Figure 17. Government Effectiveness Indicator for Hotspot Countries



Source: World Bank (2019b).

Similarly, Transparency International's Corruption Perceptions Index (CPI), is an annual survey of perceived levels of corruption in the public sector. The results of the CPI for 2018 placed all but one of the hotspot countries among the bottom half in the world in terms of transparency and corruption (Table 12). Nevertheless, each country's score has improved over the last decade, significantly so in the case of Myanmar, which has moved up the global ranking from 176th in 2010 to 132nd in 2018.

Table 12. CPI Scores for Hotspot Countries

Country	CPI Score (min 0, max 100)	Rank (out of 180)
Cambodia	20	161
China	39	87
Lao PDR	29	132
Myanmar	29	132
Thailand	36	99
Vietnam	33	117

Source: Transparency International (2018).

8.5 Administrative and Legislative Frameworks

All hotspot nations have a set of laws and policies that support biodiversity conservation. Central to these is legislation supporting the creation and management of protected areas, and wildlife protection laws. In addition, states have other legislation that influences the regulatory environment for biodiversity conservation, including forestry and fisheries policies, environmental impact regulations, and pollution control regulations. This legislation is implemented by a diverse array of different ministries, agencies and institutions. While the legal framework for biodiversity conservation in the hotspot is robust, significant issues exist in terms of coordination among institutions, and effective implementation of laws.

Protected areas lie at the heart of biodiversity conservation strategies in the hotspot. According to the WDPA, 435 terrestrial and 72 marine protected areas have been designated in the hotspot (IUCN and UNEP-WCMC 2020, Table 13).

Table 13. Protected Area Coverage in the Indo-Burma Hotspot

Country	Number of Terrestrial PAs	Total Area (km²)	% of National Land Area	Number of Marine PAs	Area of Marine PAs (km²)
Cambodia	43	62,650	34.6	2	366
China*	4	5,499	1.5	3	323
Lao PDR	27	38,059	16.1	0	0
Myanmar	46	41,435	6.1	5	1,180
Thailand	185	109,948	21.4	23	4,309
Vietnam	130	43,679	13.2	39	2,187
Total	**435**	**301,270**	**13.0**	**72**	**8,365**

Source: IUCN and UNEP-WCMC (2020). Notes: * = figures for the Indo-Burma Hotspot only; Chinese protected areas under-represented in WDPA.

This figure is likely an underestimate, because the WDPA is only updated every five years, and relies on data submitted from national governments, which are not necessarily comprehensive, particularly with regard to sub-national protected areas. Overall, at least 13 percent of the land area of the hotspot is covered by protected areas but the national coverage is very variable. Cambodia has the greatest coverage, with almost 35 percent of its land area protected. At the other extreme, Myanmar only has a little over 6 percent of its land area under protection. Distribution of protected areas by habitat is also not uniform. Across the hotspot, protected area coverage is more complete in upland and mountainous area (where agricultural productivity is lower and, hence, the opportunity costs of conservation are typically lower). Lowland evergreen forests are poorly represented in protected areas, especially in Thailand and Vietnam. With the exception of Thailand, there is also poor coverage of coastal ecosystems in protected area networks. Freshwater ecosystems are also severely under-represented in protected area networks. This is of particular concern given their importance for biodiversity, environmental services and social values.

Three large protected area complexes exist in the hotspot, all of international importance for the conservation of threatened wildlife. The Western Forest Complex in Thailand consists of 15 protected areas, with two more proposed, and covers over 18,000 square kilometers. In the Cardamom Mountains of southwestern Cambodia, there is a complex of six protected areas, covering 17,364 square kilometers. In the eastern plains and Annamite foothills of eastern Cambodia, there is a complex of seven protected areas, covering 13,700 square kilometers. Two contiguous protected areas in neighboring Vietnam bring the total area under protection to over 15,000 square kilometers.

8.5.1 Cambodia

Cambodia adopted a new constitution in 1993, and all laws and policies had to be created from scratch. Most of these laws were written with international assistance, and include some progressive elements, such as recognition of indigenous communal tenure in the Land Law and community forestry in the Forest Law. Most of the laws are relatively new, however, and many of the decrees and documents needed to interpret them adequately are still lacking. These legal and policy gaps leave loopholes that make implementation of the laws confusing and complex.

The two ministries responsible for biodiversity conservation are the Ministry of Agriculture, Forestry and Fisheries (MAFF) and the Ministry of Environment (MoE). The General Department of Administration for Nature Conservation and Protection under MoE is responsible for management of the national protected area system, and for implementation of environmental protection regulations. Two agencies within MAFF are responsible for management of natural resources throughout the rest of the country. The Fisheries Administration is responsible for fisheries, aquatic reptiles and freshwater mammals. The Forestry Administration (FA) is responsible for forest resources and wildlife outside the protected area network. Responsibility for the various multinational environmental agreements to which Cambodia is party to is also divided between the two ministries. For example, FA is responsible for CITES, while MoE is responsible for the CBD, the Ramsar Convention and implementation of Reducing Emissions from Deforestation and Forest Degradation (REDD) activities.

All protected areas were moved under management of MoE in 2016. Subsequently, in line with the national public sector reform agenda, responsibility for protected area management was devolved to provincial departments of environment, which are under the direct line management of provincial governments. This is significant, because the provincial departments of environment do not enjoy the same level of capacity and resources as MoE.

The key laws are the 2001 Land Law, the 2002 Forestry Law, and the 1996 Law on Environmental Protection and Natural Resource Management (a.k.a. the 'Environment Law'). In recent years, these laws have been supplemented by two important new documents. The 2008 Protected Areas Law strengthens the legal mandate for management of protected areas, while the 2010 National Forest Plan provides a 20-year guiding strategy for FA and includes a component dedicated to strengthening biodiversity conservation. Many of the provisions in the Protected Areas Law and Environment Law are in need of updating, to reflect current conservation practice (for example, the increased emphasis of community participation in protected area management) and respond to emerging challenges. A new Environmental and Natural Resources Code has been under preparation for several years by MoE, with input from civil society groups, but has yet to be signed into law, despite multiple drafts.

8.5.2 China

China's State Council, appointed by the National People's Congress, has ultimate responsibility for the country's environment. The State Council authorizes the Ministry of Ecology and Environment (MEE) (formerly the Ministry of Environmental Protection, formerly the State Environmental Protection Administration (SEPA)) to coordinate and monitor the management of biodiversity conservation. MEE's responsibilities include formulating laws, regulations, economic, and technical policies, compiling national programs and technical specifications, formulating management regulations and evaluation standards for nature reserves, and supervising the conservation of rare and threatened species. In addition, MEE is responsible for the implementation and supervision of multilateral environmental agreements and represents the government at the CBD.

Actual responsibility for managing forests and the majority of protected areas lies with the State Forestry and Grassland Administration (formerly the State Forestry Administration) under the Ministry of Natural Resources. Several other institutions also have biodiversity conservation responsibilities, including the Ministry of Agriculture and Rural Affairs, the Ministry of Housing and Urban-rural Development, and the Chinese Academy of Sciences. One source of independent expert advice to the State Council in policy development and planning is the China Council for International Cooperation on Environment and Development, a high-level, nongovernmental consultative forum created in 1992, consisting of senior Chinese officials and experts, together with high-profile international experts.

Key legal documents for China include laws on water pollution (1984), forests (1984), fisheries (1986), air pollution (1987), water (1988), land administration (1999) and EIA (2003). In 2015, China introduced a new Environmental Protection Law, which makes provision for ecological compensation (a form of payment for ecosystem services), as well as protection and restoration of natural ecosystems. The law significantly strengthened enforcement capabilities and penalties for non-compliance.

Environmental issues in Hong Kong SAR and Macau SAR are governed by separate administrative and legal frameworks. Hong Kong SAR's primary agency concerned with biodiversity conservation and management of the territory's protected areas is the Agriculture, Fisheries and Conservation Department. Environmental protection (including impacts and pollution control) is administered by the Environmental Protection Department, which has the critical role of coordination with mainland Chinese authorities on environmental concerns. Environmental protection in Macau SAR is managed by the Environmental Protection Bureau, which was established in 2009.

8.5.3 Lao PDR

In Lao PDR, overall responsibility for biodiversity conservation lies with MoNRE, established in 2011. MoNRE's other responsibilities include climate change, water resources and disaster preparedness. The Department of Forestry (DoF) under the Ministry of Agriculture and Forestry has responsibility for managing nationally zoned forest land, which is divided into three classes: production forest; protection forest; and conservation forest (which includes the national protected area system). DoF is also responsible for managing forest concessions and industrial forest plantations. Another department within the Ministry of Agriculture and Forestry, the Department of Livestock and Fisheries, is responsible for conservation and sustainable management of aquatic resources, including Lao PDR's large network of fish conservation zones.

Key pieces of legislation include the Wildlife Law (2008), the Fishery Law (2010), the Law on Environmental Protection (2012), the Water Law (2017) and the Forestry Law (2019). These laws are complemented by the National Environment Strategy for 2016-2025 and the National Biodiversity Strategy and Action Plan, which was developed in 2004. The Forestry Law was first developed in 1996 and revised in 2007 and again in 2019. The revisions included stronger measures to control illegal logging. Lao has a Forest Strategy to 2020, which was developed in 2002 (MAF 2004). This helped refine forest policy and includes targets for species conservation and preserving environmental services. The 2013 Ministerial Instruction on Environmental and Social Impact Assessment provides for EIA of development projects and defines conditions under which a cumulative impact assessment of interactions with other existing and planned development projects should be conducted.

8.5.4 Myanmar

The government institution with principal responsibility for the implementation of key policies relating to biodiversity conservation is the Department of Forestry. Established in 1856, it is one of the oldest forest departments in Asia (Das 2000). It is primarily responsible for management of forest lands, including logging and protected areas. Within the department, the Nature and Wildlife Conservation Division has overall responsibility for wildlife conservation and protected area management, while the University of Forestry and the Forestry Research Institute are responsible for applied forestry research.

The Department of Forestry is under the Ministry of Natural Resources and Environmental Conservation ((MoNREC) formerly the Ministry of Environmental Conservation and Forestry), together with the Environmental Conservation Department, which has responsibility for implementing environmental protection legislation, including review of EIA reports for the growing number of large development projects in the country. Regarding the management of non-forest habitats, the Department of Fisheries, under the Ministry of Livestock, Fisheries and Rural Development, plays the leading role in the conservation of aquatic resources. The department has designated several fish conservation areas and works closely with local communities and NGOs to manage these areas.

The overarching legal framework for biodiversity conservation in Myanmar is established by the 2008 constitution, which states that every citizen has a duty to assist the state with environmental conservation. The basic principles for conservation are set out in the Environmental Conservation Law (2012), which provides for a system of SEA and EIA of development projects under the supervision of MONRE, and establishes a framework for coordination among government departments, international organizations and NGOs in environmental conservation matters. More detailed guidance on environmental conservation are set out in the Environmental Conservation Rules (2014) and the EIA Procedure (2015). Other relevant legislation includes the Conservation of Water Resources and River Law and Rule (2006), the Biodiversity and Conservation of Protected Areas Law (2018) and the Forest Law (2018) (World Bank 2019a).

8.5.5 Thailand

Since 2002, management of the national protected area system has been the responsibility of the Department of National Parks, Wildlife and Plant Conservation of MoNRE. Other bodies with environment-related remits include the Department of Marine and Coastal Resources, the Royal Forestry Department (both within MoNRE), the Department of Fisheries, and the Department of Agriculture. The other main government institution involved in natural resource management is the Office of Natural Resources and Environmental Policy and Planning of MoNRE, which is responsible for developing and coordinating national and international environmental plans and policies. It hosts the secretariat of the National Biodiversity Board, functions as a clearing house for the CBD, and supports research and programs relating to access to and sharing of benefits from biodiversity use.

Important legal documents include the 1960 Wild Animals Reservation and Protection Act which led to the establishment of the first protected areas, followed by the National Parks Act of 1961. These two Acts led to the creation of many of Thailand’s protected areas. The National Forest Policy of 1985 emphasized environmental protection and committed 25 percent of the forest area to be set aside for protection, with 15 percent for economic use. Commercial logging of natural forest was banned in 1989. Other important laws included the Forest Act of 1941, the Fisheries Act of 1947, the Forest Reserve Act of 1964 and the 1992 Wild Animals Reservation and Protection (which updated and replaced the 1960 Wild Animals Act) and Enhancement and Conservation of National Environmental Quality Acts of 1992.

8.5.6 Vietnam

Responsibility for environmental management is divided among several central government institutions, including the Ministry of Agriculture and Rural Development (MARD), the Ministry of Natural Resources and Environment (MoNRE), and the Ministry of Planning and Investment. Of these institutions, MARD has the main responsibility for forest management, with the Forest Protection Department within MARD being responsible for developing the national protected area system and enforcing wildlife protection regulations. The Vietnam Environment Administration within MoNRE was formed in 2008. Its responsibilities include development of environmental laws, environmental management and implementation of nationwide biodiversity surveys. The agency is responsible for the development of a system of wetlands of national importance, and is the national contact for CBD and the Ramsar Convention. In addition, there are a number of government research institutes whose work supports biodiversity conservation and protected areas planning, including the Institute of Ecology and Biological Resources within the Vietnam Academy of Science and Technology, and the Forest Inventory and Planning Institute of MARD.

Significant new laws have been passed recently in Vietnam, chief among them being revisions of the Forestry Law (2017), Fisheries Law (2017) and Biodiversity Law (2018), and the amended Law on Environmental Protection (2014). One of the key provisions of the Forestry Law is that it allows for non-state actors to lease natural forest outside protected areas. This creates a basis for the establishment of 'conservation concessions', where a forest area is managed by a private sector organization or civil society group on a long-term lease. This model is currently being piloted in Quang Binh province by the Vietnamese NGO VietNature. Other provisions of the Forestry Law include protective measures to ensure living space for ethnic monitoring communities, support for local livelihoods, and establishment of a payment for forest ecosystem services (PFES) system. A decree formalizing the PFES system was put into effect in 2011, creating the first national legal framework supporting payments for ecosystem services in the hotspot. Another important development was Decree 156/2018/ND-CP, introduced in 2018, which provides regulations on management and protection of special-use forests and clear criteria for identification of different types of protected areas (such as national parks, nature reserves, etc.).

8.6 Conclusions

8.6.1 Constraints to Policies and Legislation

It is clear from the summaries presented above that an administrative and legislative framework for biodiversity conservation exists throughout the Indo-Burma Hotspot. There are significant limitations to the successful implementation of environmental legislation, however.

Specific limitations include the following:

- **Overlaps and lack of institutional coordination.** In all hotspot countries, responsibility for biodiversity conservation is divided among multiple agencies. Fisheries, wetland and marine conservation is typically handled by a different department or ministry to the one that manages terrestrial biodiversity. Coordination between different departments is often poor (Habito and Antonio 2007). Development plans that impact on protected areas are often approved without consultation with the management authority. National economic development takes priority over biodiversity conservation, and the institutions tasked with it (i.e., ministries of finance, planning, industry, etc.) have more political power and influence than those mandated to ensure sustainable development.
- **Human capacity and institutional resource limitations.** Government institutions mandated to protect biodiversity are generally understaffed and operate with insufficient budget (see Chapter 11). Staff that are employed, particularly in remote

areas (including protected areas), often lack the knowledge and skills necessary for effective conservation management and wildlife protection.

- **Weak governance.** As described above, most hotspot countries have problems with weak governance. This is an issue within government agencies tasked with biodiversity conservation. Poor pay and conditions, low motivation and training, lack of appropriate incentive mechanisms and lack of institutional power, lead to underperformance of government staff. At the same time, inadequate penalties for non-compliance, lack of an independent judiciary and low priority given to environmental issues create challenges with enforcing environmental legislation. Lack of transparency in planning processes and involvement of powerful vested interests can also contribute to the approval of developments with significant social and environmental costs with little or no public disclosure or consultation.

The legal frameworks that exist provide a clear opportunity for improved biodiversity conservation in the hotspot. The legislation is already in place but needs the right conditions to be implemented. Sustained improvements in implementation of environmental laws and policies are likely to be only achievable as part of comprehensive public administration reforms. These reform processes are typically gradual and may be beyond the influence of CSOs. Local-level improvements can occur, however, particularly by taking advantage of opportunities arising from increased decentralization. Piloting improvements to legislation, enhancing inter-departmental cooperation, and delivering training for protected area staff are examples of the types of action that can be taken by civil society to enhance implementation of legislation on the ground. Efforts to improve capacity of national staff should not be restricted to civil society. Building the capacity of interested and motivated government staff should be encouraged.

8.6.2 Recommendations

The past three decades have been a period of dramatic economic and social development in the Indo-Burma Hotspot. This has been facilitated by development policies promoting industrialization and economic growth. Unfortunately, these policies have often had insufficient social and environmental safeguards, and those measures that are provided for in legislation have frequently not been applied consistently and transparently. Lack of resources available to environmental agencies and governance problems have had further impacts on biodiversity. A legal and policy framework for conservation is in place in each hotspot country, however, which creates opportunities for effective and, in some cases, innovative conservation action on the ground. To maximize the benefits of the legal and policy context, conservation investments should focus on:

- Supporting the development of laws and decrees where gaps exist, for example the Cambodian Wildlife Law.
- Encouraging greater collaboration and coordination among different government agencies. Civil society groups, which often work with multiple agencies within a country, can act as a bridge between institutions which do not normally work together.
- Supporting pilot programs to help develop new modalities for conservation that can then feed back into national legal frameworks.
- Support piloting of programs in light of new legal provisions, particularly conservation concession models (e.g., in Cambodia and Vietnam), and of payments for ecosystem services mechanisms.

- Supporting best practice programs that demonstrate how the full application of the law can have multiple benefits. For example, providing protected areas staff with the training and resources to implement existing laws fully, and supporting the transparent reporting of successes and failures.
- Building the capacity and increasing the motivation of government staff so that they are better placed to implement laws and promote biodiversity conservation.

9. CIVIL SOCIETY CONTEXT OF THE INDO-BURMA HOTSPOT

9.1 Overview

CSOs actively engaged in biodiversity conservation in the Indo-Burma Hotspot or with the potential to support the conservation agenda comprise a mixture of domestic and international organizations. Domestic organizations include community-based organizations (CBOs), national and local NGOs, academic institutions, private companies, and faith-based organizations. Compared with many other parts of the world, domestic CSOs in Indo-Burma have relatively recently begun to register and engage on environmental issues. In most hotspot countries, there are still only a small number of national and local NGOs active in biodiversity conservation, and these typically face limitations in terms of human and financial resources and political leverage. Nevertheless, the last two decades have witnessed the emergence of a growing number of domestic NGOs, which are finding innovative ways to work, and bringing new perspectives to dialogues on conservation and sustainable development.

CBOs take different forms across the hotspot, including Indigenous Peoples organizations, community fisheries and forestry organizations, mutual-help groups and people's movements. They are typically interested in the wellbeing and rights (human, land, natural resource, etc.) of the communities they represent. Grassroots CBOs are present in many of the most important conservation landscapes in the hotspot, where a number of domestic and international NGOs are partnering with them to promote community-based natural resource management and respond to development projects with major social and environmental impacts. The potential for such alliances is great but greatly under-utilized. They also carry risks, due to the power imbalances inherent to them. For instance, there are suggestions that grassroots people's movements have often been replaced or suppressed by aid-funded NGOs, owing to their use of quick, relatively shallow community organizing models and the focus of many donors and NGOs on short-term projects, quantitative process indicators (rather than long-term qualitative impact indicators), and pre-planning despite constantly changing contexts (Lower Mekong Network 2018).

An important section of civil society throughout the hotspot is domestic academic institutions, which have the capacity to undertake applied biodiversity, social and economic research to inform key questions. In many countries, these academic institutions form the main reservoir of national scientific expertise, as well as playing a critical role in training new generations of conservationists and taxonomists. With a few exceptions, the private sector in the hotspot is generally not actively engaged in conservation, although signs of active philanthropy by domestic companies are beginning to be seen, facilitated in part by the emergence of public and non-public foundations in China and Thailand. Faith-based organizations can also play an important role in conservation in the region, through both promoting positive attitudes toward environmental protection and taking on-the-ground action. In the Mekong Delta of Vietnam, for instance, there are examples of Buddhist monks protecting bird and bat colonies within temple grounds, while, in Cambodia's Oddar Meanchey province, the Buddhist monks of Samraong Pagoda are protecting an 18,000 hectare block of forest, known as the Monks Community Forest.

International CSOs active in the hotspot include international NGOs (INGOs) and networks. These organizations typically have larger programs and greater financial and human capacity than domestic NGOs, and many are active in more than one country in the region. INGOs have generally been considered to have greater leverage with governments and international donors, although there are signs that this may be changing, as the overall influence of the international community on domestic policy decisions wanes and domestic NGOs grow in credibility and influence. In addition to INGOs, several academic institutions based outside the hotspot are active in conservation efforts there. These groups typically focus on evidence-based research and capacity building, particularly in biodiversity survey and taxonomy.

With the exception of consulting companies, international private sector organizations have played a relatively limited role in biodiversity conservation in the hotspot to date. Again, there are signs that this may be changing, as a number of private sector companies, most notably in the extractives industry, enter into partnerships with conservation groups to conserve biodiversity in their areas of operation. In Myanmar, for example, Shwe Taung Cement Company has supported an expansion of Panlaung-Padalin Cave Wildlife Sanctuary by 6,475 hectares, to offset impacts on karst ecosystems caused by its limestone quarrying operations.

The above overview disguises significant variation among countries in the region with respect to the level of development of local civil society and the extent and nature of its engagement in conservation. This chapter characterizes the regulatory environment and political space for CSOs in each of the hotspot countries, before reviewing patterns in capacity of CSOs, and identifying opportunities for and barriers to engaging them in biodiversity conservation.

9.2 Classification of CSOs

Generally, there are two useful ways of classifying CSOs with potential roles in biodiversity conservation, environmental protection and sustainable development in the Indo-Burma Hotspot. The first is in terms of regulatory framework: how and where they are registered and regulated. The second is in terms of the political space available to them or their ability to engage with public sector actors at regional, national, sub-national and/or grassroots levels to influence their actions and decisions. These classifications are important to identify the different elements of civil society in the hotspot, and evaluate opportunities and strategies for further engaging them in biodiversity conservation.

The various regulatory frameworks described below help to define the operating environment for INGOs and domestic CSOs. INGOs largely comply with registration to operate in the countries where they work. Most have specialized portfolios that comply with what is legally allowable as environmental work, such as community forest management, wildlife conservation, sustainable development, etc. Many INGOs work with existing domestic NGOs and CBOs, as well as with government counterpart agencies. Over time, INGOs either maintain an independent identity, transform into domestic NGOs by establishing locally registered organizations with their own local boards, or establish independent organizations, which they support as formal or informal affiliates. Examples of all three strategies can be found in the Indo-Burma Hotspot.

Among domestic CSOs, regulatory differences can be found between NGOs on one hand and CBOs on the other. While, in general, INGOs are registered with and regulated by foreign ministries or their respective counterparts in other ministries, domestic NGOs are registered with and report to local or national agencies. CBOs, on the other hand, have diverse regulatory arrangements. They may be regulated as cooperatives and associations, or localized within communes, or exist virtually only at village levels. In China and Lao PDR, most domestic CSOs are government affiliated and funded, and known as government-organized NGOs (GONGOs). In the other hotspot countries, the proportion of independently registered and funded CSOs is greater, particularly in Cambodia and Thailand.

With regard to operational 'space', there are various ways in which CSOs, having met the formal registration requirements, meet the practical operational challenges and opportunities that arise. Some CSOs, particularly INGOs and consulting companies, are funded mainly through large grants with environmental and/or sustainable development goals, which they implement with strict adherence to project logframes and budgets. The majority of CSOs, however, in implementing their work, innovate and go beyond pre-determined 'boundaries' to engage multiple sectors and penetrate various levels through partnerships with local groups.

The operational space for biodiversity conservation cuts across issues of poverty, social equity, land rights and Indigenous People's rights, and intersects with debates on food versus fuel, hydropower versus other energy options, etc. Many of these issues involve local civil society institutions and ethnic minorities as major actors. In some parts of the hotspot, notably Cambodia and Thailand, there is a concentration of NGOs working at the grassroots level with 'interested community groups', especially ones directly affected by major infrastructure projects, land concessions and other projects that overlap with their homes and surrounding environments. Some of these NGOs manage to transform operational 'space' into opportunities for effecting change. Here, the key elements of success include 'collaboration'. Hence, there have been collaborative efforts linking conservation with: livelihoods, particularly forest-based livelihoods; climate change, especially through REDD+ initiatives; disaster management, especially flood prevention and mitigation; and Indigenous People's rights, especially the conduct of free and prior informed consent. Examples of NGOs working in these and other areas are given in Appendix 5.

There are also a good number of international research and scientific organizations (some located at universities) that are active in the hotspot. If organized to generate and 'pool' evidence and 'link' traditional practices and tenure rights to conservation approaches, these organizations could have a strong voice in public discourse on conservation, and could be instrumental in sharing skills and knowledge with more NGOs and CBOs active on the ground.

Due to both regulatory barriers and constraints to political space, CSOs working on biodiversity conservation tend to avoid addressing issues activities that are perceived as politically sensitive, such as involuntary resettlement or human rights. In these instances, conservation groups are neither likely nor well positioned to espouse or defend the rights or political interests of the affected communities. However, there is significant overlap between areas of high biodiversity value and concentrations of rural poverty, and there are other, less politically sensitive, development issues where conservation groups may be better placed to respond, such as food and livelihoods, health, disaster relief, economic development, and basic grassroots institution building for planning and micro-finance.

Moreover, conservation groups can find common cause with CSOs working on indigenous and local community rights to land and natural resources, which have similar underlying causes to biodiversity loss. The big challenges are in matching community interests with CSO and government agendas (e.g., species conservation, landscape conservation, REDD+) at all levels, and in finding entry points to promote good conservation practices that address indigenous and local community rights and aspirations.

Among conservation and development groups, a sub-classification may be made between those that have biodiversity conservation as their principal mission, and those that are community-oriented but engage in conserving and restoring natural ecosystems as strategy to address human wellbeing. This distinction is not clear cut, however. The majority of CSOs that CEPF has supported since 2008, for instance, combine elements of both in their missions. There are encouraging signs of convergence of different approaches (or, at least, recognition that different approaches can reach the same destination), with biodiversity conservation moving towards community participation, and community-oriented approaches placing a stronger emphasis on biodiversity conservation.

9.3 Regulatory Framework

9.3.1 Cambodia

In 2015, the Cambodian government passed the Law on Associations and Non-Governmental Organzations (LANGO), which established a standardized mechanism to legally recognize CSOs, and formally established a relationship between them and public authorities. The passing of the LANGO dramatically changed the power relations between civil society and government, with the law’s broad controls leading to a reduction in activities of domestic NGOs, which must register with the Ministry of the Interior, and restrictions on certain activities, such as workshops and demonstrations, which require pre-approval. As recently as April 2020, the activities of the NGO Cambodia Wild Life Forest Fisheries Protection and Conservation were temporarily suspended, on the grounds that it failed to comply with articles of the LANGO (Khmer Times 202).

As regards INGOs, they are required to enter into an MoU with the Ministry of Foreign Affairs. After registration, they are required to submit reports on their finances and activities every three months. Most INGOs operating in the country also enter into MoUs with other government ministries, relevant to their area of operations. For INGOs working on biodiversity conservation, this most commonly means MAFF and/or MoE.

Domestic and international NGOs have their internal accountability mechanism, through their respective board of directors and internal accounting system. Externally, they are required to submit reports to the government. Their funders have also their own monitoring and reporting systems, which the NGOs follow on a project-by-project basis.

Working through the Cooperation Committee for Cambodia, Cambodian CSOs developed a Voluntary Certification System, which was launched in 2007, along with a Code of Ethical Principles and a set of minimum standards for NGOs. This is part of an on-going effort by the NGO community to self-regulate, to ensure transparency and accountability. There is low participation by NGOs in this initiative, however, because of difficulty in complying with the requirements, and because many donors do not make certification a requirement but rely on their own systems of due diligence when considering support to NGOs.

9.3.2 China

The activities of INGOs in China are regulated by the Overseas NGO Law, which took effect in 2017. INGOs must either register a representative office or conduct temporary activities in coordination with a Chinese partner organization. INGOs wishing to register a representative office must do so with the relevant 'Professional Supervisory Unit' (i.e., the government agency relevant to its area of operations) and seek approval from the Public Security Bureau. INGO activities are closely supervised, through regular reporting to these bodies.

The legislative and regulatory framework governing the activities of domestic CSOs in China is more complicated. The tendency of this legislation is to control and limit NGOs, and it has restricted their development (Liu 2002). The government has formulated one law and three sets of regulations on CSO establishment and related activities, as follows:

- Interim Procedures on the Registration of Social Organizations, passed in 1950.
- Management Measures on Foundations, passed in 1988, which requires foundations to have at least 100,000 Yuan to be established.
- Regulations on the Registration and Administration of Social Organizations, and Interim Procedures on the Registration and Administration of Private Non-enterprise Organizations, both adopted in 1989, which regulate domestic CSOs.
- Law of Donation, adopted in 1999, which regulates donations to public welfare organizations and offers some tax incentives.

Domestic CSOs in China are registered with the Civil Affairs offices and fall into three categories: 'social organizations', which are membership-based associations; 'non-enterprise units', which are similar to service providers, such as training schools; and 'foundations', which are further divided into public foundations and non-public foundations. Among this universe of non-profits are found many GONGOs and some quasi-independent organizations. GONGOs are frequently large organizations, sponsored by government agencies or the Communist Party, and receive most of their funding, staff, and office space from the government. In general, most public foundations and social organizations are GONGOs, while quasi-independent organizations are more common among private foundations and non-enterprise units.

In southern China, there are now a few independent non-profits that have succeeded in registering as public foundations, such as the Yunnan Green Environment Development Foundation in Kunming, Yunnan province, and the One Foundation in Shenzhen, Guangdong province. Several public and non-public foundations established at the national level also have activities in parts of southern China within the Indo-Burma Hotspot, such as the Paradise International Foundation and the SEE Foundation. Most non-public foundations, in turn, are established by private individuals or companies.

Beyond the officially registered CSOs, there are many organizations that function like non-profit CSOs but either are registered as for-profit businesses (which is often easier to do), or simply operate without registering. Unregistered groups are typically locally based, informal clubs or associations but they are sometimes networked and work in coordination with national and international organizations.

9.3.3 Lao PDR

Legislation governing the operations of INGOs in Lao PDR has been in place for some time but legislation regarding domestic CSOs has only recently begun to be introduced. To operate in the country, INGOs must seek approval from and register with the Ministry of Foreign Affairs (ADB 2011a). They are also required to register and provide financial reports to the appropriate government office under the Decree of the Prime Minister on the Regulation of NGOs, issued in 1998 (ADB 2011a). INGOs and their expatriate staff are accorded some privileges such as income tax exemption (ADB 2011a).

The constitution of Lao PDR permits the establishment of associations and organizations (ADB 2011a). Until 2009, however, there was no specific legislation to implement this constitutional provision. A limited number of development associations and other local CSOs were able to register in the absence of legislation but only through *de facto* means, such as personal connections to government (ADB 2011a). This situation changed with the issuance of Prime Ministerial Decree 115 on Associations in 2009, which was updated in 2017 with Decree 238 on Associations. These decrees allow for the registration of local associations. The Public Administration and Civil Service Authority within the Ministry of the Interior is responsible for registration. All associations are strictly forbidden from having political agendas, and can only provide development assistance and humanitarian aid. There is still nervousness in government circles about associations especially those at the provincial and district levels where they are not well known.

GONGOs, including party-affiliated mass organizations, such as the Lao Women’s Union, the Lao People’s Revolutionary Youth Union, the Lao Patriotic Front for Reconstruction, and the Lao Federation of Trade Unions, form a large part of Lao civil society. In addition to supporting formal government activities, these mass organizations carry out participatory planning activities using their extensive networks throughout the country (ADB 2011a). They can also be a very effective channel for disseminating conservation messages, as they have representatives in all villages in the country.

9.3.4 Myanmar

Until 2014, INGOs and domestic NGOs working in Myanmar were required to register as non-profit associations, under the 1988 Associations Law. They were treated as a type of business association: a class that includes such entities as partnerships, companies limited by shares, branch offices of foreign companies. In 2014, the government enacted a new Association Registration Law, which allows the registration of internation and domestic NGOs that work for the benefit of Myanmar citizens and contribute to a “strong civil society”. NGOs must register with the relevant ‘Registration Body’, to which they must report on a regular basis. Domestic NGOs have the option of registering at the national, regional or township level, and there are examples of all three. Registration at the national level has certain advantages, in terms of the ability to receive contributions from international donors.

Thailand hosts many INGOs and NGOs working on the Thai-Myanmar border (so called cross-border NGOs). They usually register under Thai laws but work closely with the communities on both side of the border. The more political ones have links with ethnic political organizations inside Myanmar, such as the Karen National Union. With specific regard to environmental issues, a group of international and domestic NGOs, including some based within and outside Myanmar, have come together to form the umbrella Burma Environmental Working Group (BEWG), which "provides a forum for member organizations to combine the successes, knowledge, expertise and voices of ethnic peoples in pursuit of not just local livelihoods, but sustainable and peaceful national, regional and international development policy" (BEWG 2020). Another important CSO networks with a focus on environmental issues is the Karen Environmental and Social Action Network (KESAN), which works to empower and educate communities and local institutions to revitalize existing indigenous knowledge and practices for increased livelihood security in Karen and in areas along the Thai-Burmese border.

The ongoing armed conflicts in different parts of the country, combined with a lack of human rights and land security, have made it challenging for local communities to manage and protect their own natural resources. In spite of this, there are CBOs with a range of activities aimed towards increasing livelihood security and environmental security throughout the country.

9.3.5 Thailand

In Thailand, CSOs can be established under the Civil and Commercial Code and the Social Welfare Act of 2003. Under Section 115 of the Civil and Commercial Code, Thai nationals can set up foundations and associations for nongovernmental, nonprofit, public benefit purposes, while the Social Welfare Act of 2003 allows for the establishment of public benefit organizations. Both laws confer legal personality to the CSO established. INGOs, on the other hand, must get a permit from the Committee on Consideration of the Entry of Foreign Private Organizations. Registered NGOs may publicly solicit for funds provided they have the necessary permit from the Ministry of Interior, and there are some ministerial regulations governing private fundraising activity (NGO Regulation Network 2011).

For many CSOs operating in Thailand, the process of registration is difficult and time consuming. For this reason, many remain unregistered and do not have legal standing. While internally they may have their own set of officers and directors and carry on their business as independent organizations, for external funding and regulatory reporting purposes, they operate as projects, working groups or units of registered organizations.

9.3.6 Vietnam

Most groups identified as CSOs in Vietnam are unregistered. In contrast to the trend in other countries, CSOs in Vietnam have to be "approved" and not simply "registered" (Booth 2011). The government retains the discretion to approve or reject an application, especially for groups seeking "to work in a more sensitive field" (ADB 2011d). Legal recognition is essential for organizations that are applying for foreign funds or seeking to engage in policy dialogue (ADB 2011d). Once organizations are legally registered, they may also run into difficulties securing project approval, especially if foreign funds are involved, which may take months to resolve.

Lack of a clear legal framework has led to an insecure and unpredictable operating environment for CSOs (Hayman *et al.* 2013). Article 76 of the revised Civil Law (2015) gives legal recognition to social organisations, social professional organisations, social funds, charity funds, social enterprises, and other not-for-profit organisations, but terms such as NGOs or CSOs still have no legal basis. A draft Law on Associations has been under discussion for almost two decades but has proven contentious and has yet to be approved by the National Assembly. For the time being, domestic NGOs are required to follow: Decree No. 45/2010/ND-CP, dated 21 April 2010, on Regulations on the Organization, Operations and Management of Associations; Decree No. 33/2012/ND-CP dated 13 April 2012, on amending and supplementing some articles of Decree No. 45/2010/ND-CP; and Decree No. 93/2019/ND-CP dated 25 November 2019, on Regulations on the Organization and Operations of Social and Charity Funds.

There are two ways that domestic NGOs can register. The fastest and easiest route is by affiliating with various semi-public organizations, such as the Vietnam Union of Science and Technology Associations. A more difficult and expensive route is to register directly with the Ministry of Science and Technology. Organizations that are able to register by the latter route have more autonomy and independence. All the same, regardless of the route followed, the government closely regulates the goals that domestic (and international) NGOs can pursue, and prohibits activities related to social justice, human rights and democratization, among others. All NGOs operating in Vietnam must be non-political, non-religious, and non-profit. Perhaps because of this inability to express independent views on political issues, there is an on-going trend in Vietnam towards transforming advocacy organizations into entrepreneurial entities, such as community-based cooperatives or social enterprises.

INGOs are regulated under a separate legal framework, specifically Decree 12/2012/ND-CP dated 1 March 2012, on the Registration and Management of Activities of Foreign Nongovernmental Organizations in Vietnam. INGOs are required to register with the Committee for Foreign Nongovernmental Organization Affairs (COMINGO), and to submit narrative and financial reports to COMINGO and the relevant provincial people's committee(s) biannually.

INGOs, due to the funding and expertise they bring, frequently partner with and are listened to by government agencies. The expertise of domestic NGOs is, on the whole, less respected by government, although there is a growing list of exceptions, as domestic NGOs grow in credibility, confidence and profile. Vietnam has an established culture of evidence-based policy making, and the opinions of scientists and academics are respected, or at least listened to, by policy makers. This makes Vietnamese universities and research institutes influential actors, and an important component of local civil society.

At the grassroots level, CBOs are recognized as legal entities (associations) under Decree 45/2010/ND-CP and Decree 33/2012/ND-CP, meaning that they can open bank accounts and mobilize external financial support. In 2015, the Revised Civil Code opened up political space for CBOs, by recognizing them as legal personalities. Under this code, groups of people with a common interest (such as water user groups or forest protection groups) can make an agreement among themselves to produce and provide services. These rights were elaborated further by Decree 77/2019/ND-CP on Cooperative Groups, which allowed them to open bank accounts and collaborate with national and international CSOs. Cooperative groups can register directly with the relevant commune people's committee.

Like Lao PDR, Vietnam also has party-affiliated mass organizations, through which public participation in the implementation of government policies is routinely channeled. Mass organizations have representatives down to the level of commune and, usually, village, and provide effective channels for disseminating information and mobilizing people at the grassroots level. For these reasons, CSOs frequently partner with mass organizations to implement activities at local levels.

9.4 Political Space

In general, countries in the hotspot are creating more 'space' for CSOs to operate in. Nevertheless, this is fragile, and hangs in the balance in the face of change. The conservation corridors identified in the Indo-Burma Hotspot (Appendix 3 and Figures 7 to 12) contain some of the most ethnically diverse and economically marginalized populations in the region, many of whom are heavily dependent on natural ecosystems for their livelihoods. Policy change to conserve biodiversity and accommodate community interests necessitates pressure, contestation, and negotiation. Despite recorded repressive actions, this policy change can be established in 'open space', or a public place using state procedures with discussions mediated by authorized representatives of government. That civil society can now be seen as a 'participant' in policy change in the Indo-Burma Hotspot is a big improvement over the situation in the 1990s, yet it remains a sensitive issue with governments and ruling parties.

Among the factors helping to create space for civil society participation in policy change is the requirement of most regional and international processes for civil society participation and consent of local and Indigenous People, for instance the United Nations Declaration on the Rights of Indigenous Peoples and the environmental and social standards of multilateral development banks recognize the principle of Free, Prior, Informed Consent. These factors are, however, offset to some degree by the trend for high-impact developments (i.e., mines, dams, economic land concessions, etc.) to be financed by private, typically intra-Asian, funding or government-to-government development assistance, which often come with fewer environmental and social safeguards (Lower Mekong Network 2018). This trend limits entry points for civil society to exert influence, while raising transparency issues.

Despite moves towards greater political space for civil society in at least some of the hotspot countries, repressive practices, such as harassment of civil society activists, especially those working on human rights and social justice issues, continue throughout. In the most extreme cases, the personal safety of activists speaking out on these issues can be put at risk. Human Rights Watch (2019) reports that more than 30 human rights defenders and civil rights activists have been killed in Thailand since 2001, and that few of those responsible have been held to account. Such risks have the effect of chilling public discourse and debate about environmental issues and development decision-making.

9.4.1 Cambodia

The development of civil society in Cambodia was interrupted by decades of armed conflict and political instability, which only subsided at the end of the 1990s with the establishment of the United Nations Transitional Authority in Cambodia. Over the following decade, there was a dramatic growth in the number of domestic and international CSOs, facilitated by a major expansion of international donor investment in the country and an open regulatory environment compared with other countries in the hotspot. A large number of national and local NGOs were established over this period. A few of these groups, such as Mlup Baitong, the Sam Veasna Center for Wildlife Conservation and Save Cambodia's Wildlife, have an explicit focus on biodiversity conservation, while a wider selection of groups have the potential to address biodiversity issues within missions that focus on natural resource management (especially community forestry and fisheries), livelihood development and other aspects of human wellbeing.

The large sums that have been invested in Cambodia by international donors have also facilitated the development of country programs by various international conservation organizations, including BirdLife International, CI, Fauna & Flora International (FFI), Wildlife Conservation Society (WCS), Wildlife Alliance, WorldFish Center and WWF. These organizations are typically better resourced, with higher capacity and larger programs, than national NGOs. To date, a large proportion of conservation projects in Cambodia have been implemented by international conservation organizations in collaboration with government counterparts.

After a long period of benign neglect, the operating environment for domestic CSOs in Cambodia became more restricted in 2015, with the passing of the LANGO. CSOs have found new restrictions placed on their activities and movements, especially in the run-up to elections. CSOs are also required to refrain from political activities, and groups involved in advocacy, legal rights and human rights are viewed negatively and their activities restricted.

9.4.2 China

Several INGOs are engaged in biodiversity conservation in southern China. WWF began working on giant panda (*Ailuropoda melanoleuca*) conservation in southwestern China and wetland management in Hong Kong in the early 1980s, and opened a China Programme Office in 1996. WCS established a China program in 1996, and subsequently opened an office in Guangzhou, Guangdong province, from where it undertakes work to combat the illegal wildlife trade. The Nature Conservancy (TNC) has been active in Yunnan province since 1998, working on conservation of Yunnan snub-nosed monkey (*Rhinopithecus bieti*), among other targets. Hong-Kong-based institutions have also contributed significantly to biodiversity conservation in southern China, through provision of technical and financial assistance, most notably KFBG, which launched a China biodiversity program in 1998, Hong Kong Bird Watching Society, which operates a joint China program with BirdLife International, and the Ocean Park Conservation Foundation.

To complement the work of these groups, numerous independent local Chinese environmental NGOs have sprung up since the early 2000s, given the increased political space at that time, rising environmental challenges and demand for public participation. One example is EcoWomen in Yunnan province, which seeks to empower women to protect their environment and to pursue sustainable socioeconomic development. Specifically, women are encouraged to participate in political processes and campaigns aimed at combating the use of pesticides. The group worked with Pesticide Action Network to document pesticide use, poisoning cases and the behavior of agrochemical companies, and use the findings for international advocacy. Other groups, such as Green Watershed, Green Society Environmental Action Network and GreenSOS, are working to monitor hydropower dam construction projects in China. The work of these groups draws attention to the social and ecological impacts of these schemes.

In the last decade, domestic Chinese CSOs have begun to work on environmental issues in neighboring countries, providing technical assistance and financial support to local partners. A notable example is the Global Environment Institute (GEI), which has introduced the Community Conservation Concession Agreement (CCCA) approach to Myanmar by supporting local partner NGOs to implement demonstration projects, strengthening the capacity of these organizations, sharing good practice from China and Southeast Asian countries, and leveraging the experience to influence developing national policy on community protected areas.

Local academic institutions, including research institutions and universities, represent another important section of civil society in China. Institutions such as the Kunming Institutes of Zoology and Botany, South China Botanical Garden, Guangxi Institute of Botany, and Xishuangbanna Tropical Botanical Garden (all under the Chinese Academy of Sciences), and various universities have made significant contributions to biodiversity conservation in southern China, primarily through research and monitoring, as well as through informing protected area management and public policy.

9.4.3 Lao PDR

Of all the countries in the hotspot, Lao PDR has the most restricted political space for civil society. Until the issuance of the Prime Ministerial Decree on Associations in 2009, there was no legal basis for the establishment of domestic NGOs. However, there was clearly a latent interest in forming CSOs, because 74 organizations had registered under the new decree by 2014 (iNGO Network 2015). These include several organizations with an explicit focus on biodiversity conservation, such as the Lao Biodiversity Association, and the Lao Wildlife Conservation Association. More groups are working on a wider set of rural development issues, sometimes with an environmental focus, such as the Community Development and Environment Association, the Poverty Reduction and Development Association, and the Sustainable Agriculture and Environment Development Association. Although there remain a number of challenges, domestic NGOs are slowly finding political space. They have, of necessity, been creative in the various ways in which they organize mutual assistance activities and obtain technical and funding support. One common means of doing this is by working in partnership with officially sanctioned INGOs, such as Global Association for People and the Environment (GAPE) and Village Focus International, which provide them with ‘cover’ as well as tangible support.

In 2017, Decree 238 on Associations introduced restrictions on international funding to domestic NGOs and a ban on them accepting foreign experts and volunteers (Lower Mekong Network 2018). Due to these and other restrictions, and because domestic NGOs are a relatively new phenomenon, civil-society-led conservation efforts in Lao PDR remain dominated by INGOs. However, political space for international CSOs is also limited, compared with other countries in the hotspot, and Lao PDR has relatively few international conservation organizations active within its borders, with only IUCN, WCS and WWF maintaining a permanent presence in the country. In addition to the conservation groups, a number of international development NGOs active in the natural resources sector are implementing projects that include biodiversity conservation among their objectives, such as Oxfam International and The Asia Foundation.

A number of academic institutions are also actively involved in the implementation of biodiversity conservation projects, for example the National University of Lao PDR. As in

China and Vietnam, academic institutions in Lao PDR are government institutions and their activities tend to be restricted to areas such as research and environmental awareness.

9.4.4 Myanmar

Regarding Myanmar, stakeholders consulted during the preparation of the ecosystem profile make a distinction between the 'cross-border' NGOs based in Thailand, and the growing community of domestic NGOs based in Myanmar. The former have a proven track record in community organizing, resource mobilization, and natural resource management at the grassroots level. There is fear among the cross-border NGOs that the ongoing rapprochement between the Myanmar government and the international community will draw funding and attention away from their work and towards Myanmar-based NGOs. They fear that Myanmar-based NGOs, while appearing to have political space, will basically be limited to collaborating with the ruling regime. While agreeing that the newly opened political space inside the country should be explored and that the number of Myanmar-based NGOs will continue to grow, they warn that the cross-border NGOs should not be forgotten, not least because of the vital role they play in generating and transmitting crucial information in and out of Myanmar.

While many are active in advocacy, there are cross-border NGOs that are focused on capacity building, education and development assistance for various ethnic groups along the Thai-Myanmar border. KESAN for instance, while engaging in anti-dam campaigns in Myanmar, is also heavily invested in livelihood, rural development and biodiversity conservation projects with its partner communities on both sides of the border. Considering the limited capacity of CBOs to source and manage financial resources, such NGOs can act as a conduit for funding as well as a technical advisor.

Within Myanmar, there is a growing number of domestic NGOs, including a number engaged in biodiversity conservation. Most national conservation NGOs have been established by retired officials from the Myanmar Forest Department, whose political connections enable them to operate with some degree of independence from government (BirdLife International 2005). In addition to limited political space, the ability of these NGOs to contribute to biodiversity conservation is constrained by limited funding opportunities. The national NGOs with the largest programs of conservation activities in Myanmar include EcoDev, the Ecological Conservation and Community Development Initiative (ECCDI), the Forest Resources, Environment, Development and Conservation Association (FREDA) and Myanmar Forest Association (MFA). These organizations are currently implementing various demonstration projects on community forest management, and mangrove protection and rehabilitation, as well as some policy analysis. Another national NGO engaged in biodiversity conservation is the Biodiversity and Nature Conservation Association (BANCA), which is involved in a number of collaborative projects with BirdLife International, FFI and other INGOs.

Many of the other domestic NGOs in Myanmar have a principal focus on rural development or health, and several are active in the natural resources sector. As in other countries, these organizations could make important contributions to biodiversity conservation goals, in areas such as sustainable livelihoods, land rights and grassroots institution building.

Due to the restricted operating space, and the very challenging funding environment arising from the present economic sanctions, few international CSOs are engaged in biodiversity conservation in Myanmar. Several groups that had active programs in the first half of the 2000s, such as BirdLife International, CI and the Smithsonian Institution, have now largely or entirely ceased work in the country. The main players among the international conservation organizations are WCS, which established a program in the country in 1993, and FFI, which began work in the country in 2007. Both organizations are registered with the Ministry of Home Affairs and have MoUs with the Myanmar Forest Department. WCS and FFI both have diverse programs, including work on site and landscape management, biodiversity survey and private sector engagement. Other international conservation organizations with programs in Myanmar include IUCN and WWF.

9.4.5 Thailand

Thailand has a long history of civil society involvement in conservation, dating back to the work of the Natural History Society of Siam to secure legal protection for rhinoceroses in the 1920s and including the efforts of the Association for the Conservation of Wildlife to promote the establishment and expansion of the national protected area system from the 1950s onward (P. P. van Dijk *in litt.* 2003). A defining moment in the development of the local conservation movement in Thailand was the dispute over the proposed construction of the Nam Choan hydropower dam within Thung Yai Naresuan Wildlife Sanctuary in the early 1980s. This proposal met with opposition from a broad-based coalition of civil society, including local communities, students and academics, environmental NGOs and representatives of the private sector. These events are now considered to have given birth to Thailand's 'green movement', which continued to develop and gain momentum since then (Carew-Reid 2002).

Today, Thailand has a reputation of relative openness to the activities of CSOs, so much so that many regional NGOs are registered in Thailand. One example is Asia Indigenous People Pact (AIPP), a network of Indigenous People's organizations and movements from Asia, which established its Secretariat in Chiang Mai in 1992. AIPP is a focal point for programs involving Indigenous People, including for environment, biodiversity, climate change adaptation and awareness and REDD, and forms linkages between CBOs, local and national NGOs, INGOs and global networks. Another important regional NGO based in Thailand is the Center for People and Forests (RECOFTC), which was established in Bangkok in 1987 under the name Regional Community Forestry Training Center for Asia and the Pacific. Over the past two decades, RECOFTC has provided training for over 10,000 people in community forestry, from national policy makers to practitioners. In 2010, RECOFTC opened country programs in Cambodia, Thailand and Vietnam, in order to help these countries to deliver on commitments to scale up community forestry (RECOFTC 2011).

Thailand also hosts a large number of local and national NGOs, with more than any other country in the hotspot, with the possible exception of Cambodia. A number of these NGOs have a specific focus on biodiversity conservation, including the Asian Elephant Foundation of Thailand, BCST, FREELAND Foundation, the Hornbill Research Foundation and the Seub Nakhasthein Foundation. These organizations have begun to use social media to elevate their initiatives. For example, the Seub Nakhasthein Foundation launched a 'Justice for Wildlife' campaign to pressure police to speed up their investigations into wildlife poaching, while FREELAND Foundation coordinated the successful 'iTHINK' campaign, which engaged celebrities and other opinion leaders to enhance public awareness of illegal wildlife trade. Other Thai NGOs are addressing broader environmental agendas, such as air and water quality, for instance the Green World Foundation, which has a program to promote water-quality testing by local communities. Yet other NGOs are working with local communities on natural resource management and other initiatives with objectives that potentially overlap with those of biodiversity conservation, such as Living River Siam Association, which supports local communities' rights to water resources, promotes traditional-knowledge-based sustainable water resource management, and advocates against threats to rivers.

Thailand also hosts a number of INGOs, such as International Rivers, WCS and WWF. These organizations are active in various areas including combating the illegal wildlife trade, building capacity of protected area managers and enforcement staff, raising environmental awareness, and advocating for sustainable development. One example is EarthRights International, which specializes in fact-finding, undertaking legal actions against perpetrators of earth rights abuses, training grassroots and community leaders, and conducting advocacy campaigns. EarthRights International has a particular focus on leadership development and, through its residential school in Chiang Mai, provides capacity building for community leaders, lawyers, and civil society leaders who work to defend human rights and the environment, offering courses and workshops on community organizing, campaigning, advocacy and legal issues (EarthRights International 2020).

While some academic institutions in Thailand face limitations in terms of financial resources, staffing and technical capacity, others have high potential to engage in biodiversity conservation. Students and staff from various academic institutions conduct a significant amount of biodiversity research every year, including King Mongkut's University of Technology and Mahidol University. Some institutions directly inform conservation management, for example the Forestry Faculty of Kasetsart University, which has developed management plans for a number of protected areas in Thailand.

9.4.6 Vietnam

In Vietnam, while there is increasing openness to the role of CSOs, there remain certain restrictions on their operations. For example, the government of Vietnam has enacted a regulation establishing thematic priority areas where NGOs can work. Furthermore, INGOs are required to work in collaboration with government counterparts on all projects.

Although government policy in Vietnam is not strongly supportive of domestic CSO development, a number of high-capacity domestic NGOs have emerged, including Center for People and Nature Reconciliation (PanNature), Center for Water Resources Conservation and Development (WARECOD), Culture Identity and Resources Use Management (CIRUM), GreenViet, Education for Nature-Vietnam (ENV) and VietNature. What is notable about these groups is that they are able to find space to operate that was not previously occupied by INGOs, for instance with developing networks of environmental journalist, piloting community co-management of inland fisheries and actively involving the general public in conservation actions. Nevertheless, most domestic NGOs to have emerged over the last two decades are still relatively small, and find themselves in a very competitive field in terms of raising funding for their programs, and recruiting and retaining suitably qualified staff.

The CSOs with the largest programs on biodiversity conservation in Vietnam remain the INGOs, which include FFI, IUCN, TRAFFIC, WCS and WWF, among others. In 2006, the Vietnamese government issued a regulation identifying thematic issues that can be the subject of INGO assistance. According to this regulation, the general thrust of INGO assistance, "should be in line with the country's orientations for socioeconomic development and strategy for hunger eradication and poverty reduction, along the lines of sectoral and local priorities and development planning, supporting the poverty reduction and development efforts of the Government of Vietnam". Human rights, social justice and democratization are not included, and some groups have interpreted this to mean that these areas cannot be supported by INGOs.

There also exist in Vietnam a large number of quasi-NGOs (or QUANGOs), staffed by serving or retired government officers and operating semi-independently from government. Several of these organizations are involved in biodiversity conservation, such as the Center of Environment and Rural Development, which is affiliated to Vinh University, and the Centre for Natural Resources and Environmental Studies, which is affiliated to Hanoi National University. As in most other countries in the region, several Vietnamese academic institutions are active in biodiversity conservation, particularly through applied research, and these are an important source of trained graduates to join environmental NGOs.

In the past, the government attempted to enact legislation recognizing and regulating CSOs. This became controversial after a domestic NGO drafted a more liberal version of the law. This was the first time that an alternative bill was submitted to the National Assembly alongside the government draft, and resulted in the shelving of the draft legislation. To prevent any repeat of this episode, the government passed decrees in 2013, restricting civil society participation in policy formulation and implementation only to mass organizations (Lower Mekong Network 2018).

Although the restrictions introduced in 2013 have made legislation considerably more difficult for civil society to influence, the expansion of education and internet access has sharply increased across the country, allowing for an explosion in social media and a proliferation of virtual civil society association through blogs, vlogs, networking sites, chatrooms, mailing lists, instant messaging, and online forms. While this led to a flourishing of activity among the CSO community, the government enacted cyber-security regulations in 2018, to remove any data deemed inappropriate.

9.5 Funding Environment

The donor context in each hotspot country is very different, and the funding modalities used by each donor are also different. The funding environment for CSOs is also quite dynamic, with new donors continually arriving in the region and existing donors leaving or changing their priorities. This makes generalizations about the funding environment for CSOs difficult. A more detailed analysis of the overall funding landscape for conservation in the hotspot is provided in Chapter 11.

Larger grants (above $50,000) are mostly available from bilateral and multilateral donor agencies and some private foundations, and they tend to be awarded to INGOs and higher capacity domestic NGOs. For most domestic CSOs, the main source of funding is small grants (below $50,000), either awarded directly by a donor agency or channeled through an INGO or other funding intermediary. This pattern of segregation of CSOs by grant size is not absolute (especially as many INGOs also compete for small grants where they are eligible to apply), nor is it surprising, given that INGOs typically have greater human and financial capacity and more established programs than their domestic counterparts. Nonetheless, domestic CSOs report difficulty in 'graduating' from small grants to larger grants, where they often have to compete for funds with INGOs that are significantly better equipped for proposal writing, and have higher profiles and more established contacts with donors.

This pattern can also be partly explained by an understandable aversion, on the part of donors, to take risks with less well known organizations, particularly where larger sums are involved. Some representatives of INGOs draw attention to a perceived lack of accountability on the part of domestic CSOs. While some domestic organizations may lack 'upward' accountability to their donors, relative to international ones, they may nevertheless perform more strongly in terms of 'downward' accountability to their local constituencies (see Agyemang *et al.* 2009), and are generally less bound by strategies and approaches formulated outside the communities where they work.

The importance of China as a donor is increasing, both in terms of bilateral assistance to other countries in the hotspot and philanthropic giving. The recent growth in philanthropy in China, particularly through the spread of corporate social responsibility and the growth of foundations, has increased the amount of funding available for local community assistance and simple environmental actions. The Law on Donation, adopted in 1999, was the first legal document regulating donation activities in China. It encouraged donations to public welfare organizations and protected the legal rights of donors and recipients. With a few exceptions, Chinese philanthropic funding for conservation is concentrated on superficial actions, such as tree-planting, which do not influence threats to biodiversity or their drivers. Moreover, many companies and individual philanthropists prefer to hire their own teams rather than making funding accessible to CSOs. For these reasons, the emergence of philanthropy in China cannot yet be considered an adequate substitute for international donor assistance to the civil society sector.

Many stakeholders consulted during the update of the ecosystem profile remain concerned that dedicated funds for biodiversity conservation are diminishing, while climate-related investments are increasing. In response, there is growing trend among CSOs to collaborate when developing and submitting funding proposals. Some formal alliances exist among NGOs in the hotspot but collaboration is more usually on an *ad hoc* basis. Complementary skill sets, good coordination and commonality of interest, are key success factors in project collaboration, which can be between NGOs or between NGOs and CBOs. Some domestic NGOs in Thailand and Cambodia have established internal disbursement and accountability systems for channeling small grants to grassroots CBOs. Thailand has a mechanism for channeling public funds to domestic NGOs and CBOs, spurring their growth at the grassroots level. No such mechanism yet exists in any of the other hotspot countries.

9.5.1 Small Granting Mechanisms

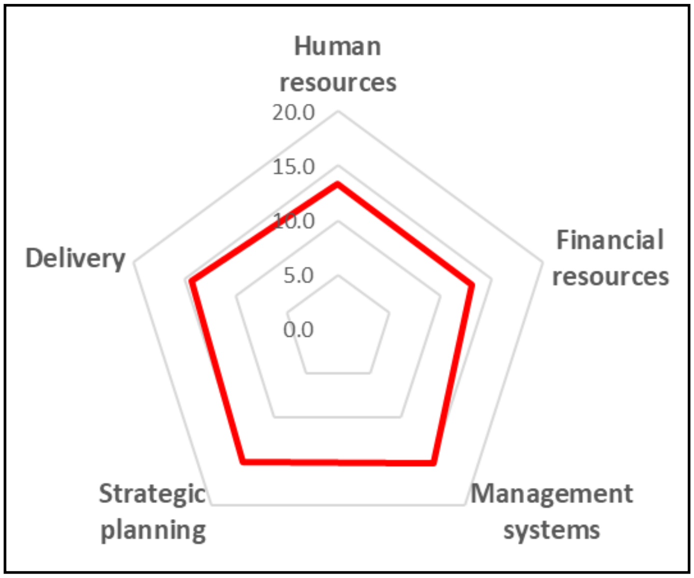
Mechanisms for awarding small ($5,000 to $50,000) and micro (under $5,000) grants are active in the Indo-Burma Hotspot but not common. There are several small grant mechanisms supported by private foundations, such as the Global GreenGrants Fund, and others supported by multilateral and bilateral agencies, such as the UNDP/GEF Small Grants Program. There are also a number of re-granting programs, such as the McConnell Foundation's small grants mechanism for civil society in Lao PDR managed by IUCN.

The collective learning of many CSOs is that micro grants enable communities to work on a range of issues that directly affect them based on their own strategies and priorities, such as land rights, local empowerment, livelihoods and marketing. Small grants, accompanied by active facilitation and technical support, are a key tool in promoting community-based natural resource management and constituency building for conservation. It is also widely recognized that, for small and micro grant mechanisms to be an effective tool for engaging local and grassroots civil society, they need to include a capacity building component to train local NGOs and CBOs in the basics of project planning, monitoring, and technical and financial reporting. Furthermore, there is a need for CBOs to be able to apply for and manage conservation grants themselves, in order to strengthen their capacity in fund management and negotiate their own strategies and priorities. It was suggested that community-centered domestic NGOs may be well placed to channel funding to CBOs through re-granting mechanisms.

9.6 Civil Society Capacity

During the second phase of investment, from 2013 to 2020, CEPF awarded grants to domestic CSOs in all six countries of the Indo-Burma Hotspot. Each organization was requested to conduct a self-assessment using CEPF's bespoke Civil Society Capacity Strengthening Tracking Tool. The purpose of this tool is to track changes over time of individual CSOs along five dimensions of capacity, and not necessarily to enable comparisons among CSOs. Another limitation is that the criteria used by the tool emphasize upward accountability to donors as opposed to downward accountability to local constituencies. Nonetheless, the aggregated results from the tool do provide some useful insights into patterns in capacity among domestic CSOs in the hotspot.

Figure 18. Aggregated Results of Civil Society Tracking Tool Scores for 82 Domestic CSOs



Baseline and final civil society tracking tools were completed by 82 domestic CSOs. Taking the final scores, reported at the end of the period of CEPF support, it can be seen that these organizations face the greatest capacity constraints with regard to human and financial resources (Figure 18).

With regard to human resources, all of the sampled CSOs reported that staff numbers are sufficient for the effective delivery of their mission. However, around half of these organizations reported that at least 60 percent of their staff are on short-term contracts. This is also an issue for most international CSOs, where one or two years is the standard contract length, due to most positions relying on project-based funding. Short-term contracts are reportedly a major contributory factor to high staff turnover in domestic and international CSOs alike. Moreover, many CSOs report that there is a limited pool of people from which they can recruit suitably qualified staff.

Eighty-four percent of the CSOs reported being able to conduct participatory appraisals with local stakeholders and communicate conservation messages, while 68 percent reported being able to conduct biodiversity surveys or research with conservation applications and only 52 percent reported being able to develop a Geographical Information System. This indicates that the technical strengths of domestic NGOs lie more towards community engagement, and suggests opportunities for partnership with INGOs, which typically have strong capacity in conservation biology.

In terms of financial resources, 81 percent of the sampled CSOs reported having secured sufficient financial resources for the effective delivery of their mission. However, only 35 percent reported having sufficient secured resources for more than the next two years. This presumably presents a challenge for long-term planning and program development, as well as for staff retention, and is likely a reflection of many domestic CSOs' reliance on short-term grants. In terms of diversity of funding sources, however, the results were more positive, with 87 percent of CSOs reporting that they had at least three sources of funding, with no one source providing more than 60 percent of the total.

With regard to management systems, 77 percent of the sampled CSOs reported that they systematically monitored and evaluated the impacts of their projects and used the results to guide management and design of future projects. However, only 23 percent reported widely disseminating the results of this monitoring to stakeholders inside and outside the organization. This shortfall in public accountability regarding the results of conservation projects is certainly not limited to domestic CSOs; it is also something that the largest INGOs have been grappling with for some time (Christensen 2002, Jepson 2005).

In terms of strategic planning, most of the sampled CSOs reported having clear governance arrangements and strategic plans. Ninety percent have a board that clearly differentiates between its oversight role and the role of management, while 94 percent have a strategic plan, with measurable indicators, covering a period of at least three years.

Finally, in terms of delivery, although less than 10 percent of the sampled CSOs are implementing projects with an annual budget over $1 million, 65 percent are implementing at least one project with an annual budget over $100,000. This suggests that significant capacity exists among domestic CSOs to manage large grants. The sampled CSOs also reported a strong commitment towards networking, with 97 percent participating in or supporting one or more civil society coalition or network, and 65 percent playing a leadership role in at least one coalition or network.

With regard to capacity building, some INGOs working in the hotspot actively support domestic CSOs through grants or mentoring but there is considerable potential to do more. Stakeholders consulted during the update of the profile recommended that donors should invest in building the technical skills of domestic CSOs, as well as individuals who can contribute to their development. They also recommended that donors go beyond supporting financial management and governance capacity, and address CSOs' needs with regard to monitoring and evaluation, advocacy, sustainable financing and communications, since these areas are sometimes overlooked.

9.7 Civil Society Networks

In order to respond to challenges greater than the skills and resources of any single organization, there is an increasing trend of CSOs in the hotspot to form networks. The two main types of network that can be identified are project-based networks and issue-based networks. Within both types of network, there is high usage of information technology for networking; face-to-face meetings are kept to a minimum (which has proven particularly important during the COVID-19 pandemic).

Project-based networks are established as required by specific projects and require coordination. This may be weak or strong, depending on the investment made to support them. The structure of coordination among participating organizations can be vertical (i.e. from INGOs down to domestic NGOs and CBOs), horizontal (i.e. among the same type of organization) or a combination of the two. Project-based networks are typically strong, because they are focused and output oriented. There is also clarity in the definition of the roles of each participating organization. The network members usually hold regular meetings to discuss project core objectives and progress towards them. The main weakness of project-based networks is with regard to sustainability, because they are highly dependent upon project funding.

Issue-based networks, on the other hand, are networks formed around a common issue, such as dams on the Mekong River or natural resource rights. Funding is sourced from the resources of member organizations, coupled with grants specifically secured from funders for use by the network. The main challenges faced by issue-based networks include the participation of global campaigners who may not be sensitive to local issues, the scrutiny that local groups may receive from their respective governments if they are associated with global campaigns, and the dangers that local groups may face when the global campaigners leave.

Neither type of network can be successful, however, without good facilitators who are provided with sufficient funding to hire good local staff to manage the network. Facilitators assist in building trust and communicating among network members, and transferring and monitoring the use of funds to and by local partners, especially local community organizations who do not have bank accounts.

Wider networking among groups engaged in biodiversity conservation does take place but is mostly *ad hoc* and limited to informal exchange of information and anecdotal experience. There have been several attempts to organize more regular, formal exchanges of experience among conservation groups, with a view to enabling more coordinated action on issues of common concern. Since 2016, a group of CSOs, funders and their intermediaries working on biodiversity conservation, natural resource rights, renewable energy, land rights issues, and/or sustainable livelihoods in the Lower Mekong Region has met under the auspices of the Lower Mekong Network. The purpose of the network is: to provide a platform on which to build common understanding; to learn, share, and discuss strategies; and to pursue common purposes and address lessons learned and common challenges so that each individual organization’s position will be strengthened, aiding them in achieving their goals in the Lower Mekong Region.

9.8 Emerging Trends

In terms of special-interest politics (Grossman and Helpman 2001), CSOs may be classified into those espousing the interest of affected communities and those espousing environmental interests. Environmental interest groups can, in turn, be sub-divided into conservation-oriented CSOs, and community-oriented CSOs that have conservation as an integral part of their culture and advocacy. Conflicts between these two groups revolve around contextualization and prioritization. Looking forwards, however, there is an emerging trend towards the two types of group finding common ground, especially as new threats emerge that directly affect the interests of communities and biodiversity conservation priorities, such as agro-industrial plantations, large dams and mines. Over the last two decades, the dominant narrative among conservation-oriented CSOs has shifted from local and indigenous communities being the main source of threat to biodiversity to being allies in responding to unsustainable development.

Among most of the CSOs consulted during the update of the ecosystem profile, there is consensus on the importance of working with local communities, who are seen as 'stewards' of natural resources. This requires specialized skills in community organizing, as well as conservation science. This, in turn, provides a motivation for CSOs to work together and leverage their skills in different fields, such as social development, enterprise development and marketing, and conservation biology.

Building long-term commitment to biodiversity conservation on the part of local communities also requires a focus on incentives for community members, such as land tenure, alternative livelihoods or payments in cash or in kind. During the 1990s, the paradigm was integrated conservation and development projects, which assumed that addressing local people's development needs would lead to reduction in pressures on natural resources. Various evaluations of the approach found the link between benefits for local people conservation objectives to be tenuous. During the 2000s, there was a paradigm shift towards establishing more explicit links between the two, such as through negotiated 'Conservation Agreements', through payments for ecosystem services, through 'wildlife friendly' commodity certification or via direct payments for conservation action, such as nest protection.

Another trend is recognition that, to be sustainable, initiatives linking human wellbeing and conservation objectives need appropriate market linkages. Prevailing socioeconomic conditions determine the success or failure of conservation initiatives. At almost all sites that are the focus of conservation interventions, issues related to economic incentives for local people are central, and, in most cases, the conservation organizations working there try to address them. However, the big gap visible in current strategies is the ability to link sustainable livelihoods to markets, and thereby enable pilot activities to be sustained and taken to scale.

A third trend is the growing influence of private investment in sectors such as forestry, mining and plantation agriculture. This investment creates challenges, including reduced civil society influence on natural resource management decision making. However, it also creates new opportunities for innovative partnerships and funding arrangements. While some CSOs are cautious to engage with the private sector, others are exploring ways of partnering with companies demonstrating a commitment to social and environmental responsibility, to raise the bar for good practice in key industries.

A fourth trend is the growing recognition that, if suitably organized, civil society can have a strong voice in public discourse on conservation. Where this has been done most effectively, for example in the case of the Save the Mekong Coalition, conservation, development and rights-based groups have been united around a common issue, economic and livelihoods arguments (which tend to carry more weight with decision makers than purely biological ones) have been employed, and vertical networking has been used to link experience from CBOs and Indigenous People's organizations into national and regional policy dialogues.

A fifth trend is the increasing role played by youth networks and organizations, both informal and formal. This trend is facilitated by growing environmental and social consciousness among the large youth population in the hotspot, as well as their rapid uptake of digital communications, which has greatly increased access to information and analysis.

These trends are characterized by one common thread: there are local community groups and Indigenous People's organizations who are well positioned to help biodiversity conservation succeed on the ground but there is a need for effective tools and facilitators to secure gains. This means linking conservation actions to targets established using objective criteria, linking pilot activities to markets for sustainability, and using experience from demonstration projects to inform national policy debates. Key success factors for networks include: a combination of global to local collaboration; joint agendas with access to funding that can be regranted all the way down to the grassroots level; strategies that combine conservation goals with human rights, livelihoods, market development, etc.; and access to campaigns and organizational linkages within and outside the hotspot.

10. CLIMATE CHANGE ASSESSMENT

The adverse impacts of climate change on biodiversity and human wellbeing are now widely accepted by scientists, government and the general public, resulting in major regional and international agreements to respond to the crisis, most notably the 2015 Paris Agreement under the United Nations Framework Convention on Climate Change (UNFCCC). In addition, a large array of mitigation and adaptation projects has been initiated by local, national, and international communities. The negative impacts of climate change have already begun and, over the coming decades, they are anticipated to be severe in the Indo-Burma Hotspot. This is partly due to the dependence of much of its population on freshwater fisheries and wetlands, which are among the most sensitive of natural resources to climate change, and the vulnerability of its coastal populations to sea-level rise. This chapter sets out the key climate change issues relevant to biodiversity conservation in the Indo-Burma Hotspot.

10.1 Paleoclimate and Development of the Hotspot's Biota

Climate is a dominant factor in controlling the global patterns of vegetation structure, productivity, and plant and animal species composition. The Earth has experienced changes in climate throughout its geological history, including cycles when it has been warmer and cooler, wetter and drier, and with higher or lower carbon dioxide (CO_2) concentrations, than at present (Overpeck *et al.* 2005). Climate change in the Pleistocene Epoch (the last 2.5 million years) has resulted in major shifts in species ranges and the reorganization of biological communities, landscapes, and biomes (Gitay *et al.* 2002).

In Southeast Asia, approximately 50 glacial cycles have occurred in the Pleistocene Epoch (Woodruff 2010), which has caused repeated fluctuations in sea level and changes in coastlines and rivers (Voris 2000, Hanebuth *et al.* 2011). For most of this epoch the land area has been up to two times larger than present, with mean sea levels 62 m lower. In general, it was cooler and drier with almost continuous land access between the mainland and Sumatra, Java and Borneo (Woodruff 2010). For the past 11,000 years the Earth has been in an interglacial period, with warmer, wetter and more stable climate conditions, and higher sea levels and less land, than much of the previous two million years (Overpeck *et al.* 2005).

These conditions, together with tectonic movements and human activity, have determined the present biogeography of the Indo-Burma Hotspot. During glacial periods, parts of the Gulf of Thailand and South China Sea disappeared, montane forests expanded to lower elevations, and grasslands proliferated, pushing out lowland forests (Sterling *et al.* 2003). When the climate warmed, lowland forests expanded to higher elevations and latitudes, and cool-adapted species became restricted to mountains (cf. Williams *et al.* 2003). The savanna forests of the central part of the hotspot evolved to occupy dry, seasonal habitats, and may have been more extensive in the past (Stott 1990), while the rise of seas to present levels enabled the expansion of inter-tidal mudflats, seagrass beds and mangroves (Woodruff 2010). The high levels of floral and faunal endemism distinctive of the Cardamom Mountains in Cambodia (e.g., Stuart and Emmett 2006), Annamite Mountains of Lao PDR/Vietnam (e.g., Surridge *et al.* 1999, Sterling *et al.* 2003) and Chin Hills of Myanmar (e.g., BirdLife International 2005) reflect the role of these mountains in providing refugia for high-rainfall-dependent and/or cool-adapted species. Northern Vietnam shares over 20 species of amphibians and reptiles with Hainan and Guangxi that are not found in Yunnan, because low sea levels enabled movement to Hainan Island, while the drier, cooler climate of Yunnan limited westward dispersal of some species (Sterling *et al.* 2003). The hotspot was part of a regional corridor for the movement of flora and fauna between mainland and insular Southeast Asia (e.g., MacKinnon and MacKinnon 1986, Tougard 2001). For example, due to past land bridges, mainland Southeast Asia and the Greater Sundas share a fifth of their herpetofauna (Sterling *et al.* 2003).

10.2 Anthropogenic Climate Change

10.2.1 Greenhouse Gas Emissions

In 2018 the Intergovernmental Panel on Climate Change (IPCC) published its Special Report on Global Warming (IPCC 2018). This report states that, to effectively limit negative impacts on ecosystems, human health and wellbeing, the global average temperature rise will need to be kept between 1.5 and 2°C, preferably closer to 1.5°C. In order to achieve this, human society will need to reduce global greenhouse gas (GHG) emissions by half from 2010 levels by 2030 and reach net-zero by 2050 (IPCC 2018). Almost all of the models used by the IPCC to calculate the world's carbon budget in order to reach the maximum 1.5°C increase target include some form of carbon removal, via sequestration and storage, afforestation and direct air capture (Levin 2018b). This points to the centrality of nature-based solutions to any plausible global response to climate change.

Unfortunately, our current carbon emissions are still rising rather than falling. There was a slight plateau in global emission numbers from 2014-2016 but it seems to have been short lived, and numbers are now again pointing in the wrong direction, at odds with the deep cuts urgently needed to respond to our planet's climate emergency (Levin and Lebling 2019). In some countries, mainly developed nations, emissions have already peaked, however their GHG emissions are not dropping quickly enough to offset the growth in emissions elsewhere (Levin and Lebling 2019).

Increased carbon dioxide in the atmosphere is the main driver of climate change, accounting for 74% of total GHG emissions (Ge and Friedrich 2020). The planet's natural carbon sinks, both oceans and on land, are increasing their storage as anthropogenic emissions increase (Levin and Lebling 2019). However, their abilities are compromised by deforestation and land-degradation, which, again, is compounded by climate change, limiting the amount of carbon they can absorb. Consequently, keeping natural carbon sinks intact, as well as expanding them, is of critical importance to mitigating climate change.

Table 14 shows GHG emissions per country in the hotspot, in total and per capita, both with and without Land-Use Change and Forestry (LUCF). The impact of LUCF is mainly through the loss of carbon storage associated with deforestation. As the numbers for China include all Chinese provinces (comparable disaggregated data for the part of China within the Indo-Burma Hotspot being unavailable), the numbers for the five hotspot countries without China has also been included for comparison. As can be seen, GHG emissions, both in absolute amount and per capita, have continued to go up, in line with the global trend.

China and the USA have been the two top GHG emitters globally since 1990, with China topping the charts since 2015 (NDC Partnership 2020). Global annual emissions must be limited to about 25-30 GtCO_2e by 2030 (Levin 2018a) if we are to achieve the maximum

1.5°C increase in average temperature set by the IPCC. However, China alone in 2016 had emissions close to 12Gt and was on an upward trajectory. Drastic action is, therefore, needed if we are to meet GHG-emission targets.

Table 14. Greenhouse Gas Emissions per Hotspot, Including and Excluding LUCF

Country		1990**		2000		2010		2016	
		Total	Per Capita	Total	Per Capita	Total	Per Capita	Total	Per Capita
Cambodia	Incl. LUCF	47.37	4.89	49.70	4.09	54.68	3.82	65.43	4.15
	Excl. LUCF	17.75	1.92	20.48	1.69	29.49	2.06	35.45	2.25
China *	Incl. LUCF	2,901.78	2.56	4,276.12	3.39	9,788.64	7.32	11,576.87	8.40
	Excl. LUCF	3,220.19	2.84	4,596.16	3.64	10,180.30	7.61	11,886.86	8.62
Lao PDR	Incl. LUCF	22.39	5.26	18.40	3.46	40.68	6.51	47.28	6.91
	Excl. LUCF	7.50	1.76	8.11	1.52	10.71	1.71	20.88	3.05
Myanmar	Incl. LUCF	176.97	4.28	183.03	3.92	198.11	3.92	219.53	4.14
	Excl. LUCF	55.81	1.35	73.33	1.57	90.86	1.80	109.17	2.06
Thailand	Incl. LUCF	174.51	3.09	267.95	4.26	363.47	5.41	417.24	6.05
	Excl. LUCF	159.77	2.82	255.45	4.06	360.62	5.37	397.27	5.76
Vietnam	Incl. LUCF	25.64	0.38	86.21	1.08	250.60	2.85	314.27	3.36
	Excl. LUCF	72.56	1.07	134.53	1.68	257.76	2.93	335.15	3.58
Six hotspot countries	Incl. LUCF	3,348.66	2.55	4,881.41	3.32	10,696.18	6.84	12,640.62	7.82
	Excl. LUCF	3,533.33	2.69	5,088.06	3.46	10,929.74	6.99	12,784.78	7.91
Hotspot countries without China	Incl. LUCF	446.88	2.49	605.29	2.92	907.54	4.01	1063.75	4.47
	Excl. LUCF	313.14	1.75	491.9	2.38	749.44	3.31	897.92	3.77

Source: https://ndcpartnership.org/climate-watch/ghg-emissions. Notes: GHG emissions in total per country in $MtCO_2e$; GHG emissions per capita in tCO_2e; latest available data are from 2016; * = the figures for China are for the entire country; ** = the 1990 figures for Cambodia's emissions per capita are not available, the figures given are for 1993, the first available year.

Although GHG emissions rates in the five countries in the hotspot excluding China are much lower, they are also rising rapidly. Indeed, they are increasing faster than the global average. This is largely due to the heavy reliance on coal and other fossil fuels in developing economies (Prakash 2018, MRC 2019a).

Table 15 shows GHG emissions per sector, for the six countries in the Indo-Burma Hotspot. Again, as the numbers for China include all of China and not only the three provinces within the hotspot, the numbers for the hotspot countries without China have been included for comparison. It is interesting to note how the numbers differ, especially the contributions to GHG emissions made by the agriculture and LUCF sectors in the five hotspot countries without China. In contrast, the contribution of the LUCF sector to GHG emissions in China is actually negative, reflecting reforestation programs, but the contribution of the energy sector is extremely high.

Table 15. GHG Emissions per Sector, 2016 Data

Sector	Global (%)	Six Hotspot Countries (%)	Hotspot Countries without China (%)	China (%)
Energy	73	82	49	85
Agriculture	12	8	23	6
LUCF	6	-1	16	-3
Industrial Processes	6	9	8	10
Waste	3	2	4	2

Source: https://ndcpartnership.org/climate-watch/ghg-emissions

The numbers in Table 15 support the current focus on mitigation projects. In China, most mitigation projects work in the energy sector, with a particular focus on renewable energy sources for both buildings and transport. In the other five hotspot countries, mitigation projects are split between renewable energy and reducing emissions from deforestation and forest degradation, and the conservation and enhancement of forest carbon stocks (REDD+) projects, with an added emphasis on sustainable agriculture (see list in Appendix 5 of current mitigation projects involving carbon sequestration in the hotspot).

GHG emissions comprise several types of gases, with carbon dioxide (CO_2) making the largest overall contribution to climate change. However, methane (CH_4), nitrous oxide (N_2O) and fluorinated gases (a combination of HFCs, PFCs, SF_6 and NF_3) are also large contributors. Methane and nitrous oxide are usually emitted from agriculture, peatland destruction, waste treatment and gas flaring, while fluorinated gases originate from industrial processes (Levin and Parsons 2019, Ge and Friedrich 2020).

As can be seen from Table 16, methane accounts for 28 percent of the GHG emissions within the five countries in the hotspot excluding China. This is a very high percentage compared to a global figure of 17 percent, and 11 percent for China. While fluorinated gases only account for 4 percent, their effect on climate change is much higher as these gases are more potent. These gases are often overlooked as opportunities for mitigation (Ge and Friedrich 2020), such as reducing the use of hydrofluorocarbons (HFCs) in cooling systems.

Other mitigation opportunities include reducing nitrous oxide in manufacture of plastics and fertilizers, and reducing methane from coal mines, waste treatment, agriculture (especially rice cultivation) and livestock (Song and Gerholdt 2019).

Table 16. GHG Emissions per Gas Type, 2016 Data

Gas	Global (%)	Six Hotspot Countries	Hotspot Countries without China	China
CO_2	75	80	61	82
CH_4	17	12	28	11
N_20	6	5	7	5
F-Gas	2	3	4	2

Source: https://ndcpartnership.org/climate-watch/ghg-emissions

10.2.2 Observed and Projected Changes in the Climate

The climate in the hotspot can generally be classified as tropical monsoonal. While there is considerable variation across the hotspot, the coolest months typically fall between November and February, especially at higher elevations in the north, while the warmest months fall in March and April, when average temperatures reach 30-38°C (MRC 2020). The monsoon season usually runs from May to October.

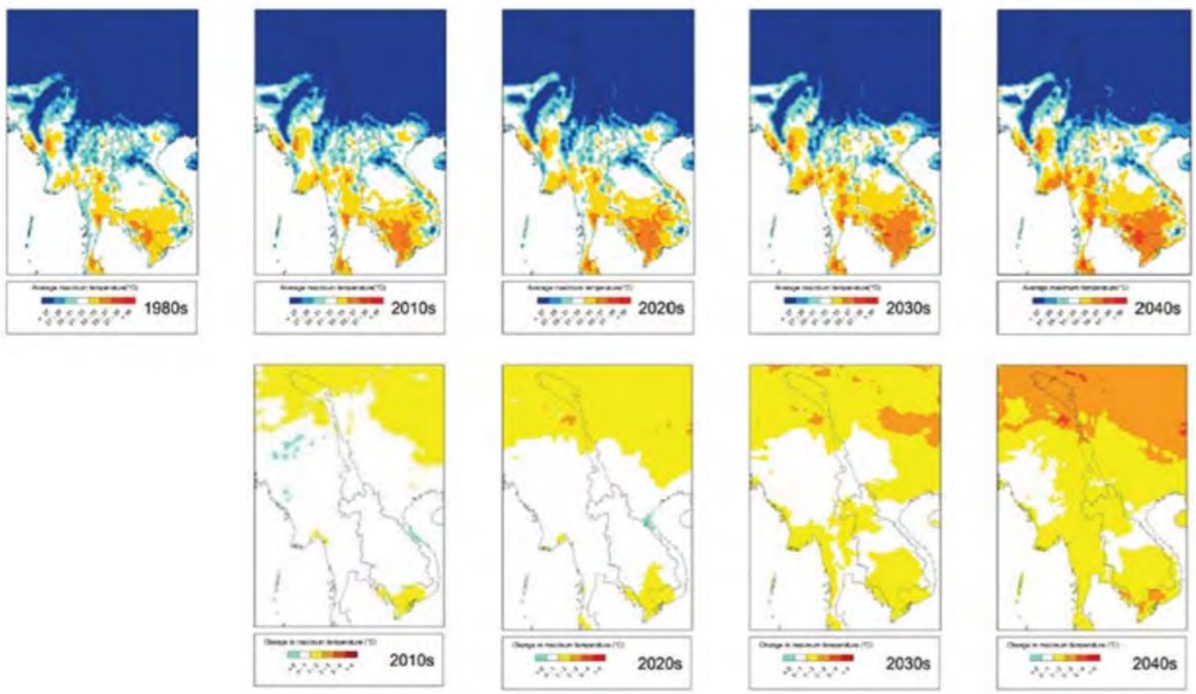
The impacts of climate change have started to be observed in the hotspot: average temperatures have gone up; rainfall patterns have changed; sea levels have begun to rise; and extreme weather events like storms and droughts are being recorded more frequently (Prakash 2018, Ha 2019, MRC 2019a). While most available data recording the impacts of climate change have so far come from the Mekong Basin, most of the hotspot will have similar trends, although in some places the impacts may be more pronounced, for example in the dry zone of central Myanmar.

There remains considerable uncertainty about the ways in which the climate will change and how these changes will impact the natural ecosystems of hotspot and the people who depend on them. In large part, this reflects uncertainty about future GHG emissions scenarios, which depend upon complex political, economic and social changes that are inherently difficult to model. Many models have been used to calculate and estimate the impact of climate change in the medium and long term under various scenarios (IPCC 2018). The maps used in this section show climate change projections developed by Helsinki University of Technology and Southeast Asia START Regional Center (TKK and SEA START RC 2009), based on the fourth generation ECHAM climate model developed from the weather forecast model of the European Centre for Medium Range Weather Forecasts, and assuming the A2 scenario for GHG emissions developed by the IPCC (2000).

Temperature

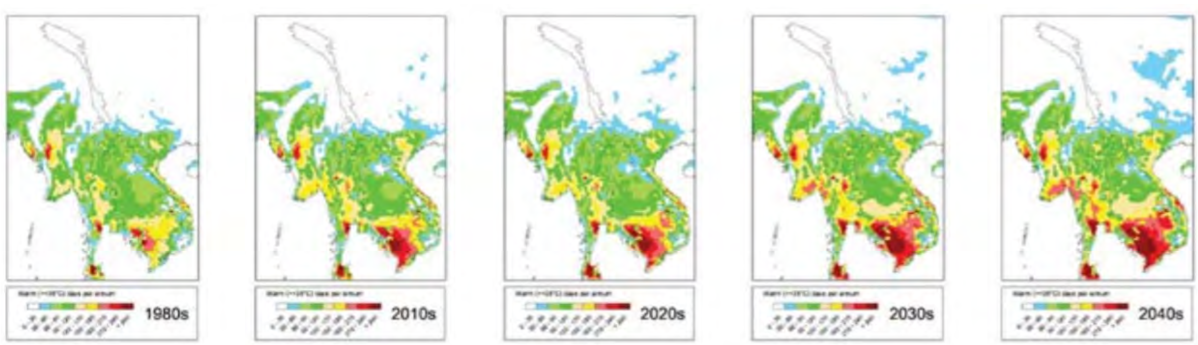
Average temperatures in the Mekong Basin are rising by 0.2°C per decade, which is in line with the global trend (MRC 2018, 2019a). Within the next 30 years, however, the temperatures in the Mekong Basin are expected to rise by 0.79°C, with higher increases in the colder northern catchment areas (MRC 2020; Figure 19). The number of hot days per year is expected to increase, especially in the dry forests of central Indochina and the inundation zone of Tonle Sap lake (Figure 20), which could have serious implications for the risk of devastating fires. At the same time, the number of cold days is expected to decrease (MRC 2019a).

Figure 19. Average Daily Maximum Temperature (Top) and Future Change in Maximum Temperature Compared to the Baseline Decade of 1980s (Bottom)



Source: TKK and SEA START RC (2009).

Figure 20. Average Annual Number of Hot Days (Maximum Temperature ≥35°C)

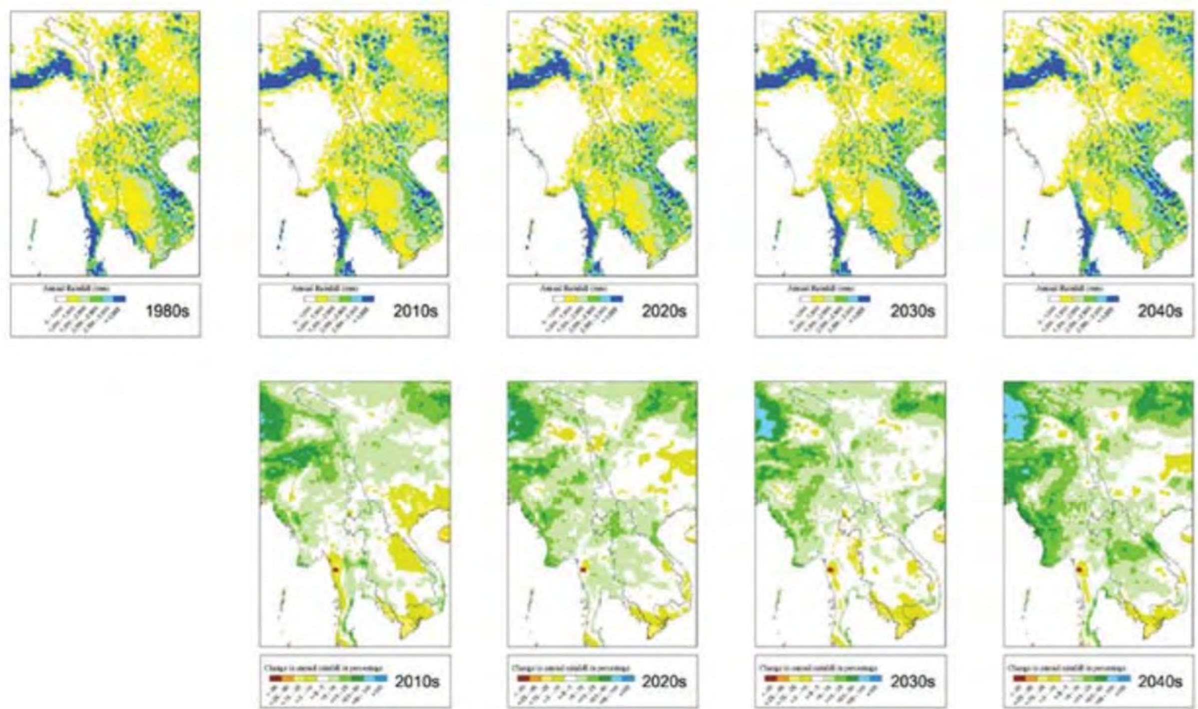


Source: TKK and SEA START RC (2009).

Rainfall and Altered River Flows

The Mekong River Commission (MRC) in 2018 had not seen clear evidence of changes in precipitation patterns, which aligns with the IPCC projections, but it did estimate that, within the next 30 years, annual precipitation would increase by 200 mm (a 13.5 percent increase) (MRC 2020). There will be increases in precipitation in norther and central parts of the hotspot, while the southern parts will become drier (MRC 2020; Figure 21). Due to higher temperatures, water cycles will be intensified, leading to higher annual rainfall in most parts of the hotspot, although, as seen many places in the world, the monsoon season will become more unreliable, with longer dry periods and heavier rain during the monsoon (Prakash 2018, Lowgren 2019). More intense rainfall during shorter monsoon seasons may lead to increased incidence of flooding due to drier soil.

Figure 21. Average Annual Rainfall (Top) and Future Change in Annual Rainfall Compared to the Baseline Decade of the 1980s (Bottom)



Source: TKK and SEA START RC (2009).

These projections are supported by the recent precipitation levels of 2019, when there was a severe drought in the hotspot and beyond, resulting in the lowest water levels in the Mekong River in more than 100 years (Ha 2019, Lowgren 2019). Although the monsoon rains usually start in late May, in 2019 they did not arrive until well into July. While this alone would alter the levels of the river, some observers suggest that withholding of water by hydropower dams compounded problems further downstream (Ha 2019, Lowgren 2019). With the increases in precipitation expected in the future, increases in flooding are expected in all parts of the Mekong basin, with the greatest impact on downstream catchment areas (MRC 2020).

Sea-level Rise

Sea-level rise has started to be recorded in the hotspot, where sea levels may already have risen by as much as 200 mm in the last 50 years (Government of Vietnam 2016a, MRC 2019a). Combined with rapid urbanization, sand mining and excessive groundwater exploitation, this has caused the land to sink (Ha 2019). Sea-level rise poses significant challenges to the availability of land for housing, the maintenance of infrastructure, and the productivity of agricultural land due to saltwater intrusion, which is a particular problem in the low-lying Mekong Delta (Prakash 2018). Here, the effects of sea-level rise are compounded by reduced sediment deposition due to upstream dam construction. The IPCC estimates that sea-levels globally will rise by 400 mm by 2100 based on a 1.5°C global average temperature increase, rising to 460 mm if an increase by 2°C is reached. This will result in massive, destructive impacts (IPCC 2018, Levin 2018a, MRC 2019a).

Extreme Weather Events
The frequency and severity of storms, droughts, heatwaves, and other extreme weather events and natural disasters has already increased and is expected to increase further in the future. Droughts have already been recorded at more frequent intervals than previously, most recently in both 2016 and 2019: the former of which created conditions for destructive fires in flooded forest around Tonle Sap Lake in Cambodia, and the latter of which saw the lowest water levels in the Mekong River for more than a century (Lowgren 2019). Intense rainfall during monsoons can lead to flash floods, soil erosion and landslides (Anh 2016), resulting in loss of life, property, and livelihoods. Vietnam, for instance, has been hard hit with several floods and landslides in the last few years (Government of Vietnam 2016b, IFRC 2020). Tropical storms are likely to increase in frequency and severity as temperature and sea-levels rise, recent examples include Cyclone Komen in 2015, which destroyed or damaged half-a-million houses in Myanmar and damaged 270,000 hectares of cropland, and Cyclone Nargis in 2008, also in Myanmar, which caused more than 140,000 deaths, mainly from storm surge (UNEP 2009, FAO 2015b, Prakash 2018, MRC 2019a).

10.3 Potential Impacts of Climate Change on Biodiversity

Climate change has impacts on biodiversity, both direct and indirect. Direct impacts include loss or shift of habitats and species' ranges, as well as reduced delivery of ecosystem services. Indirect impacts include impacts arising from human responses to climate change, such as the increased use of hydropower dams as a "low carbon" energy source. How healthy an ecosystem is, directly influences how it responds to climate change, in terms of both slowing the effects of climate change as well as reducing the incidence of sudden disasters.

Throughout Earth's history, its climate has changed and so has the distribution and composition of biodiversity. The changes happening today, however, are so comparatively rapid that they threaten many species, as well as entire ecosystems, that are unable to keep pace (Stork and Habel 2014). As a result, potentially catastrophic loss of global biodiversity is on the horizon (Trisos *et al.* 2020); the authors project that, under a high-emissions scenario, abrupt disruption of ecological assemblages will begin before 2030 in tropical oceans and spread to tropical forests by 2050.

10.3.1 Impacts on Ecosystems and Habitats

Climate change is anticipated to have significant impacts on a diverse range of coastal, lowland and upland ecosystems in the Indo-Burma Hotspot. The IPCC estimates that, even if global temperatures are kept below 1.5°C, the impacts on ecosystems and habitats will be high, let alone if the temperatures are allowed to increase by 2°C or more.

The IPCC estimates that approximately "4% (interquartile range 2–7%) of the global terrestrial land area is projected to undergo a transformation of ecosystems from one type to another at 1°C of global warming, compared with 13% (interquartile range 8–20%) at 2°C" (IPCC 2018, p8). These numbers are global, and there will be variations all over the world, yet as the number of hot days increases globally, with the highest increases in the tropics (IPCC 2018), the biodiversity of the Indo-Burma Hotspot will be severely impacted. Generally, the lower the temperature increase, the less severe the impacts will be on terrestrial, freshwater and coastal ecosystems and their ability to deliver ecosystem services (IPCC 2018). A stark example is coral reefs, which globally are expected to decline by 70 to 90 percent with a 1.5°C increase but by 99 percent or more with a 2°C increase (IPCC 2018). This would irreversibly eradicate almost all coral reefs in the hotspot, eliminating whole ecosystems and their component species.

As temperature increases are expected to be greatest in tropical regions, this will have huge impacts on the ecosystems in the hotspot. Already stressed hotspots, experiencing unpredictable monsoons and higher temperatures, may not be able to cope with even higher temperatures, even if it is just for a short period of years. Species turnover is likely to be significantly higher than background rates, and synergistic relationships among species (e.g., between flowering plants and their pollinators) will be hugely impacted, potentially with irreversible impacts. Whole ecosystems will be altered at best and lost at worst.

Inland Freshwater Wetlands

Large rivers, lakes and floodplains are dominant features of the hotspot and their productivity is regulated by distinctive seasonal flow regimes, not least the Mekong River, which flows through all six countries in the hotspot, and discharges into the South China Sea through the Mekong Delta (MRC 2018, Ha 2019). The river currently rises and falls up to 12 meters in some places, producing flood pulses that brings with them nutritious sediments, as well as "enormous amounts of larvae and tiny fish, including many critically endangered species such as the Mekong giant catfish, that are swept into the Tonle Sap Lake and other floodplains where they can mature" (Lowgren 2019). The onset of monsoon rains is usually a cue for many fish species to spawn; with the monsoon becoming more unpredictable, this is expected to have devastating consequences on fish reproduction (Ha 2019, Lowgren 2019). Higher and potentially more rapid flows, due to the heavier monsoon rains, may scour riverbeds and wash away nutrients, as well as fish eggs and larvae, while simultaneously benefitting other species.

The river is already under pressure from sediment release, pollution, urbanisation, hydropower development, flood risk management, overexploitation of fisheries, and invasion by exotic species (Rao *et al.* 2013). Climate change will add to this stress by altering the water flow levels and timings, and, eventually, lead to higher water temperatures. Longer and hotter dry seasons could lower the water levels, particularly impacting areas with shallow water, altering distinctive riverine zones. Ultimately, small floodplain wetlands could be completely dried out, eradicating these ecosystems. For seasonally flooded grasslands, already a critically endangered habitat, hotter and longer dry-seasons, plus rising CO_2 concentrations, might facilitate fires and the invasion of woody plants, effectively changing the structure and composition of these ecosystems. Indeed, a recent global study by Hoffmann *et al.* (2019) suggests that protected areas in flooded grasslands have increased vulnerability due to their typically low topographic heterogeneity and large human footprint.

Hydropower dams are being built many places on the Mekong River, at a rate faster than anywhere else in the world (Ha 2019), causing significant changes in hydrology downstream (MRC 2018). Dams impede the flow of water and sediments, block fish migrations, and only support a fraction of the fish-stock that a free-flowing river could (Hefele *et al*. 2016, Weatherby and Eyler 2017, Lowgren 2019). The cumulative effect of the disruptions to the water flow can have devastating impacts on life in and around the river and could even lead to the collapse of entire ecosystems (Lowgren 2019). In 1995, the intergovernmental MRC was established to enable cooperation on the shared water resources and sustainable development of the Mekong River. However, the MRC only counts Cambodia, Lao PDR, Thailand and Vietnam as members. The fact that China and Myanmar are not members of the MRC is increasingly becoming an issue as more dams are built upstream, leading to uneven sharing of water resources. There is a particular problem with regard to upstream dams operated with limited regard for downstream water flow (Lowgren 2019). There are also concerns about the plans of Lao PDR to turn itself into 'the battery of Southeast Asia', by building numerous dams along the Mekong River, with environmental costs not fully factored into decision making (Lowgren 2019).

Coastal Wetlands and Deltas

Coastal ecosystems, including mangroves and coral reefs are already stressed due to pollution, over-harvesting, and coastal development. These anthropogenic impacts will be enhanced as they are compounded by climate change. Sea-level rise and saltwater intrusion, plus increased water temperatures and ocean acidification, will inundate coastal wetlands, accelerate coastal erosion, increase incidence of flooding and storm events, and cause degradation of estuarine communities (Rao *et al.* 2013). Species that have narrow tolerance for salinity levels may move upstream in the region's deltas, away from the coast, while species with a wider tolerance of salinity levels may expand their ranges upstream.

Healthy mangroves are important ecosystems, because they act as a natural barrier against storms, sea-level rise and erosion, and provide habitats for many coastal species, including as spawning and nursery grounds for fishes. In addition, they have high potential to store and sequester carbon, making them important to both climate change mitigation and adaptation initiatives (SNV 2020). Whether mangroves can retreat inland will depend both on the available space for them as well as their physiological ability to do so, and most likely the species composition in the mangrove ecosystems will be changed. In many cases, in an example that illustrates the indirect impacts of climate change, engineering solutions to climate change adaptation, such as sea dykes, will prevent mangroves shifting inland in response to sea-level rise.

Lowland Forest Ecosystems

Commercial logging, agricultural expansion, shifting cultivation, and conversion to rubber and palm-oil plantations have already led to severe habitat loss and fragmentation in the lowland forests of the hotspot, including the wet evergreen forests and mixed deciduous forests (Rao *et al.* 2013). A hotter and drier climate facilitates forest fires, and places increased water stress on ecosystems, which renders them less able to fulfil their ecosystem services. The entire structure and composition of vegetation communities could change, with some communities benefitting from the change in climate while others suffer. Climate-stressed forest ecosystems are likely to be more susceptible to invasion by pest species, which could cause a cascade of ecological effects.

Montane Forest Ecosystems
Steep topography and high altitudinal gradients characterize many of the hotspot's mountain ranges, and small increases in temperature could impact a disproportionately large number of habitats and species. Rising temperatures may exceed the physiological limits of cool-adapted endemic species, and drier conditions would alter moisture gradients, which could reduce water availability for flora and fauna. Even a 1°C increase in mean annual temperature will result in a shift in isotherms of about 160 meters in elevation or 150 km in latitude (Rao *et al.* 2013).

The elevational distribution of montane forest ecosystems can be expected to reduce at their lower limit, as lowland forests move upwards in elevation, while their upper limit will ultimately remain fixed by topography. The ability of montane species, which have narrow ranges and may be highly adapted to specific air and soil gradients, to shift to cooler conditions at higher elevations will be limited by their ability to disperse and adapt. Many will suffer, consequently, while other, more rapid adapters will benefit. In general, species composition and diversity across the hotspot's mountain ranges are expected to diminish.

10.3.2 Impacts on Species

Species, already under pressure from habitat loss and over-exploitation, are especially at risk from the shifts resulting from climate change, as their resilience is low. How climate change is going to play out in the long run is impossible to determine with any certainty, there are too many variables, but the risks of climate change will most certainly have a big impact on species, and, in some cases, this impact has already started (e.g., Mawdsley *et. al.* 2009, Rao *et al.* 2013). Some species will undoubtably thrive with climate change, while others will suffer and, ultimately, some will be extirpated, leaving overall species diversity reduced. As climate change is happening at a rapid pace compared to prehistoric changes in climate, a lot will depend on the ability of species to adapt rapidly.

Risks to species include physiologically altered habitats and ecosystems, disappearing food supply (as the composition of biotic communities changes), and invasion by alien species. Species which require different habitats, for instance for different life stages like amphibians, are particularly at risk. A review of the implications of climate change for biodiversity conservation in Myanmar noted that temperature increases are a particular problem for species that exhibit temperature-dependent sex determination (Rao *et al.* 2013). These species include a number of globally threatened turtles, crocodilians and fishes. There seems to be some evidence that evolution has some ways to deal with climate change regarding temperature-dependent sex determination, like nesting earlier and by increasing production of female offspring and thereby future fertility (Tomilli *et al.* 2015). These evolutionary safeguards might not, however, be enough to mitigate the rapid climate change that the hotspot is currently experiencing.

As the impacts of climate change worsen and certain habitats become unlivable for some species, the ability of these species to find another, more suitable habitat and, therefore, survive depends on a range of factors. For instance, for species restricted to lowland forests that may need to reach a more elevated and climatically suitable habitat, they may have to migrate hundreds of kilometers. These distances alone may be insurmountable for many species but combined with the barriers to movement created by habitat loss and fragmentation at the landscape scale across large parts of the hotspot, it would be unsurprising if the more fragile and not-very-adaptable species will be extirpated (Rao *et al.*

2013). Endemic species, or species that occur only in a very few places to begin with, are particularly at risk (Stork and Habel 2014), as are species that are highly adapted to their particular environment, like, for instance, many endemic freshwater invertebrates, which may be unable to adjust to even slightly higher water temperatures and the associated lower levels of dissolved oxygen.

The loss of inter-tidal mudflats due to sea-level rise threatens the numerous populations of migratory birds that depends on them (Rao *et al.* 2013). Mudflats and other inter-tidal habitats are already being lost due to various anthropogenic causes like expansion of aquaculture and tourism development. These threats are compounded by the impacts of climate change, especially sea-level rise. The loss of some mudflats and thereby feeding grounds will push birds together and fuel competition for food. Distances that migratory birds have to fly to find suitable feeding and breeding grounds will increase, substantially prolonging their journeys and some will require additional stopovers for refuelling (Howard *et al.* 2018). Not all species will be able to adapt to this: they might not have the flight capabilities for the necessary longer journeys, and so they might suffer the severest of consequences. Another issue for migratory birds is the potential for changed timings of seasonal events, which might cause some birds to miss the peak times for food availability.

Given the pressures that many species are already under from causes other than climate change (i.e., over-exploitation, habitat degradation and loss, invasive alien species) and the difficulty of predicting climate change impacts on species and their habitats with precision, reducing pressure from existing sources will need to be a cornerstone of strategies to help species adapt to climate change. This should not, however, be interpreted as a call for business as usual. Conservation strategies will need to adapt in the face of climate change, including by a greater emphasis on maintaining ecological connectivity among sites (which may, in turn, require a focus on restoration in strategic locations), as well as a diverse array of species-specific measures, such as physical modification of seasonal wetlands to provide suitable conditions for large waterbirds for longer, or artificial incubation of turtle eggs to ensure optimal sex ratios.

10.3.3 Impacts on Protected Areas and Other Sites of Conservation Significance

The impacts of climate change will be profound on the protected area networks in the hotspot, impacting their integrity and effectiveness. Protected areas are static in location, while climate change will shift species' ranges. So, for instance, a protected area set up specifically to protect a key species, may be left without that purpose if the species shifts location (or, worse, goes extinct) due to changing environmental conditions at the site. Management of protected areas, at local, national, and regional levels, needs to try to predict where species of conservation concern might need to shift to, and plan accordingly. This is no easy task and will require extensive research and knowledge of the species and areas, as well as models to estimate how habitats may change in the medium and long term (Rao *et al.* 2013, Stork and Habel 2014).

Protected areas may need to have core zones with buffer zones or transition zones surrounding them, as well as interconnecting corridors or stepping-stones of habitats, to enhance ecological connectivity at the landscape scale and increase species' ability to disperse and shift location (Mawdsley *et al.* 2009, Stork and Habel 2014). This is especially needed in the Indo-Burma Hotspot, where protected areas increasingly support 'islands' of natural habitat surrounded by 'oceans' of agriculture and other anthropogenic habitats. Large protected areas (e.g., Nakai-Nam Theun National Protected Area in Lao PDR) and protected area complexes (e.g., Thailand's Western Forest Complex) that encompass different habitats and span wide gradients of elevation may have the greatest resilience to climate change, as they will allow species to move more freely to newer habitats and cooler refuges that will suit them physiologically better, be it at a higher elevation, or for instance a need for higher humidity (Rao *et al.* 2013). Smaller, more ecologically uniform protected areas cannot offer the same flexibility, a problem that is more acute for protected areas isolated without interconnecting conservation corridors (Stork and Habel 2014).

The indirect impacts of climate change on protected areas can be severe. For instance, if people lose their farms or homes due either to long-term climate change impacts like altered weather and rainfall patterns, or to acute disasters like cyclones, they may migrate and settle in or near protected areas. This encroachment will place additional anthropogenic stress on the area, via land clearing and slash-and-burn agriculture, the associated soil erosion, logging, poaching, and overuse of timber and non-timber forest products (NTFPs). Management of protected areas is often hindered by lack of funding and capabilities, as well as weak policies and regulatory frameworks to protect the areas (Rao *et al.* 2013). Giving communities rights to the land can encourage community enforcement of conservation policies, which can discourage encroachment as well as poaching and illegal use of forest products.

Healthy protected areas are more resilient and more likely to withstand the impacts of climate change, so the need to keep them healthy is paramount. However, many protected areas in the hotspot are already degraded, small in size, and suffering from encroachment and other drivers of degradation, and so are unable to effectively conserve biodiversity (Rao *et al.* 2013).

10.3.4 Impacts on People

Human populations are already, and will increasingly be, impacted by climate change in several ways, including: through the loss of agricultural land, aquaculture and fisheries; enhanced food insecurity; shortages of fresh water; health issues; damage to property and infrastructure; and a need to migrate and resettle elsewhere away from areas affected by sea-level rise and flooding (Anh 2016). Unless ecosystem-based adaptation is strategically integrated into development, the response of human populations to climate change will almost certainly place greater pressures on the hotspot's biodiversity.

The impacts of climate change on human populations are directly integrated with the impacts of poverty, and poverty is widely seen as the greatest barrier to addressing climate change in developing nations, which is why one cannot be addressed successfully without addressing the other (Stork and Habel 2014). The rural poor often bear the brunt of climate change (Levin 2018a), and they are likely to be directly dependent on ecosystem services, including ones provided by protected areas, yet they most often lack the technical expertise and financial resources for climate change adaptation, as well as alternative livelihood options (Bangalore *et al.* 2016, Hefele *et al.* 2016, Plan 2018).

As general degradation and over-use of resources are exacerbated by climate change, food insecurity and shortages of fresh water will worsen. For instance, fish stock will decline in size and abundance, increased salination will destroy aquaculture, and floods and droughts will render farmland less productive, even infertile at times, all leading to enhanced food insecurity. Subsistence farmers are set up for disaster if their crops are ruined by lack of rain, as is happening with the shortening of the monsoon season (Ha 2019, Lowgren 2019). As the impacts get worse and the pressures increase, people may eventually have to migrate to other areas, increasing the risk of conflicts with protected areas (Rao *et al.* 2013, Hefele *et al*. 2016). Adaptation projects will be able to delay this cycle and, in some places, even stop it but, as things currently stand, it is an uphill battle.

The countries within the Indo-Burma Hotspot are amongst the most vulnerable to the effects of climate change (MRC 2019a). For instance, Myanmar, Thailand and Vietnam have all been identified as among the top 10 countries most affected by extreme weather events in the last two decades, i.e. between 1999 and 2018 (Eckstein *et al.* 2019).

Vietnam is particularly exposed to seal level rise and floods, with 70 percent of its population living in coastal areas and low-lying deltas (Bangalore *et al.* 2016). The Mekong Delta is one of the world's most densely populated areas, as well as being incredibly fertile (Prakash 2018, Ha 2019). However, while rapid urbanization, sand mining, and excessive groundwater extraction are causing the land to sink, climate change is causing the sea to rise. Seawater is already pushing steadily inland, contaminating aquifers rendering the land infertile. Simultaneously, the fertile sediments deposited brought down to the delta by the Mekong River are increasingly being blocked by dams along the river and its tributaries, further devastating ecosystems and food production, which may eventually result in the displacement of millions of people living in the delta (Prakash 2018, Ha 2019, MRC 2020). It is estimated that, if sea-level rise reaches 1 meter then up to 39 percent of the Mekong Delta could be submerged, affecting 35 percent of the delta's population and potentially losing more than 40 percent of the total rice production in this region (Government of Vietnam 2016a).

Climate migration is an issue that is gaining international attention, despite there yet being no legal definition of the term (IOM 2020). A distinction is being made between temporary emergency migrants (people who temporarily flee due to an environmental disaster, like a cyclone) and permanent migrants (people who are forced to move home due to climate change, droughts, and general environmental degradation). This distinction is typically not made in migration statistics, yet they require entirely different responses (Hefele *et al.* 2016). Migration can sometimes be a planned adaption strategy to climate change, when individuals find temporary work elsewhere and send money home to the family, enabling them to diversify their income and agriculture, and thereby increase resilience back home (Climate and Migration Coalition 2020). At times, people have to migrate across borders but, most often, they stay within their country, usually taking the form of rural-to-urban migration; this is expected to be generally the case for the Indo-Burma Hotspot. Increased conflicts due to increased pressure on natural resources, such as freshwater, can be expected in the future, adding to the drivers of internal migration.

Health issues are another impact of climate change on humans that is on the rise. Increased air-pollution, heatwaves and related mortality, as well as increased risks from vector-borne diseases, such as malaria and dengue fever, all have implications for wild species as well as human populations (Rao *et al.* 2013, IPCC 2018, Levin 2018a).

10.4 International Agreements Relevant to Biodiversity Conservation

As the impacts of climate change have become better understood, more generally accepted and more immediate, several agreements to curb GHG emissions and/or conserve biodiversity have emerged on the international stage. One key agreement is the Convention on Biological Diversity (CBD): a multilateral treaty that entered into force in 1993, which has three main goals: the conservation of biological diversity; the sustainable use of the components of biological diversity; and the fair and equitable sharing of benefits arising from the utilization of genetic resources. Countries are required to prepare National Biodiversity Strategies and Action Plans (NBSAPs) and to ensure these plans are mainstreamed into all relevant activities. The convention's governing body is the Conference of Parties (COP). At the 14^{th} meeting of the COP in Sharm El-Sheik, Egypt in 2018, the parties adopted a set of voluntary guidelines for the design and effective implementation of ecosystem-based approaches to climate change adaptation and disaster risk reduction (CBD 2018).

The Bonn challenge is another relevant international cooperation agreement. It was launched in 2011 in Bonn, Germany by the German government and the International Union for Conservation of Nature (IUCN), and later endorsed and extended to 2030 by the New York Declaration of Forests of the 2014 UN Climate Summit (IUCN 2020a). The Bonn Challenge is a global effort to restore the world's degraded and deforested lands, using the Forest Landscape Restoration approach, and thereby aiding countries to achieve their climate change, biodiversity and land degradation commitments.

While the preceding agreements relate more specifically to biodiversity and the role of natural ecosystems in mitigating and adapting to the impacts of climate change, the most important multilateral agreement related to climate change is the United Nations Framework Convention for Climate Change (UNFCCC). Adopted in 1992 and entering into force in 1994, the UNFCCC has provided the legal framework for international cooperation on climate change for the last three decades. The UNFCCC aims to "stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system" (UNFCCC 1992, p9). It sets only non-binding limits on GHG emissions for individual countries and contains no enforcement mechanisms. Nevertheless, it does make provision for the adoption of subsequent international protocols or agreements on coordinated international action towards the objective of the convention.

10.4.1 The Paris Agreement

The most notable recent step in advancing coordinated global action on climate change is the Paris Agreement, signed in 2016 under the auspices of the UNFCCC. The agreement covers GHG emissions, adaptation to climate change and finance. The central aim of the agreement is to strengthen the global response to the negative impacts caused by climate change, by limiting the temperature increase to 2°C above pre-industrial levels, and preferably to 1.5°C. As previously mentioned, to achieve this the IPCC has estimated that global GHG emissions have to be reduced to half of the 2010 levels by 2030 and to reach net-zero levels by 2050 (IPCC 2018). Adapting to climate change, fostering climate resilience and directing international financing accordingly are also key aims of the Paris Agreement, to which ends the Green Climate Fund (GCF) was established. All six countries within the hotspot are signatories to the Paris Agreement.

Under the Paris Agreement, each country sets targets and plans its own Nationally Determined Contributions (NDCs), which should be submitted to the UNFCCC Secretariat every five years. The NDCs often build upon the National Adaptation Plans, which had been developed by most countries already. The NDCs should be progressive: each one should be more ambitious than the previous one. However, unlike its predecessor, the Kyoto Protocol, there are no means to enforce the NDCs legally, because they are voluntary targets, which are politically encouraged. If the NDCs were legally binding, countries could be penalized for not meeting them, which carries a risk of countries leaving the Paris Agreement altogether, thereby undermining the prospect of achieving its main goals.

All six countries in the hotspot have already developed and submitted their initial Intended Nationally Determined Contributions (INDCs), which will act as a baseline for all future NDCs. Despite a lot of the issues faced by the countries being similar, their INDCs place a focus on different strategies for GHG emission reductions.

Cambodia

Cambodia submitted its INDC in 2017 (Royal Government of Cambodia 2017), which highlights the fact that Cambodia is a low GHG emitter and was still a net carbon sink as recently as 2000. As Cambodia is a highly vulnerable country to climate change, addressing it is aligned closely with national development priorities. To this end, the INDC highlights that efforts to address climate change cannot be separated from economic development and poverty alleviation goals. Cambodia is making an effort to integrate climate change mitigation and adaptation into all sectors, for example via the *Climate Change Strategic Plan 2014-2023* (Royal Government of Cambodia 2013), which sets out priorities for the country's adaptation needs as well as roadmaps for the decarbonisation of key economic sectors, the enhancement of carbon sinks and the development of a climate change financing framework. Besides renewable energies and ways to reduce new GHG emissions, Cambodia's mitigation strategy mainly focuses on land use, land-use change and forestry. Cambodia aims to increase forest cover to 60 percent of national land area by 2030, by reclassifying forest areas to avoid deforestation. The government expects that this should provide an annual emissions reduction of 4.7tCO_2eq/ha/year, although it should be noted that Cambodia has experienced significant net loss of forest cover for the last decade, and this trend will need to be rapidly reversed if this target is to be met.

The country's adaptation strategies are to be integrated into all sectors of the country, with prominence given to the ones with mitigation benefits as well, such as: using community-based adaptation to successfully restore natural ecological systems; implementing management measures for protected areas; promoting climate-resilient agriculture; and scaling up of climate-smart farming systems. A common rationale given for focusing on climate adaptation is its contribution to economic development and the long-term security and wellbeing of people, rather than its potential to conserve biodiversity.

China

China submitted its INDC in 2016 (Government of the People's Republic of China 2016), which stated that by 2030 the country will achieve peak CO_2 emissions, although it will try to peak earlier if possible. China will then lower CO_2 emissions per unit of GDP by 60 to 64 percent from the 2005 level, increase the share of non-fossil fuels in primary energy consumption to around 20 percent, and increase its forest stock volume by around 4.5 billion cubic meters on the 2005 level. It should be noted that these numbers are for the whole of China, rather than the part within the hotspot.

China's mitigation strategies are focused on the energy sector, through promoting low-carbon energies including the development of wind, solar, hydro and nuclear power. It also plans to reduce the production and consumption of HCFC-22 for controlled uses, with its production to be reduced by 35 percent from the 2010 level by 2020, and to achieve effective control on emissions of HFC-23 by 2020. Enhancing afforestation, promoting voluntary tree planting by all citizens, and protecting and restoring natural forests is also mentioned in the INDC, as well as implementing a nationwide carbon emission trading system.

Adaption measures include optimizing the allocation of water resources, expanding water saving in all aspects of society, and intensifying the development and utilization of unconventional water resources, such as recycled water and desalinated sea water. China also commits to: enhance resistance to marine disasters and proactive management of coastal zones to improve resilience; track, monitor and assess the impact of climate change on biodiversity; and strengthen early warning and emergency response systems.

Lao PDR

Lao PDR submitted its INDC in 2016 (Government of Lao People's Democratic Republic 2015), which highlights the fact that the country is currently a Least Developed Country with ambitions for rapid economic development. The INDC notes that the country is highly vulnerable to climate-change and, despite the fact that Lao PDR is a low-emitting country, it has ambitious plans to reduce its GHG emissions even further while increasing its resilience. It aims to increase the level of forest cover to 70 percent of the national land area by 2020, utilise unexploited hydropower resources to export electricity to its neighbours, and increase the use of small-scale renewable energy. According to the INDC, increased forest cover in Lao PDR should reduce GHG emissions by an estimated 60,000 to 69,000 $ktCO_{2e}$ in total up to 2020 with the benefits continuing afterwards, although it accepts that reforestation and maintenance of forests is a major challenge. Hence, there is a strong desire for international assistance with programmes such as REDD+ and Forest Law, Enforcement, Governance and Trade (FLEGT).

Lao PDR views hydroelectricity as having great, underused potential, and providing clean energy while also meeting other objectives like flood, irrigation, and water supply management. However, as discussed previously, the construction of hydropower dams in Lao PDR has proven to be highly contentious and, while it might bring short-term economic gain, critics warn that it may also bring long-term environmental costs (e.g., Prakash 2018, Lowgren 2019).

For climate change adaptation, Lao PDR is focusing on increasing resilience of key economic sectors and natural resources, enhanced cooperation both nationally and internationally, and improved public awareness and understanding of climate change and its effects. As 70 percent of the population depends on agriculture, a lot of focus is understandably on this sector, especially related to food security. Other high priority areas are the provision and management of water resources, forest and land use change, transport and urban development, and public health.

Myanmar

Myanmar submitted its INDC in 2017 (Government of the Republic of the Union of Myanmar 2015). It highlights the country's extreme vulnerability to climate change, as it has been repeatedly ranked as one of the most vulnerable countries to extreme weather events globally. The INDC states that the low emissions of the country combined with the large expanse of natural forest, makes Myanmar a net GHG sink rather than emitter, though this is not backed up by the internationally recognized figures in Table 14. The country's main focus is, therefore, on adaptation to climate change, and the INDC stresses that any mitigation activities are strictly contingent on support for capacity-building, technology development and transfer, and financial resources from the international community, as well as the national and international private sector.

The mitigation objectives for the country are focused on the energy sector (mainly renewable energy, some hydroelectric power, and low-carbon cooking stoves), and the forest sector. Via the *National Forestry Master Plan 2001-2030*, Myanmar aims to increase the amount of Reserved Forest and Protected Public Forest to cover 30 percent of the national land area, and to increase protected areas to cover a further 10 percent. Both the UN-REDD program and the EU FLEGT program are identified as playing an important part in achieving this aim.

Myanmar's adaptation objectives are listed according to its priorities, which are largely informed by the imperative of economic development. As a large proportion of the population is dependent on the agriculture and forestry sectors, adaptation in these sectors are of primary concern, along with developing early warning systems. The second priority level concerns are public health protection and water resource management. Third priority level concerns include coastal zone protection, while the lowest priority level concerns include the energy and industry sectors along with biodiversity conservation.

Thailand

Thailand submitted its INDC in 2016 (Royal Thai Government 2016), in which it stated the intention to reduce its GHG emissions by 20 percent from the projected business-as-usual (BAU) level by 2030. Thailand's BAU level refers to the projections from the year 2005 onwards in the absence of major climate change policies. Thailand's main GHG emissions are from energy, hence this sector is the focus for mitigation efforts, mainly via increasing renewable energy throughout, promoting rail transport over road, and improving waste management. Thailand aims to increase its national forest cover to 40 percent through local community participation, including in particular headwater and mangrove forests, although the INDC lists this as an adaptation strategy rather than mitigation, hence the focus is on climate adaptation benefits for people, rather than on carbon storage.

As with other countries in the hotspot, Thailand is highly vulnerable to the adverse effects of climate change and, thus, adaptation efforts are key. Thailand aims to enhance climate resilience though the guidance of the Philosophy of Sufficient Economy which "stresses the middle path as an overriding principle for appropriate conduct by Thai people at all levels, from family to community to country" (Royal Thai Government 2016, p4). Sufficiency means moderation, which in many ways puts sustainability at the core. The philosophy puts emphasis on knowledge building and careful planning, incorporating local wisdom in combination with modern knowledge, techniques, and technologies. Thailand has a longer-term *Climate Change Master Plan B.E. 2558-2593 (2015-2050)*, providing a continuous framework for measures and actions.

Thailand's INDC adaptation priorities include: promoting and strengthening water resources management; economic diversification at the household level; sustainable management of community forests to enhance food security; promoting sustainable agriculture;

safeguarding biodiversity and restoring ecological integrity in protected areas and important landscapes, with emphasis on vulnerable ecosystems and Red List species; participatory marine conservation and coastal rehabilitation; promoting nature-based and sustainable tourism; increasing awareness of climate risks; and establishing effective early warning systems.

Vietnam

Vietnam submitted its INDC in 2016 (Government of Vietnam 2016a). It follows on from several previous government documents outlining the country's climate change strategies. The INDC's mitigation component outlines both unconditional and conditional contributions. The unconditional contributions are measures that will be implemented using domestic resources. These include that Vietnam will, by 2030, reduce net GHG emissions by 8 percent compared with the BAU scenario. This will be achieved by, among other things increasing forest cover to 45 percent of the national land area. The conditional contribution will take net GHG emission reductions from 8 percent to 25 percent, provided that international financial support, technology transfer and capacity building are received.

Vietnam's mitigation measures focus on the energy and forestry sectors. In the energy sector, measures include reducing energy consumption, changing the fuel structure in industry and transportation, and promoting renewable energy. In the forestry sector, they include managing and developing sustainable forest, enhancing carbon sequestration and environmental services, and conserving biodiversity associated with livelihood development and income generation, incorporating mechanisms such as REDD+ and PFES. In addition, Vietnam's INDC also identifies the development of sustainable agriculture as a mitigation measure, through reduced GHG emissions (including of methane) associated with improving the effectiveness and competitiveness of agricultural production.

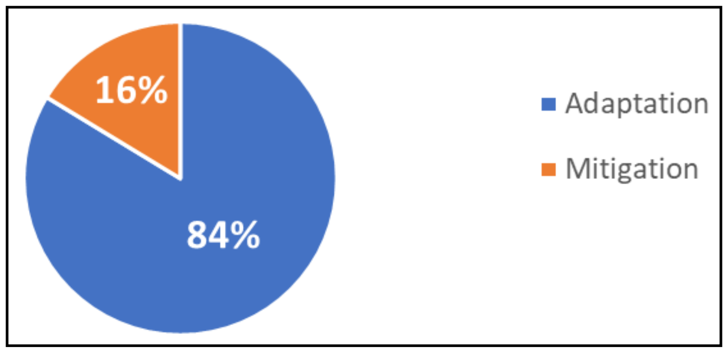
With its long coastline and low-lying deltas, Vietnam's geography causes it to be particularly vulnerable to climate change, the country is facing losses and damages beyond its resilience and capacity, even after adaptation and mitigation measures are applied. This can be seen in the adaption measures mentioned in its INDC, which focus heavily on responding to disasters and sea-level rise.

The INDC identifies three main priority areas for adaptation. First, measures to respond proactively to disasters and improve climate monitoring include implementation of disaster prevention plans and measures, and developing infrastructure and planning for the relocation and resettlement of households. Second, measures to ensure social security include ecosystem services and biodiversity conservation, integrated water resources management, sustainable management of agricultural lands, sustainable forest management, and protection, restoration and quality enhancement of coastal forests, including mangroves. Third, measures to respond to sea-level rise and urban inundation include integrated coastal zone management, and implementing anti-inundation measures for large coastal cities.

10.5 Current Project Coverage

Appendices 5 and 6 contains lists of climate change mitigation and adaptation projects in the hotspot, giving a snapshot of currently active projects. The mitigation projects listed only include projects with a carbon sequestration component. The lists were compiled from extensive searches on websites of relevant international donor organizations. The information on grants given on the donor websites are not consistent and finding comparable numbers for projects was difficult. For example, some sources include expected funding, while others only include committed funding; some sources detail loan financing while others list only grants; and some sources include all funding for a project while others list only what their organization is contributing; and some of the numbers given for regional and global projects do not include separate amounts for each country. Given these inherent difficulties, the overview figures presented in this section are best considered as a rough estimate, based on a range of assumptions, and should not be taken as statistical facts. As can be seen from the Figure 22, current funding in the hotspot is overwhelmingly for adaptation projects.

Figure 22. Current Project Funding for Adaptation versus Mitigation



10.5.1 Mitigation Projects

In the context of climate change, mitigation refers to measures that aim to reduce or prevent emissions of GHG, and measures that aim to sequester and store carbon. Mitigation projects in the hotspot aimed at reducing GHG emissions largely focus on the energy sector (mainly electricity production and transport), through promoting renewable energies, improving the energy efficiency of existing equipment, and shifting to low-carbon emitting technologies. These activities do not involve carbon sequestration and are not considered further here.

The principal mitigation approach using carbon sequestration in the hotspot is REDD+, a mechanism developed under the UNFCCC that aims to reduce emissions from forested lands and incentivize developing countries to invest in a low-carbon pathway to sustainable development, by creating monetary value for the carbon stored in forests, which can be sold as carbon offsets as well as having components of conservation, sustainable management of forests and enhancement of forest carbon stocks . The funding for REDD+ programs was meant to come from the global carbon market, which has not yet materialized at a sufficient scale, so most funding currently comes from ODA from a handful of donor countries (Duchelle *et al.* 2019). There is also a growing voluntary market for carbon credits, which has a small but important number of projects in the Indo-Burma Hotspot has sold into. The voluntary market is still significantly smaller than the regulated market (FAO 2010a, Nelson 2013) but is on an upwards trend (Donofrio *et al*. 2019), as the public demand eco-friendly credentials from private sector companies, such as achieving net-zero emission status through tree-planting schemes, for example. Airlines have long been leading buyers of voluntary carbon offsets, and recently the oil industry is gaining importance as well (Donofrio *et al.* 2019). The regulated market for carbon credits is heavily regulated, with certification which can be costly and difficult to achieve especially for smaller-scale forest projects, making the voluntary market more attractive. However, while the non-regulatory aspect of the voluntary market is benefitting many, it has its problems as well, such as cases of fraud and lack of transparency (Nelson 2013).

REDD+ has enormous synergistic potential to protect biodiversity and address climate change simultaneously but only if done well (CBD 2011). Poorly designed REDD+ projects could damage forest biodiversity and ecosystems by, for instance, focusing more on tree species with high carbon sequestration potential, potentially resulting in monoculture, than on a composition of trees and plants that also provides habitats for wildlife. It is, therefore, crucial that biodiversity is appropriately considered in the planning and implementation of REDD+ projects.

A compilation of mitigation projects with a focus on carbon sequestration in the hotspot (see Appendix 5) provides a snapshot of currently active projects. The list only includes projects with international donor funding, and almost certainly underrepresents the total number of projects involving REDD or REDD+ in the hotspot, as both the concept and funding for it is expanding. A summary of the data presented in Appendix 5 can be found in Table 17, which shows the number of mitigation projects with a carbon sequestration component per country in the hotspot. In total, 52 projects were found, with 41 focusing only on one country and 11 on more than one country. Most are regional in scope, with some spanning more globally.

Table 17. Mitigation Projects with a Carbon Sequestration Component

Country	Single-country focus	Regional or global	Total
Cambodia	9	3	12
China (hotspot only)	1	1	2
Lao PDR	10	6	16
Myanmar	4	5	9
Thailand	4	3	7
Vietnam	13	8	21

Cambodia, Lao PDR and Vietnam are generally considered to have high potential for REDD+ due to their large area of forest and high rates of forest loss and degradation. This is consistent with them having the highest number of mitigation projects currently, with Vietnam in the lead. China does not have a national REDD+ program and has very few mitigation programs with a carbon sequestration component. Table 18 shows the calculated estimates of current funding for mitigation projects in the hotspot, both in total and as an average per year. These are rough estimates, which should not be taken for actual data.

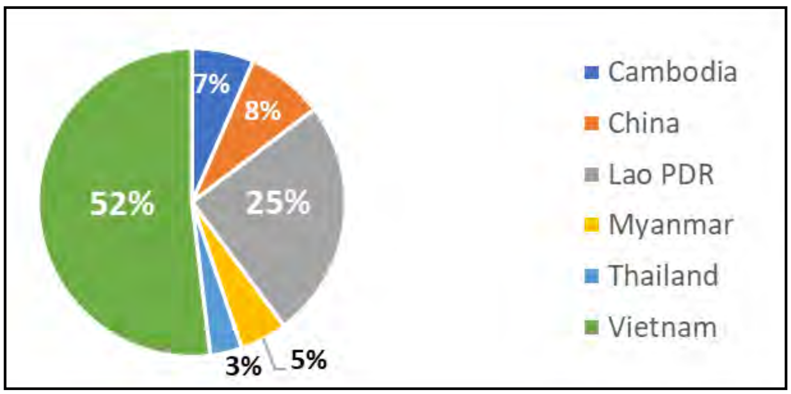
Table 18. Estimates of Current Mitigation Project Funding in Total and per Year

Country	Current Project Funding	Average Project Funding per Year
Cambodia	$46,171,198	$5,886,642
China	$57,355,928	$5,735,593
Lao PDR	$177,184,240	$22,635,153
Myanmar	$35,021,396	$4,653,207
Thailand	$23,679,851	$3,245,138
Vietnam	$366,345,353	$45,921,595
Total	**$705,757,966**	**$88,077,329**

Notes: All project funding was converted into US$; funding was divided by the total project duration, assuming even spending each year; when a fixed project duration was not given, a period of 10 years was assumed; funding for projects covering several countries was divided equally among the beneficiary countries; and funding for projects addressing both adaptation and mitigation was split 50/50 between them.

Figure 23 shows how current funding for mitigation projects with a carbon sequestration component is divided between the countries in the hotspot, based on the estimates from Table 18. Vietnam is by far the biggest receiver country, with Lao PDR coming second. It is interesting to note that despite the three provinces of China in the hotspot has fewest mitigation projects with international funding, they receive more funding than Cambodia, Thailand and Myanmar.

Figure 23. Estimated Volume of Climate Mitigation Project Funding per Hotspot Country



10.5.2 Adaptation projects

In the context of climate change, adaptation refers to human activities aimed at coping with the impacts of a changing climate. Adapting to climate change is not just an option but a necessity. In the hotspot, adaptation projects are underway across most sectors of urban and rural society. A compilation of adaptation projects (see Appendix 6) provides a snapshot of current projects, although, as the list only includes projects with international donor funding, it may not give a complete picture. In total, 128 adaption projects were found, with 92 focusing only on one hotspot country (some of which also focus on countries outside the hotspot) and 36 on more than one hotspot country. Most are regional in scope with some spanning more globally.

As can be seen from Table 19, Vietnam is the recipient of the highest number of current projects, followed by Cambodia. Table 20 gives calculated estimates of funding for current adaptation projects in the hotspot, both in total and per year.

Table 19: Climate Adaptation Projects in the Indo-Burma Hotspot

Country	Single-country Focus	Regional or Global	Total
Cambodia	27	16	43
China (hotspot only)	3	7	10
Lao PDR	13	19	32
Myanmar	17	14	31
Thailand	5	13	18
Vietnam	27	29	56

Table 20. Estimated Volume of Climate Adaptation Project Funding per Hotspot Country

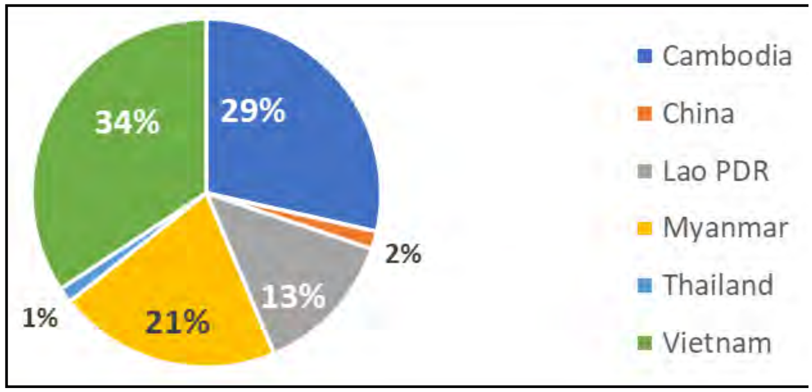
Country	Current Project Funding	Average Project Funding per year
Cambodia	$1,033,375,091	$127,422,574
China	$60,055,010	$6,855,220
Lao PDR	$486,891,850	$61,236,167
Myanmar	$747,910,194	$90,292,212
Thailand	$51,260,674	$5,611,981
Vietnam	$1,240,662,566	$171,539,377
Total	**$3,620,155,385**	**$462,957,531**

Notes: All project funding was converted into US$; funding was divided by the total project duration, assuming even spending each year; when a fixed project duration was not given, a period of 10 years was assumed; funding for projects covering several countries was divided equally among the beneficiary countries; and funding for projects addressing both adaptation and mitigation was split 50/50 between them.

Figure 24 shows how current funding for adaptation projects is divided between the countries in the hotspot, based on the estimates in Table 20. Vietnam is the largest recipient of international funding, with Cambodia a close second. Thailand and China (the provinces in the hotspot) are receiving the least.

A large proportion of the adaptation projects focus on the lower Mekong Region and the Mekong Delta in particular. The projects are wide ranging in nature and focus, and include initiatives related to: technical assistance and capacity building; ecosystem-based adaptation; climate change (especially flood) resilience infrastructure; support to prepare and submit policy documents; sustainable agriculture and aquaculture; water resource and catchment management; early warning systems; food security; sustainable forest management; and urban planning. Some of the projects are classified as both mitigation and adaptation. The classification of a project as an adaption project is often used in a broad sense, which captures general activities to promote conservation and sustainable use of natural resources, as these enhance the resilience of ecosystems to climate change.

Figure 24. Estimated Volume of Climate Mitigation Projects Funding per Hotspot Country



Ecosystem-based adaptation refers to a subset of adaptation approaches, in which the vulnerability of people to climate change is reduced through the conservation, restoration, and management of ecosystems. This is increasingly being used as an approach for adaptation, both globally as well as in the hotspot. Examples include mangrove and coastal habitat restoration instead of seawalls for shoreline protection, planting vegetation on slopes to prevent landslides, and managing forests and wetlands sustainably to regulate water flow and prevent erosion (Rao *et al.* 2013, Seddon 2018, Reid *et al.* 2019). Ecosystem-based adaptation, if properly implemented, can be a cost-effective method of safeguarding biodiversity and ecosystem services while also addressing climate change, as well as bringing multiple co-benefits, such as increased carbon storage. However, ecosystem-based adaptation projects are often not implemented with sufficient funding nor with proper application of science and local knowledge (Seddon 2018, Reid *et al.* 2019).

Most, if not all, of the adaptation projects in the hotspot, including ones that adopt ecosystem-based adaptation approaches, have got the interests of humans at their core, rather than those of biodiversity, namely minimizing the impacts of climate change on human livelihoods, security, health, and food supply. Most projects focus on ecosystems important to human wellbeing, which may result in, for instance, mangrove projects that do not include nearby grasslands or peat swamp forest, or upland forest projects that do not include restricted montane vegetation communities. In both cases, the latter are of equally or higher priority for biodiversity conservation.

10.6 Factors Influencing Conservation Efforts

Factors that hinder conservation efforts when addressing the impacts of climate change can generally be divided into three areas: lack of specific knowledge on conservation need; capacity gaps; and the role of civil society.

10.6.1 Lack of Specific Knowledge on Conservation Need

The knowledge of climate change impacts is still very general, and largely based on broad projections of future trends. It is expected that climate change will become a major driver of biodiversity loss but, as most models only predict a snapshot of the future, often towards the end of the century, it is unclear when during this century the biodiversity loss may happen and whether the process will be gradual or abrupt (Trisos *et al.* 2020). More research is needed to be able to base conservation priorities on facts and science, in order to ensure that conservation outcomes will be achieved. This is the case in general in the world as well as specifically in the Indo-Burma Hotspot. A lot of conservation efforts focus on keystone, indicator, and umbrella species, as well as flagship species for raising awareness. More research needs to be done to see how these species will adapt to climate change, as well how their ecosystems will adapt and whether that will affect their status as keystone, indicator or umbrella species, or, if not, which species might take over these positions.

10.6.2 Capacity Gaps

Many of the hotspot countries lack institutional capacity at state and provincial levels to adequately implement policies on climate change and biodiversity conservation. Capacity gaps in government institutions range from lack of technical knowledge to the inability to enforce regulations effectively. The governments in all six countries have introduced policies and regulations regarding climate change and, to a varying degree, have mainstreamed climate concerns into public policy in different sectors. However, with the exception of China, the governments of the hotspot countries acknowledge in their INDCs that they need help with capacity building, technology transfers and financial aid to translate policies into action in order to achieve their goals on climate change mitigation and adaptation, with some making their mitigation contributions conditional on receiving said support.

The imperatives of achieving economic development and security are often at odds with conservation targets, especially as environmental costs can often be hidden in monetary terms. In the long-term, neither sustained economic development nor security can be achieved without healthy ecosystems that deliver essential services. However, the need to preserve and enhance natural capital is often relegated below short-term economic and political realities. For instance, policies to subsidize petroleum products and electricity may provide some poverty relief but is in direct conflict with the national targets of reducing fossil fuels and GHG emissions (Prakash, 2018).

Climate change is costly, both in adapting to the locked-in adverse effects (for example, heightened frequency of natural disasters), as well as trying to mitigate further climate change, and the price tag is only going to increase each year. The hotspot countries need help from the international community with implementing the measures set out in their INDCs. As the impacts of climate change take hold and the number of climate migrants increases, public sector institutions and state budgets in the countries are likely to be put under further pressure.

Despite most people having now been impacted by changing weather patterns and the degradation of ecosystems, the awareness among the general public of the value and vulnerabilities of ecosystems, and their link to climate change, is still limited. While awareness is increasing in society on the need to tackle climate change, there is still a long way to go. Moreover, there is a widespread shortfall in technical capabilities and resources to implement adaptation initiatives, for instance in the start-up funding to purchase climate-resilient seeds, leaving people unable to translate awareness into action. Most of the current mitigation and adaptation projects in the hotspot include a focus on disseminate information, capacity, and technology to the population.

10.6.3 Role of Civil Society

The extent to which civil society is empowered to take a leading role in climate change initiatives will be critical to determining the success of such efforts. The massive scale of potential climate change impacts in the hotspot area, involving many millions of people, is clearly beyond the power of government agencies and international efforts alone. Mobilizing the support and active involvement of communities throughout the hotspot will be necessary to limiting impacts to people and biodiversity. Civil society groups that work at the community level are in the best position to identify how specific communities are affected by climate change, and can help with finding the right solutions that fit local cultures and ecosystems (Plan International 2018).

CSOs are increasingly getting involved in climate change mitigation and adaptation. This ranges from small, informal village and women’s groups, to larger professional agencies that might have international funding and are able to advocate their governments. One example is the newly established Vietnam Coalition for Climate Action, which brings together leaders from businesses, financial institutions, universities, communities and civil society to accelerate low-carbon development (WWF 2020). Other examples include the Rivers Coalition of Cambodia, which aims to make sure that all existing and future hydropower dam projects respect the rights of the affected people and ensure the sustainability of the environment and livelihoods (RCC 2020). Most REDD+ projects are engaging civil society and community groups as part of their sustainable development component, for instance via the NGO RECOFTC, which runs several REDD+ projects (RECOFTC 2020).

There are lots of CSOs working on climate change issues at different levels in the hotspot. However, there is some concern about the extent of freedom these organizations have, for instance, to advocate their governments about climate change policies, especially in China and Lao PDR.

10.7 Conclusion

Climate change will have a significant impact on the Indo-Burma Hotspot, impacts that could be devastating to the biologically rich ecosystems there. Three main messages stand out. First, GHG emissions are still on an upwards trajectory, despite the growing understanding of climate change, its drivers and impacts, and what needs to be done. The desire of people to achieve short-term economic prosperity is overshadowing the need to conserve natural ecosystems in the long run. Unless drastic action is taken soon, chances are that the internationally agreed targets on GHG emissions will not be met, meaning that the goal of limiting global average temperature increase to within 1.5 to 2°C will be missed. This means that there is a very high risk that the impacts on biodiversity and ecosystems could be even worse than projected.

Second, the knowledge about what might happen to species and ecosystems in the hotspot under different climate change scenarios is lacking in detail. Several models have been used to estimate these impacts but they all provide general snapshots of what might be the case, often with a timeframe towards the end of the century, without any specific details. More detailed research is needed to determine how particular species and ecosystems will react and adapt, and whether the keystone, indicator and umbrella species will change or stay the same. Conservation efforts should then be adapted accordingly.

Third, as awareness of the adverse impacts of climate change increases, so hopefully will funding for mitigation and adaptation projects. Currently, however, most of the mitigation and adaptation projects have got economic interests at their core, focusing on habitats of importance to human livelihoods and wellbeing, for example. This can result in some biodiversity rich habitats being overlooked or under-funded (for example, montane ecosystems and grasslands). Even worse, in the absence of appropriate safeguards, there is a risk of them being degraded through, for instance, planting with fast-growing exotic tree species.

11. ASSESSMENT OF CURRENT CONSERVATION INVESTMENT

11.1 Introduction

This chapter presents the results of an assessment of recent investments in biodiversity conservation in the Indo-Burma Hotspot, in order to help identify funding gaps and opportunities, and help to refine the niche for future CEPF investment in the region. The assessment focused on investments that anticipated either direct biodiversity conservation results, or significant indirect results. It excluded investments that were considered unlikely to generate direct or indirect conservation outcomes.

The assessment was conducted in April and May 2020 and was based on analysis of more than 1,600 investments (in the form of grants or similar instruments) made by more than 100 different donors over a five-year period from January 2015 to December 2019, as well as interviews with 28 key stakeholders. This five-year timeframe was chosen to allow comparison with the results of a similar assessment that took place in 2011, which covered the period 2006 to 2010 (CEPF 2012).

While it is not possible to exhaustively identify every biodiversity conservation investment made in Indo-Burma during this period, the data that were collated on more than 1,600 individual investments are considered to provide a representative sample sufficient for the needs of the analysis. For comparison, the analysis of investment during 2006-2010 was based on more than 700 grants awarded during that period (CEPF 2012).

Data collection took place through a combination of web searches (particularly for major bilateral and multilateral donors), direct enquiries to donors and recipients, and consultation with key donors and implementers. For each investment, data were collected on donor, donor type (bilateral, multilateral, fund/foundation, etc.), country (or countries) of implementation, grantee, currency, value, start and end dates, and project title (to allow identification of the theme addressed by the project, such as species conservation, sustainable natural resource management, civil society capacity building, etc.).

A significant proportion of investments were made in currencies other than United States dollars (US$), particularly investments made by bilateral donors other than the USA. In these cases, grant values were converted to US$ using historical exchange rates applicable at the grant commencement date (using www.oanda.com/currency/converter).

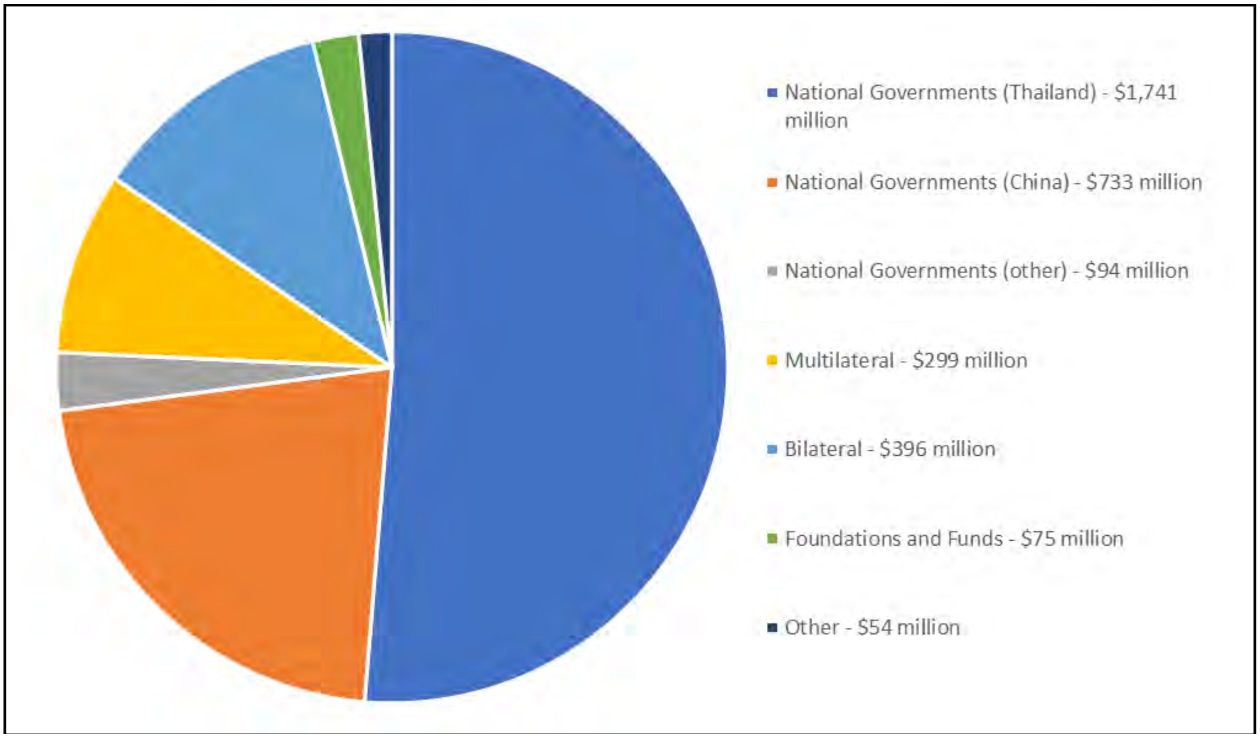
For investments made in multiple countries, including one or more outside the Indo-Burma Hotspot, grant values were discounted according to the proportion of countries of implementation that are within the hotspot. For example, a project implemented throughout the ASEAN region would be discounted by a factor of 0.5, as only five of the 10 ASEAN Member States are within Indo-Burma. Similarly, for investments executed over a period that extends before January 2015 or after December 2019, grant values were discounted according to the proportion of the grant term that fell within this period.

It is acknowledged that discounting grant values by country and grant term is a potential source of error, as it assumes that budget expenditure is evenly spread across countries of implementation, and grant term (which, in reality, is rarely the case). However, it is considered unlikely that this error is sufficiently large as to undermine the key findings of this analysis.

11.2 Major Sources of Investment in the Hotspot

During the period 2015-2019, national governments, bilateral and multilateral donors, foundations and funds, and other entities invested at least $3.4 billion in biodiversity conservation in the Indo-Burma Hotspot (Figure 25). This supported work on themes including species conservation, protected area establishment and management, combating illegal wildlife trade, sustainable natural resource management, civil society capacity building, conservation financing, and associated initiatives (see Section 0).

Figure 25. Value of Conservation Investment in the Indo-Burma Hotspot by Source (2015-2019)



The majority of this investment ($2.6 billion) represents spending by governments within the region, with funding from all other sources accounting for $824 million (or 24 percent of the total). This represents a near six-fold increase in total investment from 2006-2010. Spending by national governments has increased 6.4 times, from about $400 million, while spending by 'international sources' (i.e. sources other than national governments; predominantly from outside the hotspot countries but with around 1 percent coming from local private sector and philanthropic sources) has increased 4.3 times, from $200 million (Critical Ecosystem Partnership Fund 2012). These different rates of investment growth from different sources have resulted in the ratio of investment from national to international sources increasing from about 2:1 in 2006-2010 to 3:1 in 2015-2019.

11.2.1 National Governments

Biodiversity conservation remains a low budgetary priority for most governments within the Indo-Burma region. Three of the six nations (Cambodia, Lao PDR and Myanmar) are considered Least Developed Countries by the United Nations Department of Social and Economic Affairs, and, as such, their governments have limited revenue to allocate to biodiversity conservation.

Table 21. Estimated Total Government Budget Contributions for Conservation (2015-2019)

Country	Estimated Investment (million $)	Detail	Data sources
Cambodia	6	Based on General Directorate of Nature Conservation and Protection (GDNCAP) and General Directorate of Local Communities (GDLC) annual budgets	www.cambodianbudget.org MoE (2017)
China (Hong Kong SAR)	450	Based on reported annual budgets of the Nature Conservation and Country Parks Program of the Hong Kong Agriculture, Fisheries and Conservation Department	www.legco.gov.hk
China (Mainland)	283	Based on national and provincial level government financial reporting, factored by proportion of each province within the Indo-Burma Hotspot	State Forestry Administration Guangdong, Guangxi, Hainan and Yunnan Forestry Bureaus
Lao PDR	0.4	Based on National Protected Area annual budgets	MAF (2020)
Myanmar	7	Based on Nature and Wildlife Conservation Division (NWCD) annual budgets	Emerton *et al.* (2020)
Thailand	1,741	Based on Department of National Parks (DNP) annual budgets	www.dnp.go.th
Vietnam	81	Based on reported average public spending per square kilometer, and total area of centrally and provincially managed protected areas	Emerton *et al.* (2015) MoNRE (2015)
Total	**2,569**		

Despite this, spending by these governments (including both national government agencies, and sub-national government) represented the single largest source of investment in biodiversity conservation during 2015-2019, estimated at $2.6 billion (Table 21), or more than $500 million per annum. However, this figure represents only 0.0002% of the region's annual Gross Domestic Product (GDP) (about $320 trillion in 2018 (World Bank 2020c)), or just under $1.50 per person per year (based on an estimated regional population of 346 million; Table 5). This investment principally represents funds associated with the management of national protected area networks, including salaries for protected area management staff, infrastructure, equipment, and operating costs.

As accurate and detailed data on national government budgets for biodiversity conservation (including protected area management) are very difficult to come by, these figures are derived from a variety of sources, and, as such, should be treated with some caution. Moreover, as government conservation investment is difficult or impossible for civil society to access, and because there is limited monitoring and evaluation of the impacts of this investment on biodiversity conservation, it makes a relatively limited contribution to addressing the funding priorities for CSOs identified in this ecosystem profile.

11.2.2 Multilateral and Bilateral Donors

Multilateral Agencies

The major multilateral agencies making investments in the Indo-Burma Hotspot associated with biodiversity conservation between 2015 and 2019 were the ADB, the GEF, the United Nations Food and Agriculture Organization (FAO), UNDP and the World Bank. During this period, these donors supported a combined total of at least 300 initiatives with a total value of more than $350 million, including 179 GEF small grants (Table 22).

Table 22. Conservation Investment by Multilateral Agencies (2015-2019)

Donor	Main Countries of Intervention	Main Areas of Intervention	Estimated Investment (million $)
ADB	Hotspot-wide	Landscape-scale initiatives in Lao PDR and Vietnam. PFES in Vietnam. Sustainable development and sustainable natural resource management.	19.1
FAO	Lao PDR, Myanmar, Thailand, Vietnam	Forest Law Enforcement Governance and Trade. Ecosystem-based climate change adaptation.	14.6
GEF (UNDP as Implementing Agency)	Cambodia, Lao PDR, Thailand, Vietnam	Landscape-scale investment in Lao PDR, Thailand and Vietnam. Improving protected area management. Sustainable natural resource management.	66.6
GEF Small Grants Program	Cambodia, Lao PDR, Thailand, Vietnam	Community-based sustainable natural resource management and sustainable development. Small grant support for local CSOs. Capacity building and education.	4.3

Donor	Main Countries of Intervention	Main Areas of Intervention	Estimated Investment (million $)
World Bank	Cambodia, Lao PDR, Vietnam	Multi-million-dollar sector-wide investments to governments in the region. Sustainable development and 'green growth'. Climate change adaptation.	190.2
Other	Hotspot-wide	ICIMOD Landscape Initiative for Far-eastern Himalayas (Hi-LIFE) (including Myanmar). IUCN/GEF sustainable management of peatlands project. Various other smaller investments	4.2
Total			**299**

The major source of multilateral investment during this period was the World Bank, which implemented five GEF projects in Lao PDR and Vietnam, with a total value of $13.8 million, and made a further 14 investments in Cambodia, Lao PDR, and Vietnam, with a total value of $176 million. For the purposes of the analysis, it was decided to omit the World Bank's $387 million *Mekong Delta Integrated Climate Resilience and Sustainable Livelihoods Project* and $90 million *Climate Change and Green Growth in Vietnam* development policy financing, as they do not have a particular focus on biodiversity (instead focusing on climate change-resilient livelihoods and infrastructure).

Although it represents only a very small proportion of the total multilateral investment in the region, the GEF Small Grants Program, implemented by UNDP, has continued to support a large number of initiatives implemented by local CSOs, on themes such as community-based sustainable natural resource management.

Table 23. GEF STAR Allocations for Countries in the Indo-Burma Hotspot (GEF 2020)

Country	Biodiversity Focal Area (million $)			Total Allocation (million $)		
	GEF-5	GEF-6	GEF-7 (initial allocations)	GEF-5	GEF-6	GEF-7 (initial allocations)
Cambodia	3.85	4.29	3.42	7.28	8.59	6.42
China*	49.37	58.55	33.85	211.69	194.5	118.38
Lao PDR	6.11	6.87	5.07	10.86	11.58	8.07
Myanmar	7.62	10.98	9.84	15.35	30.26	15.59
Thailand	9.05	10.26	9.60	31.36	27.83	18.56
Vietnam	12.12	13.17	13.00	27.51	26.05	18.01

Source: GEF (2020); Note: * = figures for the whole country.

The GEF continues to be a major source of biodiversity conservation funding within the region, through GEF Implementing Agencies including ADB, UNDP, and the World Bank. Funding under the biodiversity focal area has remained a significant component of GEF System for Transparent Allocation of Resources (STAR) allocations under GEF-5, GEF-6, and GEF-7 (Table 23).

Bilateral Agencies

A large number of bilateral agencies supported initiatives associated with biodiversity conservation during this period, including AFD, the German Federal Ministry of the Environment, Nature Conservation, and Nuclear Safety (BMU), the German Federal Ministry of Economic Cooperation and Development (BMZ), the Ministry of Foreign Affairs of Denmark (Danida), the UK Department for Environment, Food and Rural Affairs (DEFRA), the Australian Department of Foreign Affairs and Trade (DFAT), the UK Department for International Development (DFID), the EU, the German Agency for International Cooperation (GIZ), the International Climate Initiative (IKI), the United States Bureau of International Narcotics and Law Enforcement Affairs (INL), KfW, the Norwegian Agency for Development Cooperation (Norad), the Norwegian Ministry of Foreign Affairs (MoFA), the Swiss Agency for Development and Cooperation (SDC), the Swedish International Development Cooperation Agency (SIDA), the United States Agency for International Development (USAID), and the United States Fish and Wildlife Service (USFWS).

These agencies made a total of at least 450 individual investments in the region with a total value of $396 million (Table 24) (including more than 150 grants by USFWS under various species-focused conservation funds).

Table 24. Conservation Investment by Bilateral Agencies (2015-2019)

Donor	Main Countries of Intervention	Main Areas of Intervention	Estimated Investment (million $)
AFD	Lao PDR	Conservation of Nam Kading National Protected Area.	1
BMU	Vietnam	Ecosystem resilience to climate change in Vietnam, including a focus on protected areas and wetlands.	15.5
BMZ	Cambodia, Lao PDR, Myanmar, Thailand, Vietnam	Biodiversity-based products as a source of livelihood improvement and biodiversity conservation.	5.5
DANIDA	Cambodia, Myanmar, Thailand, Vietnam	The *Mangroves for the Future* initiative.	4.3
DEFRA	Hotspot-wide	Species conservation through the Darwin Initiative. Combating wildlife trafficking through the Illegal Wildlife Trade Challenge Fund.	9.4
DFAT	Cambodia, Lao PDR, Myanmar, Thailand, Vietnam	Integrated coastal zone management in Vietnam. Transboundary water governance. Management of the environmental impacts of hydropower development.	37.3

Donor	Main Countries of Intervention	Main Areas of Intervention	Estimated Investment (million $)
EU	Hotspot-wide	Fisheries sector reform in Cambodia. Sustainable models of protected area financing. Transboundary water management. Combatting illegal wildlife trade.	57
GIZ	Hotspot-wide	Ecosystem-based climate change adaptation. Institutional strengthening. Transboundary natural resource management. Combating illegal wildlife trade,	32.2
IKI	Lao PDR, Thailand, Vietnam	Forest carbon stocks and REDD+. Reducing deforestation and forest degradation. Ecosystem resilience to climate change.	35.6
INL	Vietnam	Improving effectiveness of law enforcement to combat illegal wildlife trade.	8.5
KfW	Lao PDR, Myanmar, Vietnam	ASEAN Centre for Biodiversity (ACB) small grants program focusing on management of ASEAN Heritage Parks in Myanmar and Vietnam. Wetland management and conservation in Cambodia and Lao PDR. *Integrated Conservation of Biodiversity and Forestry* project in Lao PDR.	44.5
Norad	Myanmar, Vietnam	REDD+ in Myanmar and Vietnam. Conservation of forest biodiversity in Myanmar.	19.3
MOEJ	Hotspot-wide	Support for the East Asia – Australasia Flyway Partnership and the Global Coral Reef Monitoring Network.	1
MoFA (Norway)	Myanmar	Norway-Myanmar Bilateral Environmental Program.	11
SDC	Cambodia, Lao PDR, Myanmar, Vietnam	*Building River Dialogue and Governance* (BRIDGE) project, phase III. Community-based natural resource management in Myanmar.	7.7
SIDA	Cambodia, Myanmar, Thailand, Vietnam	*Mangroves for the Future* phase III. Climate change adaptation and natural resource rights in Cambodia.	10
USAID	Cambodia, Vietnam	Landscape-scale investments in Cambodia (SFB, *Greening Prey Lang*) and Vietnam (VFD, *Green Annamites*). Large regional initiatives aimed at combating illegal wildlife trade at the regional level (*Wildlife Asia*) and in Vietnam (*Saving Species*).	82.2

Donor	Main Countries of Intervention	Main Areas of Intervention	Estimated Investment (million $)
USFWS	Hotspot-wide	Small grants (typically $60,000) to local and international NGOs for projects addressing conservation of Asian elephant, marine turtles and tiger, and projects combating illegal wildlife trade.	8.5
Other	Hotspot-wide	Investment in Cambodia, Myanmar and Vietnam by DFID. Investment in Lao PDR and Myanmar by FCO for combating illegal wildlife trade. Investment in Cambodia and Myanmar by US Forest Service. Investment by the governments of Belgium, Finland, Japan, the Republic of Korea, and others.	5.6
Total			**396**

By investment value, the largest single bilateral donor during this period was USAID ($82 million). Notable initiatives supported by USAID included:

- The *Supporting Forests and Biodiversity* (SFB) project, implemented by Winrock International with the government of Cambodia and various civil society partners, which aimed to improve the conservation and governance of Cambodia's Eastern Plains and Prey Lang landscapes.
- The *Green Annamites* project, implemented by ECODIT with the government of Vietnam and civil society partners, which aims to protect globally significant biodiversity and support community livelihoods in Thua Tien Hue and Quang Nam provinces.
- The *Vietnam Forest and Deltas* (VFD) program, implemented by Winrock International with the government of Vietnam, which, since 2018, has focused on developing Vietnam's PFES system.

The EU supported a number of notable initiatives during this period, including fisheries sector reform in Cambodia, developing sustainable models of protected area financing in Cambodia, Lao PDR and Myanmar (with WCS), sustainable aquaculture in Myanmar (with GIZ), support to the MRC for sustainable transboundary water management, and efforts to combat illegal wildlife trade.

11.2.3 Foundations and Funds

At least 50 different foundations and funds invested in biodiversity conservation in Indo-Burma during 2015-2019, making at least 600 grants with a total value of more than $75 million (and an average value of about $175,000) (Table 25). Of these, the most significant (by value invested) were Margaret A. Cargill Philanthropies ($16.6 million), CEPF ($13.2 million), and the McKnight Foundation ($7.4 million). A significant proportion of this investment (at least $18.2 million) was made collectively by a variety of small foundations (such as family foundations), many of whom operate largely anonymously and make grants by invitation only.

Table 25. Conservation Investment by Foundations and Funds (2015-2019)

Donor	Main Countries of Intervention	Main Areas of Intervention	Estimated Investment (million $)
Arcus Foundation	Cambodia, China, Lao PDR, Myanmar, Vietnam	Species-focused primate conservation.	2.4
Critical Ecosystem Partnership Fund	Hotspot-wide	Species-focused conservation. Combating illegal wildlife trade. Community-based site conservation. Mainstreaming biodiversity into development. Civil society capacity building.	13.2
Fondation Segré	Cambodia, Lao PDR, Myanmar, Thailand, Vietnam	Species-focused conservation.	3.2
Helmsley Charitable Trust	Myanmar	Civil society capacity building. Marine Protected Areas (MPAs). Ecosystem and landscape-scale initiatives.	5
MacArthur Foundation	Cambodia, China, Vietnam	Protected area and natural resources governance and management. Monitoring conservation effectiveness. Community and biodiversity resilience to climate change.	3.9
Margaret A. Cargill Philanthropies	Cambodia, Lao PDR, Myanmar, Thailand, Vietnam	Biodiversity-friendly fisheries. Fisheries monitoring and science. Conservation and natural resource management at multiple scales. Capacity building to strengthen conservation leadership.	16.6
McKnight Foundation	Cambodia, Lao PDR, Thailand, Vietnam	Community rights to land and natural resources. Empowering local communities. Advocacy for sustainable and equitable development. Small grant support to local CSOs. Information sharing and participation.	7.4
Mohamed bin Zayed Species Conservation Fund	Hotspot-wide	Small grants (generally up to $12,000) for species-focused conservation.	0.3

Donor	Main Countries of Intervention	Main Areas of Intervention	Estimated Investment (million $)
Rainforest Trust	Hotspot-wide	Facilitating formal protected area establishment for unprotected sites of high biodiversity value (particularly in Cambodia, Myanmar and Vietnam).	2.3
Rufford Foundation	Cambodia, Lao PDR, Myanmar, Thailand, Vietnam	Small grants (less than $10,000) to individuals for species research and conservation.	0.5
Save Our Species	Cambodia, Lao PDR, Thailand, Vietnam	Species-focused conservation initiatives (such as Irrawaddy dolphin, freshwater turtles and saola).	0.36
The McConnell Foundation	Lao PDR	Community-based water resources management. Access to justice. Support to the Lower Mekong Network.	1.7
Other	Hotspot-wide	Investment by a various funds and foundations (including family foundations), many of whom operate on a by-invitation basis, and largely anonymously. Major focus on species and site-based conservation.	18.2
Total			**75**

11.2.4 Other

In addition to the 'traditional' bilateral and multilateral donors, and funds/foundations, several other donor types also invested in biodiversity conservation in Indo-Burma. These included international zoos and aquaria (such as Chester Zoo, Taronga Zoo, and Wildlife Reserves Singapore (WRS)), private companies (such as Coca-Cola, Marriott Hotels and Resorts, Nam Theun 2 Power Company, Thai Union Group, and Toyota Motor Corporation), high-net-worth individuals (such as those supporting the work of Rising Phoenix Co. Ltd in north-eastern Cambodia), and CSOs (such as the National Geographic Society, Synchronicity Earth, and the WWF network).

Although relatively small in total value, funding by international zoos made significant contributions to species-focused conservation in the hotspot, particularly by providing longer-term core support to local CSOs (rather than the short-term project-based funding generally offered by other types of donor). This is similar to the model of funding implemented by Synchronicity Earth, which seeks to provide a degree of financial stability to selected CSOs (such as Thailand's Living River Siam Association, and Save Vietnam's Wildlife) by providing modest levels of funding support for core operations, over several years.

Rapid economic development within the region has started to provide opportunities for private sector support for biodiversity conservation from within the region (particularly in

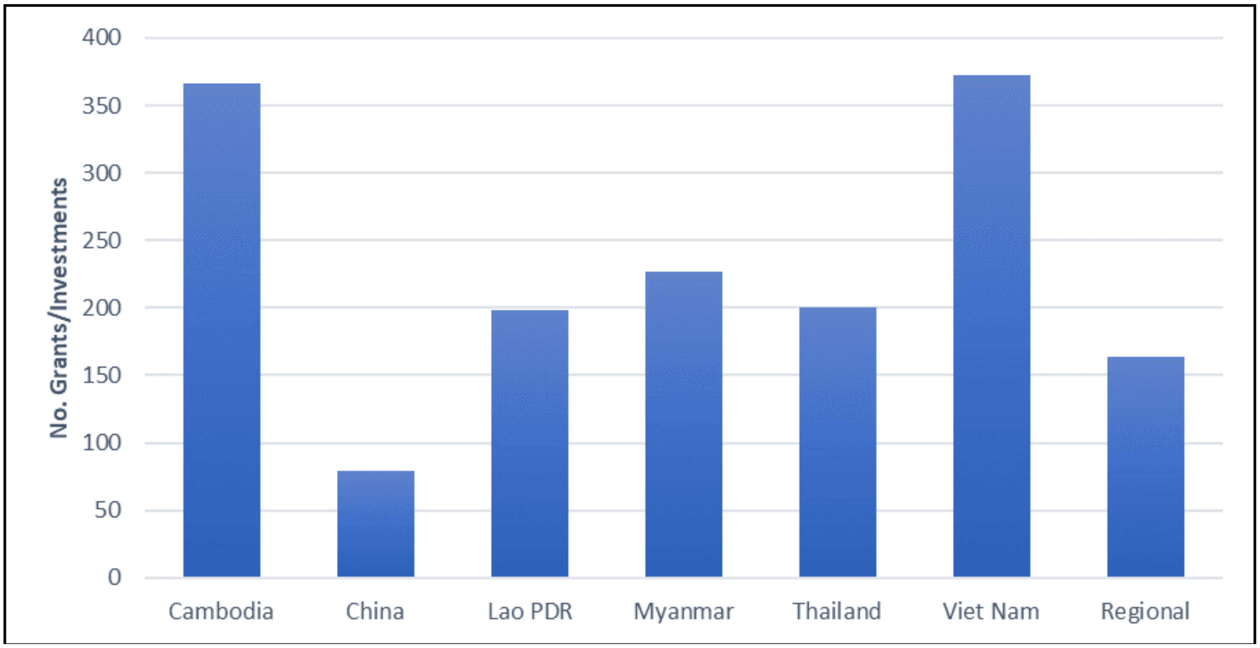
China, Thailand, and Vietnam), including through corporate social responsibility (CSR) initiatives, and efforts to mitigate the environmental and social impacts of development projects (such as the Theun-Hinboun hydropower project).

Total investment by 'other' funding sources during the study period was at least $54 million (including $24 million through the WWF network). This is likely to be a significant underestimate, however, as detailed information (particularly on private sector investment) is often not publicly available.

11.3 Summary of Investment by Country

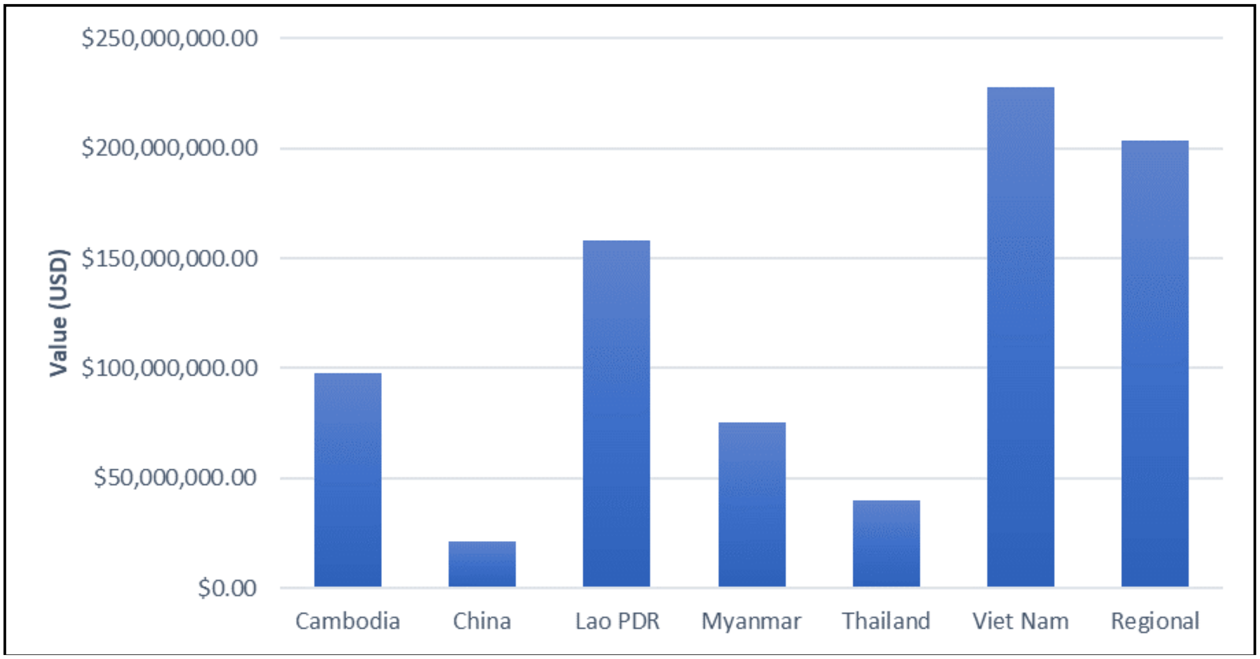
The data on investment by international sources (see Section 11.2) show a wide variation in level of investment among the six countries. In terms of number of grants awarded (or investments made) during the study period, Cambodia and Vietnam each received more than 350, Lao PDR, Myanmar, and Thailand each received about 200, China received about 80, and there were about 160 regional investments, implemented in more than one country within the hotspot (Figure 26).

Figure 26. Number of Conservation Grants by Country (2015-2019)



Variation among countries was more marked in terms of total value of investment per country. Vietnam received the most investment in the region, at nearly $230 million. Lao PDR received about $160 million, and the other countries each received less than $100 million. A large proportion of the total investment was for regional initiatives (Figure 27).

Figure 27. Value of Conservation Investment by Country (2015-2019)



Although the total value of investment made in 2015-2019 was much higher than in 2006-2010, the distribution of funds among countries remained broadly similar, with investments in Vietnam and regional investments receiving the highest proportion of funds in both periods, and China, Myanmar, and Thailand receiving the least. The most significant difference was the larger proportion of investment made in Lao PDR, which in 2015-2019 received significantly more funds than Cambodia. This can be attributed largely to major investments made in Lao PDR in recent years by multilateral donors, such as the World Bank's $38.6 million *Green Resilient Growth* project, which includes efforts to reduce the environmental impacts of hydropower, logging, and agriculture.

11.3.1 Cambodia

During the study period Cambodia received at least $98 million in biodiversity conservation investment, more than double that received in 2006-2010. The majority of this investment was from bilateral donors ($50 million), particularly USAID's landscape-scale initiatives and EU investment in fisheries sector reform. Multilateral donors only accounted for $18 million, including UNDP/GEF investment in landscape-scale conservation of biodiversity and carbon stocks in Cambodia's eastern plains.

Although funds and foundations collectively invested only $17 million in Cambodia during this period, this investment supported important efforts focused on species conservation and protected area management (while bilateral and multilateral investment was more focused on sustainable natural resource management and sustainable development). Examples include conservation of Cambodia's populations of Irrawaddy dolphin, freshwater turtles and large waterbirds.

At least $14 million was invested in biodiversity conservation in Cambodia by other donors during this period, including by high-net-worth individuals, private companies such as the Toyota Motor Corporation and Mitsui & Co., international zoos such as WRS, and the WWF network.

11.3.2 China

The areas of China within the Indo-Burma Hotspot received less investment in biodiversity conservation than any other country in the region, at only $21.5 million. However, this figure may be an underestimate, as data on investment by domestic funds and the Chinese private sector were not readily accessible. This limited investment from international sources likely reflects China's global economic status, and a perception that significant international biodiversity conservation investment is, therefore, unnecessary.

International biodiversity investment in China during this period was largely from multilateral sources ($14 million), particularly FAO/GEF investment in sustainable forest management and UNDP/GEF investment in wetland protected areas in Hainan, and MPAs along the coast of southern China. Bilateral investment ($4 million) included funding by DEFRA's Illegal Wildlife Trade Challenge Fund to WCS, Beijing Normal University, and the Zoological Society of London (ZSL), and USFWS grants for primate conservation and combating illegal wildlife trade.

11.3.3 Lao PDR

Aside from Vietnam, Lao PDR received more international investment in biodiversity conservation in 2015-2019 than any other country in the region, at $136 million. The majority of this investment ($98 million) was from multilateral sources, including $78 million from the World Bank for projects supporting protected area management, sustainable use of natural assets, and integrated water resources management.

Bilateral funding in Lao PDR was dominated by investment by KfW ($14 million) supporting the Lao Ministry of Agriculture and Forestry in "Integrated Conservation of Biodiversity and Forestry".

A relatively large number of investments were made in Lao PDR by funds and foundations, and other sources, although these were largely in the form of small grants (less than $50,000). These projects focused on themes including threatened species conservation and research (including support by the Arcus Foundation, CEPF, Save Our Species, and the Rufford Foundation), community-based fish conservation, civil society capacity building, community land rights and sustainable natural resource management, and efforts to mitigate the environmental impacts of hydropower development.

A notable example of private sector investment for conservation is the approximately $1 million per annum (index linked from a mid-2000s baseline) provided by Nam Theun 2 Power Company Ltd in support of Nakai Nam Theun National Protected Area. This is a legal obligation of the company under the Nam Theun 2 Concession Agreement, as compensation for biodiversity losses occasioned by the project. Other hydropower projects, such as Nam Ngiep 1, have similar components in their concession agreements.

11.3.4 Myanmar

More than $75 million was invested in biodiversity conservation in Myanmar during the study period, more than five times the investment made in 2006-2010. This investment came particularly from bilateral donors, with the Norwegian MoFA supporting a significant bilateral environmental program and the EU investing more than $21 million in a sustainable aquaculture program via GIZ.

As with other countries in the region, bilateral and multilateral donors investing in Myanmar tended to prioritize policy and institutional support, sustainable development, and sustainable natural resource management over species-focused investment (with notable exceptions such as DEFRA's Darwin Initiative and the KfW-supported *Integrated Tiger Habitat Conservation Program*). A larger number of species-focused investments were made by funds and foundations, including work supporting freshwater turtle conservation, gibbons and other threatened primates, Asian elephant (particularly in the Rakhine Yoma), and Irrawaddy dolphin.

11.3.5 Thailand

Thailand's current classification as a 'middle income' country by the World Bank (World Bank 2020b) precludes it from significant investment by many bilateral donors. In addition, Thailand's public spending for biodiversity conservation is far greater than that of any other country in the hotspot. As a result, Thailand is not a funding priority for many international donors, and the country received international biodiversity investment of just $40 million in 2015-2019.

The majority of this investment was made by multilateral agencies, particularly the GEF, through UNDP as an implementing agency, which invested more than $6 million in supporting conservation in the Western Forest Complex and $3 million in conservation, restoration, and management of peat-swamp ecosystems. The limited bilateral investment that was made in Thailand during this period largely comprised IKI funding for ecosystem-based climate change adaptation initiatives.

Only a relatively small number of international funds and foundations supported biodiversity conservation in Thailand, including CEPF, Fondation Segré, the Rufford Foundation, and some anonymous donors. Their investment included a focus on civil society capacity building, species-focused conservation (particularly focusing on tiger conservation), and efforts to support the effectiveness of law enforcement in and around protected areas.

A significant amount of biodiversity conservation work in Thailand was supported by domestic sources, such as the Thai private sector. While this study does include data on investments by companies including Thai Union Group, Toyota Motor Thailand and the Mall Group, it is likely incomplete, due to the large number of funding sources, the relatively small contribution of each, and the limited public availability of data.

11.3.6 Vietnam

Vietnam received the largest share of total conservation investment in the hotspot in 2015-2019, at $228 million. The vast majority of this investment came from bilateral ($111 million) and multilateral ($102 million) agencies, with the World Bank alone investing

$73 million through investments including protection of coastal forests and strengthening partnerships to protect threatened wildlife.

The GEF, through UNDP as implementing agency, was another significant multilateral donor during this period, investing in protected area management effectiveness and mainstreaming natural resource management and biodiversity conservation into socio-economic development planning.

The major bilateral donor for biodiversity in Vietnam in 2015-2019 was Germany, with significant investments made by BMU, GIZ, IKI, and KfW. These included BMU's support for protected area solutions for biodiversity and climate change, GIZ's work with MARD on forest biodiversity and ecosystem services, and IKI's support for ecosystem-based climate change adaptation and REDD+.

11.3.7 Regional Initiatives

Although the countries of Indo-Burma are diverse in terms of ecosystems, many of the threats facing biodiversity are shared throughout the region (such as habitat loss and degradation, illegal hunting of wildlife, and limited protected area management effectiveness). As a result, many donors choose to support multi-country initiatives, in order to increase the geographic scale of their conservation impacts and share learning and best-practices between countries.

During the study period, at least $229 million was invested by international donors in initiatives that focused on more than one country within the region. The majority of this investment ($163 million) was by bilateral donors, particularly USAID (including the large regional Wildlife Asia program that seeks to combat illegal wildlife trade), DFAT (investing in transboundary water governance), and IKI (supporting the Biodiversity Finance Initiative – BIOFIN and REDD+).

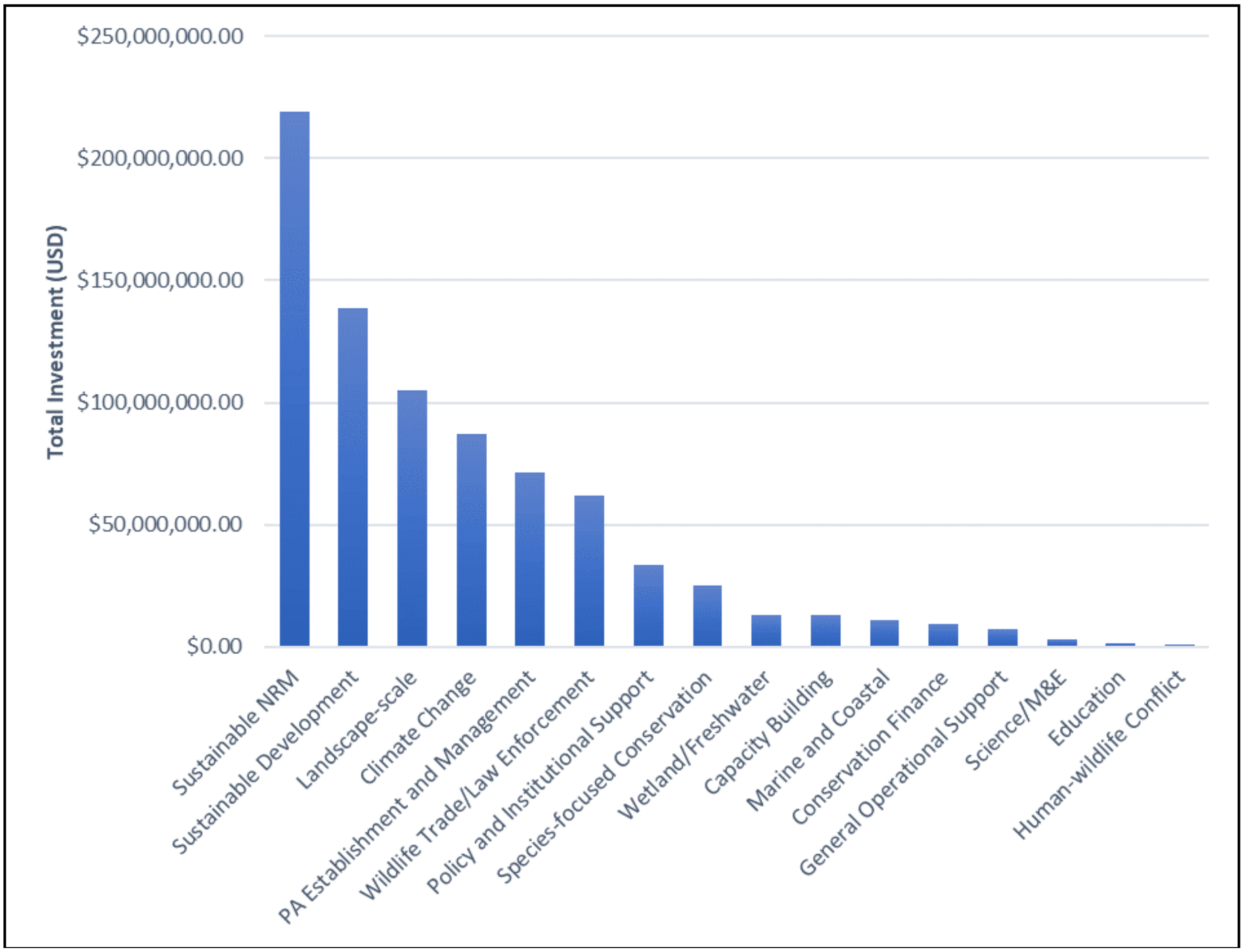
Although fewer investments by funds and foundations and other donors focused on multiple countries, some important work was supported. This included:

- Efforts supported by Margaret A. Cargill Philanthropies to share lessons learned in the Lower Mekong with the Ayeyarwady Basin (with WCS).
- Transboundary gibbon conservation between China and Vietnam supported by the Arcus Foundation (with FFI).
- Investment by CEPF to combat illegal wildlife trade networks operating between China, Lao PDR and Vietnam (with WCS).

11.4 Thematic Distribution of Investment

In addition to "core" biodiversity conservation initiatives (such as projects focusing on species conservation and protected area management), investments in a wide variety of approaches can generate direct and/or indirect conservation results. To illuminate the thematic distribution of investment in the region, each of the 1,600 investments analyzed by this study was assigned to one of 16 themes (Figure 28). For projects that likely addressed more than one theme, only a single theme was chosen. For this reason, there is likely to be some overlap between closely related themes, such as sustainable natural resource management, sustainable development, and landscape-scale conservation efforts.

Figure 28. Conservation Investment by Theme (2015-2019)



11.4.1 Sustainable Natural Resource Management

The Indo-Burma Hotspot has a large and rapidly growing human population, and a strong emphasis on natural resources sectors, such as agriculture, forestry and fisheries. Unsustainable natural resource management, such as large-scale conversion of forests to agricultural land, is a key driver of biodiversity loss in the region, and a priority for international donor investment.

During 2015-2019, the hotspot received at least $219 million of investment in sustainable natural resource management initiatives, including $95 million from the World Bank in the form of two large initiatives in Lao PDR and Vietnam. The *Forest Sector Modernization and Coastal Resilience Enhancement Project* in Vietnam included a focus on reducing economic incentives to convert coastal forests to agricultural land, while the *Mekong Integrated Water Resources Management* project worked with the MRC on various aspects of transboundary water and fisheries management and provided significant bilateral support to the Lao government.

Various other donors also had a significant focus on sustainable natural resource management, including DFAT and KfW support for transboundary water resources management (particularly through the MRC), USAID investment in Cambodia and Vietnam, and the McKnight Foundation's support for community rights to land and natural resources.

11.4.2 Sustainable Development

Over the last decade, the countries of the Indo-Burma Hotspot have undergone rapid economic growth (Table 26), much of which has been associated with exploitation of natural resources (see Chapter 7) and biodiversity loss (see Chapter 6). Many international donors support efforts for sustainable development, particularly framed around the 17 Sustainable Development Goals (SDGs). These include a focus on conservation and sustainable use of marine and terrestrial biodiversity (SDGs 14 and 15).

During 2015-2019, the Indo-Burma Hotspot received investment of at least $138 million for sustainable development initiatives. As with funding for sustainable natural resource management, the largest source of this investment ($55 million) was the World Bank, in the form of the *Green Resilient Growth* initiative in Lao PDR. This included targeted actions to reduce the environmental impacts of hydropower, logging and agriculture.

Table 26. GDP of the Hotspot Countries

Country	**GDP** (billion $)**	
	2008	**2018**
Cambodia	10.6	19.6
China*	5,029	19,582
Lao PDR	6.1	12.6
Myanmar	40.9	84.4
Thailand	319.5	441.7
Vietnam	103.4	187.7

Source: World Bank (2020c); Notes: * = figures for whole country; ** = real GDP based on constant 2010 prices.

Other notable sustainable development initiatives during this period included investment by the ADB for the *Nam Ngum River Basin Development Sector Project* in Lao PDR and the *Greater Mekong Subregion (GMS) Biodiversity Conservation Corridors Project*, BMZ for the ACB, and the EU for sustainable aquaculture development in Myanmar.

11.4.3 Landscape-scale Conservation

Indo-Burma includes several landscapes of particular importance for global biodiversity, including the Mekong River (and its major tributaries), the Annamite mountains between Lao PDR and Vietnam, Cambodia's Tonle Sap and its inundated zone, and the limestone mountains of northern Vietnam and southern China. As major threats to biodiversity often operate at the landscape scale (such as forest conversion to agricultural land, and the impacts of major hydropower development), several donors (particularly multilateral and bilateral donors) have chosen to fund large initiatives that operate at these scales.

During 2015-2019, investment of at least $96 million was made in landscape-scale conservation initiatives. Notable examples include GEF investment in the dry dipterocarp forests of southern Lao PDR, the USAID-funded SFB and *Greening Prey Lang* projects in Cambodia, and investment by IKI in the Central Annamites of Lao PDR and Vietnam. Although such initiatives successfully mobilized large amounts of funding for these landscapes, critics argue that biodiversity conservation impacts often do not scale with the value of such investment, and that a significant proportion of such resources can be lost before they reach the ground, due to multiple layers of administration.

11.4.4 Climate Change

Global climate change is now widely recognized as one of the most significant threats to the world's ecosystems and economies (Diaz *et al.* 2019). As such, it has become a major funding priority for international donors over the last decade. Investments of at least $87 million were made on this theme during 2015-2019, particularly by bilateral donors. These biodiversity-related investments represent only a small fraction of overall investment in climate change mitigation and adaptation over this period.

For example, IKI made total investments of more than $23 million, particularly in the Lower Mekong countries (Cambodia, Lao PDR, Thailand and Vietnam), on themes such as ecosystem-based climate change adaptation and resilience, and REDD+ (Reducing Emissions from Deforestation and forest Degradation, and the conservation and enhancement of forest carbon stocks). Norad supported at least 14 initiatives in Myanmar and Vietnam, including the $11 million *UN-REDD Vietnam Phase II Program*.

11.4.5 Protected Area Establishment and Management

Well managed protected areas remain one of the most effective tools for achieving biodiversity conservation (UNEP-WCMC *et al.* 2018). All of the countries in Indo-Burma have established networks of protected areas (and MPAs), although funding support and management effectiveness vary widely. Recent funding support for facilitating protected area establishment (such as that of Rainforest Trust) has, therefore, focused on sites of exceptional biodiversity value that are yet to receive formal protection. The majority of protected-area-focused funding has been to address gaps in management effectiveness, including by directly supporting the operations of protected area management staff.

During this period, investment in protected area establishment and management of at least $72 million was made in the region, particularly by multilateral and bilateral agencies. This included the World Bank's $17 million *Lao Environment and Social (Protected Areas and Wildlife) Project*, the $6 million GEF-funded *Strengthening Sustainability of Protected Area Management* project in Myanmar, implemented by UNDP, and the EU-funded *Biodiversity Conservation and Management of Protected Areas in ASEAN* project.

11.4.6 Wildlife Trade and Law Enforcement

Previously a niche topic, combatting illegal wildlife trade has become a significant focus of international donor investment in recent years. This has been driven particularly by the governments of the UK (through the DEFRA-managed Illegal Wildlife Trade Challenge Fund) and the US (particularly through the USAID *Wildlife Asia* (regional) and *Saving Species* (Vietnam) projects). The attention given to this issue can be expected to intensify in the near future, given the links between the trade in wildlife and the emergence of zoonotic diseases, such as COVID-19.

In 2015-2019, investment of at least $62 million was made in initiatives that addressed this theme in Indo-Burma. Although the majority of this was from bilateral sources (particularly USAID, INL, DEFRA, and the EU), significant investments were also made by the GEF, through UNDP, and various small funds and foundations.

11.4.7 Policy and Institutional Support

Effective biodiversity conservation depends on effective institutions implementing appropriate public policy. Institutional weaknesses and ineffective policy are common challenges faced by developing countries, with impacts far wider than biodiversity. As a result, policy and institutional support is a common theme of international investment, particularly by bilateral and multilateral donors.

In 2015-2019, the region received nearly $34 million in investment on policy and institutional support for biodiversity conservation. The largest single source of this investment was the Norwegian MoFA, which invested $9.6 million in supporting Myanmar's MoNREC through the Norway-Myanmar Bilateral Environmental Program. Other significant investments in this theme included GIZ's support for forest policy reform in Lao PDR and Vietnam, and GEF investment through UNDP in China, Lao PDR and Thailand.

11.4.8 Species-focused Conservation

Although various themes of investment can contribute to conservation, species-focused initiatives remain the most targeted response to threats directly addressing the fundamental unit of biodiversity: the species. By number, species-focused initiatives dominated the investments made in Indo-Burma in 2015-2019, with at least 410 individual grants awarded (153 more than the next most numerous investment theme: sustainable natural resource management). However, the average value of these investments was less than $70,000, and the majority were less than $30,000. In total, species-focused conservation received only $25 million in Indo-Burma in 2015-2019, about 3 percent of the total investment during that period.

The major donors for species conservation in Indo-Burma in 2015-2019 were funds and foundations, reflecting the limited ability of many bilateral and multilateral donors to provide dedicated support for species conservation. In addition to the well-known examples, such as the Arcus Foundation, CEPF, Fondation Segré, Mohamed bin Zayed Species Conservation Fund, and Save Our Species, at least $5.5 million in species-focused investment was made by diverse smaller foundations (including several family foundations). Several of these operate largely on an invitation-only basis and prefer to remain anonymous.

Some bilateral donors also made significant investments in species-focused conservation during this period. Examples include the KfW-funded *Integrated Tiger Habitat Conservation Program*, the large number of species-focused grants awarded by USFWS throughout the region, and DEFRA's Darwin Initiative.

11.4.9 Capacity Building

Indo-Burma's civil society has grown rapidly in the last decade, although significant challenges remain in terms of financial sustainability, governance, and the political space in which CSOs operate (see Section 11.6). Large numbers of CSOs operate throughout the region, focusing on themes including community-based natural resource management, education/awareness-raising, supporting the management effectiveness of protected areas, and informing public policy reform. Local civil society, if given the necessary tools and support, has the potential to generate long-term conservation impacts just as effectively, and potentially more efficiently, than international NGOs.

As a result, investments in civil society capacity building have become a priority for international donors. At least $13 million was invested in this during the study period, nearly half of which was by funds and foundations (including $1.8 million by CEPF). One notable capacity building initiative supported during this period was the Royal University of Phnom Penh Center for Biodiversity Conservation's Masters of Science in Biodiversity Conservation, which was established in partnership with FFI and, during the study period, received funding support from Margaret A. Cargill Philanthropies.

11.4.10 Wetland/Freshwater Conservation

The Indo-Burma Hotspot includes several freshwater systems of significant importance for biodiversity and local livelihoods, including the Mekong, its '3S' tributaries (the Sekong, Sesan, and Srepok), the Tonle Sap lake, and the Ayeyarwady, Salween (Nu/Thanlwin), Chao Phraya and Red Rivers. These systems are threatened by various factors, including the impacts of planned and current hydropower development, unsustainable fishing practices, channel modification for improved navigation, and pollution.

Conservation of wetland and freshwater biodiversity appears to have been a relatively low priority for international donors during 2015-2019, despite its connections to food security and sustainable rural livelihoods. Indo-Burma received investment of at least $13 million for this theme. Bilateral investment came particularly from BMU (for the *Mekong WET* project implemented by IUCN) and GIZ (with Cambodia's Ministry of Agriculture, Forestry and Fisheries (MAFF)). Several funds and foundations also invested in this theme, including CEPF, the MacArthur Foundation and Margaret A. Cargill Philanthropies.

11.4.11 Other Themes

International donors also supported work addressing a variety of other themes during 2015-2019, including marine and coastal conservation, conservation finance, environmental education, science/monitoring and evaluation, human-wildlife conflict, and general operational support. However, these themes were not significant funding priorities for many donors, and they received only modest levels of support compared with the above themes.

11.5 Trends in Conservation Investment over the Last Decade

There have been several changes in the conservation investment landscape of the hotspot over the past decade, including in terms of the total value of investment, the make-up of donors investing, and their thematic priorities and funding modalities.

As outlined in Section 11.2, there has been a significant increase in the value of investment made by both national governments and international sources. Total investment has grown from about $600 million in 2006-2010 ($119 million per annum) to $3.4 billion in 2015-2019 ($679 million per annum). This is a result of several factors, including: economic development of the countries within the region, allowing for greater public spending on biodiversity conservation; a growing understanding among international stakeholders of the urgency of implementing nature-based solutions to societal and environmental challenges in the region; and the increasing absorptive capacity of the region's public sector institutions and civil society.

Economic development in the hotspot has led to changes in the make-up of donors that are investing in biodiversity there. For example, some bilateral donors such as JICA, have largely withdrawn, leaving the governments of Germany, the UK, and the USA as the major bilateral donors remaining. In particular, Thailand's status as a 'middle income' country has resulted in a significant reduction of bilateral funding availability there.

Similarly, as economies and public institutions have grown and developed, the focus of international donors has shifted from poverty reduction and protected area establishment, to conservation through sustainable development and sustainable natural resource management.

Other significant changes in the thematic focus of international donors include:

- A reduced emphasis on species-focused conservation (perhaps based on an expectation that funding for sustainable development will also generate species conservation outcomes).
- A reduced emphasis on supporting the core management operations of protected areas (based on an expectation that government spending will be sufficient for effective protected area management).
- An increased emphasis on climate change funding, including mitigation, adaptation, ecosystem and community resilience, and carbon markets (based on global trends, including an understanding of the likely disproportionate impacts of climate change on developing countries).
- An increased emphasis on funding to combat illegal wildlife trade (led by the governments of the US and UK): a trend likely to continue in the future due to a greater global appreciation of the link between illegal wildlife trade and pandemics such as COVID-19.

In terms of funding modalities, there has been a growing trend (led by the GEF and continued by the GCF for large, multi-year (five years or longer) landscape-scale or thematic initiatives implemented by multilateral agencies alongside government environment and finance ministries, and executed by international NGOs. While such initiatives have been successful in mobilizing large volumes of funding, and have generated some worthwhile conservation results, critics argue that this model of funding is not an efficient use of resources and is largely inaccessible to local CSOs. Similarly, while large USAID projects have supported important work in several landscapes and themes, critics argue that the model of working through large US-based consulting firms is not an efficient use of resources, or likely to generate sustainable impacts within the region.

Although there may have been an increase in the number of funds and foundations investing in the region over the last decade, most of these organizations are relatively small, and many do not make their resources widely available through open calls for proposals.

In recent years, the MacArthur Foundation and McKnight Foundation have both announced their withdrawal from the region. These two donors supported a great deal of biodiversity conservation work in the hotspot over the last decade. Their absence will likely further increase demand for biodiversity funding from remaining donors, such as CEPF and USFWS.

11.6 Investments in Domestic Civil Society

The Indo-Burma Hotspot is now home to a large and growing domestic civil society, although a relatively small number of local CSOs focus specifically on biodiversity conservation (see Chapter 9). In countries such as Myanmar and Vietnam, these organizations have begun to enjoy increasing political space in which to operate, including opportunities to engage constructively with government bodies and inform public policy. Political space is more limited in Cambodia, China and Lao PDR, however, particularly for organizations that focus on politically sensitive issues such as hydropower development, and community rights to land and natural resources.

As domestic CSOs have grown in number and capacity, several international donors have increased their focus on awarding grants to local CSOs and addressing gaps in civil society capacity. For example, during 2015-2019, CEPF invested more than $1.8 million in this theme and awarded grants to 85 different local CSOs. This trend recognizes the fact that, for some types of work (such as working with local communities), local organizations may enjoy greater legitimacy in the eyes of local stakeholders, and, with lower overheads, may be able to generate conservation impacts more efficiently than international groups.

As the number of CSOs has increased, however, so has competition for funding. Local groups must often compete for resources with international NGOs, who typically enjoy advantages with regards to donor requirements to submit English-language proposals. Local CSOs may also struggle to comply with donor expectations of preparing detailed logical frameworks, responding to environmental and social safeguard policies, providing regular written progress reports, and meeting international standards for financial management.

Local organizations that are heavily reliant on support from a small number of international donors are vulnerable to changes in donor priorities, or their withdrawal from the region. Some organizations resort to shifting their thematic focus to address whatever topics donors are prioritizing at that time, leading to ‘mission drift’.

The most significant challenge facing many local CSOs is funding security. While many organizations only require modest sums to cover core costs, they often have very limited financial reserves, and can be seriously impacted by delays in fund disbursement, or gaps in funding. Many donors are only willing to award short-term (often one year) small grants to local CSOs, with budgets dominated by funds for project activities, and limited resources for core costs. Organizations have no guarantee that funding will continue in future years, which impacts their ability to retain experienced staff, meet the expectations of project stakeholders, and generate lasting conservation impacts. Notable exceptions to this include support for local CSOs by some international zoos and organizations such as Synchronicity Earth, who prioritize longer-term partnerships and technical support, rather than short-term, project-based funding.

The COVID-19 pandemic is likely to impact the financial security of local CSOs negatively, although the full scale and severity of this impact has yet to be seen. Some local CSOs are already reporting impacts on funding from international zoos and aquaria, as these organizations are experiencing dramatic reductions in revenue during 2020. The global recession that is likely to result from the pandemic may reduce the availability of biodiversity funding from all sources over the coming years, as donor governments reduce ODA, multilateral agencies increase their focus on economic support and public health, and other types of donor experience economic hardship. An exception may be funding for work combating illegal wildlife trade, given the link between illegal wildlife trade and the emergence of zoonotic diseases.

11.7 Strategic Funding Initiatives

Funding from international sources is inherently insecure. Bilateral funding, for instance, is vulnerable to the changing priorities of donor governments. By way of example, in 2020, the US government announced plans to cut annual expenditure by the USFWS Rhinoceros and Tiger Conservation Fund from about $3.5 million to $1.6 million (Mongabay 2020). Funds and foundations can be susceptible to 'donor fatigue' (particularly on issues such as biodiversity conservation that are capable of absorbing large sums of funding without necessarily producing many high profile success stories), and may choose to withdraw from supporting regions and themes at short notice. Moreover, while achieving biodiversity conservation outcomes requires long-term, sustained investment in sites, initiatives, and organizations, project-based funding by international donors generally prioritizes short-term impacts achieved during the life of the grant.

Public funding from within the region is potentially a more stable source of long-term investment. However, these economies are still developing, and (with the exception of China and Thailand) only very limited resources are available for biodiversity.

There is a need, therefore, for alternative models of biodiversity conservation funding. A number of options have been proposed for this, including biodiversity trust funds, Payments for Ecosystem Services (PES), REDD+, and other forms of private sector investment.

Biodiversity trust funds operate on the theory that, by investing capital, sufficient income can be generated to support protected area management at priority sites, or other conservation efforts. The Bhutan Trust Fund for Environmental Conservation is a successful example of this from elsewhere in Asia. Within Indo-Burma, this model has been applied in Cambodia (by the Central Cardamoms Protected Forest Trust Fund, established in 2016 with the support of CI) and Myanmar (by the Myanmar Biodiversity Fund, established in 2019 with the support of WCS). To date, however, both of these funds have struggled to attract sufficient capital to become fully operational.

PES is based on the assumptions that ecosystem services can be assigned an economic value, and that businesses benefiting from them can be required to make payments to the communities or bodies that own or manage these resources. There has been significant investment in PES in Indo-Burma over the last decade (particularly by USAID). Since 2011, Vietnam has operated a successful PFES system, which has made payments of more than $500 million through the Vietnam Forest Protection and Development Fund to thousands of households living upstream of hydropower dams and other 'service users' (USAID 2019). There are now plans in place (again supported by USAID) to expand Vietnam's PFES system to Carbon Payment for Forest Ecosystem Services (C-PFES), requiring Vietnam's 100 largest carbon emitters (cement manufacturers and coal-fired power stations) to pay up to $2 per metric ton of carbon emitted.

Critics of PES/PFES note, however, that payments are not performance-based. There is generally no explicit link made between the payments and protection of the resource in question. In the case of communities living in/around catchment forests, there is often no requirement for these forests to be well managed or well protected. Also, with payments usually made to communities rather than protected area management authorities, PES currently makes only limited contribution to biodiversity conservation at these sites.

REDD+ is another widely touted approach that seeks to provide financial incentives for forest conservation, including results-based payments for reducing deforestation, and trading 'carbon credits' by international governments and corporations. Much investment has been made in developing REDD+ in Indo-Burma over the last decade, particularly by IKI and Norad. More than $11 million of carbon credits from Cambodia's forests have been sold since 2016 (including $2.6 million to the Walt Disney Company), associated with forested land in Keo Seima Wildlife Sanctuary, Phnom Kravanh, Prey Lang, and Koh Kong (Phnom Penh Post 2019). Nevertheless, significant challenges must be resolved before REDD+ can be considered a viable tool for biodiversity conservation funding, particularly in countries experiencing systemic, unsustainable extraction of forest resources.

11.8 Gap Analysis

Although $3.4 billion was invested in biodiversity conservation in Indo-Burma over the last five years (including $824 million from international sources), significant threats to the hotspot's biodiversity remain. Clearly, the availability of financial resources is not the only limiting factor. For conservation to be more effective, the right people/organizations need to be provided with the right type of support, at the right time. While the resources available for investment in the hotspot by CEPF are only modest in the context of the overall funding landscape, they can have a disproportionate impact if they are well targeted.

The analysis presented in this chapter has illuminated a wide disparity in the thematic distribution of investment in recent years. Funding for sustainable natural resource management and sustainable development work accounts for nearly half of all investment recorded. Funding is also relatively abundant for landscape-scale initiatives and climate change projects. Less investment is available for explicit species-focused conservation, protected area management, combating illegal wildlife trade, capacity building, and wetland/freshwater conservation. These are all topics that CEPF has invested in significantly in recent years.

Stakeholders consulted during the update of the ecosystem profile consistently emphasized the lack of donor interest in funding species-focused conservation, despite this being a cornerstone of effective biodiversity conservation. This topic is a priority for only few major donors (such as the Arcus Foundation, CEPF, Mohamed bin Zayed Species Conservation Fund, USFWS, and the international zoo and aquarium community), who often only award relatively small grants. Moreover, a significant proportion of these grants focus on research activities rather than conservation ones. Funding availability is also skewed towards charismatic megafauna, such as tiger and Asian elephant.

In terms of the geographic distribution of funding by international donors, the limited investment in China and Thailand may reflect the perceived greater availability of domestic funding sources in these countries, the limited capacity of many Thai CSOs to comply with English-language application and reporting requirements, and the administrative challenges faced by Chinese CSOs in receiving international funds.

Although this study did not focus on the geographic distribution of funding at sub-national scales, stakeholders considered that the most high-profile conservation corridors (such as the Central Annamites, the Tanintharyi Range and the Western Forest Complex) are receiving at least some degree of international investment. CEPF resources may have the greatest added value where they focus on less high-profile landscapes, such as Myanmar's karst limestone, or Cambodia's 3-S basin.

11.9 Recommendations

With bilateral and multilateral donors increasingly prioritizing sustainable natural resource management and sustainable development initiatives over 'core' biodiversity conservation funding, and notable foundations such as the MacArthur Foundation and McKnight Foundation no longer investing in the hotspot, there remains a need for CEPF investment in Indo-Burma.

In terms of thematic focus, stakeholders urged CEPF to continue investing in species-focused conservation, particularly for non-charismatic species, and continue to support successful initiatives that have benefited from previous CEPF investment (such as primate conservation in Vietnam and freshwater turtle conservation in Myanmar).

Although the availability of funding for combating illegal wildlife trade has increased in recent years, given the scale of this threat to the hotspot's biodiversity, stakeholders encouraged CEPF to maintain it as a funding priority. Efforts should be made to target this funding to work that is not already well supported by other donors such as USAID and DEFRA. Given the link between illegal wildlife trade and pandemics such as COVID-19, there may be a niche for CEPF in supporting initiatives that seek to reduce the risk of zoonotic disease emergence.

Domestic CSOs are increasingly demonstrating their ability to lead genuine local environmental movements and generate sustainable conservation impacts. Stakeholders urged CEPF to continue its focus on building the capacity of local civil society in biodiversity conservation. Given that the stability of funding is a bigger challenge for local groups than the total level of funding awarded, CEPF could consider offering multi-year funding agreements to selected groups. These could be managed on an annual basis, with performance-based renewals.

CEPF small grants have supported important work in the region over the past decade. Nonetheless, stakeholders argued that, for many organizations, $20,000 is no longer sufficient to justify the administrative costs of managing such a grant. Stakeholders recommended that CEPF consider increasing the maximum value of small grants to $40,000 to $50,000. This may require CEPF to award a smaller total number of small grants, which could be accompanied by a greater degree of technical support and mentoring by the RIT.

In terms of geographic focus, stakeholders encouraged CEPF to continue targeting investment to KBAs. Stakeholders felt that the geographic priorities targeted by CEPF during the second phase (i.e., Sino-Vietnamese Limestone, Mekong and Major Tributaries, Tonle Sap Lake and Inundation Zone, Hainan Mountains, and Myanmar) remained valid, although CEPF could consider identifying specific geographic priorities within Myanmar.

Stakeholders encouraged CEPF to continue to utilize the RIT as a vehicle for coordinating investment with other funders, facilitating collaboration between CSOs, and seeking opportunities to foster long-term biodiversity funding from within the region. Opportunities may include collaboration with the IUCN Species Survival Commission (SSC) Asian Species Action Partnership (ASAP) or with upcoming funding streams planned by SOS, DEFRA, and other donors.

12. CEPF INVESTMENT NICHE

The ecosystem profile provides a shared situational analysis and overarching set of investment priorities that can facilitate coordinated support by CEPF and other funders for biodiversity conservation actions with a leading role for civil society.

The 2011 ecosystem profile was formulated through an inclusive, participatory process that engaged more than 470 stakeholders. During 2019 and 2020, the profile was updated, with inputs from more than 170 representatives of civil society, donor and government organizations. The profile articulates an investment strategy that focuses on those taxonomic, geographic and thematic priorities where additional resources can be used most effectively in support of conservation initiatives with a leading role for CSOs. At the same time, the profile focuses attention on activities that can contribute to protection of the rights and assets of the rural poor while addressing biodiversity conservation. The basic premise underlying the investment strategy is that conservation investment should be targeted where it can have the maximum impact on the highest conservation priorities while supporting the livelihoods of some of the poorest sections of society. Chapter 13 outlines a comprehensive investment strategy. Within this shared strategy, a niche for CEPF was defined that best fits with its approach, while playing to CEPF's unique strengths and contributing to the fund's global objectives.

The biodiversity of the Indo-Burma Hotspot is facing unprecedented levels of threat. Forests, grasslands and other terrestrial habitats are being degraded, fragmented and lost, primarily as a result of expansion of industrial agriculture and the interconnected threat of commercial timber extraction. Construction of hydropower dams and associated infrastructure is the principal threat to freshwater habitats in the hotspot, which make a disproportionate contribution to food security and rural livelihoods through provision of fish, irrigation, sedimentation and other critical ecosystem services. While more limited in extent, quarrying for cement production presents a severe threat to biodiversity, especially to hyperendemic species restricted to limestone karst formations. As terrestrial and freshwater habitats are fragmented, degraded and lost, their ability to support diverse communities of plant and animal (and presumably fungus and microbe) species is diminishing. At the same time, many of these species are under pressure from high and unsustainable levels of offtake, driven by demand for wildlife, timber and NTFPs both within and, in some cases, outside the hotspot. The number of species threatened with extinction is growing at an alarming rate, and a wave of extinctions appears imminent (if it has not already begun, unnoticed, among the invertebrate taxa that comprise the vast majority of multicellular life). These threats are compounded by global climate change, whose effects are just beginning to be observed in the hotspot but are predicted to become a major driver of biodiversity loss, especially in fragmented ecosystems under pressure from other threats.

With the level of resources available to it, it is not realistic that CEPF can directly address threats on this scale. Rather, CEPF needs to make strategic investments that demonstrate responses to key conservation issues that are effective both over time and in a range of different contexts. The experience from these demonstration projects can then be used to inform and inspire replication by other conservation practitioners, as well as uptake into larger initiatives supported by hotspot governments, international funders and, in the future, private sector actors.

To this end, the CEPF niche builds on the experience of the first two investment phases by focusing on approaches that have demonstrated success, moving from pilot projects to longer-term interventions, and integrating results more concretely into public policy and private sector practice. At the same time, the CEPF niche responds to major conservation issues, such as trade and consumption of wildlife, hydropower development, expansion of industrial agriculture and limestone quarrying, with strategies developed through extensive consultation with practitioners in the field. These strategies focus on the places where these conservation issues are most acutely felt: the Mekong River and its major tributaries; the Northern Plains seasonally inundated forests and Tonle Sap Lake and inundation zone in Cambodia; the limestone highlands along the Vietnam-China border; and Myanmar's Chindwin River and limestone karst landscapes. The overall objective of the new phase of CEPF investment will be to demonstrate effective, scalable approaches to major conservation issues that leverage the skills, experience and energy of civil society actors.

The implementation of this shared strategy will be coordinated through regular meetings between CEPF and other funders, under the auspices of the Lower Mekong Funder Collaborative. As other funders make decisions about investment in the region and develop their grant portfolios, CEPF will adapt the development of its own portfolio to avoid duplication, address gaps and take advantage of opportunities for collaboration, synergy and amplification. One important area for collaboration will be sharing experience among grantees of different funders. This was done with some success during the mid-term and final assessment workshops of the second investment phase, in 2015 and 2019, respectively, where grantees of the Chino Cienega Foundation, MacArthur Foundation, Margaret A. Cargill Philanthropies, McConnell Foundation and McKnight Foundation in the Lower Mekong Region exchanged good practice and lessons learned with CEPF grantees in the Indo-Burma Hotspot.

13. CEPF INVESTMENT STRATEGY AND PROGRAM FOCUS

13.1 Priority Species, Sites and Corridors

To maximize the contribution of CEPF investment to the conservation of global biodiversity, the full lists of globally threatened species, KBAs and conservation corridors in the hotspot were refined into a focused set of priority outcomes (priority species, sites and corridors) for investment over a five-year period. The purpose of selecting priority sites and corridors was to enable investment by CEPF and other funders in site-based and landscape-scale conservation to focus on the highest priority geographic areas. The purpose of selecting priority species was to enable investments in species-focused conservation to be directed at globally threatened species whose conservation needs cannot adequately be addressed by general habitat protection (site-scale or landscape-scale) alone.

13.1.1 Prioritization of Species

Invertebrates were not included in the prioritization of species for several reasons. First, the conservation needs of most invertebrate species are poorly known, beyond general habitat protection provided for by site- and corridor-scale conservation. Second, very few CSOs in the Indo-Burma Hotspot have the necessary expertise to design and implement species-focused conservation actions for invertebrates. Third, a very low proportion of invertebrate species are directly threatened by over-exploitation, provided that adequate habitat conservation is in place. Fourth, given the very large number of invertebrate species and the limited amount of conservation investment in the Indo-Burma Hotspot, a species-by-species conservation strategy is less feasible than one focused on invertebrate communities or entire ecosystems, through site-scale action.

For similar reasons, no priority plant species were identified. The 2011 ecosystem profile listed 48 priority plant species, representing 16 percent of the list of globally threatened plants occurring in the hotspot at that time. However, during the second investment phase, out of more than 180 grants, only three priority plant species were addressed by species-focused actions; in each case, the species co-occurred with primate species that were the main focus of the grant. This provides strong empirical evidence that prioritizing individual species is not an effective strategy for engaging civil society in the conservation of globally threatened plant species in the Indo-Burma Hotspot. Based upon this experience, a strategy of site-based conservation, adopting an ecosystem approach, is likely to be more effective for the third phase.

For these reasons, prioritization of species outcomes was carried out only for vertebrates. Five criteria were used to select priority species from among the full list of globally threatened vertebrate species in the hotspot. The application of these criteria to the species in the Indo-Burma Hotspot is summarized in Appendix 1. Comprehensive global threat assessments of reptiles and reassessments of other taxa since 2011 allowed the prioritization criteria to be applied consistently across all non-marine vertebrates for the first time.

The first criterion was whether the hotspot population is significant for conservation of the species, relative to the global population; or, in other words, whether actions in Indo-Burma are an essential part of a successful global conservation strategy. For most species, a notional quantitative threshold was used to retain species for the next stages of prioritization. Vulnerable and Endangered species had to have at least 10 percent of their global population in the hotspot, while no threshold was set for Critically Endangered species. The rationale for this was that Critically Endangered species are so at risk that any viable population is potentially globally significant, even if it is numerically insignificant at present. Moreover, in a handful of cases, such as straw-headed bulbul, the species may have no extant population in the hotspot but the hotspot may nevertheless present the best opportunity for reintroduction of the species and re-establishment of a population that is viable into the long term. Indeed, conservation efforts for many Critically Endangered species are likely to warrant hands-on population management, including establishing new populations. Localities for reintroduction need to be selected where the chance of success is highest; the current geographic distribution of the remnant population may be a poor guide to this.

These thresholds were not inflexible in the case of species with a special claim for attention, such as those with a distinct subspecies endemic (or nearly endemic) to the hotspot and severely threatened. Hog deer provides an example: the entire population of its eastern subspecies *Axis porcinus annamiticus* inhabits Indo-Burma, and may comprise fewer than 100 animals. Although this population may well represent less than 10 percent of the global population of the species (two South Asian protected areas each support at least 1,000 animals of the nominate race; Biswas *et al*. 2002), the subspecies in the hotspot is still considered globally significant because of its taxonomic distinctiveness. The sarus crane subspecies *Antigone antigone sharpii* furnishes a comparable example.

Other case-specific exceptions to the quantitative thresholds were made in consideration of maintaining the ancestral breadth of geographic distribution and habitat use, even where current subspecific taxonomy does not reflect this. For example, the few hundred (at maximum) Irrawaddy dolphins in the hotspot's rivers (i.e., the Mekong and Ayeyarwady) are numerically small compared with the world's coastal populations but they comprise the majority of the world's permanent freshwater populations of the species. Given their isolation, if the species were to be extirpated from its remaining, ecologically distinct, freshwater habitats, recolonization would be implausible.

Only those species for which the hotspot population was considered globally significant were assessed against the remaining four criteria. The second criterion was the need for species-focused conservation action; that is, where a species's conservation needs cannot be adequately addressed by general habitat protection alone. Many species that are not harvested can be confidently expected to survive, provided that suitable habitat is preserved in large enough blocks to support viable populations, despite projected environmental change. One exception to this rule is species with very tiny geographic ranges (i.e., those that qualify as Critically Endangered under criterion B), which may go extinct due to localized disturbance, habitat loss or pollution, despite effective general habitat protection at the site or landscape scale. Among the Indo-Burma Hotspot's vertebrates, these are mainly reptiles, amphibians and fishes.

Species-focused conservation action is required for species that are susceptible to hunting, trapping or fishing, either because they are targeted to meet demand from the illegal wildlife trade (e.g., helmeted hornbill and Indochinese box turtle (*Cuora galbinifrons*)) or for local consumption (e.g., Jullien's golden carp) or because they are caught in indiscriminate snare lines set by hunters (e.g., saola and large-antlered muntjac). Large tracts of suitable habitat in the hotspot are now bereft of many species of large mammals, large birds, large reptiles and large fish that used to inhabit them, because sustained hunting and fishing has led to widespread local extirpations. No amount of habitat protection will prevent the hotspot-wide extinction of species in these groups if offtake is not restrained.

The specific needs of some species relate to their ecology. For example, there is no lack of suitable habitat in the hotspot for *Gyps* vultures (which inhabit towns in some parts of their range) but the massive depletion of wild ungulates, coupled with changes in domestic stock husbandry, mean that, for the present, food supplementation is probably essential for their survival in the hotspot (Gilbert *et al*. 2007). Furthermore, these species require targeted action to address poisoning, which seems to be a major factor preventing recovery of their populations.

Consideration of fishes, particularly migratory species, was more complicated. Much fishing is non-selective and longstanding, such that customary fishing methods are not considered incompatible with the conservation of most species. Species-focused conservation action to address over-fishing was only considered necessary for those species that are specifically targeted by exploitation that is directly driving major population declines, such as in some species in demand in the aquarium trade (e.g., Asian arowana). The wider issue, of the need for fishing to be sustainable, is in part addressed by identifying most of the Mekong and its major tributaries (one of the hotspot's major catchments), the Tonle Sap lake and its inundation zone, and the Chindwin River as priority corridors.

Many fish species are facing complex, inter-related threats, involving over-exploitation, habitat degradation and loss, physical barriers to migration, pollution and, possibly, climate change. For some of these species there is no single, preeminent threat that, if ameliorated in isolation, would lift the species out of danger. In this regard, fishes differ from many terrestrial vertebrates for which, if offtake was reduced to non-threatening levels, the species would recover, unconstrained (at least in the short term) by habitat condition and availability. The conservation needs of many fish species are, therefore, considered 'multiple'. Because these needs are not met by general habitat protection in isolation, this was considered to meet the criterion of need for species-focused conservation action.

The third prioritization criterion was the need for greatly improved information on status and distribution in Indo-Burma. This criterion was included to highlight species for which available information is so limited that it precludes any form of meaningful conservation action. As the conservation of all species would benefit from improved information, this category was reserved for species that are not known to persist at any site, or those few for which, even though they are known to persist somewhere, the interventions needed are entirely unclear, and the first action must, therefore, be research to clarify what interventions are needed.

Species that met the first criterion and either the second or third were also evaluated against two further criteria: urgency for conservation action; and level of opportunity for CEPF and funders with a similar approach to enhance existing conservation efforts for the species significantly, given the level of funding they are likely to be able to invest over the 'baseline' level.

The fourth criterion, urgency of conservation action, was relatively straightforward to apply and highly reflective of Red List category. In particular, few species categorized as

Vulnerable, the safest of the three globally threatened categories, were considered as high priorities for action in the next five years. Of the few Vulnerable species so considered, some represent species whose Southeast Asian population is much more threatened than the global average, such as sarus crane, whose population in Cambodia and Vietnam has declined by 77 percent since 2013 (Tran Triet *et al.* 2020). For the others, their global threat status may not be reflective of their current Red List category.

The fifth criterion, by contrast, was the most subjective and the one most likely to undergo abrupt change in the future. Nonetheless, it is important to consider whether CEPF and institutions of similar mode and scope of operation can meaningfully add to existing actions so that scarce resources are used wisely. It results, necessarily, in some of the most iconic and threatened species not being selected as priority species. Tiger is one of the species closest to extinction in Indo-Burma (its global Red List category of Endangered reflects that status of larger populations outside the hotspot) but the total sum of money spent on tiger conservation globally is so large (Walston *et al*. 2010) that even if all CEPF's available resources for Indo-Burma were funneled into tiger-related activity, the incremental gains would be low. A similar argument can be made for Chinese pangolin (*Manis pentadactyla*) and Sunda pangolin (*M. javanica*): two species that are close to extinction in the hotspot but that are receiving (relatively) large amounts of funding related to combatting the illegal wildlife trade, such that the incremental gains on the conservation of these species from CEPF funding would likely be low.

Species were thus selected as priorities if: (i) the Indo-Burma population is significant to their global conservation prospects; *and either* (ii) species-focused action is required *or* (iii) there is a pressing need for a great improvement of the information base; *and both* (iv) the urgency for action *and* (v) the opportunity for additional investment are high. The first four criteria are reasonable for defining an objective list of hotspot priority species for the conservation community as a whole. By contrast, the fifth criterion, by introducing the element of shortfall in current investment, precludes the use of the CEPF list as a general list of species priorities for the hotspot. Moreover, all the criteria were viewed from a hotspot perspective. Thus, for long-distance migrant birds, where the essential and urgent interventions for their conservation need to take place in the parts of their range outside the hotspot (an example being the Palaearctic-breeding Baer's pochard), even if the hotspot is highly important for the population, the second criterion (requirement for species-focused action) and fourth criterion (urgency for conservation action) are not met within the hotspot. Thus, some species in urgent global need of assistance are not considered priorities here.

13.1.2 Prioritization of Sites

The main criterion for selecting priority sites from among the full list of KBAs in the hotspot was whether or not the site lies within a priority corridor. All KBAs within a priority corridor were automatically considered priority sites (Appendix 2; Table 27). The rationale for this is that location within a priority corridor gives site-based actions added conservation value. In addition, 24 limestone karst KBAs in Myanmar were identified as priority sites. The unique geographic pattern of limestone karst in Myanmar, with its highly dispersed, non-contiguous distribution, coupled with high levels of extremely localized endemism, means that it is not well suited to the conservation corridor concept. Instead, the network of sites was considered as a single geographic unit, equivalent to a corridor for priority-setting purposes.

13.1.3 Prioritization of Corridors

Five criteria were used to select priority corridors from among the full list of corridor outcomes. First, only conservation corridors supporting globally significant populations of Critically Endangered and Endangered species were considered. Second, preference was given to conservation corridors supporting globally significant populations of one or more landscape species. Third, preference was given to conservation corridors supporting (near-)unique or otherwise exceptional examples of ecological and evolutionary processes. Fourth, the urgency of conservation action, and fifth, the opportunity for investment additional to the baseline level, were both considered, applying a similar rationale to that discussed above in relation to priority species. The application of the selection criteria to the conservation corridors in Indo-Burma is presented in Appendix 3. As with the prioritization of species, the fifth criterion, which highlighted shortfalls between baseline investment and investment needs that are within the budgetary realm of CEPF and other funders, precludes the use of this corridor prioritization as a general map of variation in conservation importance across the hotspot.

13.1.4 General Considerations

For all priority outcomes for CEPF investment, the most important selection criteria were urgency for conservation action and opportunity for additional investment. Priority species, sites and corridors were selected only where current threats, if not mitigated, were predicted to cause their regional extinction (in the case of species) or the loss of key elements of biodiversity (in the case of sites and corridors) within the next 20 years. In addition, priority species, sites and corridors were only selected where there were considered to be good opportunities for CEPF and other organizations to invest in conservation actions by civil society that complement investments by governments and other donors. In this regard, experience from the second investment phase, in terms of both response to calls for proposals and performance of awarded grants, was one of the most important considerations in determining whether priorities identified in the 2011 update of the ecosystem profile continued to provide good opportunities for CEPF investment in the third phase.

The starting point for the lists of priority species, sites and corridors was the 2011 update of the ecosystem profile (CEPF 2012). Wholesale changes to Red List assessments, particularly among reptiles, amphibians and fishes, required major review of the priority species list. This review was conducted in collaboration with the IUCN-SSC ASAP: an alliance of conservation organizations with the collective aim of focusing urgent conservation attention on the non-marine vertebrate species most at risk of extinction in Southeast Asia, hosted by WRS.

In comparison, relatively minor changes to the lists of KBAs and conservation corridors were made since the 2011 update. The main changes arose from an exercise to identify freshwater KBAs in the Lower Mekong Basin, conducted by the IUCN Freshwater Biodiversity Unit in 2018 (Máiz-Tomé 2019), and a program of research conducted by FFI and partners in Myanmar between 2014 and 2019, which led to the identification of 24 limestone karst KBAs (Komerički *et al.* in prep.). Where there were greater changes was in the need for additional conservation investment from CEPF and like-minded funders. In most cases, this was a genuine change, resulting from major investments in a conservation corridor by other donors and/or a change in the socio-political or security context. In one case, this was a change in perception, informed by CEPF's experience of identifying the Hainan Mountains as a priority corridor during the second investment phase, only to find it extremely challenging to generate fundable grant applications from civil society groups active there. Based on this experience, the Hainan Mountains was removed from list of priority corridors.

The list of priority sites and corridors was reviewed in detail during the mid-term assessment workshop in March 2015, while the final assessment workshop in May 2019 provided another opportunity to solicit feedback from stakeholders. There was broad consensus at these meetings that CEPF should not make wholesale changes to its geographic priorities, with participants noting that conservation efforts take a long time to effect lasting change and, while there has been good progress in many places over the second investment phase, switching to a different set of priorities would risk losing the progress made to date. In particular, there was agreement to retain the Mekong River and Major Tributaries, the Tonle Sap Lake and Inundation Zone and the Sino-Vietnamese Limestone Corridors, and the KBAs therein, as geographic priorities for investment, and to add additional priorities if resources allow.

In the 2011 ecosystem profile, Myanmar was recognized as a national-scale conservation priority. This was in response to the fact that conservation investment was very low, following a long period of international isolation, meaning that there was high need and opportunity for conservation investment throughout the country. Also, the types of site-based conservation actions needed in Myanmar were quite different from those in the other hotspot countries. In particular, there was a need for significant expansion of the protected area system, based on further KBA analysis and adopting community-based models. By 2020, the situation in Myanmar has changed significantly. There has been a significant increase in international donor funding for biodiversity conservation and natural resources management, including major initiatives in several corridors at a level where additional funding from CEPF would not be expected to have a significant incremental impact. Also, there has been a comprehensive reassessment of KBAs in the country, including identification of KBAs in limestone karst ecosystems, which were only superficially covered during earlier exercises. Furthermore, a body of evidence has been amassed on the opportunities and pitfalls of different approaches to protected area establishment and alternative models, which may prove more socially acceptable in certain contexts. For these reasons, Myanmar was no longer considered a national-level geographic priority but, instead, the prioritization criteria were applied to its corridors individually. This led to the prioritization of the Chindwin River corridor, plus limestone karst as a second geographic priority.

The lists of priority species, sites and corridors for the third CEPF investment phase were included in the draft ecosystem profile that was circulated for online review during July 2020. The lists were then finalized, taking into account review comments from in-region stakeholders, as well as representatives of CEPF's donor partners and other participating funders.

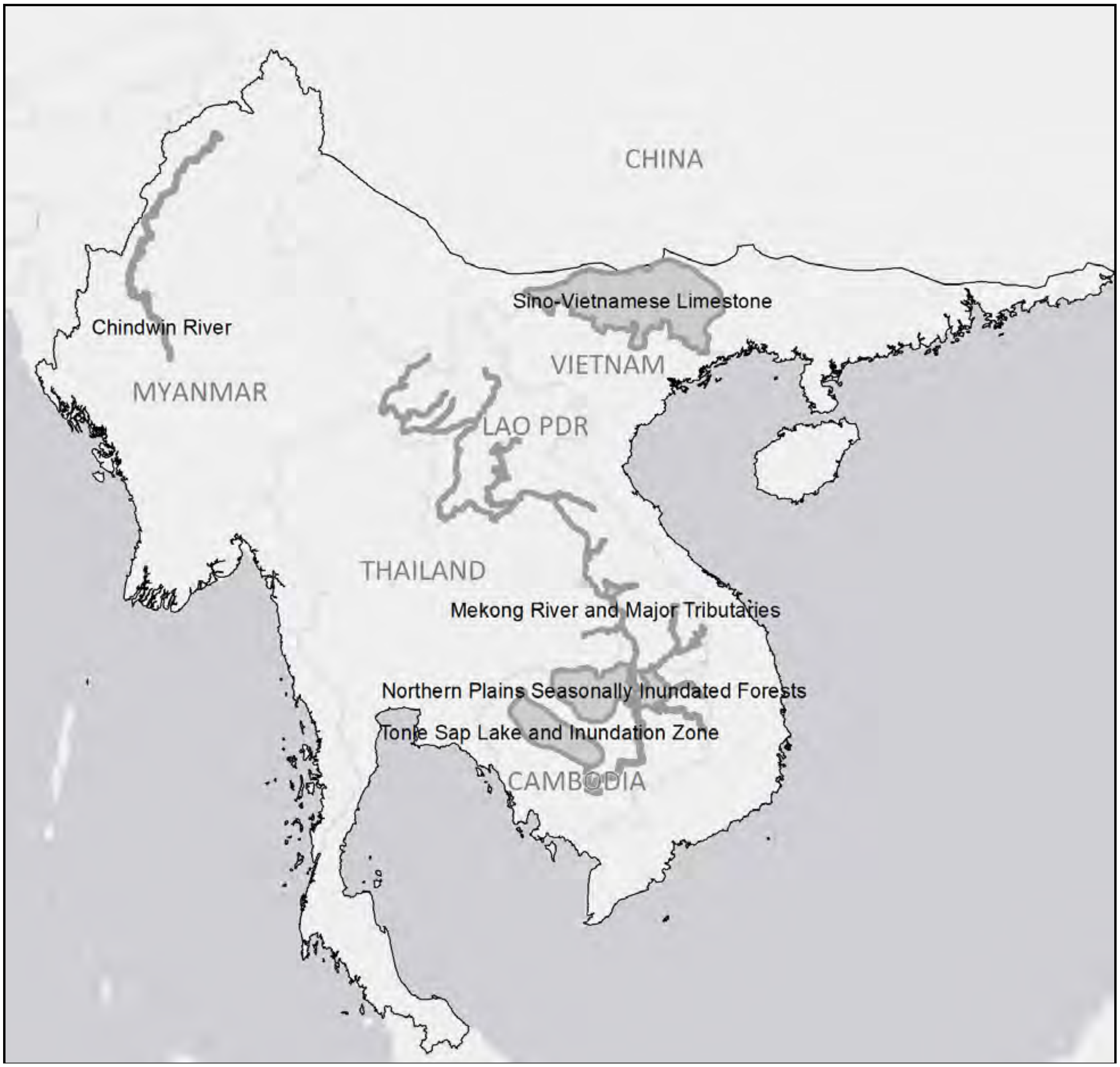
The ecosystem profile recognizes that all of the site and corridor outcomes in the Indo-Burma Hotspot are, by definition, conservation priorities. Investments in any of these places will contribute to the conservation of global biodiversity. Given the size and diversity of the hotspot, and the very modest resources available to CEPF and other funders that may use the ecosystem profile to guide their investments, it is inevitable that many places with irreplaceable biodiversity values will not be included among the priority sites and corridors. A good case could be made for including almost any of the sites and corridors left off the priority lists but difficult decisions must be made, if resources are not to be spread too thinly to achieve lasting impacts. It should be re-emphasized here that investments in the conservation of priority species can be made irrespective of location, and are not restricted to the priority corridors and sites.

13.1.5 Priority Corridors and Sites

Five priority corridors were selected (Figure 29); the key biodiversity values of each are briefly summarized below. The five priority corridors contain a total of 66 KBAs, which were all automatically selected as priority sites (Table 27). In addition to the five corridors, a network of 24 limestone karst KBAs in Myanmar was identified as a geographic priority for investment. The 90 priority sites represent 16 percent of the site outcomes in the hotspot (Appendix 2).

The five corridors and the network of limestone karst KBAs cover a combined area of 120,623 hectares, equivalent to 5 percent of the total area of the hotspot. This is a major reduction in area from the geographic priorities in the 2011 ecosystem profile, which covered 786,551 hectares, or 34 percent of the hotspot. This is due to a tighter focusing of geographic priorities in Myanmar, from the whole country to one corridor and one network of sites. The Hainan Mountains corridor was dropped as a priority and replaced with the similarly sized Northern Plains Seasonally Inundated Forests corridor.

Figure 29. Priority Corridors for CEPF Investment in the Indo-Burma Hotspot



Note: not shown on this map is Myanmar Limestone Karst, a network of small sites dispersed throughout the country; these sites are too small to appear on a map this scale.

Table 27. Priority Corridors and Sites for Investment in the Indo-Burma Hotspot

Priority Corridor	Priority Sites	Countries	Area (km^2)
Chindwin River	Upper Chindwin River: Kaunghein to Padumone Section	Myanmar	5,281
Mekong River and Major Tributaries	Lower Nam Ou; Mekong Confluence with Nam Kading; Mekong Confluence with Xe Bangfai; Mekong Channel near Pakchom; Mekong River from Kratie to Lao PDR; Mekong River from Phou Xiang Thong to Siphandon; Mekong River from Louangphabang to Vientiane; Pakxan Wetlands; Sekong River; Sesan River; Siphandon; Srepok River; Thala Stueng Treng; Ubon Nam Mun; Upper Lao Mekong; Upper Xe Kaman; Western Siem Pang; Xe Champhon	Cambodia, Lao PDR and Thailand	19,435
Myanmar Limestone Karst*	Ataran Taung Karst; Bayin Nyi Karst; Dhammata Karst; Himeinkanein Karst; Hpa-an; Hpruso Karst; Kayin Linno Karst; Kayon Karst; Kyauk Nagar; Montawa Cave; Myaleik Taung; Naung Ka Myaing Karst; Padamyar Karst; Panlaung-Pyadalin Cave; Parpant Caves; Pathein Karst; Pharbaung Karst; Phayartan Karst**; Sabel Karst; Tar Tar Karst; Waiponla Karst; Weibyan Karst; Yathae Pyan Karst; Ywangan Karst	Myanmar	536
Northern Plains Seasonally Inundated Forests	Chhep; Dong Khanthung; O Skach; Upper Stung Sen Catchment	Cambodia and Lao PDR	19,322
Sino-Vietnamese Limestone	Ba Be; Ban Bung; Ban Thi-Xuan Lac; Bangliang; Bat Dai Son; Binh An; Cham Chu; Chongzuo; Daweishan; Diding; Du Gia; Funing Niaowangshan; Fuping-Gula-Dingye; Gulongshan; Khau Ca; Lam Binh; Longhua; Longhushan; Longshan Section of Nonggang; Malipo; Na Chi; Nonggang; Paiyangshan; Shangsi-Biannian; Sinh Long; Tat Ke; Tay Con Linh; Than Xa; Trung Khanh; Tung Vai; Xidamingshan	China and Vietnam	58,502
Tonle Sap Lake and Inundation Zone	Ang Trapeang Thmor; Bakan; Boeung Chhmar-Moat Khla; Chhnuk Tru; Dei Roneat; Kampong Laeng; Lower Stung Sen; Preah Net Preah-Kra Lanh-Pourk; Prek Toal; Stung-Chi Kreng-Kampong Svay; Stung Sen-Santuk-Baray; Veal Srongae	Cambodia	17,547

Notes: * = Myanmar Limestone Karst is a dispersed network of small sites, which does not meet the criteria for a conservation corridor but is nevertheless recognized as a geographic priority for CEPF investment; it is included here to provide a complete list of priority KBAs in one place. ** = Phayartan Karst is located within Lenya KBA but is several orders of magnitude smaller; therefore, only the limestone karst is considered a priority site and not the wider KBA within which it lies.

Priority Corridor 1: Chindwin River. The Chindwin River is the largest tributary of the Ayeyarwady: Myanmar's largest river and the second largest river in the hotspot after the Mekong. It rises in the hills surrounding the Hukaung Valley in Kachin State and flows for 1,200 kilometers before joining the Ayeyarwady River upstream of Bagan. The combined Ayeyarwady-Chindwin Basin is the largest in Myanmar, and the two rivers deliver ecosystem services essential to Myanmar's economy and the wellbeing of local communities. These include provision of water for irrigation, industry and domestic use, fisheries production and transportation. The main threats to the biodiversity and ecosystem service values of the Chindwin include gold mining along the river and its tributaries, climate change and deforestation, as well as agricultural expansion and other land use changes (SEI and MEI 2018). The Chindwin River also supports some of the least altered riverine ecosystems and biotic communities remaining in the hotspot. The river is free flowing from its headwaters to the confluence with the Ayeyarwady and thence to the sea. It is, therefore, important for migratory fishes, although these are less well documented than those of other major rivers in the hotspot. The Chindwin River has extensive sandbanks and sandbars, which support important populations of sandbar-nesting bird and turtle species, most notably Burmese roofed turtle (*Batagur trivittata*): one of the most severely threatened turtles in the world. Other globally threatened species for which the Chindwin supports globally significant species include Burmese frog-faced softshell turtle (currently recognized as a subspecies of *Chitra indica*) and Burmese peacock softshell (*Nilssonia formosa*). Many of these values are shared with the mainstream of the Ayeyarwady River. The latter, however, is the focus of a major investment in environmental protection and natural resources management, in the form of the World Bank-financed *Ayeyarwady Integrated River Basin Management Project*, which has a total project cost of around $100 million and aims to strengthen integrated, climate resilient management and development of the Ayeyarwady River Basin and national water resources. Since the project is working on the Ayeyarwady mainstream, CEPF investment will focus on the Chindwin River, complementing work on and adopting a lower-key approach to integrated river basin management, as well as community-based natural resources management, with a leading role for civil society.

Priority Corridor 2: Mekong River and Major Tributaries. The Mekong River and its major tributaries, including the Srepok, Sesan and Sekong (Xe Kong) rivers, represent some of the best remaining examples of the riverine ecosystems of Indo-Burma, and provide services vital to the livelihoods of tens of millions of people. The biodiversity values of these rivers have yet to be fully evaluated but they are known to be vital for many globally threatened fish species, including some of the largest freshwater fishes in the world. The corridor also supports significant populations of sandbar-nesting turtles, for which the need for effective conservation action is urgent. Furthermore, the Mekong and its major tributaries support one of the fullest riverine bird communities remaining in Indo-Burma, including globally significant congregations of species such as white-shouldered ibis (not a river-channel nester, but seasonally strongly associated with channels as feeding habitat), river tern (*Sterna aurantia*), great thick-knee (*Esacus recurvirostris*), river lapwing (*Vanellus duvaucelii*) and small pratincole (*Glareola lactea*), and the entire world population of Mekong wagtail. Among mammals, one of the world's three freshwater populations of Irrawaddy dolphin inhabits the corridor, and patchy populations of otters remain. At the ecosystem level, there are some specialized habitats, including the best example of seasonally inundated within-channel true forest in Asia. Because of these values, one section of the corridor has been designated as a Ramsar site and another as a 50,000-hectare wildlife sanctuary. Yet the corridor's values are highly threatened, both by locally originating threats and by major development projects driven by national development agendas, especially hydropower dams. The third phase of CEPF investment will focus on a slightly enlarged corridor, whose boundaries have been extended to incorporate four KBAs in Cambodia, Lao PDR and Thailand that are ecologically linked to the river system: Thala Stueng Treng; Ubon Nam Mun; Western Siem Pang; and Xe Champhon. Since 2011, the biodiversity values of the upper sections of the corridor have diminished, following the construction of the Xayaburi dam on the Mekong mainstream, while a similar fate has befallen the Srepok and Sesan Rivers, following construction of the Lower Sesan II dam. Nevertheless, significant sections of river retain globally important biodiversity, and continue to underpin human wellbeing in the Lower Mekong countries. Therefore, projects throughout the corridor will be considered eligible for support, although priority will be given to those in the Mekong-3S Rivers Confluence and the Xe Champhon Wetlands Complex.

Priority Corridor 3: Northern Plains Seasonally Inundated Forests. The Northern Plains Seasonally Inundated Forests corridor comprises a mosaic of open, seasonally inundated deciduous forests, denser semi-evergreen forests, and seasonal and permanent wetlands (pools, grasslands, streams and rivers). The corridor, which stretches across a sparsely-populated landscape in northern Cambodia and southwestern Lao PDR, supports significant populations of various globally threatened species, including vultures, large waterbirds (including giant ibis and white-shouldered ibis) turtles (including yellow-headed temple turtle (*Heosemys annandalii*) and elongated tortoise (*Indotestudo elongata*)) and mammals (including Eld's deer and large-spotted civet (*Viverra megaspila*)), as well as the most significant known breeding populations of masked finfoot and white-winged duck in Cambodia (Tordoff *et al.* 2005). The corridor has been the focus of two decades of conservation efforts, supported by CEPF and other funders, which have developed some of the most effective and socially sustainable conservation approaches in the hotspot. There is a clear need to amplify these approaches and adapt them in the face of emerging threats, such as climate change and agro-industrial plantations, as well as in-migration, which is anticipated to accelerate in the post-COVID-19 period.

Priority Corridor 4: Sino-Vietnamese Limestone. The Sino-Vietnamese Limestone corridor is particularly important for the conservation of primates, as it supports the entire global population of two Critically Endangered species: Tonkin snub-nosed monkey and cao vit crested gibbon. The corridor is also of high global importance for plant conservation, supporting high levels of endemism in many groups, such as orchids. The corridor supports the richest assemblages of conifer species in the region, including *Xanthocyparis vietnamensis* (Endangered). It also supports a large number of broadleaf tree species with restricted ranges, such as *Magnolia aromatica* and *M. coriacea* (both Endangered). Through a land-use history of commercial logging and shifting cultivation, the natural habitats of the Sino-Vietnamese Limestone corridor (limestone, lowland evergreen and montane evergreen forest) have become fragmented, highly so in places, and remaining blocks are often threatened by overexploitation of forest products. Nevertheless, the corridor presents tremendous opportunities to engage civil society groups in biodiversity conservation. Many of the most important populations of threatened and endemic species occur outside formal protected areas, at sites that lend themselves to community-based conservation approaches. Furthermore, many KBAs are threatened by incompatible development initiatives, and there is an important role for civil society to play in reconciling conservation and development agendas in the corridor.

Priority Corridor 5: Tonle Sap Lake and Inundation Zone. Tonle Sap, the largest lake in mainland Southeast Asia, is an integral and essential part of the Lower Mekong ecosystem. During the monsoon season, as the water level in the Mekong River rises, the Tonle Sap River, which drains the lake, reverses its direction, raising the water level in the lake by up to 8 meters and causing it to inundate an area of up to 16,000 square kilometers (six times the area of the lake during the peak of the dry season). This seasonal flood regime has led to the development of flooded forest and grassland habitats around the periphery of the lake, important for species of otters, waterbirds and grassland birds, including two Critically Endangered species: Bengal florican; and yellow-breasted bunting. The flooded forests around the lake support the largest breeding colonies of large waterbirds remaining in Southeast Asia, including important congregations of globally threatened species, such as greater adjutant (*Leptoptilos dubius*). The extensive area of flooded forest and high levels of nutrients transported by the annual flood result in very high levels of aquatic productivity, helping to make the lake the most important fishery in Cambodia, responsible for around 60 percent of protein intake by the country's population. The system is also critically important for agricultural and fisheries production in Vietnam, as waters draining from the lake provide around 50 percent of the dry-season flow in the Mekong Delta. The Tonle Sap Lake and inundation zone provide critical breeding, spawning and feeding habitats for many species of migratory fish, including several globally threatened species, such as giant dog-eating catfish and Jullien's golden carp. The Tonle Sap system faces a wide array of threats, including agricultural development in the inundation zone, clearance of flooded forest, changes to fishing practices and management arrangements in the lake, and changes in hydrological flows due to upstream developments on the Mekong River and its tributaries. In 2019, the flood pulse that charges the lake largely failed, impacting agriculture around the lake and resulting in declines of fish catches by 60 to 70 percent (Weatherby and Lichtefeld 2020). As in the case of the Chindwin River and the Mekong River and Major Tributaries corridors, there is great potential for conservation interventions that also address human livelihoods and other development goals, both directly and by securing the delivery of critical ecosystem services.

13.1.6 Priority Species

One hundred and thirty-six globally threatened vertebrate species were selected as priority species (Table 28), equivalent to 24 percent of the full list of 561 globally threatened vertebrates in the hotspot. The priority species include 39 reptiles, 34 mammals, 31 fishes and 27 birds but only five amphibians, which reflects the fact that amphibians require species-focused conservation action only in exceptional cases. The list of priority species excludes various other species that are high, in some cases very high, global priorities for conservation but for which, for one reason or another, the CEPF modality is not appropriate.

The priority species include 28 turtles (10 endemic to the hotspot), 15 primates (13 endemic) and 10 ungulates (three endemic), reflecting the high threat posed to all these groups by overexploitation, mostly driven by demand from the illegal wildlife trade. The priority species also include 12 large and medium-sized waterbirds, which are not heavily sought after in trade but are either dispersed breeders or colonial breeders that disperse widely during the non-breeding season; these species require species-focused conservation action throughout their ranges in order to address incidental persecution, disturbance and loss of key habitats. All three vulture species breeding in the hotspot are also priorities, having seen heavy reductions in their food supply in recent decades and being at permanent risk from either deliberate poisoning (especially by toxic pesticides, such as carbofuran) or the possibility that veterinary drugs that have caused massive declines in India may be promoted in Southeast Asia.

Thirty-one fishes are identified as priority species. These include some of the largest freshwater fishes in the world, which are threatened by over-exploitation and disruption to migration by dams. At the other end of the size spectrum, the priority fishes include four species of stone loach (*Schistura* spp.), characterized by extremely small geographic ranges, which are especially vulnerable to localized threats.

By contrast, only five amphibians met the criteria, indicating the predominance of broad-scale habitat factors in threatening amphibians in Indo-Burma in recent decades. Three of them are Critically Endangered species with tiny ranges, which implies that their conservation needs may not be met by broad-scale habitat conservation efforts but, rather, may involve highly targeted habitat protection, combined with pollution prevention. The potential threat of the fungal disease chytridiomycosis needs further evaluation, although there are initial indications that amphibian species in the hotspot can be infected without necessarily undergoing population declines (e.g., Le Thi Thuy Duong *et al.* 2017).

There have been significant changes to the list of priority species since the 2011 ecosystem profile. Twelve species have been dropped from the list, for various reasons, including significantly increased funding availability from other sources (and, thus, reduced opportunity for additional investment), taxonomic change, and improved understanding of conservation status (as opposed to actual improvement). Forty-four species have been added to the list, for a net gain of 32 vertebrate species. The newly added species include 14 species discovered in the 21st century that were assessed for the first time since the 2011 ecosystem profile, including skywalker hoolock, which was described in 2017 and added to the Red List in 2020. They also include seven species that were previously included on the provisional list of priority species, such as Annamite striped rabbit, whose Red List status changed from Data Deficient to Endangered in 2019. Additionally, they include three turtles recently afforded full species status, including Bourret's box turtle (*Cuora bourreti*) and Southern Vietnam box turtle, which were assessed separately from Indochinese box turtle in 2016. The remaining 20 species were added to the list due to a change in their conservation status (and, thus, in the assessed urgency for conservation action) or a change in the assessed opportunity for additional investment.

Compared with the 2011 ecosystem profile, the number of globally threatened vertebrate species has increased from 104 to 136. However, due to an increase in the number of vertebrates assessed as globally threatened, the proportion of globally threatened vertebrates prioritized for investment has actually decreased from 27 to 24 percent. Moreover, with the removal of 48 plant species, the absolute number of priority species in the hotspot has decreased from 152 to 136.

Twenty-four priority species (seven fishes, six birds, six reptiles, four mammals and an amphibian) have an over-riding need for greatly improved information on their status and distribution before conservation action can be taken for them in any meaningful way. For some of these, it is not clear whether they need species-focused action (e.g., various fish that have had their sole known localities impacted by hydropower development and have not been searched for since). For others, it is abundantly clear that they are in need of species-focused action (if they are still extant) but no populations are presently known (including some of the rarest and/or most enigmatic species in the world, such as white-eyed river-martin, pink-headed duck and kouprey). For yet others, populations are known but it is not clear why the species is so threatened and, therefore, the actions needed cannot be defined (e.g., white-bellied heron).

Table 28. Priority Species for CEPF Investment in the Indo-Burma Hotspot

Priority Species	English Name	Conservation Need(s) Requiring Species-Focused Action	Over-riding Need for Improved Information
MAMMALS			
Aonyx cinereus	Asian Small-clawed Otter	Control of overexploitation	
Axis porcinus	Hog Deer	Control of overexploitation; population management	
Bos sauveli	Kouprey		Yes
Bubalus arnee	Wild Water Buffalo	Control of overexploitation	
Chrotogale owstoni	Owston's Civet	Control of overexploitation	
Dicerorhinus sumatrensis	Hairy Rhinoceros		Yes
Eudiscoderma thongareeae	Thongaree's Disc-nosed Bat	Targeted forest protection in and around known range	
Hoolock hoolock	Western Hoolock	Control of overexploitation	
Hoolock tianxing	Skywalker Hoolock	Control of overexploitation	
Lutra sumatrana	Hairy-nosed Otter	Control of overexploitation	
Lutrogale perspicillata	Smooth-coated Otter	Control of overexploitation	
Moschus berezovskii	Forest Musk Deer	Control of overexploitation	
Moschus fuscus	Black Musk Deer	Control of overexploitation	
Muntiacus vuquangensis	Large-antlered Muntjac	Control of overexploitation	
Murina balaensis	Bala Tube-nosed Bat	Targeted forest protection in and around known range	
Nesolagus timminsi	Annamite Striped Rabbit	Control of overexploitation	
Nomascus concolor	Black Crested Gibbon	Control of overexploitation; targeted habitat protection	
Nomascus hainanus	Hainan Gibbon	Population management; habitat restoration	
Nomascus leucogenys	Northern White-cheeked Gibbon	Control of overexploitation	
Nomascus nasutus	Cao Vit Crested Gibbon	Control of overexploitation; habitat restoration	
Nomascus siki	Southern White-cheeked Gibbon	Control of overexploitation	
Orcaella brevirostris	Irrawaddy Dolphin	Reduction of fishing-related accidental death	
Pseudoryx nghetinhensis	Saola	Control of overexploitation	Yes
Pygathrix cinerea	Grey-shanked Douc	Control of overexploitation	

Priority Species	English Name	Conservation Need(s) Requiring Species-Focused Action	Over-riding Need for Improved Information
Pygathrix nemaeus	Red-shanked Douc	Control of overexploitation	
Rhinoceros sondaicus	Javan Rhinoceros		Yes
Rhinopithecus avunculus	Tonkin Snub-nosed Monkey	Control of overexploitation	
Rhinopithecus strykeri	Myanmar Snub-nosed Monkey	Control of overexploitation	
Rucervus eldii	Eld's Deer	Control of overexploitation; population management	
Trachypithecus delacouri	Delacour's Leaf Monkey	Control of overexploitation	
Trachypithecus germaini	Indochinese Silvered Leaf Monkey	Control of overexploitation	
*Trachypithecus poliocephalus**	White-headed Leaf Monkey	Control of overexploitation	
Trachypithecus shortridgei	Shortridge's Leaf Monkey	Control of overexploitation	
Viverra megaspila	Large-spotted Civet	Control of overexploitation	
BIRDS			
Antigone antigone	Sarus Crane	Control of overexploitation	
Ardea insignis	White-bellied Heron		Yes
Asarcornis scutulata	White-winged Duck	Control of overexploitation	
Calidris pygmea	Spoon-billed Sandpiper	Control of overexploitation; targeted habitat protection	
Carpococcyx renauldi	Coral-billed Ground-cuckoo	Control of overexploitation	
Emberiza aureola	Yellow-breasted Bunting	Control of overexploitation	
Eurychelidon sirintarae	White-eyed River-martin		Yes
Gyps bengalensis	White-rumped Vulture	Provision of adequate food; control of persecution	
Gyps tenuirostris	Slender-billed Vulture	Provision of adequate food; control of persecution	
Heliopais personatus	Masked Finfoot	Highly targeted habitat protection	
Houbaropsis bengalensis	Bengal Florican	Retention of suitable agricultural practices	
Hydrornis gurneyi	Gurney's Pitta	Highly targeted habitat protection	
Leptoptilos dubius	Greater Adjutant	Control of overexploitation	
Leptoptilos javanicus	Lesser Adjutant	Control of overexploitation	
Lophura edwardsi	Edwards's Pheasant		Yes

Priority Species	**English Name**	**Conservation Need(s) Requiring Species-Focused Action**	**Over-riding Need for Improved Information**
Mergus squamatus	Scaly-sided Merganser		Yes
Polyplectron katsumatae	Hainan Peacock-pheasant	Control of overexploitation	
Pseudibis davisoni	White-shouldered Ibis	Control of overexploitation; targeted habitat protection	
Pycnonotus zeylanicus	Straw-headed Bulbul	Assessment of feasibility of reintroduction	
Rheinardia ocellata	Crested Argus	Control of overexploitation	
Rhinoplax vigil	Helmeted Hornbill	Control of overexploitation	
Rhodonessa caryophyllacea	Pink-headed Duck		Yes
Rimator pasquieri	White-throated Wren-babbler	Highly targeted habitat protection	
Rynchops albicollis	Indian Skimmer		Yes
Sarcogyps calvus	Red-headed Vulture	Provision of adequate food; control of persecution	
Sterna acuticauda	Black-bellied Tern	Population management	
Thaumatibis gigantea	Giant Ibis	Control of overexploitation; targeted habitat protection	
REPTILES			
Batagur affinis	Southern River Terrapin	Control of overexploitation	
Batagur baska	Northern River Terrapin		Yes
Batagur borneoensis	Painted Terrapin	Control of overexploitation	
Battagur trivittata	Burmese Roofed Turtle	Control of overexploitation	
Chitra chitra	Striped Narrow-headed Softshell Turtle	Control of overexploitation	
Chitra indica†	Indian Narrow-headed Softshell Turtle	Control of overexploitation	
Crocodylus siamensis	Siamese Crocodile	Control of overexploitation	
Cuora bourreti	Bourret's Box Turtle	Control of overexploitation	
Cuora galbinifrons	Indochinese Box Turtle	Control of overexploitation	
Cuora mccordi	McCord’s Box Turtle	Control of overexploitation	
Cuora mouhotii	Keeled Box Turtle	Control of overexploitation	
Cuora picturata	Southern Vietnam Box Turtle	Control of overexploitation	
Cuora trifasciata‡	Chinese Three-striped Box Turtle	Control of overexploitation	
Cuora yunnanensis	Yunnan Box Turtle		Yes
Cuora zhoui	Zhou’s Box Turtle		Yes

Priority Species	English Name	Conservation Need(s) Requiring Species-Focused Action	Over-riding Need for Improved Information
Cyrtodactylus chanhomeae	Chanhome’s Bent-toed Gecko	Control of overexploitation; protection of an adequate area from quarrying	
Cyrtodactylus gialaiensis	Gia Lai Bent-toed Gecko	Restriction of various human activities within its tiny range	
Cyrtodactylus jaegeri	Khammouane Brown-headed Bent-toed Gecko	Protection of an adequate area from quarrying	
Cyrtodactylus nigriocularis	Black-eyed Bent-toed Gecko	Highly targeted habitat protection	
Cyrtodactylus takouensis	Ta Kou Bent-toed Gecko	Restriction of various human activities within its tiny range	
Dixonius kaweesaki	Sam Roi Yot Leaf-toed Gecko	Control of overexploitation; protection of an adequate area from quarrying	
Gekko lauhachindai	Lauhachinda’s Cave Gecko	Protection of an adequate area from quarrying	
Geochelone platynota	Burmese Star Tortoise	Control of overexploitation	
Goniurosaurus huuliensis	Supreme Gecko	Restriction of various human activities within its tiny range	
Heosemys depressa	Arakan Forest Turtle	Control of overexploitation	
Indotestudo elongata	Elongated Tortoise	Control of overexploitation	
Indotyphlops lazelli	Hong Kong Blind Snake		Yes
Manouria emys	Asian Giant Tortoise	Control of overexploitation	
Mauremys annamensis	Vietnamese Pond Turtle	Control of overexploitation	
Mauremys mutica	Asian Yellow Pond Turtle	Control of overexploitation	
Mauremys nigricans	Red-necked Pond Turtle	Control of overexploitation	
Morenia ocellata	Burmese Eyed Turtle		Yes
Nilssonia formosa	Burmese Peacock Softshell	Control of overexploitation	
Pelochelys cantorii	Asian Giant Softshell Turtle	Control of overexploitation	
Platysternon megacephalum	Big-headed Turtle	Control of overexploitation	
Rafetus swinhoei	East Asian Giant Softshell Turtle		Yes
Sacalia bealei	Beale’s Eyed Turtle	Control of overexploitation	
Sacalia quadriocellata	Four-eyed Turtle	Control of overexploitation	
Shinisaurus crocodilurus	Chinese Crocodile Lizard	Control of overexploitation	

Priority Species	English Name	Conservation Need(s) Requiring Species-Focused Action	Over-riding Need for Improved Information
AMPHIBIANS			
Amolops hongkongensis	Hong Kong Cascade Frog		Yes
Laotriton laoensis	Laos Warty Newt	Control of overexploitation	
Leptobrachella botsfordi	Botsford's Leaf-litter Toad	Highly targeted habitat protection; prevention of pollution	
Megophrys damrei	Bokor Horned Toad	Highly targeted habitat protection; prevention of pollution	
Oreolalax sterlingae	Sterling's Toothed Toad	Highly targeted habitat protection; prevention of pollution	
FISH			
Aaptosyax grypus	Mekong Giant Salmon Carp	Multiple	
Balantiocheilos ambusticauda	Siamese Bala-shark		Yes
Betta simplex	Simple Mouthbrooder	Multiple	
Catlocarpio siamensis	Giant Carp	Multiple	
Ceratoglanis pachynema	Club-barbel Sheatfish	Prevention of pollution	
Datnioides pulcher	Siamese Tiger Perch	Multiple	
Epalzeorhynchos bicolor	Redtail Shark Minnow	Multiple	
Fluvitrygon kittipongi	Roughback Whipray	Multiple	
Fluvitrygon oxyrhyncha	Marbled Freshwater Stingray	Multiple	
Fluvitrygon signifer	White-edged Freshwater Whipray	Multiple	
Hemitrygon laosensis	Mekong Freshwater Stingray	Multiple	
Luciocyprinus striolatus	Monkey-eating Fish	Multiple	
Nemacheilus troglocataractus	Blind Cave Loach	Protection from disturbance	
Oreoglanis lepturus	Slender-tailed Bat Catfish	Multiple	
Pangasianodon gigas	Mekong Giant Catfish	Multiple	
Pangasianodon hypophthalmus	Striped Catfish	Multiple	
Pangasius sanitwongsei	Giant Dog-eating Catfish	Multiple	
Poropuntius deauratus	Yellow Tail Brook Barb	Multiple	

Priority Species	**English Name**	**Conservation Need(s) Requiring Species-Focused Action**	**Over-riding Need for Improved Information**
Probarbus jullieni	Jullien's Golden Carp	Multiple	
Probarbus labeamajor	Thick-lipped Barb	Multiple	
Scaphognathops theunensis	Nam Theun Barb		Yes
Schistura leukensis	Nam Leuk Loach		Yes
Schistura nasifilis	Vietnamese Loach		Yes
Schistura spiloptera	Spot-finned Loach		Yes
Schistura tenura	Slender-tailed Loach		Yes
Scleropages formosus	Asian Arowana	Control of overexploitation	
Sewellia albisuera	Stitched Hillstream Loach	Multiple	
Sewellia breviventralis	Butterfly Loach	Multiple	
Systomus compressiformis	Compressed Barb	Multiple	
Trigonostigma somphongsi	Somphongs's Rasbora		Yes
Urogymnus polylepis	Giant Freshwater Stingray	Multiple	

See Appendix 1 for justification for selection of priority species.
Notes: * = includes both Cat Ba leaf monkey (*Trachypithecus poliocephalus*) and white-headed leaf monkey (*T. leucocephalus*), which are not recognized as full species by IUCN (2020b); † = includes *Chitra vandijki*, which is not recognized as a separate species by IUCN (2020b); *C. indica sensu stricto* does not occur in the hotspot. ‡ = includes *Cuora cyclornata,* which is not recognized as a separate species by IUCN (2020b); *C. trifasciata sensu stricto* also occurs in the hotspot.

In addition to the species in Table 28, 23 species of global conservation concern (11 mammals, six amphibians, four fishes and two birds) were identified that cannot presently be assessed as priority species. These species are not presently listed as globally threatened on the Red List but are otherwise considered likely to meet the selection criteria for priority species. They are, therefore, included on a list of provisional priority species that could become eligible for CEPF investment if their global threat status is reassessed as globally threatened (Appendix 4). However, because whatever new information allows their categorization may also affect their eligibility as CEPF priority species, review will be needed at the time that their global threat status is updated on the IUCN Red List.

In addition, several taxa currently considered by the Red List in species-level synonymy may be valid species and, should they be treated as such, would automatically be categorized as globally threatened and warrant treatment as priority species: white-headed leaf monkey (*Trachypithecus leucocephalus*) (currently within *T. poliocephalus*); Burmese frog-faced softshell turtle (*Chitra vandijki*) (currently within *C. indica*); and Vietnamese three-striped box turtle (*Cuora cyclornata*) (currently within *C. trifasciata*). Should any subspecific taxon within a priority species be treated as a valid species in future revisions of the Red List, it will automatically be considered as a CEPF priority species, provided that the species is assessed as globally threatened and the hotspot supports a globally important population.

13.2 Strategic Directions and Investment Priorities

This section presents a comprehensive investment strategy for CEPF and other donors interested in supporting conservation efforts led by civil society. The strategy comprises 11 strategic directions, grouped into five components. Each strategic direction is defined broadly but contains a number of investment priorities, which outline the particular types of activities that will be eligible for support. The strategic directions and investment priorities are summarized in Table 29 and described in greater detail afterwards.

The investment strategy for the Indo-Burma Hotspot was updated during the final assessment workshop in May 2019, and also draws on the analysis presented in Chapters 3 to 11. Participants at the final assessment workshop were asked to review the investment strategy for the second phase (2013-2020), discuss what worked, what did not work and why, and propose updates, if needed, with justifications. They were also asked to focus on conservation approaches where civil society could play a leading role in implementation (in collaboration with government, where appropriate), and where additional funding would make a significant difference compared with baseline levels of conservation investment from governments and major international donors.

Of the 11 strategic directions in the overall strategy, six were included within the CEPF investment niche (Table 29). These six strategic directions contain 23 of the 45 investment priorities in the overall strategy, focusing on ones that play to the unique strengths of the fund and contribute directly to its global objectives, while complementing the investment strategies of other funders. These six strategic directions form the thematic priorities for CEPF investment in the Indo-Burma Hotspot.

Table 29. Strategic Directions and Investment Priorities in the Indo-Burma Hotspot

Strategic Directions	Investment Priorities
COMPONENT I: CONSERVATION OF PRIORITY SPECIES	
1. Safeguard priority globally threatened species by mitigating major threats [CEPF niche]	1.1 Sustain long-term conservation programs for core populations of priority species
	1.2 Reestablish viable wild populations of priority species in line with global guidelines
	1.3 Conduct research on globally threatened species for which there is a need for greatly improved information on status and distribution
	1.4 Research and pilot innovative funding sources for species conservation
	1.5 Support species champions at the community level to implement locally identified actions for priority species

2. Mitigate zoonotic disease risks by reducing illegal trade and consumption of and threats to wildlife [CEPF niche]	2.1 Support enforcement agencies to unravel high-level wildlife trade networks by promoting the application of global best practice with investigations, intelligence and informants
	2.2 Facilitate collaboration among enforcement agencies involved in combatting illegal wildlife trade, as well as with other sectors as part of a One Health approach
	2.3 Work with private and state-owned companies, with a particular focus on logistics and online platforms, to reduce their involvement in wildlife trafficking
	2.4 Support targeted campaigns to reduce demand and mobilize public participation in detecting and reporting wildlife crime
	2.5 Understand and support action to address linkages between biodiversity and human health, including the role of biodiversity loss in the emergence of zoonotic diseases
COMPONENT II: PROTECTION AND STEWARDSHIP OF PRIORITY SITES	
3. Strengthen management effectiveness at protected areas as a tool to conserve priority sites	3.1 Support the use of global standards and tools for protected area management by all stakeholders and embed in national policy
	3.2 Develop accredited training programs for protected area practitioners within domestic academic institutions and other qualified bodies
	3.3 Pilot the direct involvement of civil society organizations in protected area management and document best practice
	3.4 Support the use of the results of global standards and tools for adaptive protected area management and budgeting
4. Empower local communities to engage in conservation and management of priority sites [CEPF niche]	4.1 Support communities to analyze conservation issues and inform them about rights and opportunities related to natural resource management and conservation
	4.2 Pilot, amplify and develop sustainability mechanisms for community forests, community fisheries and community-managed protected areas through authentic, community-led processes
	4.3 Develop co-management mechanisms for protected areas that enable community participation in zoning, management and governance
	4.4 Revise KBA identification in the hotspot using the new KBA standard
	4.5 Undertake third-party evaluation of project impacts in the priority sites

5. Strengthen biodiversity conservation by promoting sustainable livelihoods and incentives for local communities at priority sites	5.1 Promote sustainable livelihood projects that demonstrably link livelihood and socio-economic improvements to conservation outcomes at priority sites, and document and share practices and lessons
	5.2 Develop and strengthen best-practice ecotourism initiatives at priority sites
COMPONENT III: ENHANCEMENT OF ECOLOGICAL CONNECTIVITY AND RESILIENCE	
6. Demonstrate scalable approaches for integrating biodiversity and ecosystem services into development planning in the priority corridors [CEPF niche]	6.1 Analyze development policies, plans and programs; evaluate their impact on biodiversity and ecosystem services, and propose and actively support the application of alternative development scenarios, nature-based solutions and mitigation measures
	6.2 Develop demonstration projects for ecosystem restoration, with protocols suitable for replication
	6.3 Engage the media in order to increase awareness, inform public debate and influence decision making on mainstreaming biodiversity into development planning
	6.4 Pilot and scale-up models for biodiversity-friendly production, including certification and eco-labelling
7. Minimize the social and environmental impacts of agro-industrial plantations and hydropower dams in the priority corridors	7.1 Support land registration for local and indigenous communities at priority sites
	7.2 Upgrade the legal status of unprotected priority sites threatened by incompatible land uses
	7.3 Strengthen the voices of communities who are potentially or actually affected by agro-industrial plantations and hydropower dams
	7.4 Work with the private sector to ensure that agro-industrial plantations and hydropower dams are developed and operated in an environmentally and socially responsible manner
	7.5 Identify water, food and energy nexus models and develop policy options
	7.6 Support research and monitoring of the impacts of agro-industrial plantations and hydropower dams

COMPONENT IV: DEVELOPMENT OF A CONSERVATION CONSTITUENCY	
8. Strengthen the capacity of civil society to work on biodiversity, communities and livelihoods at regional, national, local and grassroots levels [CEPF niche]	8.1 Support networking mechanisms that enable collective civil society responses to priority and emerging threats
	8.2 Provide core support for the sustainable organizational and technical capacity development of domestic civil society organizations
	8.3 Establish mechanisms to match volunteers to civil society organizations' training needs
9. Conduct targeted education, training and awareness raising to build capacity and support for biodiversity conservation among all sections of society	9.1 Invest in the professional development of future conservation leaders through support to vocational, certificate, diploma and graduate programs at domestic academic institutions, and promote regional replication to each country
	9.2 Investigate the feasibility of establishing an Indo-Burma Conservation Field Studies Center
	9.3 Foster leadership for sustainable development by investing in professional development of key individuals
	9.4 Implement programs of experiential education to connect school children to nature in priority corridors and beyond
	9.5 Conduct targeted, effective outreach and awareness raising for behavioral change among rural and urban populations in regard to the values of natural ecosystems, with a focus on livelihoods, consumption patterns and lifestyle
	9.6 Conduct targeted training and awareness raising activities for decision makers in government and the private sector on biodiversity conservation, including impacts of development policies and projects on ecosystems
COMPONENT V: COORDINATION AND MONITORING OF CONSERVATION INVESTMENT	
10.Evaluate the impacts of conservation investment on biodiversity and human wellbeing through systematic monitoring	10.1 Develop common standards and systems for monitoring the impacts and effectiveness of conservation actions
	10.2 Develop common standards and systems for monitoring the negative impacts of development policies, plans and actions across multiple scales
	10.3 Support systematic efforts to build capacity for monitoring and data analysis among domestic organizations
	10.4 Develop and test mechanisms for ensuring that monitoring results inform national policy debates and local adaptive management

11.Provide strategic leadership and effective coordination of conservation investment through a regional implementation team [CEPF niche]	11.1 Build a broad constituency of civil society groups working across institutional and political boundaries towards achieving the shared conservation goals described in the ecosystem profile

The shared investment strategy is both ambitious and indicative of the scale of the conservation challenges still facing the Indo-Burma Hotspot. The amount of resources required to adequately support work under all parts of the strategy over the next five years very likely exceeds the amount of resources available to any individual funder for investing in civil society. For this reason, it is important for grant making to remain competitive, and to seek out value for money and opportunities for leverage.

Strategic Direction 1: Safeguard Priority Globally Threatened Species by Mitigating Major Threats

Indo-Burma is one of the most important hotspots in the world for the conservation of globally threatened species. It supports 1,298 globally threatened species, including many found nowhere else (Section 5.1). For certain taxonomic groups, such as turtles, Indo-Burma supports more globally threatened species than any other hotspot. Moreover, conservation of threatened species is recognized as a high priority by the CBD, and addressed by Aichi Biodiversity Target 12, that "by 2020 the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained" (SCBC 2010).

Despite the importance of Indo-Burma for globally threatened species, species-focused conservation receives almost no attention from national governments in the hotspot. Moreover, although several international donors (including CEPF) have opened specific funding windows for species-focused conservation, it only receives a small (and dwindling) proportion of overall conservation investment (3 percent during 2015-2019 (see Section 11.4.8), down from 8 percent during 2006-2010). In part, this reflects an assumption on the part of governments and some donors that conservation of representative examples of natural ecosystems, for instance through the establishment of protected areas, will be sufficient to maintain viable populations of the species that occur there. While this is true for many species, a significant number require additional action, particularly to address overexploitation, as evidenced by the "empty-forest syndrome" of protected areas with high levels of forest cover but heavily depleted wildlife populations. The relative low priority given to species-focused conservation also reflects a mindset that species conservation does not contribute to (or is in some way obstructive to) human development goals. The COVID-19 pandemic of 2020 has given the lie to the assumption that the conservation of species should be viewed as a luxury or something that should be left to private philanthropy. The Indo-Burma Hotspot, which combines being on the frontlines of the global extinction crisis with being a center of origin for zoonotic diseases (e.g., avian influenza, Severe Acute Respiratory Syndrome (SARS)), presents tremendous opportunities for focused interventions in species conservation that deliver benefits for human health, wellbeing and economic development, not to mention responding to the linked biodiversity and climate crises facing the planet.

The first phase of CEPF investment has demonstrated that many CSOs active in the hotspot have good capacity to take actions for globally threatened species, particularly INGOs. These actions often provide opportunities for collaboration with domestic CSOs, and with them opportunities for skills transfer. Wherever possible, projects should include capacity building for domestic CSOs in species-focused research and action as an explicit objective. This strategic direction is restricted to the priority species listed in Table 28 but is not geographically restricted to the priority sites and corridors.

Investment Priority 1.1: Sustain Long-term Conservation Programs for Core Populations of Priority Species

One hundred and thirty-six of the 1,298 globally threatened species in Indo-Burma have been identified as priority species. The most common conservation action required for these species is securing core populations from overexploitation. Particularly important is reduction in indiscriminate snaring, which frequently results in the capture of non-target species, and control of targeted collection of high-value species, such as turtles and orchids. Learning from past experience with site-based protection of species and their habitats, more attention should be focused on major improvements in protection and enforcement of laws against poaching, while consideration should be given to the role of each partner and to respective accountabilities (Brook *et al.* 2011). In addition to securing core populations from overexploitation, other priority species require additional species-focused actions, such as supplementary feeding in the case of Critically Endangered vulture species, and highly targeted habitat protection in the case of various bird, reptile and amphibian species with highly restricted ranges. Moreover, many priority fish species face complex, inter-related threats, including over-exploitation, habitat loss, physical barriers to migration and pollution, and are in need of multiple conservation actions.

Of the 113 priority species with conservation needs requiring species-focused action (Table 28), most are already benefiting from such action. More than 30 benefited from species-focused action during the second CEPF investment phase. While many of these conservation programs are beginning to show positive results, including reduction in threats and, in some cases, increase in population size, very few of them have secured long-term funding, making the gains to date fragile. This is particularly the case in the post-COVID-19 period, where pressures on priority species may intensify as people turn to natural resources as a source of food and income.

Projects supported under this investment priority will focus on sustaining conservation programs for priority species. Where opportunities to do so exist, preference will be given to securing long-term financing for species conservation and recovery efforts. Given the uncertain prospects for the global economy over the next three-to-five years, however, this will not always be possible. Simply keeping activities going through this difficult period may be the most realistic strategy to maintain conservation gains in the short-term and contribute to sustainability in the long term. In line with the overall objective of the investment phase, preference will be given to projects that demonstrate scalable approaches that can be replicated for other globally threatened species in the hotspot.

Investment Priority 1.2: Reestablish Viable Wild Populations of Species in Line with Global Guidelines

Many of the priority species in the Indo-Burma Hotspot have undergone significant contractions of range from their historical distributions and are now found in a handful of remnant populations. In some cases, only one potentially viable population is known to remain and, in some cases, not even that. Even where conservation efforts have been successful at reducing immediate threats from over-exploitation and habitat loss, these populations are still vulnerable to stochastic events, such as disease and fire, at the mercy of sudden changes in the political or security situation, and, in the longer term, exposed to difficult-to-predict climate-related impacts (see Section 10.3.2). For these reasons, there is a need to reestablish additional wild populations of these species. This will not only reduce the extinction risks of the species in question but, also, help to restore ecological functions provided by priority species, which are, in many cases, ecological keystone species.

There are a few examples of reintroductions of priority species in the hotspot that have met with, at least, initial success, for example Burmese star tortoise (*Geochelone platynota*) in Myanmar and Siamese crocodile in Vietnam. Projects supported under this investment priority must demonstrate a clear rationale for reintroduction, in terms of reduced extinction risk for the targeted priority species. Improving ecological function, as part of ecological restoration or rewilding initiatives will be viewed preferentially but should not be the primary justification. Projects must also evaluate the success of reintroduction efforts and disseminate lessons learned, to provide examples for other conservation practitioners to learn from. All projects must follow the *Guidelines for Reintroductions and Other Conservation Translocations* developed by the IUCN Species Survival Commission (IUCN/SSC 2013) and should demonstrate the requisite technical guidance and government permissions.

Investment Priority 1.3: Conduct Research on Globally Threatened Species for which there is a Need for Greatly Improved Information on Status and Distribution

Twenty-four priority species require greatly improved information on their status and distribution before conservation action can be taken in any meaningful way. Therefore, support will be provided for applied research on the status, abundance, ecology, threats and distribution of these species, and for applying the results to conservation planning, protected area management, awareness raising and/or community outreach. If the need for greatly improved information on the status and distribution of any of these species is met, they will immediately become eligible for focused conservation actions under Investment Priority 1.1. This investment priority is particularly well suited to domestic academic institutions, and can provide an opportunity for graduate students, such as those being trained under Investment Priority 9.1, to gain valuable field experience.

Investment Priority 1.4: Research and Pilot Innovative Funding Sources for Species Conservation

As mentioned above, the specific actions that are needed to conserve threatened species and avert a wave of extinctions across the hotspot do not find a natural home within the strategies of national governments or most multilateral and bilateral agencies. While a few global funding mechanisms for species conservation exist, such as the IUCN-managed Save Our Species initiative, the Mohamed bin Zayed Species Conservation Fund and the species conservation funds managed by USFWS, they are only modestly resourced, and demand massively outstrips supply. As a result, the availability of funding for species conservation in the Indo-Burma Hotspot is grossly insufficient to support even the highest priority actions.

Thus, there is a need to increase the availability of funding for priority species conservation in the hotspot.

Projects supported under this investment priority will explore and then pilot new funding streams for species conservation from innovative sources. These may include contributions from private sector companies, high-net-worth individuals, the general public (via crowd funding) or other sources (see Section 11.2.4). Projects could establish new funding mechanisms or work with existing mechanisms to develop targeted funding opportunities for priority species in Indo-Burma and then leverage the necessary funds to operationalize them. The types of funding mechanism that could be supported under this investment priority are not limited to grant-making funds and foundations but also include mechanisms linked to individual species or species groups, such as wildlife-friendly products or sponsorship.

Investment Priority 1.5 Support Species Champions at the Community Level to Implement Locally Identified Actions for Priority Species

In contrast to other conservation approaches, species-focused conservation initiatives in Indo-Burma have tended to be conceptualized and led by outside experts, with varying levels of understanding and ownership by local communities. As a result, many of these initiatives remain dependent upon inputs of external expertise and resources, while opportunities to leverage traditional ecological knowledge remain under-realized (see Section 3.1.2). There is a need, therefore, to identify, engage and support (technically and financially) local champions, who can lead conservation actions for priority species at the community level.

Projects supported under this investment priority will support a cohort of ‘species champions’: local people who (currently or potentially) play leadership roles in designing and implementing conservation actions for priority species at the community level. While these conservation actions should be informed by conservation science, they should be identified and designed by the communities themselves, to ensure ownership and social sustainability. Where possible, local funding sources, such as commune budgets or community-owned enterprises, should be explored, to enhance financial sustainability. Preference will be given to initiatives that promote traditional ecological knowledge and traditional management practices and then use them to re-establish communities’ connections with nature and strengthen their voice in management and governance of natural resources.

Strategic Direction 2: Mitigate Zoonotic Disease Risks by Reducing Trade and Consumption of and Threats to Wildlife

Poaching, trade and consumption of wildlife was prioritized as the second-ranked threat to biodiversity in the Indo-Burma Hotspot during the stakeholder consultations (Figure 13). Demand from the wildlife trade is the major factor driving overexploitation of threatened animal species in the hotspot (see Section 6.2.3), and is the largest single factor contributing to the declines of the priority species listed in Table 28. Although wildlife trade/law enforcement receives increasing attention from international donors (it received 8 percent of the total investment during 2015-2019; see Section 11.4.6), support is dominated by a few large initiatives (mainly financed by USAID, INL, DEFRA, and the EU), and wildlife trade remains a low budgetary priority for national governments in the hotspot. Given the links between the wildlife trade and the emergence of zoonotic diseases, such as

SARS and COVID-19 (e.g., Swift *et al.* 2007, Everard *et al.* 2020), and considering that Indo-Burma is the global epicenter of the illegal wildlife trade, reducing trade and consumption of wildlife in the hotspot will not only contribute massively to the conservation of global biodiversity but will also help to mitigate the risk of emergence of future zoonotic diseases.

Investment Priority 2.1: Support Enforcement Agencies to Unravel High-level Wildlife Trade Networks by Promoting the Application of Global Best Practice with Investigations, Intelligence and Informants

Through the concerted efforts of governments and civil society over the last two decades, the capacity of enforcement officers has been increased, coordination among agencies has improved, and the illegal wildlife trade has been destabilized and driven further underground. Nevertheless, demand for wildlife still exists at many levels, and the profits to be made from meeting this demand are enormous. As a result of these factors, the wildlife trade in the hotspot has come under the control of organized crime syndicates, which are overpowering enforcement efforts, by corrupting officers, circumventing weak laws, and exploiting a lack of high-level political will to tackle the issue. Efforts to control the wildlife trade will not be successful as long as arrests and prosecutions are confined to low-level dealers and middlemen, and crime bosses are able to operate with impunity. While actions to unravel the criminal networks that control the majority of the wildlife trade in the Indo-Burma Hotspot must be led by government, CSOs can play a supporting role, by introducing enforcement agencies to global best practice with regard to conducting investigations, gathering intelligence and running informants. Stakeholders consulted during the update of the ecosystem profile believed that CSOs could build the necessary support among government agencies by leveraging concerns about the links between wildlife crime and zoonotic disease risk.

Investment Priority 2.2: Facilitate Collaboration among Enforcement Agencies Involved in Combatting Wildlife Crime, as well as with Other Sectors as Part of a One Health Approach

Over the last two decades, international trade in wildlife within and through the hotspot has been facilitated by increasing liberalization of trade in the ASEAN region, simplification of border controls, and investments in transnational transport infrastructure (see Section 7.3.1). While international cooperation on cross-border wildlife trafficking is on the increase, thanks to the establishment of the ASEAN WEN among other initiatives, there is still significant room for improvement. In many cases, enforcement officials simply remain unaware of the illegality of trade and consumption of many species, or do not consider it a serious issue. There is a need to expand initiatives for reducing trafficking of wildlife, both within hotspot countries and across international borders. The roles for CSOs in these initiatives include facilitating cooperation among different enforcement agencies within and between countries, providing training and materials on wildlife law and identification skills for enforcement officials, engaging non-traditional actors (such as the United Nations Office on Drugs and Crime or ministries of health) in collaborative efforts, and promoting the integration of wildlife crime into the World Health Organization's 'One Health' approach for controlling zoonotic disease risk, which involves multiple sectors working together simultaneously to protect people, wild animals and ecosystems.

Investment Priority 2.3: Work with Private and State-owned Companies, with a Particular Focus on Logistics and Online Platforms, to Reduce their Involvement in Wildlife Trafficking

One of the barriers to combating trade and consumption of wildlife trade has been the low priority given to the issue among government officials at all levels. On the rare occasions when there have been high-profile pronouncements by senior government figures, for instance following the 2003 outbreak of SARS, the impacts have been marked and immediate but rarely sustained. While there are some indications that this may change in response to the COVID-19 pandemic (e.g., Tatarski 2020), there is a need to work in parallel to engage the private sector, in particular companies involved in logistics or online retail: two sectors implicated in facilitating wildlife trade (e.g., ENV 2020). Similar approaches were piloted during under earlier CEPF investment phases, with positive results.

This investment priority recognizes that logistics companies (i.e., airlines, shipping firms, etc.) and online platforms (i.e., social media, e-commerce, etc.) are important, if unwitting, agents in facilitating wildlife trade, not only within the hotspot but also from source countries in other parts of the world (such as southern Africa) to and through the hotspot. There are opportunities for CSOs to engage with these companies, because trafficking of endangered wildlife only forms a small part of their business and the profits they make from it may be outweighed by the potential reputational risks of being branded as wildlife traffickers.

Investment Priority 2.4: Support Targeted Campaigns to Reduce Demand and Mobilize Public Participation in Detecting and Reporting Wildlife Crime

Although some of the key markets for priority species threatened by overexploitation and trade lie outside Indo-Burma, and are, therefore, ineligible for CEPF funding under this investment strategy, a significant proportion of the wildlife illegally exploited in the hotspot is consumed there, either close to the point of source or in urban centers. In this regard, Thailand, Vietnam, and southern China are the major consumer markets. While strengthened enforcement of wildlife protection and trade legislation may reduce pressure on wild populations of priority species, at least at specific sites, a significant reduction in consumer demand is needed to secure these populations in the long term. Pilot civil society initiatives to promote changes in attitudes toward consumption of priority species and mobilize public participation in efforts to detect and report wildlife crime have met with initial success, during CEPF investment phases I and II. However, their impacts on consumption levels have not been systematically assessed and, in any case, any decline would be very difficult to attribute to a particular initiative. The consensus among stakeholders consulted during the update of the ecosystem profile was that initiatives to reduce consumer demand take time to deliver results, so must be sustained, and must be linked to strengthened enforcement of laws against wildlife consumption. This investment priority presents good opportunities to build on the results of earlier phases of CEPF investment, such as by involving the general public in conservation actions through wildlife trade hotlines and volunteer groups.

Investment Priority 2.5 Understand and Support Action to Address Linkages between Biodiversity and Human Health, Including the Role of Biodiversity Loss in the Emergence of Zoonotic Diseases

Over the last decade, and especially following the COVID-19 pandemic, there has been increasing appreciation of the linkages between biodiversity and human health. These linkages include the role of biodiversity loss (fragmentation of forests, reduction in vertebrate species diversity, trade and consumption of wildlife, etc.) in the emergence of zoonotic diseases (e.g., Ostfeld 2009), the interconnections between domestic-dog-mediated rabies, biodiversity conservation and human health (e.g., Machalaba *et al.* 2015, Bindra 2018), and the transmission of diseases between domestic livestock and wild ungulates (e.g., Martin *et al.* 2011). Under this investment priority, CEPF will support targeted research to better understand linkages between biodiversity and human health in the Indo-Burma Hotspot, as well as pilot actions that reduce risks to human health in ways that promote conservation of biodiversity. Particular priority will be given to projects addressing one or more of the priority species listed in Table 28.

Strategic Direction 3: Strengthen Management Effectiveness at Protected Areas as a Tool to Conserve Priority Sites

Over the period 2015-2019, protected area management received 9 percent of conservation investment in the hotspot by international donors, although protected areas also benefited directly from investments under other themes, such as landscape-scale conservation (see Section 11.4). Protected areas were also a principal focus of conservation investment by national governments (see Section 11.2.1), although the bulk of this funding went to infrastructure and staff salaries, not operational management.

An important niche for conservation donors is to fund CSOs to provide support to protected area managers and enforcement agencies in systematic, sustained ways, which are a departure from the short-term interventions and one-off training courses of the past, whose impacts were rapidly diluted by turnover in staff, limitations in government budgetary support and lack of incentive systems. A recent review of the relative success of different approaches to site-based conservation in the hotspot concluded that, to be effective, site-based approaches require committed support of relevant government officials, as well as capable, trained staff with proper incentives and motivation (Eberhardt 2011). Projects eligible for support under this strategic direction are limited to the 35 priority sites that contain formal protected areas, comprising five in the Mekong River and Major Tributaries corridor, two in the Northern Plains Seasonally Inundated Forests, seven in the Tonle Sap Lake and Inundation Zone corridor, 20 in the Sino-Vietnamese Limestone corridor and one Myanmar limestone karst KBA.

Investment Priority 3.1: Support the Use of Global Standards and Tools for Protected Area Management by all Stakeholders and Embed in National Policy

Overall, despite significant investments by national governments and a long succession of interventions at individual sites funded by international donors, only a few protected areas in the hotspot are effectively preventing erosion of their biodiversity values. For example, the Seima Protected Forest in southeastern Cambodia is frequently cited as a model for integrated site-based conservation (Eberhardt 2011). In general, however, a small number of exceptional protected areas notwithstanding, the pattern is one of unchecked exploitation of high-value timber, NTFP and animal species, coupled with gradual degradation and encroachment of natural habitats. To be more effective, protected areas need a substantial number of trained forest rangers, stable budgets to ensure adequate patrolling operations, systematized enforcement patrolling, monitoring and management, and a national system of protected area management accountability for directors and staff (Brook *et al.* 2011). Some of these elements are already available, such as the SMART system for monitoring and reporting on patrolling operations, and the *Competence Standards for Protected Area Jobs in South East Asia* developed by the ASEAN Regional Centre for Biodiversity

Conservation (Appleton *et al.* 2003). However, stakeholders at the final assessment workshop identified the need for these standards and tools to be used more widely, and for their use to be enshrined in national policy. Accordingly, projects supported under this investment priority will need to demonstrate close collaboration between civil society and government.

Investment Priority 3.2: Develop Accredited Training Programs for Protected Area Practitioners within Domestic Academic Institutions and Other Qualified Bodies

Given the large number of priority sites with protected status where enhanced management effectiveness is urgently required, developing separate training initiatives at individual sites is unlikely to be cost effective. Therefore, this investment priority supports training programs for protected area practitioners at the national or sub-national level. These training programs should draw on best practice with protected area management from within and outside the hotspot, and should be accredited by universities, government agencies or other competent authorities. While training needs may differ among priority sites, training programs could be built around a core set of competencies, and then tailored to the needs of particular groups of trainees. If it is to lead to sustained improvements in management effectiveness, training needs to be reinforced over long periods. For this reason, funding under this investment priority is limited to training programs that are institutionalized within domestic academic institutions or other qualified bodies, such as forestry colleges.

Investment Priority 3.3: Pilot the Direct Involvement of Civil Society Organizations in Protected Area Management and Document Best Practice

The shortcomings of formal protected areas are widely acknowledged, and the factors limiting their effectiveness are consistently diagnosed, such as lack of incentive systems for managers and enforcement staff, insufficient and inappropriate budgets, and limited opportunities for local revenue generation. Many of these limiting factors can only be addressed as part of comprehensive public administration reform processes, which CSOs working on biodiversity conservation have little or no ability to influence. For this reason, alternative approaches to enhancing protected area management effectiveness have been proposed, whereby CSOs are directly involved in protected area management. These approaches have the potential to break the impasse and demonstrate significant and lasting improvements in protected area management effectiveness. There is a need to pilot such approaches in a range of contexts to provide examples of success, and to document best practice to facilitate wider uptake.

Investment Priority 3.4: Support the Use of the Results of Global Standards and Tools for Adaptive Protected Area Management and Budgeting

The roll out of global standards and tools, such as SMART, under Investment Priority 3.1 should generate more systematic information on threats facing protected areas and the effectiveness of management responses. This investment priority will support projects that use this information for adaptive protected area management and budgeting. These projects will involve some combination of establishing systems for adaptive management and training protected area managers in their use. To be most cost effective, and to build communities of practice, projects should provide this support to multiple protected areas.

Strategic Direction 4: Empower Local Communities to Engage in Conservation and Management of Priority Sites

Throughout the Indo-Burma Hotspot, governments lack the necessary capacity, resources and political will to manage formal protected area systems effectively, let alone to do this for sites outside these systems (which make up 61 percent of the priority sites). At many sites, however, mobilized local communities, if sufficiently informed and empowered, can effectively prevent biodiversity loss, and, in many cases, are already doing so, following traditional management practices or adopting new models for community-based conservation. Moreover, given the constraints on local participation and access to resources imposed by existing protected area regulations in most countries in the region, community-based conservation initiatives can provide greater opportunities for meaningful participation in decision making regarding the use of natural resources than conventional protected area approaches. Consequently, such initiatives can contribute to improved livelihoods for rural people, especially those with high levels of dependence on natural resources.

During the first years of the 2000s, various community-based approaches to conservation were piloted in the hotspot, including community-based primate conservation groups in northern Vietnam (e.g., Swan and O'Reilly 2004), and village-protected fish conservation zones in deepwater pools in southern Lao PDR (e.g., Baird 2001) and, independently, in Hainan (e.g., Padilla and Fellowes 2010). These pilots demonstrated that community-based approaches could be viable alternatives to conventional protected area approaches under certain circumstances, in particular, where a substantial proportion of pressure on biodiversity originates within the community and government agencies enforce restrictions on exploitation of high value species by outsider actors.

Over the last 15 years, these pilot approaches were replicated throughout the hotspot (e.g., Pilgrim *et al.* 2011), including under CEPF investment phases I and II. The lessons learned from this experience have been reviewed, including by Eberhardt (2011), who found that the primary conditions for success were "a commitment to participatory process, clear land tenure regimes, community institutions capable of equitably representing their 'constituencies' and of negotiating their interests, and an interest in conservation, whether through benefits of sustainable harvest, or economic gain through direct payments". There is now a need to amplify these approaches more widely, and to enhance financial and social sustainability, particularly through ensuring local community ownership and equitable sharing of benefits.

With the exception of Investment Priority 4.4, which focuses on KBA identification, to be eligible for support under this strategic direction, projects must focus on one or more of the 90 priority sites listed in Table 27. Recognizing the critical role of gender relations in determining men and women's access to and participation in management of natural resources (see Section 7.2.5), projects must also integrate gender considerations into their design and implementation.

Investment Priority 4.1: Support Communities to Analyze Conservation Issues and Inform Them about Rights and Opportunities Related to Natural Resource Management and Conservation

To empower local communities to engage in conservation, the first step is to support them to analyze conservation issues that affect them and assist them to explore different options for responding to these issues. A number of approaches to facilitating community knowledge generation and analysis have been demonstrated in the hotspot, including *thai baan* research, which was developed in Thailand and replicated in other hotspot countries. A prerequisite for communities exploring different conservation options in an informed manner is ensuring that they understand their rights and responsibilities, for example in regard to access and benefit sharing. This understanding should extend beyond government legislation to include customary laws and regulations. Also, any analysis of options for site-based conservation should include an exploration of the potential adverse impacts on local people of conservation area establishment, alongside promotion of the potential benefits. Communities should also be presented with options to plan and manage land and/or natural resources collectively that do not involve designation of any form of conservation area.

Investment Priority 4.2: Pilot, Amplify and Develop Sustainability Mechanisms for Community Forests, Community Fisheries and Community-Managed Protected Areas through Authentic, Community-Led Processes

Although the majority of donor and government investment in site-based conservation over recent decades has focused on protected areas, there has been an increasing recognition of the potential for innovative, community-based conservation of natural ecosystems outside formal protected areas, whether through the establishment of community forests, community fisheries or community-managed protected areas. This is recognized in the Seventh Conference of the Parties to the CBD's Decision on Protected Areas, which "underlines the importance of conservation of biodiversity not only within but also outside protected areas" and suggests that parties "recognize and promote a broad set of protected area governance types... which may include areas conserved by indigenous and local communities". A similar conclusion was reached by a recent study by Porter-Bolland *et al.* (2011), which found community forests to be as, if not more, effective at reducing rates of deforestation, compared with formal protected areas.

Experience with community forests is particularly well advanced in Cambodia, where the National Forest Programme sets an objective of bringing 20,000 square kilometers of forest under community management by 2030 (Royal Government of Cambodia 2010). Community fisheries are well established in Lao PDR, where more than 1,300 community co-managed fish conservation zones are formally recognized (Ounboundisane *et al.* 2018) and Cambodia, and being tested in the other hotspot countries. Community-managed wetlands have also been piloted in the hotspot, for example at Goot Ting marshes in northeastern Thailand (Parr *et al.* 2011). There is a need to amplify these approaches to a greater number of priority sites, particularly in the Mekong River and Major Tributaries, and Sino-Vietnamese Limestone corridors, which contain, respectively, 13 and 11 KBAs that lie entirely outside formal protected areas.

The hotspot also contains various models of indigenous and community conserved areas, some established autonomously by communities, others induced by outside actors. Such areas can provide cost effective conservation investments, especially where local communities are motivated to conserve them for their spiritual values. One challenge is supporting community autonomy over these areas and getting outsiders to support communities rather than dictate how they should manage them (J. Ironside *in litt.* 2012). Another is ensuring equitable governance at the community level, to avoid elite capture of benefits.

Although there are examples of community forests, community fisheries and community protected areas across the hotspot as a whole, in no country are there good examples of all three approaches. Therefore, projects supported under this investment priority will pilot these approaches where this is needed, document and amplify good practice approaches where these exist (including between countries), and, crucially, build community capacity to secure funds to support conservation and management of community-based approaches to site conservation. All projects must adopt authentic, community-led approaches, build ownership and capacity at the community level, and pursue objectives set by communities themselves.

Investment Priority 4.3: Develop Co-Management Mechanisms for Protected Areas that Enable Community Participation in Zoning, Management and Governance

Even within protected areas, there are many opportunities to engage local stakeholders in zoning, management and governance, for instance through joint patrolling or community representation on management boards or advisory committees. Throughout the hotspot, pilot initiatives have been implemented in this direction. At Kuiburi National Park in Thailand, for example, local people and other stakeholders participated in the management planning process through a 'park management board working group' (Parr *et al.* 2008). Through such pilots, a number of important lessons have been learned, particularly related to the need for participatory project and activity planning, increased attention to provision of tangible benefits that meet both conservation and development objectives and are tailored to heterogeneous communities, increased support for awareness-raising activities, clear monitoring of activities and impacts, and truly committed partner support for implementation. There has been good recent experience in Cambodia of participatory protected area zoning with local communities, for instance at Kulen Promtep Wildlife Sanctuary. This approach can enhance acceptance of protected area objectives among local people and establish a basis for joint planning and implementation of conservation activities. However, there remains a need to mainstream community protected area models into protected area zoning in Cambodia.

To be eligible for support under this investment priority, projects must demonstrate meaningful participation of local communities that gives them a genuine voice in protected area management decision making at priority sites. This is essential because, at some protected areas, co-management structures exist but the voice of local people is not being heard. Given the fact that ethnic minority groups have a disproportionate influence on (and, by implication, are disproportionately impacted by) formal protected areas (see Section 7.2.3), priority will be given to mechanisms that engage ethnic minorities in protected area management. This may require provision of capacity building to enable more effective and equitable involvement in management actions and decision making.

Investment Priority 4.4: Revise KBA Identification in the Hotspot Using the New KBA Standard

As discussed in Chapter 5, most of the KBAs in the Indo-Burma Hotspot were identified prior to the adoption of the *Global Standard for the Identification of Key Biodiversity Areas* (IUCN 2016). Consequently, significant work is required to update the KBA analysis in each country to meet the KBA Standard. In particular, the thresholds and documentation standards of the KBA Standard are more stringent than those used formerly, and there are additional steps of expert review and confirmation. In addition, the global threat status of many species has been updated or assessed for the first time since the KBAs were originally identified, while new criteria have been adopted, allowing KBAs to be identified for other elements of biodiversity, such as threatened ecosystems.

Updating the list of KBAs in the Indo-Burma Hotspot to meet the KBA Standard will bring many benefits. With the exception of Myanmar, this will be the first comprehensive assessment of site-scale conservation priorities for nearly two decades; as such, it can be expected to put new sites on the map and catalyze conservation action for them. The results can inform national-level spatial planning for conservation, as well as climate change mitigation and adaptation, helping governments to plan for sustainable development and meet their obligations under the CBD, UNFCCC and other multilateral environmental agreements. Moreover, the work will provide a robust, up-to-date inventory of sites that contribute significantly to the global persistence of biodiversity, which can be used to inform the application of environmental standards by international financial institutions or Equator Banks that finance large-scale development projects in sectors with large environmental footprints, such as transport, mining, energy and agriculture. In order to ensure that the results of any exercise are updated periodically and are leveraged to mainstream biodiversity in the ways outlined, preference will be given to projects that propose a continuous process rather than a one-off exercise. This may entail the establishment of national and/or regional KBA coordination groups or similar bodies, which bring together KBA data holders and data users.

Investment Priority 4.5: Undertake Third-party Evaluation of Project Impacts in the Priority Sites

It is anticipated that a wide variety of conservation approaches will be piloted at priority sites under Strategic Direction 4, covering all hotspot countries and a diversity of social and environmental contexts. Because the priority sites only represent 16 percent of the site outcomes in Indo-Burma, maximizing the impacts of these investments at the scale of the hotspot will require an explicit focus on documenting lessons learned. This will, in turn, enable amplification of good practice approaches, with an understanding of success factors, pitfalls to avoid and context-specific considerations.

Under the previous CEPF investment phases, most evaluation of site-based conservation projects was based on self-reporting by grantees. This will continue during the third phase but be complemented by rigorous third-party evaluation of project impacts (in particular those on biodiversity and human wellbeing). To this end, grants will be awarded under this investment priority to CSOs with the requisite skills and experience. Each grant will evaluate a cohort of projects with common features, such as being implemented in the same country or priority corridor or adopting a similar approach. The CSOs undertaking the third-party evaluations will be expected to develop impact measures and other elements of the evaluation design collaboratively with the grantees being evaluated. Preference will be given to projects that transfer skills in project evaluation to domestic CSOs.

Strategic Direction 5: Strengthen Biodiversity Conservation by Promoting Sustainable Livelihoods and Incentives for Local Communities at Priority Sites

Almost without exception, the priority KBAs in the Indo-Burma Hotspot have people living in or around them, sometimes in large numbers. Many of these people’s livelihoods are dependent upon the biodiversity within these sites, either directly, through extraction of wildlife, timber and NTFPs, or indirectly, through provision of water for irrigation and domestic use, flood control and other ecosystem services. For example, some 70 percent of the population of rural Cambodia relies at least partly on NTFPs for food and cash income (Blaser *et al.* 2011), while a study in northern Myanmar found NTFP collection to be the highest source of income for 31 percent of respondents, making it second only to farming

(Rao *et al*. 2010). The contribution that KBAs make to livelihoods and human wellbeing can provide a strong incentive for local communities to conserve them. However, for this to happen, local people's rights to access resources sustainably need to be recognized, grassroots institutions for natural resource management need to be established and strengthened, and clear linkages need to be formed between livelihood interventions and conservation goals.

Livelihood improvement for local people is widely promoted as a strategy for biodiversity conservation at the site scale. However, unfocused investments in livelihood improvement are unlikely to have positive impacts on biodiversity conservation, and may even have negative ones, for instance through increasing local extraction and/or consumption of natural resources. Across the hotspot, government and donor investment in livelihood improvement dwarfs investment in biodiversity conservation, meaning that it should not be considered a priority for conservation funders unless there are very clear linkages between the two. Several projects that directly linked livelihood improvement to conservation objectives were supported under previous CEPF investment phases, featuring negotiated agreements, direct payments for nest protection, ecolabelling of agricultural products and other innovative approaches. There is a need to refine these approaches, understand the key success factors and replicate them widely.

To be eligible for support under this strategic direction, projects must focus on one or more of the 90 priority sites listed in Table 27. Projects must present strong theories of change, which demonstrate clear linkages between the livelihood intervention and conservation of the global biodiversity values of the site(s) in question. Recognizing the critical role of gender relations in determining men's and women's access to and participation in management of natural resources (see Section 7.2.5), projects must also integrate gender considerations into their design and implementation. Finally, project should give consideration to supporting climate-resilient livelihoods.

Investment Priority 5.1: Pilot Sustainable Livelihood Projects that Demonstrably Link Livelihood and Socio-economic Improvements to Conservation Outcomes at Priority sites, and Document and Share Practices and Lessons

In many cases, threats to biodiversity from overexploitation of natural resources can be addressed by putting in place regulations and management structures to regulate their sustainable use. Such measures include community forests and community fisheries, which are provided for under Investment Priority 4.2. In some cases, however, sustainable use may not be a feasible strategy, for instance if the resource in question requires a total halt on extraction in order to recover. This is the case for many high-value timber species and wildlife species such as turtles, whose populations are already at such low levels that they cannot sustain even the lowest level of offtake.

To date, most initiatives to control overexploitation of natural resources in Asia have aimed at enforcing the law rather than finding alternatives (SCBD 2011). However, these have not been tremendously successful, at least not within the Indo-Burma Hotspot, due, at least in part, to the economic cost of changing behavior. Many conservation practitioners feel that neither enforcement nor alternative livelihoods work well in isolation but can do if they are applied in unison. People involved in the unsustainable exploitation of wildlife, timber and NTFPs can be persuaded to switch to other activities, if faced with a combination of disincentives (fines, confiscations, etc.) and economic alternatives; honey and beeswax production is an example of an alternative that can provide better revenue in certain specific contexts (Kim *et al*. 2008, SCBD 2011).

Among the various approaches that link livelihood improvements to conservation outcomes, there is a growing body of experience from the hotspot that negotiated agreements are an effective tool. Best-practice examples include initiatives led by WCS in the Northern Plains of Cambodia that link ecotourism revenue and access to markets for sustainable commodities to compliance with participatory land-use plans regulating where local people can farm and access resources, and initiatives led by GEI and partners in Myanmar that apply CCCAs, with clearly defined socio-economic benefits for compliance with mutually agreed conservation goals. There is a need to consolidate and amplify such approaches, and to document and disseminate lessons learned. To this end, preference will be given to supporting ongoing initiatives, particularly ones with demonstrated value chains and links to markets rather that providing short-term support to new initiatives with limited prospects for sustainability.

Investment Priority 5.2: Develop and Strengthen Best-practice Ecotourism Initiatives at Priority Sites

One alternative livelihood that is widely promoted as a means of addressing poverty alleviation and biodiversity conservation goals is ecotourism. However, most self-styled ‘ecotourism’ ventures in the hotspot are very far from the definition and principles of ecotourism espoused by The International Ecotourism Society (1990): "responsible travel to natural areas that conserves the environment and improves the wellbeing of local people". While a number of good examples have been developed in the hotspot over the last decade, most notably in Cambodia and Lao PDR, there remains a need to develop best-practice models and to strengthen existing ones. In view of the downturn in international visitors during the COVID-19 pandemic, consideration should be given to diversifying livelihood options at the household and community level, to avoid over-dependence on tourism as a source of income, as well as in developing products aimed at the domestic market.

Projects supported under this investment priority should demonstrate that they have been developed with the consent and ownership of local communities, and that they deliver livelihood benefits clearly linked to conservation objectives. Moreover, because there is a real danger of elite capture of community-based ecotourism ventures, projects must consider how to ensure transparency and accountability around benefit sharing.

Strategic Direction 6: Demonstrate Scalable Approaches for Integrating Biodiversity and Ecosystem Services into Development Planning in the Priority Corridors

Natural ecosystems across the hotspot are becoming increasingly fragmented and their ecological integrity is diminishing. Consequently, they have a reduced ability to sustain viable populations of globally threatened species, adapt to climate change, and provide services essential to human wellbeing, such as water regulation. As a general rule, conservation interventions in the hotspot have tended to focus on tackling immediate threats, rather than addressing the root causes and enabling factors, which include economic growth and regional economic integration, changes in consumption patterns, and weak regulatory and governance frameworks (see Section 6.8). Rather than these causes and factors being viewed as unassailable obstacles, they should rather be seen as opportunities for civil society to mainstream biodiversity, communities and livelihoods into economic development and secure broader political, institutional and financial support for these goals. In this way, the natural ecosystems of the hotspot will be better able to support a green economic recovery post COVID-19 and enhance the resilience of the hotspot countries to climate change.

This strategic direction is in line with Sustainable Development Goal 15 of the United Nations, which sets a target for the global community to "integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts." It also addresses Aichi Biodiversity Targets 2, that "by 2020, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes," and 7, that "by 2020 areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity" (SCBD 2010).

To be eligible for support under this strategic direction, projects must demonstrate scalable approaches that are suitable for replication by civil society or private sector actors or incorporation into government programs. Projects must also target one of the five priority corridors listed in Table 27 (Chindwin River, Mekong River and Major Tributaries, Northern Plains Seasonally Inundated Forests, Tonle Sap Lake and Inundation Zone, and Sino-Vietnamese Limestone) or one of the 24 Myanmar limestone karst KBAs.

Investment Priority 6.1: Analyze Development Policies, Plans and Programs, Evaluate their Impact on Biodiversity and Ecosystem Services, and Propose and Actively Support the Application of Alternative Development Scenarios, Nature-based Solutions and Mitigation Measures

Many of the major threats in the priority corridors originate from land-use and development policies, plans and programs formulated with insufficient consideration of their impacts on biodiversity, communities and livelihoods. As a result, site-based conservation interventions, such as protected area management or community forestry, are frequently undermined by incompatible development activities, such as industrial agriculture, large infrastructure, mining and quarrying (see Section 6.3). A major factor contributing to this trend is the limited integration of conservation objectives into development planning processes, especially in sectors with potentially significant impacts on natural ecosystems: industry; energy; transport; forestry; agriculture; fisheries; and tourism.

There are several means by which CSOs can promote better integration of biodiversity and ecosystem services into development policies, plans and programs, including: conducting and disseminating research into alternatives; promoting comprehensive options assessments; undertaking independent reviews of EIAs and SEAs; and monitoring and evaluating the impacts of development policies, plans and programs on biodiversity. Projects supported under this investment priority will: analyze the impacts of development policies, plans and programs on biodiversity and ecosystem services; propose and actively support alternative development scenarios and mitigation measures; and promote meaningful participation of affected communities in development decision making. Preference will be given to projects that promote nature-based solutions and biodiversity-centric alternative development scenarios, especially in the context of post-COVID-19 recovery (see ADB 2020). Such alternatives could include development (or renewal) of low-intensity agroforestry (see Section 6.3.2) or ecological farming methods (see Section 6.8.3) as alternatives to industrial agriculture that maintain and revitalize traditional knowledge, culture and livelihoods.

Investment Priority 6.2: Develop Demonstration Projects for Ecosystem Restoration, with Protocols Suitable for Replication

As explained in Section 6.1, Indo-Burma is the most threatened hotspot in the world, based on the proportion of original habitat remaining (CI 2011). In certain parts of the hotspot, habitat fragmentation is now so advanced that it is questionable whether remaining blocks of natural habitat are large enough to maintain the biodiversity values they are important for into the long term, even with significant improvements in management effectiveness. For example, some of the primate species endemic to the Sino-Vietnamese Limestone corridor are restricted to habitat fragments a few tens of square kilometers in area. Ecosystem restoration efforts are required to enhance the integrity of core areas in the short term, and to establish connectivity with other areas of habitat in the longer term.

At the same time, loss (or serious depletion) of populations of keystone species, such as Asian elephant, hornbills, large ungulates and large carnivores, is leading to ecological changes, loss of ecosystem function and reduction in delivery of ecosystem services. As the ecosystem service values (and nature-based tourism potential) of remaining natural habitats diminish, so too does support for their conservation among local communities and government decision makers. In this context, it becomes important to restore representative examples of key ecosystems, to demonstrate their real values. Projects supported under this investment priority will demonstrate approaches for ecosystem restoration within the priority corridors, either targeting priority sites or the intervening habitats that connect them. To realize their demonstration value, these projects should develop restoration protocols that are suitable for replication elsewhere in the hotspot.

Investment Priority 6.3: Engage the Media in Order to Increase Awareness, Inform Public Debate and Influence Decision Making on Mainstreaming Biodiversity into Development Planning

To date, the major steps taken by governments and donors to mainstream biodiversity into economic development have been to introduce environmental standards and policies (including on EIA) and to make provisions for limited public participation in development decision-making processes. Significant though these steps have been, they have proven insufficient to fully integrate biodiversity into other sectors. Individual CSOs and, especially, civil society networks are often well placed to promote biodiversity mainstreaming, because they have good connections at the grassroots level and a good understanding of the impacts of policies and projects on biodiversity and local communities. One of the approaches adopted by civil society with demonstrated effectiveness during previous phases of CEPF investment has been use of the media as a tool for raising awareness about development issues with major social and environmental implications, and thereby increasing the quality of public debate. Projects supported under this investment priority will consolidate and amplify this approach, making use of both traditional and new media. As recommended by the long-term vision exercise (Section 3.2), it is important not just to view the media as a channel to convey conservation messages to other target groups but, rather, to engage with the media as a key target group in their own right. To this end, projects could provide trainings and briefings for journalists on key conservation issues, train citizen journalists, and build and strengthen specialist networks of environmental journalists.

Investment Priority 6.4: Pilot and Scale-up Models for Biodiversity-friendly Production, Including Certification and Eco-labelling

During the previous phases of CEPF investment in the Indo-Burma Hotspot, some of the greatest progress with mainstreaming biodiversity and local livelihoods into development has been made with regard to biodiversity-friendly production. Most investments have been made in relation to rice production, with the promotion of wildlife-friendly ecolabels, such as Ibis Rice. However, there has also been progress with developing biodiversity-friendly models for tea cultivation, orchid cultivation, wild medicinal plant collection, and cement manufacture. These models involve ecolabelling, third-party certification or some combination of the two. There is a need to take existing models to scale, so that they can achieve economic sustainability, as well as to pilot new models for other products, giving particular attention to products linked to biodiversity loss, such as rubber, coffee, cardamom and palm oil.

Strategic Direction 7: Minimize the Social and Environmental Impacts of Agro-industrial Plantations and Hydropower Dams in the Priority Corridors

During the final assessment workshop in May 2019, industrial agriculture and large infrastructure (i.e., hydropower dams and associated infrastructure) were ranked as the number one and number three overall threat, respectively (Figure 13). Stakeholders considered industrial agriculture to be the top ranked threat in Cambodia and Vietnam, while large infrastructure was considered the top ranked threat in Lao PDR, Thailand and regionally (Table 4). To some degree, these threats are addressed by Strategic Direction 6, which aims to mainstream biodiversity, community and livelihood concerns into development planning. However, recognizing the extreme immediacy and scale of these two threats, stakeholders identified a need for additional, targeted activities, specifically addressing them. Consequently, during the 2011 update, detailed strategies were developed to respond to each of these threats. These strategies were then revisited during the 2019-2020 update, especially during the final assessment workshop, where two additional investment priorities were proposed (Investment Priorities 7.5 and 7.6).

The strategy for addressing the threat presented by agro-industrial plantations identifies four areas with high potential for impact where additional conservation investment would make a significant difference. The first of these (undertaking economic valuation of alternatives) is addressed by Investment Priority 6.1. The remaining three areas (strengthening prior claims by communities to key sites, strengthening the voice of affected communities during the project approval process, and developing industry guidelines or policies on siting plantations) are addressed by Investment Priorities 7.1, 7.3 and 7.4, respectively.

The strategy for addressing the threat posed by hydropower dams identified five areas with high potential for impact where there was a high need for additional conservation investment. The first of these (build capacity of domestic NGOs and CBOs, especially in technical skills, messaging and communication, and negotiation skills) is addressed by Investment Priority 8.2. The remaining four areas (conduct activities supporting conservation of fisheries and biodiversity, including protected area designation, management, patrolling and monitoring; fund professional media that are accurate, attractive, concise and compelling and can be used to influence decision makers; conduct research into energy alternatives, energy conservation and realistic assessments of power demand; and conduct research to address gaps in studies on hydropower dam impacts commissioned by the MRC) are addressed by Investment Priorities 7.2, 7.3, 7.5 and 7.6 respectively.

To be eligible for support under this Strategic Direction, activities must address threats posed by agro-industrial plantations and/or hydropower dams, and target one of the five priority corridors listed in Table 27 (Chindwin River, Mekong River and Major Tributaries, Northern Plains Seasonally Inundated Forests, Tonle Sap Lake and Inundation Zone, and Sino-Vietnamese Limestone).

Investment Priority 7.1: Support Land Registration for Local and Indigenous Communities at Priority Sites

During the final assessment workshop, industrial agriculture was identified as the top-ranked threat to biodiversity in the hotspot, and as the number-one threat in Cambodia and Vietnam (Table 4, Section 6.3.1). One of the approaches with significant potential for impact identified during the stakeholder consultations was strengthening communities' prior claims to key sites, through a combination of systematic land registration for local and indigenous communities, and designation of community forests, fisheries and conservation reserves. The latter is addressed by Investment Priority 4.2 and the former by this investment priority. While there has been significant progress with land registration at some sites, including both household and community claims, there remain a lot of land conflicts between local and indigenous communities and companies that have been granted ELCs. Resolving these conflicts, while challenging, remains very relevant.

Projects supported under this investment priority will support registration of land ownership and tenure by communities living in and around priority sites, particularly Indigenous People. In addition to strengthening their prior claims over agricultural and forest land in the face of ELCs, this will also establish a foundation for sustainable natural resource management, by creating conditions for long-term thinking, and help communities to be better placed to share benefits from future REDD+ projects that may be developed at the priority sites.

Investment Priority 7.2: Upgrade the Legal Status of Unprotected Priority Sites Threatened by Incompatible Land Uses

This investment priority is especially relevant to the Mekong and Major Tributaries and Sino-Vietnamese Limestone corridors, which, between them, contain 22 priority sites that lie entirely outside formal protected areas, plus several others that are only partly protected. Several of these 'unprotected' sites are imminently threatened by incompatible land uses, including agro-industrial plantations and hydropower dams. As one element of the strategy to respond to the threat posed by hydropower dams, stakeholders recommended that the status of certain state-owned lands within priority sites be upgraded to protected forest, protected area or other suitable legal designation. Although they may have limitations in terms of mitigating logging, hunting and grazing, protected areas in tropical countries have proven to be a useful mechanism for stopping land clearance (Bruner *et al.* 2001), and thus they can be an important tool in mitigating the impacts of large-scale development projects. Projects supported under this investment priority must ensure that any proposals for upgrading the legal protection status of land are developed with the participation of local and indigenous communities, according to the principle of free, prior and informed consent.

Investment Priority 7.3: Strengthen the Voices of Communities who are Potentially or Actually Affected by Agro-industrial Plantations and Hydropower Dams

Recent experience from across the hotspot shows that government decision makers and project proponents remain largely unaware of many of the impacts of large-scale development projects, and voices of concern from local communities and CSOs are not being heard. This is especially true for agro-industrial plantations and hydropower dams, which are typically not financed by international financial institutions or Equator Banks, and not, therefore, subject to stringent social and environmental standards. As the economies of the hotspot countries develop and their dependence on ODA diminishes, the influence of international CSOs and multilateral and bilateral donors on development decision making is waning. However, there are signs that governments can show responsiveness when local people tell their own story, verified by credible research and analysis.

This investment priority is intended to support initiatives that strengthen the voices of communities affected by development projects with major impacts on biodiversity, including through action research, strengthening of community institutions and networks, and policy advocacy. The voice of communities needs to be heard at all stages of the project cycle, not only during planning, appraisal and approval but also during implementation of social and environmental management plans, to ensure that commitments made by developers are met.

Investment Priority 7.4: Work with the Private Sector to Ensure that Agro-industrial Plantations and Hydropower Dams are Developed and Operated in an Environmentally and Socially Responsible Manner

A moratorium on agro-industrial plantations and hydropower dams across the hotspot is not a realistic objective; neither is it necessarily a desirable one, given the economic necessity for energy, agricultural commodities and employment. What is required, however, is to ensure that such developments are sited in areas of marginal biodiversity and ecosystem service value, using methods or designs to reduce impacts (such as the construction of effective fish passageways at dams), with the free, prior and informed consent of affected communities, and with appropriate compensation for any negative social or environmental impacts.

Projects supported under this investment priority will engage constructively with private sector companies involved in agro-industrial plantations and hydropower dam development to ensure that these developments are designed and operated in an environmentally and socially responsible manner. In some cases, such as palm oil, tea and coffee, markets for sustainably produced commodities already exist, providing a clear economic incentive for companies to improve the environmental and social standards of their plantations. In other cases, the business case presented to companies may need to be built upon a mixture of reputational risk (which is more likely to be of concern to international rather than domestic companies) and social license to operate (i.e. companies that have a reputation for environmental and social responsibility are likely to face less opposition from local communities and CSOs, and have less risk of their projects being contested). In line with the recommendations from the long-term vision exercise (Section 3.2), projects should focus initially on specific, market-leading companies within each hotspot country.

Investment Priority 7.5: Identify Water, Food and Energy Nexus Models and Develop Policies Options

There is growing recognition of the interdependencies among the systems that supply water, food and energy (McCallum *et al.* 2020). As human populations grow and levels of per capita consumption increase, it will become increasingly difficult to meet demands for water, food and energy (Obersteiner *et al.* 2016). Nexus frameworks are considered to provide one of the few means available for helping decision makers understand the complex interrelationships among these three sectors, although development of such frameworks has been limited to date (McCallum *et al.* 2020). Projects supported under this investment priority will develop computer models that allow decision makers to explore trade-offs among supply of water, food and energy under different land-use and development scenarios and apply the results to develop policy options. In this way, the projects will help promote evidence-based decision making that takes account of the essential contributions of natural ecosystems to ensuring a sustainable supply of water, food and energy, to meet the needs of a growing population into the future.

Investment Priority 7.6: Support Research and Monitoring of the Impacts of Agro-industrial Plantations and Hydropower Dams

Over the last decade, in spite of voices of concerns from affected communities, civil society and many observers within the region's governments, a number of large agro-industrial plantation and hydropower dam developments have proceeded, including the Xayabouri and Don Sahong dams on the Lower Mekong River, and the Lower Sesan II dam, which affects two of its major tributaries. While the worst environmental and social impacts of these and other projects are, by now, unavoidable, it is nevertheless essential to undertake independent and participatory research and monitoring of these impacts.

Projects under this investment priority will support such research and monitoring. The results can be used to generate a more accurate understanding of the costs and benefits of similar projects, leading to better decision making and, hopefully, improved economic, environmental and social outcomes. There may also be opportunities to use the results of research and monitoring to formulate recommendations to mitigate or compensate for social and environmental impacts. For example, within ELCs, there may be various options, including opportunities to return land to local communities and/or undertake ecological restoration.

Strategic Direction 8: Strengthen the Capacity of Civil Society to Work on Biodiversity, Communities and Livelihoods at Regional, National, Local and Grassroots Levels

As discussed in Section 9.1, the leverage that INGOs have with governments and their ability to influence development policy and planning is starting to diminish. At the same time, domestic CSOs are growing in influence and stature, and beginning to play leading roles in efforts to address key threats to biodiversity. While the contribution of INGOs to conservation efforts is likely to remain critical for some time to come, responsibility is gradually shifting to a new generation of domestic CSOs that are growing in credibility and exploring new avenues for influencing the development trajectories in the hotspot. All of the stakeholder consultations held by CEPF over the last decade have emphasized the need for international donors to invest directly in the development of domestic civil society, in order to develop skilled, authoritative and well coordinated advocates for biodiversity conservation at regional, national, local and grassroots levels. The thematic study on conservation investment (Chapter 11) also identified capacity building for civil society as a funding gap. Only the government of Thailand makes significant funding available for civil society, and this is not specifically for capacity building, while less than 2 percent of international donor investment in conservation between 2015 and 2019 was on capacity building (see Section 11.4.9).

Given the need for greater investment in capacity building for female conservation practitioners in the hotspot (see Section 7.2.5), projects must integrate gender considerations into their design and implementation and demonstrate strategies to ensure gender equity in access to capacity building. Moreover, preference will be given to supporting networks and organizations with women and/or Indigenous People in leadership positions.

Investment Priority 8.1: Support Networking Activities that Enable Collective Civil Society Responses to Priority and Emerging Threats

A key finding of the chapter on the civil society context was that one of the most effective strategies adopted by CSOs to respond to conservation issues has been establishment of multi-tier, issue-based networks (see Section 9.7). One of the most effective networks over the last decade has been the Save the Mekong Coalition, which brings together international and domestic NGOs, CBOs, academics, journalists and concerned individuals throughout the hotspot. Network approaches leverage the skills, networks and geographical coverage of different organizations to form a whole that is greater than the sum of its parts. They can foster collaborative action and provide a means of engaging actors who might not usually be part of the conservation movement but are natural allies when common interests are at stake, particularly rural development and rights-based NGOs. Networks can also enable civil society actors to raise a collective voice to influence development policies and projects, such as contributed to the decision of the Thai cabinet in February 2020 to halt blasting of rapids to improve navigation along the Mekong River (Bangkok Post 2020). The need for further support for networking activities was strongly emphasized by participants at the final assessment workshop in May 2019, who emphasized the need to connect CSOs with informational resources, to empower them to speak credibly about issues, and to facilitate sharing of lessons and good practice.

Investment Priority 8.2: Provide Core Support for the Sustainable Organizational and Technical Capacity Development of Domestic Civil Society Organizations

Another key finding from Chapter 9 on civil society context was that providing funding only for project activities is not helping domestic CSOs to develop their own priorities and programs, or to recruit and retain appropriately qualified and experienced staff. Most donor funding available to domestic CSOs is in the form of micro- and small grants with short timeframes (two years at maximum). Consequently, most of their staff are on short-term contracts, leading to rapid turnover, and many report capacity limitations in terms of human and financial resources (see Section 9.6). CEPF and other funders have provided core support to a growing number of domestic CSOs over the last decade. Participants at the final assessment workshop welcomed this support, noting that it is critical for sustainability, because few other donors are able to cover CSOs core costs, making them reliant on short-term grants. They went on to recommend that CEPF and other funders should consider making longer term commitments to individual CSOs, to prioritize human resources over other dimensions of capacity, and to include technical capacity building, because this is sometimes overlooked. In line with the recommendations of the long-term vision exercise (Section 3.2), projects supported under this investment priority should support capacity development in one or more of the following areas: (i) governance and organizational capacity; (ii) project cycle management, including participatory situational analysis, proposal development and implementation; (iii) conservation management and research; (iv) community-based natural resource management and co-management; (v) communications and advocacy; and (vi) engagement with business, especially in the agriculture, energy and tourism sectors.

Investment Priority 8.3: Establish Mechanisms to Match Volunteers to Civil Society Organizations' Training Needs

Domestic CSOs in the Indo-Burma Hotspot have various training needs; some, such as proposal writing, are common to many, while others are specific to individual organizations. Although one-off training courses are useful for some topics, they cannot address all of an organization's capacity needs. To complement such approaches, there is a need to increase the number and quality of volunteers working with CSOs, so that each organization can get the specific help that it needs. Several international schemes, such as Australian Volunteers International and Voluntary Service Overseas, are already placing volunteers with CSOs in the hotspot for periods of up to two years, although current demand greatly outstrips supply. Another potential, but underused, resource is independent volunteers who are willing to donate their time to capacity building. While the tradition of volunteering is strong in some countries outside the hotspot, recent years have seen a growth in interest in volunteering among young people in the hotspot; such mechanisms can play an important role in building the next generation of conservationists. The limiting factor for domestic CSOs is not necessarily a lack of availability of suitable volunteers but a lack of means to contact them. There is, therefore, a need for mechanisms to match up capacity needs with suitable volunteers, which is the gap addressed by this investment priority.

Strategic Direction 9: Conduct Targeted Education, Training and Awareness Raising to Build Capacity and Support for Biodiversity Conservation among All Sections of Society

While conservationists have done a good job of documenting the values of Indo-Burma's natural ecosystems and the threats that they face, they have not been so successful at communicating these values to others outside the conservation community, or to building this community. As a result, the constituency of support for conservation goals among decision makers, opinion formers and the general public remains small, as does the number of trained conservationists able to promote them, at a time when conservation issues are increasingly becoming a topic of public debate (insofar as this is permitted). Low public awareness and knowledge of conservation issues was widely cited as a contributory factor to biodiversity loss, and was considered as one of the top-ranked 'threats' in China and Vietnam by participants at the final assessment workshop (Table 4). At the same time, shortage of suitably qualified staff was cited as a major challenge by CSOs active in the hotspot (see Section 9.6).

Environmental education and awareness raising remains one of the largest funding gaps in the hotspot, receiving just 0.2 percent of conservation investment from international donors over the period 2015 to 2019 (see Section 11.4). In part, this reflects the fact that education and awareness activities need a long time to show measurable results and do not, therefore, lend themselves to short-term grant support. Formal training of conservationists has also received patchy, limited support, as evidenced by the continued reliance on international technical expertise by many of the larger conservation organizations working in the hotspot. However, education, training and awareness raising all present significant opportunities to engage domestic academic institutions in the delivery of an integrated conservation strategy and, thereby, leverage the capacities of one of the strongest sections of local civil society.

The need for additional conservation investment in education, training and awareness raising was emphasized by stakeholder consulted during the update of the ecosystem profile. While education, training and awareness raising may not immediately address the threats biodiversity identified in Chapter 6, without further investment in these areas, it is likely that such threats will continue to intensify, and support for addressing them will be found lacking. In this way, this strategic direction will make a direct contribution to Aichi Biodiversity Target 1 that "by 2020, at the latest, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably" (SCBC 2010).

Recognizing that capacity building and support for the development of female conservation practitioners in the hotspot needs greater investment (see Section 7.2.5), projects must integrate gender considerations into their design and implementation, and demonstrate strategies to ensure gender equity in access to education, training and awareness raising.

Investment Priority 9.1: Invest in the Professional Development of Future Conservation Leaders through Support to Vocational, Certificate, Diploma and Graduate Programs at Domestic Academic Institutions, and Promote Regional Replication to Each Country

In addition to financial constraints facing domestic CSOs and the relatively low appeal of the non-profit sector as a career choice for young people, a shortage of suitably qualified conservation professionals is a major barrier to development of local conservation movements in the Indo-Burma Hotspot. One of the most important initiatives to address this shortage is the masters degree course in biodiversity conservation at the Royal University of Phnom Penh, funded initially by the MacArthur Foundation and, since 2013, by Margaret A. Cargill Philanthropies, and supported technically by FFI. Stakeholders consulted during the update of the ecosystem profile recommended that this course be continued as a high priority, and, if possible, similar courses be developed in other hotspot countries, especially Lao PDR and Vietnam. Stakeholders observed that there may be opportunities for students on these courses to be affiliated with projects supported under other investment priorities, and/or to undertake internships at INGOs with well established programs in the region.

Investment Priority 9.2: Investigate the Feasibility of Establishing an Indo-Burma Conservation Field Studies Center

To complement the formal training opportunities provided for under Investment Priority 9.1, participants at the final assessment workshop recommended that CEPF and other funders ensure an adequate focus on non-formal education opportunities, especially for early-career conservationists and young people considering a career in conservation. One of the key recommendations to come out of the long-term vision exercise (Section 3.2) was for a feasibility study to look into the possibility of establishing a conservation field studies center for the Indo-Burma Hotspot. The long-term vision for such a center would be a self-financing center offering field-based training opportunities for both senior high school and undergraduate students, equipping them with practical skills for fieldwork in terrestrial, freshwater and coastal habitats, as well as with conservation and sustainable livelihood activities with farming and fishing communities in the hotspot countries. The goal of such a center would be to increase the number of young people who choose to pursue careers in practical field-based conservation and sustainable development related work, and to equip them with the necessary knowledge and skills to do so.

Investment Priority 9.3: Foster Leadership for Sustainable Development by Investing in Professional Development of Key Individuals

Alongside graduate training programs, a complementary approach to fostering leadership for sustainable development is by investing in the professional development of key individuals. Such investments may include structured training courses but may also involve exchange visits, internships, mentoring arrangements and networking. Priority for such investments will be given to individuals in leadership positions within domestic CSOs and networks. Compared with Investment Priority 9.1, which focuses on professional development of young people embarking on a career in sustainable development, the emphasis of this investment priority is on supporting the professional development of mid-career professionals.

Investment Priority 9.4: Implement Programs of Experiential Education to Connect School Children to Nature in Priority Corridors and Beyond

The effectiveness of conventional methods of environmental education in the Indo-Burma Hotspot has not been demonstrated, even when these have been integrated into school curricula. Stakeholders suggested that experiential methods might achieve more, such as organizing visits to protected areas for school children. For such activities, protected area staff can play a role as nature interpreters (Hau 2005, Fellowes *et al.* 2008) and CSOs providing long-term support to the protected areas can facilitate visits. Stakeholders recommended that international donors invest some resources in piloting such experiential approaches within the priority corridors, and that the impacts be monitored in a systematic way, in order that the effectiveness of these approaches can be compared with more conventional methods. Stakeholders also recommended developing a repository of course materials in local languages, which could be customized by the large number of CSOs whose community-level activities involve environmental education.

Investment Priority 9.5: Conduct Targeted, Effective Outreach and Awareness Raising for Behavioral Change among Rural and Urban Populations in Regard to the Values of Natural Ecosystems, with a Focus on Livelihoods, Consumption Patterns and Lifestyle

Without a constituency of support for conservation goals among the general public, governments are unlikely to forego short-term economic gains in favor of long-term environmental sustainability. CSOs have a key role to play in raising awareness of the values of natural ecosystems and the impacts of consumption patterns upon them. In line with the recommendations from the long-term vision exercise (Section 3.2), projects supported under this investment priority should explore possibilities for urban nature education centers, as well as protected area visitor education centers in national parks close to urban centers, across the Indo-Burma Hotspot. People in the Indo-Burma Hotspot are increasingly living in towns and cities with limited exposure to nature in their daily lives. Urban dwellers are also the major consumers of energy, forest products and other natural resources, as well as the group that next generation of government and private sector leaders will predominantly be drawn from. In this context, urban or peri-urban nature education centers located in remnant habitats in or close to towns and cities will become increasingly important, not only for the mental and physical health benefits that access to nature provides but also to educate urbanites to understand the demands that their lifestyles place on the natural environment and to promote more sustainable patterns of production and consumption.

Investment Priority 9.6: Conduct Targeted Training and Awareness Raising Activities for Decision Makers in Government and the Private Sector on Biodiversity Conservation, Including Impacts of Development Policies and Projects on Ecosystems

To complement activities supported under Investment Priority 9.5, this investment priority will directly target decision makers in government and the private sector. These decision makers will be exposed to conservation issues, with a particular emphasis on the impacts of development policies and projects on natural ecosystems and the implications for human wellbeing, economic development and national security. A variety of approaches may be used, according to the audience and the issue(s) addressed, including site visits, small-group briefings, peer-to-peer exchanges, establishing environmental caucuses among parliamentarians, and issuing awards to recognize contributions to conservation.

Strategic Direction 10: Evaluate the Impacts of Conservation Investment on Biodiversity and Human Wellbeing through Systematic Monitoring

Billions of dollars have been invested in biodiversity conservation in the hotspot in recent decades by national governments and international donors (see Chapter 11). The impacts of much of this investment are difficult to demonstrate, because they were monitored in an unsystematic fashion or not at all. As a result, it is difficult to evaluate the effectiveness of different approaches and adapt implementation and funding strategies to concentrate on actions with the greatest chance of success. One factor contributing to this problem is that most monitoring to date has been undertaken within the context of conservation projects. Issues of objectivity notwithstanding, the timeframes of these projects are substantially shorter than the timeframes over which the impacts of conservation investments typically occur, particularly in terms of changes in the state of biodiversity. There is a need, therefore, for long-term monitoring programs that are delinked from individual conservation projects.

Reflecting the high need for systematic monitoring of the impacts of conservation investment on biodiversity and human wellbeing, a detailed strategy on the theme was developed during the 2011 update of the ecosystem profile. This strategy was then revisited during the 2019-2020 update, especially during the final assessment workshop, where an additional investment priority was proposed (Investment Priority 10.2). The strategy recognized that a comprehensive, systematic monitoring system covering the entire hotspot was an aspirational goal for the long term, and identified four areas where action could realistically be taken over the next five years towards the goal of developing model approaches that contribute to national and regional monitoring systems and processes. The first area (development of systems that can be applied coherently by different countries and stakeholders to monitor conservation effectiveness across multiple scales) is addressed by Investment Priority 10.1. The second area (systematic efforts to build capacity for monitoring, including development of training curricula, guidelines and methods) is addressed by Investment Priority 10.3. The third area (mechanisms to ensure that monitoring initiatives inform policy debates and adaptive management at local level) is addressed by Investment Priority 10.4. The fourth area (greater priority given to monitoring to support evidence-based decision making, and long-term financing for monitoring and securing government uptake) is a set of general principles that are adopted by the strategic direction as a whole. In these ways, the strategic direction contributes directly to Aichi Biodiversity Target 19 that "by 2020, knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied" (SCBC 2010).

Investment Priority 10.1: Develop Common Standards and Systems for Monitoring the Impacts and Effectiveness of Conservation Actions

While some CSOs have adopted organization-specific monitoring systems, few common standards and systems have been adopted that allow for comparisons to be made across programs of similar work or among sites. The few exceptions to this generalization include the SMART system for monitoring protected area patrolling, and the *Guidelines for Assessing Fish Conservation Zones in Lao PDR* (Loury *et al.* 2019). Common standards and systems must allow the impacts of conservation actions on biodiversity to be measured but their scope should be wider than this. Experience from Africa suggests that improved indicators of social, economic and wide environmental impacts of projects against baselines are a clear need, if lessons from field experience are to be captured and capitalized upon (Roe *et al*. 2009). As a basis for long-term financial sustainability and mainstreaming of biodiversity into other sectors, it may also be useful to integrate biodiversity monitoring with monitoring the impacts of climate change and forest carbon projects.

Projects supported under this investment priority will develop standards and systems that draw on international best practice but are locally appropriate. This argues for standards and systems that enable both qualitative/perception-based assessment (lower cost) and quantitative assessment (higher cost). They should also be suitable for indefinite continuation with resources and expertise available within the hotspot. In addition to developing common standards and systems, projects should make them accessible to practitioners and managers at multiple levels (local, sub-national, national). This could be done, for example, through translation of materials into local languages or by developing online training courses.

Investment Priority 10.2: Develop Common Standards and Systems for Monitoring the Negative Impacts of Development Policies, Plans and Actions across Multiple Scales

Participants at the final assessment workshop recommended that, in addition to the standards and systems for monitoring conservation impacts that are provided for under Investment Priority 10.1, there is also a need for common standards and systems for monitoring the negative impacts of development policies. Such standards and systems could support monitoring of the impacts of agro-industrial plantations and hydropower dams under Investment Priority 7.6 but they should have wider application, covering the range of development impacts on biodiversity, communities and livelihoods. Having a set of common standards and systems will help civil society to speak with a common voice when raising concerns about the impacts of development. It will also facilitate assessment of the cumulative impacts of development policies, plans and actions, which is increasingly important given the multiple, inter-related threats facing natural ecosystems in the hotspot.

Investment Priority 10.3: Support Systematic Efforts to Build Capacity for Monitoring and Data Analysis among Domestic Organizations

Due to the timeframes over which changes to threats and, especially, the state of biodiversity and the benefits it provides to humans, take place, monitoring programs must be long term if they are to generate robust and meaningful information. For reasons of financial and institutional sustainability, therefore, there is a need for domestic organizations, especially NGOs and academic institutions, to take a leading role in implementing long-term monitoring programs. To this end, there is a need to support systematic efforts to build capacity for monitoring among these organizations, including the development of training curricula, guidelines and methods. These training efforts should adopt the common standards and systems developed under Investment Priorities 10.1 and 10.2, and, where possible, link to graduate training programs supported under Investment Priority 9.1.

Investment Priority 10.4: Develop and Test Mechanisms for Ensuring that Monitoring Results Inform National Policy Debates and Local Adaptive Management

The final investment priority under this strategic direction is intended to support the development and testing of innovative and effective mechanisms for communicating monitoring results. One key audience will be decision makers and opinion formers at the national level, including senior government officials, journalists, managers of development NGOs and executives in private companies, so that the monitoring results have a bearing on national policy debates relevant to biodiversity conservation. Another key audience will be protected area managers and conservation project managers, so that the results inform adaptive management.

Strategic Direction 11: Provide Strategic Leadership and Effective Coordination of Conservation Investment through a Regional Implementation Team

In every hotspot approved for investment, CEPF works with a Regional Implementation Team or RIT to convert the plans in the ecosystem profile into a cohesive portfolio of grants that exceeds in impact the sum of its parts. The RIT will consist of one or more CSOs active in conservation in the hotspot. The RIT will be selected by the CEPF Donor Council based on approved terms of reference. The team will operate in a transparent and open manner, consistent with CEPF's mission and all provisions of the CEPF Operational Manual. Organizations that are members of the RIT will not be eligible to apply for other CEPF grants within the same hotspot. Applications for grants from formal affiliates of those organizations that have an independent board of directors will be accepted, subject to additional external review.

Investment Priority 11.1: Build a Broad Constituency of Civil Society Groups Working across Institutional and Political Boundaries towards Achieving the Shared Conservation Goals Described in the Ecosystem Profile

The RIT will provide strategic leadership and local knowledge to build a broad constituency of civil society groups working across institutional and political boundaries toward achieving the conservation goals described in the ecosystem profile. It will implement a number of functions, as set out in the terms of reference, including:

- Act as an extension service to assist civil society groups in designing, implementing, and replicating successful conservation activities.
- Review all grant applications and manage external reviews with technical experts and advisory committees.
- Award small grants up to an agreed threshold amount and decide jointly with the CEPF Secretariat on all other applications.
- Lead the monitoring and evaluation of individual projects using standard tools, site visits, and meetings with grantees, and assist the CEPF Secretariat in portfolio-level monitoring and evaluation.

- Build the institutional capacity of grantees to ensure efficient and effective project implementation.
- Widely communicate CEPF objectives, opportunities to apply for grants, lessons learned, and results.

The RIT will directly support strategic development of the grant portfolio and contribute in its own right to the achievement of critical conservation results that yield portfolio-wide benefits. Such activities may include facilitating learning exchanges between grantees and other stakeholders, identifying leveraging opportunities at the grant or portfolio level, or collaborating with other donors to align support to CSOs and their conservation projects.

In line with the overall CEPF investment niche, and Strategic Direction 8 in particular, capacity building will be at the core of the RIT's role. The RIT will be responsible for ensuring that partners have the institutional and individual capacity needed to design and implement conservation projects that contribute to the overall investment strategy. This is not capacity building for its own sake; rather, it is targeted specifically to appropriate strategic stakeholders to ensure delivery of CEPF's objectives through improved projects and higher quality implementation. Experience has shown that these capacity building efforts are essential to ensuring good projects that are integrated into a wider hotspot strategy and a common conservation vision.

As identified during the final assessment of the second phase of CEPF investment in the hotspot (Section 3.1.2), there is a need for greater integration of the CEPF portfolio into government plans and priorities. To this end, greater use will be made of National Advisory Committees: informal committees, established by the RIT, which bring together stakeholders from government, civil society and the donor community to oversee the development of the grant portfolio in each country. National Advisory Committees can help to align CEPF grant making with national priorities, as well as provide a platform for sharing experience and lessons learned from the portfolio, especially good practice models relevant to national conservation policy. The long-term aim, as set out in the long-term vision (Section 3.2), is for the National Advisory Committee in each country to be formalized and strengthened and be able to act as an independent advisory committee, as well as a forum for integrating lessons learned from the work of civil society into national policy.

14. INDO-BURMA HOTSPOT LOGICAL FRAMEWORK: 2020-2025

Objective	Targets	Means of Verification	Important Assumptions
Demonstrate effective, scalable approaches to major conservation issues that leverage the skills, experience and energy of civil society actors.	At least 50 CSOs, including at least 40 domestic organizations, actively participate in conservation actions guided by the ecosystem profile. At least 12 alliances and networks formed among civil society actors to avoid duplication of effort and maximize impact in support of the CEPF ecosystem profile. At least 25 Key Biodiversity Areas targeted by CEPF grants have new or strengthened protection and management. At least 100,000 hectares of production landscapes with strengthened management of biodiversity. At least 3 development plans or policies influenced to accommodate biodiversity. At least 5,000 women and 5,000 of men receive direct socio-economic benefits through increased income, food security, resource rights or other measures of human wellbeing.	Grantee and RIT performance reports. Annual portfolio overview reports; portfolio midterm and final assessment reports. Protected Areas Tracking Tool (SP1 METT).	The CEPF ecosystem portfolio will effectively guide and coordinate conservation action in the Indo-Burma Hotspot. Investments by other funders will support complementary activities that reduce threats to priority corridors, sites and species, and improve the operating environment for civil society.

Intermediate Outcomes	Intermediate Indicators	Means of Verification	Important Assumptions
Outcome 1: Priority globally threatened species safeguarded by mitigating major threats. $3,200,000	Long-term conservation programs for core populations of at least 25 priority species sustained until 2025. Viable wild populations of at least 3 priority species reestablished. Knowledge of the status and distribution of at least 3 priority species improved through research. At least $1 million in funding for species conservation leveraged from innovative sources. At least 10 community-level species champions implement locally identified actions for priority species.	Grantee and RIT performance reports. CEPF Secretariat supervision mission reports. IUCN Red List species accounts.	National and international laws provide an appropriate basis for species-focused conservation action. Government agencies grant permission to reintroduce priority species. Sufficient civil society capacity to implement species-focused conservation exists among civil society or can be built. Innovative funding sources for species conservation (e.g., private companies, high net worth individuals, etc.) can be identified and accessed. Community members interested and able to become species champions can be identified.

Intermediate Outcomes	Intermediate Indicators	Means of Verification	Important Assumptions
Outcome 2: Zoonotic disease threats mitigated by reducing trade and consumption of and threats to wildlife. $1,000,000	At least 1 high-level wildlife trade network unraveled by enforcement agencies employing global best practice with investigations and informants. At least 2 initiatives to reduce transportation, sale and consumption of wildlife piloted in collaboration with enforcement agencies and/or actors in the public health sector. At least 5 private and/or state-owned companies introduce effective measures to reduce their involvement in the transportation, sale and consumption of wildlife. At least 3 campaigns implemented to reduce consumer demand for wildlife and mobilize public participation in wildlife crime detection and reporting. At least 3 journal papers published on linkages between biodiversity and human health, including the role of biodiversity loss in the emergence of zoonotic diseases.	Grantee and RIT performance reports. CEPF Secretariat supervision mission reports. Court records and press coverage of prosecutions for wildlife crime. Scientific journal papers.	Sufficient political will to control overexploitation of wildlife species exists or can be generated. Government conservation agencies are receptive to working with civil society to address illegal trafficking of wildlife. Actors in the public health sector are receptive to collaborating with conservation organizations as part of a One Health approach. Companies are willing to engage with civil society to address transportation, sale and consumption of wildlife. Local media are willing to support public awareness campaigns. General public is receptive to conservation messages about consumption of wildlife.

Intermediate Outcomes	Intermediate Indicators	Means of Verification	Important Assumptions
Outcome 3: Local communities empowered to engage in conservation and management of priority sites. $2,000,000	Awareness of local conservation issues and rights and opportunities related to natural resource management raised among local communities within at least 5 priority sites. Community forests, community fisheries and/or community-managed protected areas piloted, amplified and/or made more sustainable within at least 10 priority sites. Co-management mechanisms that enable community participation in zoning, management and governance of formal protected areas developed for at least 5 priority sites. Lists of KBAs in at least 3 hotspot countries updated in line with the new KBA standard. Third-party evaluation of project impacts on biodiversity and human wellbeing undertaken in at least 10 priority sites.	Grantee and RIT performance reports. CEPF Secretariat supervision mission reports. Protected Areas Tracking Tool (SP1 METT). Formal legal declarations or community agreements designating new protected areas. World Database on KBAs. Third-party impact evaluation reports.	Local communities are willing to play an active role in site-based conservation. Government policies provide for community management of forests, fisheries and conservation areas. Protected area managers are receptive to involving local communities in zoning, management and governance. Appropriate, cost-effective site-based monitoring protocols for biodiversity and human wellbeing impacts can be developed. Sufficient civil society capacity to implement site-based conservation exists or can be built

Intermediate Outcomes	Intermediate Indicators	Means of Verification	Important Assumptions
Outcome 4: Demonstration projects developed for integrating biodiversity and ecosystem services into development planning in the priority corridors. $1,400,000	At least 4 development policies, plans or programs analyzed, with impacts on biodiversity and ecosystem services evaluated and alternative development scenarios, nature-based solutions and mitigating measures proposed. Demonstration projects for ecological restoration developed in at least 2 priority corridors. Public debate and awareness of at least 3 key environmental issues increased through coverage in domestic media. Models for biodiversity-friendly production piloted for at least 3 commodities.	Grantee and RIT performance reports. CEPF Secretariat supervision mission reports. Official land-use and development plans and policies covering the priority corridors.	Governments and donors remain committed to environmentally sustainable development. Governments create space for civil society to engage in the review and formulation of development policies, plans and programs. Government decision making can be influenced by arguments about the biodiversity and ecosystem service values of natural ecosystems. Increased awareness of environmental issues will translate into increased support for conservation initiatives. Sufficient civil society capacity to undertake biodiversity mainstreaming exists or can be built. Markets for sustainably produced commodities from the hotspot exist or can be built.

Intermediate Outcomes	Intermediate Indicators	Means of Verification	Important Assumptions
Outcome 5: Civil society capacity to work on biodiversity, communities and livelihoods strengthened at regional, national, local and grassroots levels. $1,000,000	At least 15 civil society networks enable collective responses to priority and emerging threats. At least 50 domestic CSOs demonstrate improvements in organizational capacity. At least 20 domestic CSOs demonstrate improved performance with gender mainstreaming. At least 1 mechanism established to match volunteers to CSOs' training needs.	Grantee and Regional Implementation Team performance reports. CEPF Secretariat supervision mission reports. Civil society organizational capacity tracking tool. Gender tracking tool.	Civil society actors able to work collaboratively to respond to conservation challenges. The operating environment for civil society remains constant or improves across the hotspot. Key capacity limitations of CSOs can be addressed through grant support.
Outcome 6: A Regional Implementation Team provides strategic leadership and effectively coordinates CEPF investment in the Indo-Burma Hotspot. $1,400,000	At least 50 CSOs, including at least 40 domestic organizations actively participate in conservation actions guided by the ecosystem profile. At least 75 percent of domestic CSOs receiving grants demonstrate more effective capacity to design and implement conservation actions. At least 2 participatory assessments are undertaken and documented.	Regional Implementation Team performance reports. CEPF Secretariat supervision mission reports. Civil society organizational capacity tracking tool.	Qualified organizations will apply to serve as the Regional Implementation Team in line with the approved terms of reference and the ecosystem profile. The CEPF call for proposals will elicit appropriate proposals that advance the goals of the ecosystem profile. CSOs will collaborate with each other, government agencies, and private sector actors in a coordinated regional conservation program in line with the ecosystem profile.
Funding Summary	**Amount**		
Total Budget	$10,000,000		

15. SUSTAINABILITY

Sustainability of CEPF's investments in the Indo-Burma Hotspot will be achieved if their results endure well beyond the investment period. Recognizing that threats to biodiversity in the hotspot are at a scale that precludes easy fixes, and which will require sustained effort over decades to fully address, sustainability was a paramount consideration throughout the process to update the ecosystem profile. In particular, the investment strategy was developed with sustainability in mind, and many of the investment priorities explicitly address it.

Institutional sustainability is addressed through an explicit focus on strengthening the capacity of CSOs (Strategic Direction 8) and training future conservation leaders (Strategic Direction 9). This focus, which is integral to CEPF's global mission, recognizes that the emergence of domestic CSOs creates opportunities to support the growth of conservation movements with sufficient credibility and legitimacy to influence national and regional debates on the future direction of natural ecosystems. Strengthening the capacity of conservation movements in the hotspot will contribute to sustainability by reducing dependence on external technical and financial support. Furthermore, specific capacity building measures, such as training programs for protected area practitioners (Investment Priority 3.2) and conservation professionals (Investment Priority 9.1), will be institutionalized within domestic academic institutions.

Financial sustainability is addressed in various parts of the investment strategy. Under Strategic Direction 1, long-term conservation programs for priority species will be sustained, while innovative funding sources to sustain species conservation efforts into the long-term will be explored. Under Investment Priorities 2.3, 6.5 and 7.4, grantees will engage with private and state-owned companies, develop joint conservation actions, and leverage support for their implementation. Other opportunities to engage the private sector in supporting innovative conservation actions are presented by Investment Priorities 2.4, 5.2 and 9.6.

Political sustainability is addressed by integrating biodiversity and ecosystem services into development plans, policies and programs (Strategic Direction 6). Economic arguments for the conservation of biodiversity, based on ecosystem service values, will be developed and widely promoted among different sectors, such as agriculture, energy and industry. Major government investments in protected areas (Strategic Direction 3) and reforestation (Investment Priority 6.2) will be leveraged towards conservation goals through demonstration projects and promotion of best practice.

Societal sustainability for the goals of the investment strategy will be achieved through a major emphasis on engaging wider civil society as positive stakeholders in conservation in various ways. Local communities will be empowered to engage in management of priority sites (Strategic Direction 4), to adopt alternative livelihoods (Strategic Direction 5) and to formalize their traditional rights over land and resources (Strategic Direction 7). There will also be support to species champions at the community level, who will implement locally identified actions for priority species (Investment Priority 1.5), as well as for farmers to adopt wildlife-friendly production practices (Investment Priority 6.4). The wider public, especially urban dwellers, will be involved in programs to reduce consumer demand for wildlife and support enforcement agencies to tackle wildlife crime (Strategic Direction 2), and engaged by targeted education, training and awareness raising aimed at building support for biodiversity conservation (Strategic Direction 9).

Finally, the sustainability of the strategy will be ensured by the means of its creation: through a participatory process involving more than 170 stakeholders from across the hotspot. CEPF will continue to collaborate with other funders with overlapping interests and missions, to align its support to civil society in the hotspot and leverage additional support to ensure delivery of the investment strategy. The investment strategy is truly a common vision for action, jointly owned by multiple stakeholders. This will ensure that, as in the previous phases of CEPF investment, the ambitious goals of the strategy are realized through partnership.

16. CONCLUSION

In terms of species diversity and endemism, Indo-Burma is one of the most biologically important regions on the planet. A spate of discoveries of new species during the 1990s focused the attention of the global conservation community on the hotspot. Changing political climates in several countries meant that increasing amounts of international donor assistance, including conservation investment, flowed into most countries in the hotspot from the 1990s onwards. Over the last five years, conservation investment from international sources averaged at least $160 million per year.

In spite of the considerable sums invested in conservation, the biodiversity of the hotspot continues to face massive and accelerating threats, most significantly industrial agriculture, poaching, trade and consumption of wildlife, large infrastructure (in particular, hydropower dams) and logging. The root causes and enabling factors of biodiversity loss include population growth, urbanization and migration patterns, economic growth and increasing consumption, regional economic integration, weak regulatory and governance frameworks, and development models that prioritize large-scale projects with insufficient transparency or public participation. If these threats continue unabated, the natural ecosystems of the hotspot will continue to be degraded and lost, their capacity to deliver ecosystem services will erode, the resilience of the region to the effects of climate change will diminish, the rate of species extinctions will accelerate, and the risk of emergence of zoonotic diseases will increase. Civil society is well placed to address both immediate threats to biodiversity and their underlying causes. However, current investment does not always target the highest conservation priorities or promote the most effective approaches, and the potential to engage civil society in biodiversity conservation has yet to be fully realized. In this context, the opportunities for CEPF and other funders to support biodiversity conservation in the hotspot are almost limitless.

In order to focus potential future investment by CEPF and other funders, the ecosystem profile for Indo-Burma was updated during 2019 and 2020. Drawing on experience from two previous phases of investment dating back to 2008, and engaging stakeholders through a regional workshop in May 2019 and an online consultation in July-August 2020, the CEPF Secretariat updated the ecosystem profile and presented a refreshed investment strategy for the five-year period from 2020 to 2025. This strategy comprises 45 investment priorities, grouped into 11 strategic directions under five broad components.

Over the next investment phase, CEPF funding will concentrate on six of these strategic directions, containing 23 investment priorities. The objective of CEPF's investment will be to demonstrate effective, scalable approaches to major conservation issues that leverage the skills, experience and energy of civil society actors. The geographic focus will be five priority corridors (the Chindwin River, the Mekong River and Major Tributaries, the Northern Plains Seasonally Inundated Forests, the Sino-Vietnamese Limestone, and the Tonle Sap Lake and Inundation Zone) plus a network of limestone karst sites in Myanmar. Moreover, CEPF investment will focus on 136 priority species that require species-focused action in addition to site-based and landscape-scale conservation. Although ambitious, the CEPF investment strategy is realistic, and represents an important opportunity to realize the potential of civil society in the hotspot, and to make a lasting contribution to the conservation of Indo-Burma's unique and irreplaceable biodiversity values.

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APPENDICES

Appendix 1. Globally Threatened Species in the Indo-Burma Hotspot

No.	Scientific Name	Common Name	Global Threat Status			Distribution by Country						Selection Criteria for Priority Species				
			Critically Endangered	Endangered	Vulnerable	Cambodia	China	Lao PDR	Myanmar	Thailand	Vietnam	Indo-Burmese Population is Globally Signif.	Species-focused Action Required	Over-riding Need for Improved Info	Urgency for Conservation Action	Opportunity for Additional Investment
	MAMMALS (comprehensive Red List assessment)		**18**	**37**	**42**	**38**	**50**	**48**	**47**	**58**	**58**					
1	*Ailurus fulgens*	Red Panda		EN			+		+			Yes	No	No	N/A	N/A
2	***Aonyx cinereus***	**Asian Small-clawed Otter**			**VU**	**+**	**+**	**+**	**+**	**+**	**+**	**Yes**	**Yes**	**No**	**High**	**High**
3	*Arctictis binturong*	Binturong			VU	+	+	+	+	+	+	Yes	Yes	No	Medium	High
4	*Arctonyx collaris*	Greater Hog Badger			VU	+	?	+	+	+	+	Yes	No	N/A	N/A	N/A
5	***Axis porcinus***	**Hog Deer**		**EN**		**+**	**ex?**	**ex?**	**+**	**?**	**ex?**	**Yes**	**Yes**	**No**	**High**	**High**
6	*Bos gaurus*	Gaur			VU	+	+	+	+	+	+	Yes	Yes	No	Medium	High
7	*Bos javanicus*	Banteng		EN		+	?	+	+	+	+	Yes	Yes	No	Medium	High
8	***Bos sauveli***	**Kouprey**	**CR**			**ex?**		**ex?**		**ex**	**ex**	**Yes?**	**N/A**	**Yes**	**High***	**High**
9	***Bubalus arnee***	**Wild Water Buffalo**		**EN**		**ex?**		**ex**	**+**	**+**	**ex**	**Yes**	**Yes**	**No**	**High**	**High**
10	*Budorcas taxicolor*	Takin			VU		+		+			Yes	Yes	No	Medium	High
11	*Capricornis sumatraensis*	Southern Serow			VU					+		No	N/A	N/A	N/A	N/A
12	***Chrotogale owstoni***	**Owston's Civet**		**EN**		**?**	**+**	**+**			**+**	**Yes**	**Yes**	**No**	**High**	**High**
13	*Cuon alpinus*	Dhole		EN		+	+	+	+	+	ex?	Yes	Yes	No	Medium	High
14	*Cynogale bennettii*	Otter Civet		EN						ex?		No	N/A	N/A	N/A	N/A
15	***Dicerorhinus sumatrensis***	**Hairy Rhinoceros**	**CR**			**ex**		**ex**	**ex?**	**ex**	**ex**	**Yes?**	**N/A**	**Yes**	**High***	**High**
16	*Elephas maximus*	Asian Elephant		EN		+	+	+	+	+	+	Yes	Yes	No	High	Low

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17	***Eudiscoderma thongareeae***	**Thongaree's Disc-nosed Bat**	**CR**							**+**		**Yes**	**Yes**	**No**	**High**	**High**
18	*Hapalomys delacouri*	Lesser Marmoset Rat			VU		+	+			+	Yes	N/A	Yes	Medium	High
19	*Hapalomys longicaudatus*	Greater Marmoset Rat		EN					ex?	ex?		Yes	N/A	Yes	Medium	High
20	*Helarctos malayanus*	Sun Bear			VU	+	+	+	+	+	+	Yes	Yes	No	Medium	High
21	*Hesperoptenus tomesi*	Large False Serotine			VU					+		No	N/A	N/A	N/A	N/A
22	*Hipposideros alongensis*	Ha Long Leaf-nosed Bat			VU						+	Yes	No	No	N/A	N/A
23	*Hipposideros halophyllus*	Thailand Leaf-nosed Bat			VU					+		Yes	Yes	No	Medium	High
24	*Hipposideros khaokhouayensis*	Phou Khaokhouay Leaf-nosed Bat			VU			+			+	Yes	No	No	N/A	N/A
25	*Hipposideros pendleburyi*	Pendlebury's Leaf-nosed Bat			VU					+		Yes	No	No	N/A	N/A
26	*Hipposideros scutinares*	Shield-nosed Leaf-nosed Bat			VU			+			+	Yes	No	No	N/A	N/A
27	***Hoolock hoolock***	**Western Hoolock**		**EN**			**?**		**+**			**Yes**	**Yes**	**No**	**High**	**High**
28	*Hoolock leuconedys*	Eastern Hoolock			VU		+		+			Yes	No	No	N/A	N/A
29	***Hoolock tianxing***	**Skywalker Hoolock**		**EN**			**+**		**+**			**Yes**	**Yes**	**No**	**High**	**High**
30	*Hylobates agilis*	Agile Gibbon		EN						+		No	N/A	N/A	N/A	N/A
31	*Hylobates lar*	White-handed Gibbon		EN			ex?	+	+	+		Yes	No	No	N/A	N/A
32	*Hylobates pileatus*	Pileated Gibbon		EN		+		+		+		Yes	Yes	No	Medium	Medium
33	*Kerivoula flora*	Flores Woolly Bat			VU						?	No	N/A	N/A	N/A	N/A
34	*Lepus hainanus*	Hainan Hare		EN			+					Yes	No	No	Medium	Medium
35	***Lutra sumatrana***	**Hairy-nosed Otter**		**EN**		**+**		**?**	**Ex?**	**+**	**+**	**Yes**	**Yes**	**No**	**High**	**High**
36	***Lutrogale perspicillata***	**Smooth-coated Otter**			**VU**	**+**	**+**	**+**	**+**	**+**	**+**	**Yes**	**Yes**	**No**	**High**	**High**
37	*Macaca arctoides*	Bear Macaque			VU	+	+	+	+	+	+	Yes	No	No	N/A	N/A
38	*Macaca leonina*	Northern Pig-tailed Macaque			VU	+	+	+	+	+	+	Yes	No	No	N/A	N/A
39	*Macaca nemestrina*	Sundaland Pig-tailed Macaque			VU					+		No	N/A	N/A	N/A	N/A

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40	*Manis javanica*	Sunda Pangolin	CR			+	?	+	+	+	+	Yes	Yes	No	High	Medium
41	*Manis pentadactyla*	Chinese Pangolin	CR				+	+	+	+	+	Yes	Yes	No	High	Medium
42	*Maxomys rajah*	Rajah Sundaic Maxomys			VU					+		No	N/A	N/A	N/A	N/A
43	*Maxomys whiteheadi*	Whitehead’s Sundaic Maxomys			VU					+		No	N/A	N/A	N/A	N/A
44	***Moschus berezovskii***	**Forest Musk Deer**		**EN**			**+**				**+**	**Yes**	**Yes**	**No**	**High**	**High**
45	***Moschus fuscus***	**Black Musk Deer**		**EN**			**+**		**+**			**Yes**	**Yes**	**No**	**High**	**High**
46	***Muntiacus vuquangensis***	**Large-antlered Muntjac**	**CR**			**ex?**		**+**			**+**	**Yes**	**Yes**	**No**	**High**	**High**
47	*Murina aenea*	Bronze Tube-nosed Bat			VU					+		No	N/A	N/A	N/A	N/A
48	***Murina balaensis***	**Bala Tube-nosed Bat**	**CR**							**+**		**Yes**	**Yes**	**No**	**High**	**High**
49	*Murina rozendaali*	Gilded Tube-nosed Bat			VU					?		No	N/A	N/A	N/A	N/A
50	*Myotis pilosus*	Rickett's Big-footed Myotis			VU		+	+			+	Yes	No	No	N/A	N/A
51	*Naemorhedus baileyi*	Red Goral			VU		+		+			Yes	Yes	No	Medium	High
52	*Naemorhedus griseus*	Chinese Goral			VU		+		+	+		Yes	Yes	No	Medium	Medium
53	*Neofelis nebulosa*	Mainland Clouded Leopard			VU	+	+	+	+	+	+	Yes	Yes	No	Medium	Medium
54	*Neohylomys hainanensis*	Hainan Gymnure		EN			+					Yes	No	Yes	Medium	Medium
55	***Nesolagus timminsi***	**Annamite Striped Rabbit**		**EN**				**+**			**+**	**Yes**	**Yes**	**No**	**High**	**High**
56	*Niviventer hinpoon*	Limestone Rat		EN						+		Yes	No	No	N/A	N/A
57	***Nomascus concolor***	**Black Crested Gibbon**	**CR**				**+**	**+**			**+**	**Yes**	**Yes**	**No**	**High**	**High**
58	*Nomascus gabriellae*	Yellow-cheeked Gibbon		EN		+		+			+	Yes	Yes	No	Medium	Medium
59	***Nomascus hainanus***	**Hainan Gibbon**	**CR**				**+**					**Yes**	**Yes**	**No**	**High**	**High**
60	***Nomascus leucogenys***	**Northern White-cheeked Gibbon**	**CR**				**ex?**	**+**			**+**	**Yes**	**Yes**	**No**	**High**	**High**
61	***Nomascus nasutus***	**Cao Vit Crested Gibbon**	**CR**				**+**				**+**	**Yes**	**Yes**	**No**	**High**	**High**
62	***Nomascus siki***	**Southern White-cheeked Gibbon**		**EN**				**+**			**+**	**Yes**	**Yes**	**No**	**High**	**High**

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63	*Nycticebus bengalensis*	Bengal Slow Loris			VU	+	+	+	+	+	+	Yes	No	No	N/A	N/A
64	*Nycticebus coucang*	Greater Slow Loris			VU					+		No	N/A	N/A	N/A	N/A
65	*Nycticebus pygmaeus*	Pygmy Loris			VU	+	+	+			+	Yes	No	No	N/A	N/A
66	***Orcaella brevirostris***	**Irrawaddy Dolphin**		**EN**		**+**		**+**	**+**	**+**	**+**	**Yes**	**Yes**	**No**	**High**	**High**
67	*Panthera pardus*	Leopard			VU	+	+	ex?	+	+	ex?	Yes	Yes	No	Medium	High
68	*Panthera tigris*	Tiger		EN		ex?	+	+	+	+	ex?	Yes	Yes	No	High	Low
69	*Petinomys setosus*	Temminck's Flying Squirrel			VU				+	+		Yes	No	No	N/A	N/A
70	*Petinomys vordermanni*	Vordermann's Flying Squirrel			VU				+	?		No	N/A	N/A	N/A	N/A
71	*Prionailurus planiceps*	Flat-headed Cat		EN						ex?		No	N/A	N/A	N/A	N/A
72	*Prionailurus viverrinus*	Fishing Cat			VU	+			+	+	ex?	Yes	N/A	Yes	Medium	High
73	***Pseudoryx nghetinhensis***	**Saola**	**CR**					**+**			**+**	**Yes**	**Yes**	**Yes**	**High**	**High**
74	*Pteromyscus pulverulentus*	Smoky Flying Squirrel		EN						+		No	N/A	N/A	N/A	N/A
75	*Pteropus lylei*	Lyle's Flying Fox			VU	ex?	+			+	+	Yes	Yes	No	Medium	High
76	***Pygathrix cinerea***	**Grey-shanked Douc**	**CR**								**+**	**Yes**	**Yes**	**No**	**High**	**High**
77	***Pygathrix nemaeus***	**Red-shanked Douc**		**EN**		**?**		**+**			**+**	**Yes**	**Yes**	**No**	**High**	**High**
78	*Pygathrix nigripes*	Black-shanked Douc		EN		+					+	Yes	Yes	No	Medium	High
79	***Rhinoceros sondaicus***	**Javan Rhinoceros**	**CR**			**ex**	**ex**	**ex**	**ex?**	**ex**	**ex**	**Yes?**	**N/A**	**Yes**	**High***	**High**
80	***Rhinopithecus avunculus***	**Tonkin Snub-nosed Monkey**	**CR**				**+**				**+**	**Yes**	**Yes**	**No**	**High**	**High**
81	***Rhinopithecus strykeri***	**Myanmar Snub-nosed Monkey**	**CR**						**+**			**Yes**	**Yes**	**No**	**High**	**High**
82	***Rucervus eldii***	**Eld's Deer**		**EN**		**+**	**+**	**+**	**+**	**+**	**ex?**	**Yes**	**Yes**	**No**	**High**	**High**
83	*Rusa unicolor*	Sambar			VU	+	+	+	+	+	+	Yes	Yes	No	Medium	High
84	*Sousa chinensis*	Indo-Pacific Humpback Dolphin			VU	+	+		+	+	+	No	N/A	N/A	N/A	N/A

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85	*Symphalangus syndactylus*	Siamang		EN						+		No	N/A	N/A	N/A	N/A
86	*Tapirus indicus*	Asian Tapir		EN					+	+		Yes	No	No	N/A	N/A
87	***Trachypithecus delacouri***	**Delacour's Leaf Monkey**	**CR**								**+**	**Yes**	**Yes**	**No**	**High**	**High**
88	*Trachypithecus francoisi*	François's Leaf Monkey		EN			+				+	Yes	Yes	No	Medium	High
89	***Trachypithecus germaini***	**Indochinese Silvered Leaf Monkey**		**EN**		**+**		**+**	**+**	**+**	**+**	**Yes**	**Yes**	**No**	**High**	**High**
90	*Trachypithecus hatinhensis*	Hatinh Leaf Monkey		EN				+			+	Yes	Yes	No	Medium	High
91	*Trachypithecus laotum*	Lao Leaf Monkey			VU			+				Yes	Yes	No	Medium	High
92	*Trachypithecus phayrei*	Phayre's Leaf Monkey		EN			+	+	+	+	+	Yes	Yes	No	Medium	High
93	*Trachypithecus pileatus*	Capped Leaf Monkey			VU				+			Yes	Yes	No	Medium	High
94	***Trachypithecus poliocephalus***	**White-headed Leaf Monkey**	**CR**				**+**				**+**	**Yes**	**Yes**	**No**	**High**	**High**
95	***Trachypithecus shortridgei***	**Shortridge's Leaf Monkey**		**EN**			**+**		**+**			**Yes**	**Yes**	**No**	**High**	**High**
96	*Ursus thibetanus*	Asian Black Bear			VU	+	+	+	+	+	+	Yes	Yes	No	Medium	High
97	***Viverra megaspila***	**Large-spotted Civet**		**EN**		**+**	**+**	**+**	**+**	**+**	**ex?**	**Yes**	**Yes**	**No**	**High**	**High**
	BIRDS (comprehensive Red List assessment)		**18**	**32**	**58**	**35**	**59**	**32**	**63**	**70**	**56**					
98	*Aceros nipalensis*	Rufous-necked Hornbill			VU		+	+	+	+	+	Yes	Yes	No	Medium	Medium
99	*Acrocephalus sorghophilus*	Streaked Reed-warbler		EN			+					No	N/A	N/A	N/A	N/A
100	*Acrocephalus tangorum*	Manchurian Reed-warbler			VU	+	v	+	+	+	+	Yes	Yes	No	Medium	Medium
101	*Anser cygnoides*	Swan Goose			VU		+	v		v		No	N/A	N/A	N/A	N/A
102	*Anser erythropus*	Lesser White-fronted Goose			VU		+		v			No	N/A	N/A	N/A	N/A
103	*Anthracoceros malayanus*	Black Hornbill			VU					+		No	N/A	N/A	N/A	N/A
104	***Antigone antigone***	**Sarus Crane**			**VU**	**+**	**+**	**ex?**	**+**	**ex**	**+**	**Yes**	**Yes**	**No**	**High**	**High**

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105	*Apus acuticauda*	Dark-rumped Swift			VU				+	+		No	N/A	N/A	N/A	N/A
106	*Aquila heliaca*	Eastern Imperial Eagle			VU	+	+	+	+	+	+	No	N/A	N/A	N/A	N/A
107	*Aquila nipalensis*	Steppe Eagle		EN			+		+	+	+	No	N/A	N/A	N/A	N/A
108	*Aquila rapax*	Tawny Eagle			VU				?	v		No	N/A	N/A	N/A	N/A
109	*Arborophila ardens*	Hainan Partridge			VU		+					Yes	No	No	N/A	N/A
110	*Arborophila charltonii*	Chestnut-necklaced Partridge			VU				+	+		Yes	No	No	N/A	N/A
111	***Ardea insignis***	**White-bellied Heron**	**CR**				**+**		**+**			**Yes**	**N/A**	**Yes**	**High**	**High**
112	***Asarcornis scutulata***	**White-winged Duck**		**EN**		**+**		**+**	**+**	**+**	**+**	**Yes**	**Yes**	**No**	**High**	**High**
113	*Aythya baeri*	Baer's Pochard	CR				+	v	+	+	+	Yes	No	No	N/A	N/A
114	*Aythya ferina*	Common Pochard			VU		+			+	+	No	N/A	N/A	N/A	N/A
115	*Berenicornis comatus*	White-crowned Hornbill		EN					+	+		Yes	Yes	No	Medium	High
116	*Buceros bicornis*	Great Hornbill			VU	+	+	+	+	+	+	Yes	Yes	No	Medium	High
117	*Buceros rhinoceros*	Rhinoceros Hornbill			VU					+		Yes	Yes	No	Medium	High
118	***Calidris pygmea***	**Spoon-billed Sandpiper**	**CR**				**+**		**+**	**+**	**+**	**Yes**	**Yes**	**No**	**High**	**High**
119	*Calidris tenuirostris*	Great Knot		EN		+	+		+	+	+	Yes	No	No	N/A	N/A
120	*Calliope obscura*	Black-throated Blue Robin			VU		+			+		Yes	N/A	Yes	Medium	High
121	***Carpococcyx renauldi***	**Coral-billed Ground-cuckoo**			**VU**	**+**		**+**		**+**	**+**	**Yes**	**Yes**	**No**	**High**	**High**
122	*Centropus rectunguis*	Short-toed Coucal			VU					+		No	N/A	N/A	N/A	N/A
123	*Chatarrhaea longirostris*	Slender-billed Babbler			VU				?			No	N/A	N/A	N/A	N/A
124	*Chloropsis sonnerati*	Greater Green Leafbird		EN					+	+		Yes	No	No	N/A	N/A
125	*Chrysomma altirostre*	Jerdon's Babbler			VU				+			Yes	N/A	Yes	Medium	High
126	*Ciconia boyciana*	Oriental Stork		EN			+		v			No	N/A	N/A	N/A	N/A
127	*Ciconia episcopus*	Asian Woollyneck			VU	+	v	+	+	+	+	Yes	Yes	No	Medium	High
128	*Ciconia stormi*	Storm's Stork		EN					+	+		No	N/A	N/A	N/A	N/A

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129	*Clanga clanga*	Greater Spotted Eagle			VU	+	+	+	+	+	+	Yes	Yes	No	Medium	High
130	*Clanga hastata*	Indian Spotted Eagle			VU	+			+			Yes?	N/A	Yes	Medium	High
131	*Columba punicea*	Pale-capped Pigeon			VU	+	ex?	+	+	+	+	Yes	No	No	N/A	N/A
132	*Corvus pectoralis*	Collared Crow			VU		+				+	Yes	Yes	No	Medium	High
133	*Cyornis brunneatus*	Brown-chested Jungle-flycatcher			VU		+			+		Yes	No	No	N/A	N/A
134	*Egretta eulophotes*	Chinese Egret			VU		+			+	+	No	N/A	N/A	N/A	N/A
135	***Emberiza aureola***	**Yellow-breasted Bunting**	**CR**			**+**	**+**	**+**	**+**	**+**	**+**	**Yes**	**Yes**	**No**	**High**	**High**
136	*Emberiza rustica*	Rustic Bunting			VU		v					No	N/A	N/A	N/A	N/A
137	*Emberiza sulphurata*	Yellow Bunting			VU		+					No	N/A	N/A	N/A	N/A
138	***Eurychelidon sirintarae***	**White-eyed River-martin**	**CR**							**ex?**		**Yes?**	**N/A**	**Yes**	**High***	**High**
139	*Fregata andrewsi*	Christmas Island Frigatebird	CR			+	+			+	v	No	N/A	N/A	N/A	N/A
140	*Gallinago nemoricola*	Wood Snipe			VU		+	+	v	ex?	+	Yes	N/A	Yes	Medium	High
141	*Garrulax konkakinhensis*	Chestnut-eared Laughingthrush			VU			+			+	Yes	No	No	N/A	N/A
142	*Gorsachius goisagi*	Japanese Night-heron		EN			+					No	N/A	N/A	N/A	N/A
143	*Gorsachius magnificus*	White-eared Night-heron		EN		+	+				+	Yes	Yes	No	Medium	High
144	*Graminicola striatus*	Chinese Grass-babbler			VU	+	+		+	ex	ex	Yes	No	No	N/A	N/A
145	***Gyps bengalensis***	**White-rumped Vulture**	**CR**			**+**	**ex**	**+**	**+**	**ex?**	**ex?**	**Yes**	**Yes**	**No**	**High**	**High**
146	***Gyps tenuirostris***	**Slender-billed Vulture**	**CR**			**+**		**+**	**+**	**ex**	**ex?**	**Yes**	**Yes**	**No**	**High**	**High**
147	*Haliaeetus leucoryphus*	Pallas's Fish-eagle		EN		v	+		+	ex?		No	N/A	N/A	N/A	N/A
148	***Heliopais personatus***	**Masked Finfoot**		**EN**		**+**		**+**	**+**	**+**	**+**	**Yes**	**N/A**	**Yes**	**High**	**High**
149	***Houbaropsis bengalensis***	**Bengal Florican**	**CR**			**+**					**+**	**Yes**	**Yes**	**No**	**High**	**High**
150	***Hydrornis gurneyi***	**Gurney's Pitta**	**CR**						**+**	**+**		**Yes**	**Yes**	**No**	**High**	**High**
151	*Laniellus langbianis*	Grey-crowned Crocias		EN							+	Yes	No	No	N/A	N/A

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152	*Larus relictus*	Relict Gull			VU		v				v	No	N/A	N/A	N/A	N/A
153	***Leptoptilos dubius***	**Greater Adjutant**		**EN**		**+**		**ex?**	**ex?**	**+**	**+**	**Yes**	**Yes**	**No**	**High**	**High**
154	***Leptoptilos javanicus***	**Lesser Adjutant**			**VU**	**+**	**ex?**	**+**	**+**	**+**	**+**	**Yes**	**Yes**	**No**	**High**	**High**
155	*Locustella pleskei*	Styan's Grasshopper Warbler			VU		+				+	Yes	Yes	No	Medium	High
156	*Lophophorus sclateri*	Sclater's Monal			VU		+		+			Yes	Yes	No	Medium	High
157	***Lophura edwardsi***	**Edwards's Pheasant**	**CR**								**+**	**Yes?**	**N/A**	**Yes**	**High***	**High**
158	*Megapodius nicobariensis*	Nicobar Megapode			VU				ex			No	N/A	N/A	N/A	N/A
159	***Mergus squamatus***	**Scaly-sided Merganser**		**EN**			**+**		**+**	**+**	**v**	**Yes?**	**N/A**	**Yes**	**High**	**High**
160	*Mulleripicus pulverulentus*	Great Slaty Woodpecker			VU	+	ex?	+	+	+	+	Yes	Yes	No	Medium	High
161	*Mycteria cinerea*	Milky Stork		EN		+				ex	ex	No	N/A	N/A	N/A	N/A
162	*Neophron percnopterus*	Egyptian Vulture		EN					v			No	N/A	N/A	N/A	N/A
163	*Nisaetus nanus*	Wallace's Hawk-eagle			VU				+	+		Yes	No	No	N/A	N/A
164	*Numenius madagascariensis*	Far-eastern Curlew		EN			+			+	+	Yes	No	No	N/A	N/A
165	*Oriolus mellianus*	Silver Oriole		EN		+	+			+		Yes	No	No	N/A	N/A
166	*Otus sagittatus*	White-fronted Scops-owl			VU				+	+		Yes	No	No	N/A	N/A
167	*Pavo muticus*	Green Peafowl		EN		+	+	+	+	+	+	Yes	Yes	No	Medium	High
168	*Phylloscopus hainanus*	Hainan Leaf-warbler			VU		+					Yes	No	No	N/A	N/A
169	*Pitta nympha*	Fairy Pitta			VU		+	+		+	+	No	N/A	N/A	N/A	N/A
170	*Platalea minor*	Black-faced Spoonbill		EN		+	+			+	+	Yes	Yes	No	Medium	Medium
171	***Polyplectron katsumatae***	**Hainan Peacock-pheasant**		**EN**			**+**					**Yes**	**Yes**	**No**	**High**	**High**
172	*Polplectron inopinatum*	Mountain Peacock-pheasant			VU					+		No	N/A	N/A	N/A	N/A
173	*Polyplectron malacense*	Malaysian Peacock-pheasant			VU				+	ex?		No	N/A	N/A	N/A	N/A
174	***Pseudibis davisoni***	**White-shouldered Ibis**	**CR**			**+**	**ex?**	**+**	**ex?**	**ex**	**ex**	**Yes**	**Yes**	**No**	**High**	**High**

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175	*Psittacula longicauda*	Long-tailed Parakeet			VU				+	+		No	N/A	N/A	N/A	N/A
176	*Psittiparus margaritae*	Black-headed Parrotbill			VU	+					+	Yes	No	N/A	N/A	N/A
177	***Pycnonotus zeylanicus***	**Straw-headed Bulbul**	**CR**						**ex?**	**ex**		**Yes?**	**Yes**	**No**	**High****	**High**
178	*Rhabdotorrhinus corrugatus*	Wrinkled Hornbill		EN						+		No	N/A	N/A	N/A	N/A
179	***Rheinardia ocellata***	**Crested Argus**		**EN**				**+**			**+**	**Yes**	**Yes**	**No**	**High**	**High**
180	***Rhinoplax vigil***	**Helmeted Hornbill**	**CR**						**+**	**+**		**Yes**	**Yes**	**No**	**High**	**High**
181	***Rhodonessa caryophyllacea***	**Pink-headed Duck**	**CR**						**ex?**			**Yes?**	**N/A**	**Yes**	**High***	**High**
182	*Rhyticeros subruficollis*	Plain-pouched Hornbill			VU				+	+		Yes	Yes	No	Medium	Low
183	*Rhyticeros undulatus*	Wreathed Hornbill			VU	+		+	+	+	+	Yes	Yes	No	Medium	High
184	*Rimator naungmungensis*	Naung Mung Wren-babbler			VU				+			Yes	No	No	N/A	N/A
185	***Rimator pasquieri***	**White-throated Wren-babbler**		**EN**							**+**	**Yes**	**Yes**	**No**	**High**	**High**
186	***Rynchops albicollis***	**Indian Skimmer**			**VU**	**ex?**	**ex**	**ex**	**ex?**	**v**	**ex**	**Yes?**	**N/A**	**Yes**	**High**	**High**
187	***Sarcogyps calvus***	**Red-headed Vulture**	**CR**			**+**	**+**	**+**	**+**	**ex?**	**+**	**Yes**	**Yes**	**No**	**High**	**High**
188	*Saundersilarus saundersi*	Saunders's Gull			VU		+				+	Yes	Yes	No	Medium	High
189	*Sitta formosa*	Beautiful Nuthatch			VU		+	+	+	+	+	Yes	Yes	No	Medium	High
190	*Sitta magna*	Giant Nuthatch		EN			+		+	+		Yes	Yes	No	Medium	High
191	*Sitta victoriae*	White-browed Nuthatch		EN					+			Yes	No	No	N/A	N/A
192	*Spelaeornis kinneari*	Pale-throated Wren-babbler			VU		+				+	Yes	No	No	N/A	N/A
193	*Stachyris nonggangensis*	Nonggang Babbler			VU		+					Yes	No	No	N/A	N/A
194	*Stachyris oglei*	Snowy-throated Babbler			VU				+			Yes	No	No	N/A	N/A
195	***Sterna acuticauda***	**Black-bellied Tern**		**EN**		**ex**	**v**	**+**	**+**	**ex**	**ex**	**Yes**	**Yes**	**No**	**High**	**High**
196	*Thalasseus bernsteini*	Chinese Crested Tern	CR				v			+		No	N/A	N/A	N/A	N/A
197	***Thaumatibis gigantea***	**Giant Ibis**	**CR**			**+**		**+**		**ex**	**+**	**Yes**	**Yes**	**No**	**High**	**High**

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198	*Tragopan blythii*	Blyth's Tragopan			VU				+			Yes	No	No	N/A	N/A
199	*Treron capellei*	Large Green-pigeon			VU				+	+		Yes	No	No	N/A	N/A
200	*Tringa guttifer*	Spotted Greenshank		EN		+	+		+	+	+	Yes	No	No	N/A	N/A
201	*Trochalopteron ngoclinhensis*	Golden-winged Laughingthrush		EN							+	Yes	No	No	N/A	N/A
202	*Trochalopteron yersini*	Collared Laughingthrush		EN							+	Yes	No	No	N/A	N/A
203	*Turdinus calcicola*	Rufous Limestone-babbler			VU					+		Yes	No	No	N/A	N/A
204	*Turdus feae*	Grey-sided Thrush			VU		+	+	+	+		Yes	No	No	N/A	N/A
205	*Urocissa whiteheadi*	Hainan Magpie		EN			+					Yes	No	No	N/A	N/A
	REPTILES (comprehensive Red List assessment)		**28**	**42**	**54**	**24**	**36**	**30**	**34**	**38**	**75**					
206	*Achalinus hainanus*	Hainan Odd-scaled Snake			VU		+					Yes	No	No	N/A	N/A
207	*Amyda cartilaginea*	Asiatic Softshell Turtle			VU	+		+	+	+	+	Yes	Yes	No	Medium	High
208	***Batagur affinis***	**Southern River Terrapin**	**CR**			**+**				**+**	**?**	**Yes**	**Yes**	**No**	**High**	**High**
209	***Batagur baska***	**Northern River Terrapin**	**CR**						**ex?**	**ex**		**Yes**	**N/A**	**Yes**	**High**	**High**
210	***Batagur borneoensis***	**Painted Terrapin**	**CR**							**+**		**Yes**	**Yes**	**No**	**High**	**High**
211	***Battagur trivittata***	**Burmese Roofed Turtle**		**EN**					**+**			**Yes**	**Yes**	**No**	**High**	**High**
212	*Boiga bourreti*	Bourret's Cat Snake		EN		?		?			+	Yes	No	No	N/A	N/A
213	*Boiga saengsomi*	Banded Cat Snake		EN						+		Yes	No	No	N/A	N/A
214	*Bronchocela vietnamensis*	Vietnamese Long-tailed Agama			VU						+	Yes	No	No	N/A	N/A
215	*Bungarus slowinskii*	Red River Krait			VU			?			+	Yes	No	No	N/A	N/A
216	*Calamaria yunnanensis*	Yunnan Reed Snake		EN			+					Yes	No	No	N/A	N/A
217	*Caretta caretta*	Loggerhead Turtle			VU		+		+		+	No	N/A	N/A	N/A	N/A
218	*Chelonia mydas*	Green Turtle		EN		?	+			+	+	No	N/A	N/A	N/A	N/A

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219	***Chitra chitra***	**Striped Narrow-headed Softshell Turtle**	**CR**							**+**		**Yes**	**Yes**	**No**	**High**	**High**
220	***Chitra indica*†**	**Indian Narrow-headed Softshell Turtle**		**EN**					**+**			**Yes**	**Yes**	**No**	**High**	**High**
221	*Cnemaspis caudanivea*	Hon Tre Island Rock Gecko			VU						+	Yes	No	No	N/A	N/A
222	*Cnemaspis neangthyi*	Neang Thy's Rock Gecko		EN		+						Yes	No	No	N/A	N/A
223	*Cnemaspis niyomwanae*	Niyomwan's Rock Gecko		EN						+		Yes	No	No	N/A	N/A
224	*Cnemaspis nuicamensis*	Nui Cam Hill Rock Gecko			VU						+	Yes	No	No	N/A	N/A
225	*Cnemaspis psychedelica*	Psychedelic Rock Gecko		EN							+	Yes	No	No	N/A	N/A
226	*Cnemaspis tucdupensis*	Tuc Dup Hill Rock Gecko			VU						+	Yes	No	No	N/A	N/A
227	***Crocodylus siamensis***	**Siamese Crocodile**	**CR**			**+**		**+**	**?**	**+**	**+**	**Yes**	**Yes**	**No**	**High**	**High**
228	*Cryptelytrops honsonensis*	Hon Son Pit Viper			VU						+	Yes	No	No	N/A	N/A
229	*Cryptelytrops kanburiensis*	Kanburi Pit Viper		EN					?	+		Yes	No	No	N/A	N/A
230	*Cryptelytrops rubeus*	Ruby-eyed Green Pitviper			VU	+					+	Yes	No	No	N/A	N/A
231	*Cuora amboinensis*	Asian Box Turtle			VU	+			+	+	+	Yes	Yes	No	Low	Low
232	***Cuora bourreti***	**Bourret's Box Turtle**	**CR**					**+**			**+**	**Yes**	**Yes**	**No**	**High**	**High**
233	***Cuora galbinifrons***	**Indochinese Box Turtle**	**CR**				**+**	**+**			**+**	**Yes**	**Yes**	**No**	**High**	**High**
234	***Cuora mccordi***	**McCord's Box Turtle**	**CR**				**+**					**Yes**	**Yes**	**No**	**High**	**High**
235	***Cuora mouhotii***	**Keeled Box Turtle**		**EN**			**+**	**+**	**+**		**+**	**Yes**	**Yes**	**No**	**High**	**High**
236	***Cuora picturata***	**Southern Vietnam Box Turtle**	**CR**								**+**	**Yes**	**Yes**	**No**	**High**	**High**
237	***Cuora trifasciata*‡**	**Chinese Three-striped Box Turtle**	**CR**				**+**	**+**			**+**	**Yes**	**Yes**	**No**	**High**	**High**
238	***Cuora yunnanensis***	**Yunnan Box Turtle**	**CR**				**+**					**Yes?**	**N/A**	**Yes**	**High**	**High**
239	***Cuora zhoui***	**Zhou's Box Turtle**	**CR**				**+**				**+**	**Yes?**	**N/A**	**Yes**	**High**	**High**
240	*Cyrtodactylus auribalteatus*	Golden-belted Bent-toed Gecko			VU					+		Yes	No	No	N/A	N/A

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241	*Cyrtodactylus badenensis*	Ba Den Bow-fingered Gecko			VU						+	Yes	No	No	N/A	N/A
242	*Cyrtodactylus bichnganae*	Bich Ngan's Bent-toed Gecko			VU						+	Yes	No	No	N/A	N/A
243	*Cyrtodactylus brevidactylus*	Short-toed Bent-toed Gecko		EN					+			Yes	No	No	N/A	N/A
244	*Cyrtodactylus caovansungi*	Cao Van Sung's Bent-toed Gecko		EN							+	Yes	No	No	N/A	N/A
245	***Cyrtodactylus chanhomeae***	**Chanhome's Bent-toed Gecko**	**CR**							**+**		**Yes**	**Yes**	**No**	**High**	**High**
246	*Cyrtodactylus chrysopylos*	Shan State Bent-toed Gecko			VU				+			Yes	No	No	N/A	N/A
247	***Cyrtodactylus gialaiensis***	**Gia Lai Bent-toed Gecko**	**CR**								**+**	**Yes**	**Yes**	**No**	**High**	**High**
248	*Cyrtodactylus grismeri*	Grismer's Bent-toed Gecko			VU						+	Yes	No	No	N/A	N/A
249	*Cyrtodactylus huongsonensis*	Huong Son Bent-toed Gecko			VU						+	Yes	No	No	N/A	N/A
250	*Cyrtodactylus huynhi*	Huynh's Bent-toed Gecko			VU						+	Yes	No	No	N/A	N/A
251	***Cyrtodactylus jaegeri***	**Khammouane Brown-headed Bent-toed Gecko**	**CR**					**+**				**Yes**	**Yes**	**No**	**High**	**High**
252	*Cyrtodactylus khammouanensis*	Khammouane Bent-toed Gecko			VU			+				Yes	No	No	N/A	N/A
253	*Cyrtodactylus khelangensis*	Lampang Bent-toed Gecko		EN						+		Yes	No	No	N/A	N/A
254	*Cyrtodactylus lomyenensis*	Lomyen Bent-toed Gecko			VU			+				Yes	No	No	N/A	N/A
255	***Cyrtodactylus nigriocularis***	**Black-eyed Bent-toed Gecko**	**CR**								**+**	**Yes**	**Yes**	**No**	**High**	**High**
256	*Cyrtodactylus otai*	Ota's Bent-toed Gecko		EN							+	Yes	No	No	N/A	N/A
257	*Cyrtodactylus phuketensis*	Phuket Bent-toed Gecko		EN						+		Yes	No	No	N/A	N/A
258	*Cyrtodactylus phuquocensis*	Phou Quoc Bent-toed Gecko		EN							+	Yes	No	No	N/A	N/A
259	***Cyrtodactylus takouensis***	**Ta Kou Bent-toed Gecko**	**CR**								**+**	**Yes**	**Yes**	**No**	**High**	**High**

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260	*Cyrtodactylus thuongae*	Tay Ninh Bent-toed Gecko			VU						+	Yes	No	No	N/A	N/A
261	*Dermochelys coriacea*	Leatherback Sea Turtle			VU	+	+		+	+		No	N/A	N/A	N/A	N/A
262	*Dibamus bogadeki*	Bogadek's Burrowing Lizard		EN			+					Yes	No	No	N/A	N/A
263	***Dixonius kaweesaki***	**Sam Roi Yot Leaf-toed Gecko**	**CR**							**+**		**Yes**	**Yes**	**No**	**High**	**High**
264	*Dixonius taoi*	Phu Quy Leaf-toed Gecko			VU						+	Yes	No	No	N/A	N/A
265	*Elaphe moellendorffi*	Moellendorff's Trinket Snake			VU		+				+	Yes	No	No	N/A	N/A
266	*Enhydris longicauda*	Tonle Sap Water Snake			VU	+						Yes	Yes	No	Medium	Medium
267	*Enhydris vorisi*	Voris's Water Snake		EN					+			Yes	N/A	Yes	Medium	High
268	*Eretmochelys imbricata*	Hawksbill Turtle	CR			+	+		+	+	+	No	N/A	N/A	N/A	N/A
269	*Gekko aaronbaueri*	Aaron Bauer's Gecko			VU			+				Yes	No	No	N/A	N/A
270	*Gekko badenii*	Golden Gecko		EN							+	Yes	No	No	N/A	N/A
271	*Gekko boehmei*	Boehme's Gecko			VU			+				Yes	No	No	N/A	N/A
272	*Gekko bonkowskii*	Bonkowski's Gecko			VU			+				Yes	No	No	N/A	N/A
273	***Gekko lauhachindai***	**Lauhachinda's Cave Gecko**	**CR**							**+**		**Yes**	**Yes**	**No**	**High**	**High**
274	*Gekko russelltraini*	Russell Train's Marble Gecko			VU						+	Yes	No	No	N/A	N/A
275	*Gekko sengchanthavongi*	Sengchanthavong's Gecko			VU			+				Yes	No	No	N/A	N/A
276	*Gekko takouensis*	Ta Kou Marbled Gecko			VU						+	Yes	No	No	N/A	N/A
277	*Gekko thakhekensis*	Thakhek Gecko			VU			+				Yes	No	No	N/A	N/A
278	*Gekko vietnamensis*	Vietnam Gecko			VU						+	Yes	No	No	N/A	N/A
279	***Geochelone platynota***	**Burmese Star Tortoise**	**CR**						**+**			**Yes**	**Yes**	**No**	**High**	**High**
280	*Geoemyda spengleri*	Black-breasted Leaf Turtle		EN			+				+	Yes	Yes	No	Medium	High
281	*Goniurosaurus bawanglingensis*	Bawangling Cave Gecko		EN			+					Yes	No	No	N/A	N/A
282	*Goniurosaurus catbaensis*	Cat Ba Tiger Gecko		EN							+	Yes	No	No	N/A	N/A

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283	***Goniurosaurus huuliensis***	**Supreme Gecko**	**CR**								**+**	**Yes**	**Yes**	**No**	**High**	**High**
284	*Goniurosaurus lichtenfelderi*	Lichtenfelder's Gecko			VU						+	Yes	No	No	N/A	N/A
285	*Heosemys annandalii*	Yellow-headed Temple Turtle		EN		+			?	+	+	Yes	Yes	No	Medium	High
286	***Heosemys depressa***	**Arakan Forest Turtle**	**CR**						**+**			**Yes**	**Yes**	**No**	**High**	**High**
287	*Heosemys grandis*	Giant Asian Pond Turtle			VU	+		+	+	+	+	Yes	Yes	No	Low	Low
288	*Heosemys spinosa*	Spiny Turtle		EN					?	+		Yes	Yes	No	Medium	High
289	***Indotestudo elongata***	**Elongated Tortoise**	**CR**			**+**	**+**	**+**	**+**	**+**	**+**	**Yes**	**Yes**	**No**	**High**	**High**
290	***Indotyphlops lazelli***	**Hong Kong Blind Snake**	**CR**				**+**					**Yes?**	**N/A**	**Yes**	**High**	**High**
291	*Leiolepis boehmei*	Böhme's Butterfly Lizard			VU					+		Yes	No	No	N/A	N/A
292	*Leiolepis guentherpetersi*	Peters' Butterfly Lizard		EN							+	Yes	No	No	N/A	N/A
293	*Leiolepis ngovantrii*	Ngo Van Tri's Lady Butterfly Lizard			VU						+	Yes	No	No	N/A	N/A
294	*Lepidochelys olivacea*	Olive Ridley			VU	+			+	+	+	No	N/A	N/A	N/A	N/A
295	*Lycodon paucifasciatus*	Rendahl's Wolf Snake			VU						+	Yes	No	No	N/A	N/A
296	*Malayemys subtrijuga*	Malayan Snail-eating Turtle			VU	+		+		+	+	Yes	Yes	No	Low	Low
297	***Manouria emys***	**Asian Giant Tortoise**	**CR**						**+**	**+**		**Yes**	**Yes**	**No**	**High**	**High**
298	*Manouria impressa*	Impressed Tortoise			VU	?	?	+	+	+	+	Yes	Yes	No	Medium	High
299	***Mauremys annamensis***	**Vietnamese Pond Turtle**	**CR**								**+**	**Yes**	**Yes**	**No**	**High**	**High**
300	***Mauremys mutica***	**Asian Yellow Pond Turtle**		**EN**			**+**				**+**	**Yes**	**Yes**	**No**	**High**	**High**
301	***Mauremys nigricans***	**Red-necked Pond Turtle**		**EN**			**+**					**Yes**	**Yes**	**No**	**High**	**High**
302	*Mauremys reevesii*	Chinese Three-keeled Pond Turtle		EN			+					Yes	Yes	No	Medium	High
303	*Mauremys sinensis*	Chinese Stripe-necked Turtle		EN			+				+	Yes	Yes	No	Medium	High
304	***Morenia ocellata***	**Burmese Eyed Turtle**			**VU**				**+**			**Yes**	**Yes**	**No**	**High**	**High**

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305	*Naja atra*	Chinese Cobra			**VU**		**+**	**+**			**+**	Yes	No	No	N/A	N/A
306	*Naja mandalayensis*	Mandalay Cobra			**VU**				**+**			Yes	No	No	N/A	N/A
307	*Naja siamensis*	Siamese Cobra			**VU**	**+**		**+**	**+**	**+**	**+**	Yes	No	No	N/A	N/A
308	***Nilssonia formosa***	**Burmese Peacock Softshell**		**EN**					**+**			**Yes**	**Yes**	**No**	**High**	**High**
309	*Notochelys platynota*	Malayan Flat-shelled Turtle			VU				?	+	+	No	N/A	N/A	N/A	N/A
310	*Oligodon lacroixi*	Lacroix Kukri Snake			VU						+	Yes	No	No	N/A	N/A
311	*Ophiophagus hannah*	King Cobra			VU	+	+	+	+	+	+	Yes	Yes	No	Medium	Medium
312	*Palea steindachneri*	Wattle-necked Softshell Turtle		EN			+				+	Yes	Yes	No	Medium	High
313	***Pelochelys cantorii***	**Asian Giant Softshell Turtle**		**EN**		**+**	**+**	**+**	**+**	**+**	**+**	**Yes**	**Yes**	**No**	**High**	**High**
314	*Pelodiscus sinensis*	Chinese Softshell Turtle			VU		+				+	No	N/A	N/A	N/A	N/A
315	*Physignathus cocincinus*	Asian Water Dragon			VU	+	?	+		+	+	Yes	No	No	N/A	N/A
316	***Platysternon megacephalum***	**Big-headed Turtle**		**EN**			**+**	**+**	**+**	**+**	**+**	**Yes**	**Yes**	**No**	**High**	**High**
317	*Protobothrops sieversorum*	Three-horned-scaled Pit Viper		EN				+			+	Yes	No	No	N/A	N/A
318	*Protobothrops trungkhanhensis*	Trung Khanh Pit Viper		EN			?				+	Yes	No	No	N/A	N/A
319	*Pseudocalotes floweri*	Thai False Bloodsucker			VU	+				+		Yes	No	No	N/A	N/A
320	*Pseudocalotes poilani*	Laotian False Bloodsucker		EN				+				Yes	No	No	N/A	N/A
321	*Python bivittatus*	Burmese Python			VU	+	+		+	+	+	Yes	No	No	N/A	N/A
322	*Python kyaiktiyo*	Myanmar Short-tailed Python			VU				+			Yes	No	No	N/A	N/A
323	***Rafetus swinhoei***	**East Asian Giant Softshell Turtle**	**CR**				**+**				**+**	**Yes**	**Yes**	**Yes**	**High**	**High**
324	***Sacalia bealei***	**Beale's Eyed Turtle**		**EN**			**+**					**Yes**	**Yes**	**No**	**High**	**High**
325	***Sacalia quadriocellata***	**Four-eyed Turtle**		**EN**			**+**	**+**			**+**	**Yes**	**Yes**	**No**	**High**	**High**

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326	***Shinisaurus crocodilurus***	**Chinese Crocodile Lizard**		**EN**			**+**				**+**	**Yes**	**Yes**	**No**	**High**	**High**
327	*Siebenrockiella crassicollis*	Black Marsh Turtle			VU	+			+	+	+	Yes	Yes	No	Low	Medium
328	*Tomistoma schlegelii*	False Gharial		EN						ex	?	No	N/A	N/A	N/A	N/A
329	*Viridovipera truongsonensis*	Truong Son Pit Viper		EN				?			+	Yes	No	No	N/A	N/A
	AMPHIBIANS (comprehensive Red List assessment)		**3**	**42**	**53**	**11**	**41**	**17**	**9**	**8**	**52**					
330	*Alcalus tasanae*	Tasan Frog			VU				?	+		Yes	No	No	N/A	N/A
331	*Amolops cucae*	Nam Tha Frog		EN							+	Yes	No	No	N/A	N/A
332	*Amolops hainanensis*	Hainan Torrent Frog		EN			+					Yes	No	No	N/A	N/A
333	***Amolops hongkongensis***	**Hong Kong Cascade Frog**		**EN**			**+**					**Yes**	**Yes**	**No**	**High**	**High**
334	*Amolops minutus*	Tiny Sucker Frog		EN			+				+	Yes	No	No	N/A	N/A
335	*Amolops splendissimus*	Mu Hum Sucker Frog			VU		?				+	Yes	No	No	N/A	N/A
336	*Amolops torrentis*	Torrent Sucker Frog			VU		+					Yes	Yes	Yes	Medium	Medium
337	*Amolops tuberodepressus*	Mount Wuliang Sucker Frog			VU		+					Yes	No	No	N/A	N/A
338	*Amolops vitreus*	Vitreous Cascade Frog			VU			+			+	Yes	No	No	N/A	N/A
339	*Ansonia siamensis*	Siamese Stream Toad			VU					+		Yes	No	No	N/A	N/A
340	*Ansonia thinthinae*	Thin Thin's Stream Toad		EN					+	?		Yes	No	No	N/A	N/A
341	*Buergeria oxycephala*	Hainan Stream Frog			VU		+					Yes	No	No	N/A	N/A
342	*Chiromantis samkosensis*	Samkos Bush Frog			VU	+						Yes	No	No	N/A	N/A
343	*Gracixalus jinxiuensis*	Jinxiu Small Treefrog			VU						+	Yes	No	No	N/A	N/A
344	*Gracixalus lumarius*	Thorny Tree Frog		EN							+	Yes	No	No	N/A	N/A
345	*Gracixalus quangi*	Quang's Treefrog			VU			?			+	Yes	No	No	N/A	N/A

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346	*Gracixalus quyeti*	Quyet's Treefrog		EN				?			+	Yes	No	No	N/A	N/A
347	*Hylarana montivaga*	Lang Bian Plateau Frog		EN							+	Yes	No	No	N/A	N/A
348	*Ingerana borealis*	Boreal Floating Frog			VU		?		?			Yes	No	No	N/A	N/A
349	*Ingerana liui*	Liu's Papillae-tonged Frog			VU		+					Yes	No	No	N/A	N/A
350	*Kurixalus baliogaster*	Belly-spotted Frog			VU			+			+	Yes	No	No	N/A	N/A
351	*Kalophrynus cryptophonus*	Bamboo Sticky Frog		EN							+	Yes	No	No	N/A	N/A
352	*Kalophrynus honbaensis*	Hon Ba Sticky Frog			VU						+	Yes	No	No	N/A	N/A
353	***Laotriton laoensis***	**Laos Warty Newt**		**EN**				**+**				**Yes**	**Yes**	**No**	**High**	**High**
354	*Leptobrachella alpina*	Asian Alpine Toad		EN			+					Yes	No	No	N/A	N/A
355	*Leptobrachella applebyi*	Appleby's Leaf-litter Toad		EN							+	Yes	No	No	N/A	N/A
356	*Leptobrachella bidoupensis*	Bi Doup Leaf-litter Toad		EN							+	Yes	No	No	N/A	N/A
357	***Leptobrachella botsfordi***	**Botsford's Leaf-litter Toad**	**CR**								**+**	**Yes**	**Yes**	**No**	**High**	**High**
358	*Leptobrachella firthi*	Firth's Leaf-litter Toad		EN				?			+	Yes	No	No	N/A	N/A
359	*Leptobrachella isos*	Gia Lai Leaf-litter Toad			VU	+		?			+	Yes	No	No	N/A	N/A
360	*Leptobrachella melica*	Musical Leaf-litter Toad		EN		+		?			?	Yes	No	No	N/A	N/A
361	*Leptobrachella pluvialis*	Rainy Toad		EN			?				+	Yes	No	No	N/A	N/A
362	*Leptobrachella sola*	Hala Bala Leaf-litter Toad		EN						+		Yes	No	No	N/A	N/A
363	*Leptobrachella tengchongensis*	Tengchong Leaf-litter Toad		EN			+					Yes	No	No	N/A	N/A
364	*Leptobrachium echinatum*	Hoang Lien Moustached Toad		EN							+	Yes	No	No	N/A	N/A
365	*Leptobrachium hainanense*	Hainan Pseudomoustached Toad			VU		+					Yes	No	No	N/A	N/A
366	*Leptobrachium leucops*	Yin Yang Toad			VU						+	Yes	No	No	N/A	N/A
367	*Leptobrachium ngoclinhense*	Ngoc Linh Spadefoot Toad		EN							+	Yes	No	No	N/A	N/A

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368	*Leptobrachium rakhinensis*	Rakhine Litter Frog		EN					+			Yes	No	No	N/A	N/A
369	*Leptobrachium xanthops*	Phou Ajol Spadefoot Toad		EN				+			?	Yes	No	No	N/A	N/A
370	*Limnonectes fragilis*	Fragile Wart Frog			VU		+					Yes	No	No	N/A	N/A
371	*Limnonectes isanensis*	Isan Big-headed Frog			VU			?		+		Yes	No	No	N/A	N/A
372	*Limnonectes liui*	Liu's Papillae-tongued Frog			VU		+	?	?			Yes	No	No	N/A	N/A
373	*Limnonectes megastomias*	Khorat Big-mouthed Frog			VU	?				+		Yes	No	No	N/A	N/A
374	*Liuixalus hainanus*	Hainan Small Treefrog			VU		+					Yes	No	No	N/A	N/A
375	*Liuixalus ocellatus*	Ocellated Small Treefrog			VU		+					Yes	No	No	N/A	N/A
376	*Liuixalus romeri*	Romer's Treefrog		EN			+					Yes	No	No	N/A	N/A
377	*Megophrys auralensis*	Aural Horned Toad			VU	+						Yes	No	No	N/A	N/A
378	*Megophrys brachykolos*	Short-legged Horned Toad		EN			+					Yes	No	No	N/A	N/A
379	***Megophrys damrei***	**Bokor Horned Toad**	**CR**			**+**						**Yes**	**Yes**	**No**	**High**	**High**
380	*Megophrys gigantica*	Giant Piebald Horned Toad			VU		+					Yes	Yes	No	Medium	High
381	*Megophrys synoria*	O'Reang Horned Toad			VU	+					?	Yes	No	No	N/A	N/A
382	*Microhyla annamensis*	Vietnam Rice Frog			VU						+	Yes	No	No	N/A	N/A
383	*Microhyla arboricola*	Tree-dwelling Narrow-Mouth Frog			VU						+	Yes	No	No	N/A	N/A
384	*Microhyla pineticola*	Pine Narrow-Mouth Frog			VU						+	Yes	No	No	N/A	N/A
385	*Microhyla pulchella*	Pretty Narrow-Mouth Frog		EN							+	Yes	No	No	N/A	N/A
386	*Nanorana liui*	Vocal-sacless Spiny Frog			VU		+					Yes	No	No	N/A	N/A
387	*Nanorana maculosa*	Piebald Spiny Frog		EN			+					Yes	Yes	Yes	Medium	Medium
388	*Nanorana unculuanus*	Yunnan Asian Frog		EN			+				?	Yes	No	No	N/A	N/A
389	*Nanorana yunnanensis*	Yunnan Spiny Frog		EN			+	?	?		+	Yes	No	No	N/A	N/A
390	*Odorrana geminata*	Geminated Cascade Frog			VU		+				+	Yes	No	No	N/A	N/A

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391	*Odorrana hainanensis*	Hainan Frog			VU		+					Yes	No	No	N/A	N/A
392	*Odorrana indeprensa*	Khao Yai Frog			VU					+		Yes	No	No	N/A	N/A
393	*Odorrana jingdongensis*	Jingdong Stinking Frog			VU		+	?	?		+	Yes	No	No	N/A	N/A
394	*Odorrana yentuensis*	Yen Tu Sharp-nosed Frog		EN							+	Yes	No	No	N/A	N/A
395	*Oreolalax granulosus*	Yunnan Lazy Toad			VU		+					Yes	Yes	Yes	Low	Low
396	*Oreolalax jingdongensis*	Jingdong Lazy Toad			VU		+					Yes	Yes	Yes	Low	Low
397	***Oreolalax sterlingae***	**Sterling's Toothed Toad**	**CR**								**+**	**Yes**	**Yes**	**No**	**High**	**High**
398	*Paramesotriton guangxiensis*	Guangxi Warty Newt		EN			+					Yes	No	Yes	Medium	Medium
399	*Parapelophryne scalpta*	Hainan Little Toad			VU		+					Yes	No	No	N/A	N/A
400	*Philautus cardamonus*	Phnom Samkos Bubble-nest Frog		EN		+						Yes	No	No	N/A	N/A
401	*Quasipaa acanthophora*	Lang Son Spiny Frog			VU		?				+	Yes	No	No	N/A	N/A
402	*Quasipaa boulengeri*	Spiny-bellied Frog		EN			+				?	Yes	No	No	N/A	N/A
403	*Quasipaa exilispinosa*	Little Spiny Frog			VU		+					No	N/A	N/A	N/A	N/A
404	*Quasipaa fasciculispina*	Spiny-breasted Frog			VU	+				+		Yes	No	No	N/A	N/A
405	*Quasipaa shini*	Spiny-flanked Frog			VU		+					No	N/A	N/A	N/A	N/A
406	*Quasipaa spinosa*	Giant Spiny Frog			VU		+	?	?		+	Yes	Yes	No	Medium	High
407	*Raorchestes gryllus*	Lang Bian Bubble-nest Frog			VU						+	Yes	No	No	N/A	N/A
408	*Rhacophorus calcaneus*	Vietnam Flying Frog		EN							+	Yes	No	No	N/A	N/A
409	*Rhacophorus helenae*	Helen's Tree Frog		EN							+	Yes	No	No	N/A	N/A
410	*Rhacophorus marmoridorsum*	Marble-backed Tree Frog			VU						+	Yes	No	No	N/A	N/A
411	*Rhacophorus spelaeus*	Cave Treefrog			VU			+				Yes	No	No	N/A	N/A
412	*Rhacophorus vampyrus*	Vampire Flying Frog		EN							+	Yes	No	No	N/A	N/A
413	*Rhacophorus yaoshanensis*	Yaoshan Treefrog		EN			+					No	N/A	N/A	N/A	N/A

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414	*Rhacophorus yinggelingensis*	Yinggeling Treefrog			VU		+					Yes	Yes	Yes	Low	Low
415	*Sylvirana faber*	Cardamom Stream Frog			VU	+						Yes	No	No	N/A	N/A
416	*Sylvirana spinulosa*	Fine-spined Frog			VU		+					Yes	No	No	N/A	N/A
417	*Theloderma bambusicolum*	Bamboo Moss Frog			VU	?					+	Yes	No	No	N/A	N/A
418	*Theloderma bicolor*	Chapa Bug-eyed Frog		EN							+	Yes	No	No	N/A	N/A
419	*Theloderma nebulosum*	Misty Moss Frog		EN							+	Yes	No	No	N/A	N/A
420	*Theloderma palliatum*	Cloaked Moss Frog		EN							+	Yes	No	No	N/A	N/A
421	*Theloderma petilum*	Slender Moss Frog			VU			+			+	Yes	No	No	N/A	N/A
422	*Theloderma ryabovi*	Ryabov's Bug-eyed Frog		EN							+	Yes	No	No	N/A	N/A
423	*Tylototriton hainanensis*	Hainan Knobby Newt		EN			+				?	Yes	No	No	N/A	N/A
424	*Tylototriton notialis*	Laos Knobby Newt			VU			+			+	Yes	No	No	N/A	N/A
425	*Tylototriton shanorum*	Taunggyi Knobby Newt			VU				+			Yes	No	No	N/A	N/A
426	*Tylototriton vietnamensis*	Vietnamese Knobby Newt		EN							+	Yes	No	No	N/A	N/A
427	*Tylototriton ziegleri*	Ziegler's Knobby Newt			VU		?				+	Yes	No	No	N/A	N/A
	FISH (comprehensive Red List assessment)		**25**	**43**	**66**	**30**	**27**	**60**	**21**	**61**	**38**					
428	***Aaptosyax grypus***	**Mekong Giant Salmon Carp**	**CR**			**ex?**		**+**		**ex?**		**Yes**	**Yes**	**No**	**High**	**High**
429	*Acipenser sinensis*	Chinese Sturgeon	CR				ex?					No	N/A	N/A	N/A	N/A
430	*Anguilla japonica*	Japanese Eel		EN		v	v				v	No	N/A	N/A	N/A	N/A
431	***Balantiocheilos ambusticauda***	**Siamese Bala-shark**	**CR**			**?**		**?**		**ex?**		**Yes?**	**N/A**	**Yes**	**High**	**High**
432	*Balantiocheilos melanopterus*	Silver Shark		EN						+		Yes	Yes	No	Medium	High
433	*Bangana behri*	Humphead Carp			VU	+	+	+		+	+	Yes	No	No	N/A	N/A

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434	*Bangana musaei*	Khammouane Karst Cave Fish			VU			+				Yes	Yes	No	Medium	High
435	*Bangana tonkinensis*	Red River Carp			VU		+				+	Yes	No	No	N/A	N/A
436	*Barilius dogarsinghi*	Manipur Baril			VU				+			No	N/A	N/A	N/A	N/A
437	*Betta pi*	Pi Mouthbrooder		EN						+		Yes	No	No	N/A	N/A
438	***Betta simplex***	**Simple Mouthbrooder**	**CR**							+		**Yes**	**Yes**	**No**	**High**	**High**
439	*Betta splendens*	Siamese Fighting Fish			VU					+		Yes	Yes	No	Medium	High
440	*Botia rostrata*	Twin-banded Loach			VU		+		?			Yes	No	No	N/A	N/A
441	***Catlocarpio siamensis***	**Giant Carp**	**CR**			**+**		**+**		**+**	**+**	**Yes**	**Yes**	**No**	**High**	**High**
442	***Ceratoglanis pachynema***	**Club-barbel Sheatfish**	**CR**					**?**		**+**		**Yes**	**Yes**	**No**	**High**	**High**
443	*Cirrhinus microlepis*	Small-scaled Mud Carp			VU	+		+		+	+	Yes	No	No	N/A	N/A
444	*Cranoglanis bouderius*	Helmet Catfish			VU		+					Yes	No	No	N/A	N/A
445	*Cryptotora thamicola*	Waterfall-climbing Cave Fish			VU					+		Yes	No	No	N/A	N/A
446	*Cyprinion semiplotum*	Assamese Kingfish			VU				?			Yes	No	No	N/A	N/A
447	*Cyprinus intha*	Inle Carp		EN					+			Yes	N/A	N/A	N/A	N/A
448	*Danio erythromicron*	Emerald Dwarf Rasbora		EN					+			Yes	N/A	N/A	N/A	N/A
449	***Datnioides pulcher***	**Siamese Tiger Perch**	**CR**			**+**		**+**		**ex**	**+**	**Yes**	**Yes**	**No**	**High**	**High**
450	*Datnioides undecimradiatus*	Thinbar Datnoid			VU	+		+		+	+	Yes	Yes	No	Medium	High
451	*Devario apopyris*	Nam Youan Danio			VU		?	+				Yes	No	No	N/A	N/A
452	*Devario auropurpureus*	Inle Danio		EN					+			Yes	No	No	N/A	N/A
453	*Devario browni*	Brown's Danio			VU				+			Yes	No	No	N/A	N/A
454	*Devario yuensis*	Lokchao Danio			VU				+			Yes	No	No	N/A	N/A
455	*Discherodontus halei*	Hale's Barb		EN						?		Yes	No	No	N/A	N/A
456	*Ellopostoma mystax*	Enigmatic Loach		EN						+		Yes	No	No	N/A	N/A

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457	***Epalzeorhynchos bicolor***	**Redtail Shark Minnow**	**CR**							**+**		**Yes**	**Yes**	**No**	**High**	**High**
458	*Epalzeorhynchos munense*	Red Fin Shark Minnow			VU	+		+		+		Yes	No	No	N/A	N/A
459	***Fluvitrygon kittipongi***	**Roughback Whipray**		**EN**						**+**		**Yes**	**Yes**	**No**	**High**	**High**
460	***Fluvitrygon oxyrhyncha***	**Marbled Freshwater Stingray**		**EN**		**+**				**+**		**Yes**	**Yes**	**No**	**High**	**High**
461	***Fluvitrygon signifer***	**White-edged Freshwater Whipray**		**EN**						**+**		**Yes**	**Yes**	**No**	**High**	**High**
462	*Garra bispinosa*	Two-spined Garra			VU		+					Yes	No	No	N/A	N/A
463	*Garra flavatra*	Panda Garra			VU				+			Yes	N/A	N/A	N/A	N/A
464	*Glyphis siamensis*	Irrawaddy River Shark	CR						+			Yes	N/A	Yes	High	Low
465	*Gymnostomus horai*	Hora’s Minnow		EN					+			Yes	No	No	N/A	N/A
466	*Hemimyzon confluens*	Nam Ngum Loach			VU			+				Yes	No	No	N/A	N/A
467	***Hemitrygon laosensis***	**Mekong Freshwater Stingray**		**EN**		**+**		**+**		**+**		**Yes**	**Yes**	**No**	**High**	**High**
468	*Hypsibarbus lagleri*	Lagler’s Barb			VU	+		+		+		Yes	No	No	N/A	N/A
469	*Indostomus crocodilus*	Armoured Stickleback			VU					+		Yes	Yes	No	Medium	High
470	*Labeo pierrei*	Pierre’s Labeo			VU	+		+		+	+	Yes	No	No	N/A	N/A
471	*Laubuka caeruleostigmata*	Flying Minnow		EN		+		+		+		Yes	Yes	No	Medium	High
472	*Luciocyprinus langsoni*	Shuttle-like Carp			VU		+				+	Yes	No	No	N/A	N/A
473	***Luciocyprinus striolatus***	**Monkey-eating Fish**		**EN**			**ex?**	**+**				**Yes**	**Yes**	**No**	**High**	**High**
474	*Mastacembelus oatesii*	Oates’s Spiny Eel		EN					+			Yes	No	No	N/A	N/A
475	*Microrasbora rubescens*	Red Dwarf Rasbora		EN					+			Yes	No	No	N/A	N/A
476	*Mystacoleucus lepturus*	Slender-tailed Mystacoleucus			VU		+	+		+		Yes	Yes	No	Medium	Medium
477	*Mystus bocourti*	King Bagrid			VU	+		+		+	+	Yes	No	No	N/A	N/A
478	*Nemacheilus banar*	Ba Na Loach			VU			?			+	Yes	No	No	N/A	N/A

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479	***Nemacheilus troglocataractus***	**Blind Cave Loach**	**CR**							**+**		**Yes**	**Yes**	**No**	**High**	**high**
480	*Neolissochilus hendersoni*	Henderson's Brook Carp			VU					+		Yes	No	No	N/A	N/A
481	*Neolissochilus subterraneus*	Cave Brook Carp			VU					+		Yes	No	No	N/A	N/A
482	*Ompok fumidus*	Smoky Butter Catfish			VU					+		No	N/A	N/A	N/A	N/A
483	*Oreoglanis heteropogon*	Pointy-bearded Bat Catfish		EN						+		Yes	No	No	N/A	N/A
484	***Oreoglanis lepturus***	**Slender-tailed Bat Catfish**	**CR**					**+**				**Yes**	**Yes**	**No**	**High**	**High**
485	*Oreoglanis siamensis*	Siamese Bat Catfish		EN						+		Yes	No	No	N/A	N/A
486	*Oreonectes anophthalmus*	Guangxi Blind Cave Fish			VU		+					Yes	Yes	No	Medium	High
487	*Osphronemus exodon*	Elephant Ear Gourami			VU	+		+		+		Yes	No	No	N/A	N/A
488	*Oxygaster pointoni*	Trey Slak Russey			VU	+		+		+		Yes	No	No	N/A	N/A
489	***Pangasianodon gigas***	**Mekong Giant Catfish**	**CR**			**+**		**+**		**+**	**+**	**Yes**	**Yes**	**No**	**High**	**High**
490	***Pangasianodon hypophthalmus***	**Striped Catfish**		**EN**		**+**		**+**		**+**	**+**	**Yes**	**Yes**	**No**	**High**	**High**
491	*Pangasius krempfi*	Krempf's Catfish			VU	+	+	+		+	+	Yes	Yes	No	Medium	High
492	***Pangasius sanitwongsei***	**Giant Dog-eating Catfish**	**CR**			**+**	**+**	**+**		**+**	**+**	**Yes**	**Yes**	**No**	**High**	**High**
493	*Parosphromenus paludicola*	Marsh Licorice Gourami		EN						+		Yes	Yes	No	High	Medium
494	*Pethia ornata*	Ornate Barb			VU				+			Yes	N/A	N/A	N/A	N/A
495	*Poropuntius bolovenensis*	Bolovens Barb		EN				+				Yes	No	No	N/A	N/A
496	*Poropuntius consternans*	Alarming Barb		EN				+				Yes	No	No	N/A	N/A
497	***Poropuntius deauratus***	**Yellow Tail Brook Barb**		**EN**							**+**	**Yes**	**Yes**	**No**	**High**	**High**
498	*Poropuntius lobocheiloides*	Mujuk Barb		EN				+				Yes	No	No	N/A	N/A
499	*Poropuntius solitus*	Solitus Barb		EN				+				Yes	No	No	N/A	N/A
500	*Poropuntius speleops*	Cave Barb			VU					+		Yes	No	No	N/A	N/A

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501	*Pristis pristis*	Largetooth Sawfish	CR			ex?	?	ex?	?	ex?	?	No	N/A	N/A	N/A	N/A
502	***Probarbus jullieni***	**Jullien's Golden Carp**	**CR**			**+**		**+**		**+**	**+**	**Yes**	**Yes**	**No**	**High**	**High**
503	***Probarbus labeamajor***	**Thick-lipped Barb**		**EN**		**+**		**+**		**+**		**Yes**	**Yes**	**No**	**High**	**High**
504	*Pseudohemiculter dispar*	South Sharpbelly			VU		+	+			+	Yes	No	No	N/A	N/A
505	*Pseudolaubuca hotaya*	Ca Muong			VU						+	Yes	No	No	N/A	N/A
506	*Pterocryptis inusitata*	Insuitata Sheatfish		EN				+				Yes	No	No	N/A	N/A
507	*Ptychidio jordani*	Ratmouth Barbel	CR				+					Yes	No	No	N/A	N/A
508	*Rhinogobius albimaculatus*	Spot-cheeked Goby			VU			+				Yes	No	No	N/A	N/A
509	*Rhinogobius chiengmaiensis*	Chiang Mai Stream Goby			VU					+		Yes	No	No	N/A	N/A
510	*Rhinogobius lineatus*	Brown-lined Goby		EN				+				Yes	No	No	N/A	N/A
511	*Rhodeus laoensis*	Laotian Bitterling			VU			+				Yes	No	No	N/A	N/A
512	*Sawbwa resplendens*	Burmese Rammy Nose		EN					+			Yes	No	No	N/A	N/A
513	*Scaphognathops bandanensis*	Bandan Sharp-mouth Barb			VU	+		+		+	+	Yes	No	No	N/A	N/A
514	***Scaphognathops theunensis***	**Nam Theun Barb**	**CR**					**+**				**Yes**	**N/A**	**Yes**	**High**	**High**
515	*Schistura atra*	Black Loach			VU			+				Yes	No	No	N/A	N/A
516	*Schistura bairdi*	Baird's Loach		EN		+		+				Yes	No	No	N/A	N/A
517	*Schistura bolavenensis*	Bolaven's Loach		EN				+				Yes	No	No	N/A	N/A
518	*Schistura deansmarti*	Dean Smart's Cave Loach			VU					+		Yes	No	No	N/A	N/A
519	*Schistura jarutanini*	Srisawat Blind Cave Loach			VU					+		Yes	No	No	N/A	N/A
520	*Schistura kaysonei*	Laotian Cave Loach			VU			+				Yes	No	No	N/A	N/A
521	*Schistura kontumensis*	Kon Tum Loach			VU						+	Yes	No	No	N/A	N/A
522	***Schistura leukensis***	**Nam Leuk Loach**	**CR**					**+**				**Yes**	**N/A**	**Yes**	**High**	**High**
523	***Schistura nasifilis***	**Vietnamese Loach**	**CR**								**ex?**	**Yes?**	**N/A**	**Yes**	**High**	**High**

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524	*Schistura nudidorsum*	Bare-backed Loach		EN				+				Yes	No	No	N/A	N/A
525	*Schistura oedipus*	Mae Hong Son Blind Cave Loach			VU					+		Yes	No	No	N/A	N/A
526	*Schistura pridii*	Mini Dragon Loach		EN						+		Yes	No	No	N/A	N/A
527	*Schistura quasimodo*	Humpback Loach		EN				+				Yes	No	No	N/A	N/A
528	*Schistura spekuli*	Lai Chau Cave Loach			VU						+	Yes	No	Yes	Medium	High
529	*Schistura spiesi*	Spies's Blind Cave Loach			VU					+		Yes	No	No	N/A	N/A
530	***Schistura spiloptera***	**Spot-finned Loach**	**CR**								**+**	**Yes**	**N/A**	**Yes**	**High**	**High**
531	*Schistura susannae*	Susanne's Loach			VU						+	Yes	No	No	N/A	N/A
532	***Schistura tenura***	**Slender-tailed Loach**	**CR**					**+**				**Yes?**	**N/A**	**Yes**	**High**	**High**
533	*Schistura thanho*	Tha Nho Loach		EN							+	Yes	No	No	N/A	N/A
534	*Schistura tubulinaris*	Tube-nostriled Loach			VU			+				Yes	No	No	N/A	N/A
535	***Scleropages formosus***	**Asian Arowana**		**EN**		**+**				**+**	**+**	**Yes**	**Yes**	**No**	**High**	**High**
536	*Serpenticobitis cingulata*	Banded Serpent Loach			VU			+		+		Yes	No	No	N/A	N/A
537	***Sewellia albisuera***	**Stitched Hillstream Loach**	**CR**								**+**	**Yes**	**Yes**	**No**	**High**	**High**
538	***Sewellia breviventralis***	**Butterfly Loach**	**CR**								**+**	**Yes**	**Yes**	**No**	**High**	**High**
539	*Sewellia lineolata*	Reticulated Hillstream Loach			VU						+	Yes	No	No	N/A	N/A
540	*Sewellia marmorata*	Marbled Hillstream Loach		EN							+	Yes	No	No	N/A	N/A
541	*Sewellia patella*	Limpet Hillsteam Loach		EN							+	Yes	No	No	N/A	N/A
542	*Sewellia pterolineata*	Stripe-finned Hillstream Loach		EN							+	Yes	No	No	N/A	N/A
543	*Sinocyclocheilus anatirostris*	Duck-billed Golden-line Fish			VU		+					Yes	No	No	N/A	N/A
544	*Sinocyclocheilus angularis*	Golden-line Angle Fish			VU		+					Yes	No	No	N/A	N/A
545	*Sinocyclocheilus anophthalmus*	Eyeless Golden-line Fish			VU		+					Yes	No	No	N/A	N/A

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546	*Sinocyclocheilus cyphotergous*	Humpback Golden-line Barbel			VU		+					Yes	Yes	No	Medium	Medium
547	*Sinocyclocheilus hyalinus*	Hyaline Fish			VU		+					Yes	No	No	N/A	N/A
548	*Sinocyclocheilus microphthalmus*	Small-eyed Golden-line Fish			VU		+					Yes	No	No	N/A	N/A
549	***Systomus compressiformis***	**Compressed Barb**	**CR**						**ex?**			**Yes**	**Yes**	**No**	**High**	**High**
550	*Tenualosa thibaudeaui*	Mekong Herring			VU	+	?	+	?	+	+	Yes	No	No	N/A	N/A
551	*Terateleotris aspro*	Apron Freshwater Sleeper		EN				+				Yes	No	No	N/A	N/A
552	*Tor sinensis*	Red Mahseer			VU		+	+		+	+	Yes	No	No	N/A	N/A
553	***Trigonostigma somphongsi***	**Somphongs's Rasbora**	**CR**							**+**		**Yes**	**N/A**	**Yes**	**High**	**High**
554	*Triplophysa gejiuensis*	Gejiu Blind Loach			VU		+					Yes	No	No	N/A	N/A
555	*Troglocyclocheilus khammouanensis*	Paa Kham Khom			VU			+				Yes	No	No	N/A	N/A
556	***Urogymnus polylepis***	**Giant Freshwater Stingray**		**EN**		**+**		**+**	**?**	**+**	**+**	**Yes**	**Yes**	**No**	**High**	**High**
557	*Wallago attu*	Helicopter Catfish			VU	+		+	+	+	+	Yes	No	No	N/A	N/A
558	*Yasuhikotakia nigrolineata*	Black-lined Loach			VU		+	+		?		Yes	No	No	N/A	N/A
559	*Yasuhikotakia sidthimunki*	Dwarf Clown Loach		EN				?		+		Yes	Yes	No	Medium	High
560	*Yasuhikotakia splendida*	Jaguar Loach			VU			+		+		Yes	No	No	N/A	N/A
561	*Yunnanilus brevis*	Inle Loach			VU				+			Yes	N/A	N/A	N/A	N/A
	INVERTEBRATES (not yet any comprehensive Red List assessment)		**19**	**41**	**88**	**6**	**26**	**25**	**9**	**44**	**60**					
562	*Acinolaemus carcharodon*	Order: Stylommatophora			VU						+					
563	*Acmella* sp. nov.	Order: Littorinimorpha			VU						+					
564	*Acrocyrtus* sp. nov.	Order: Collembola			VU						+					
565	*Anauchen informis*	Order: Stylommatophora			VU						+					

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566	*Anonyxmolytes lilliput*	Order: Coleoptera			VU	?					+					
567	*Anulotaia forcarti*	Order: Architaenioglossa		EN						+						
568	*Archineura maxima*	Order: Odonata	CR								+					
569	*Bayadera hyalina*	Order: Odonata			VU					+						
570	*Bertia cambojiensis*	Order: Stylommatophora	CR								+					
571	*Brotia annamita*	Order: Sorbeoconcha			VU			?			+					
572	*Brotia citrina*	Order: Sorbeoconcha			VU			?	?	+						
573	*Brotia hoabinhensis*	Order: Sorbeoconcha			VU						+					
574	*Brotia laodelectata*	Order: Sorbeoconcha			VU			+								
575	*Brotia paludiformis*	Order: Sorbeoconcha			VU					+						
576	*Brotia solemiana*	Order: Sorbeoconcha			VU					+						
577	*Brotia subgloriosa*	Order: Sorbeoconcha			VU					+						
578	*Brotia wykoffi*	Order: Sorbeoconcha			VU					+						
579	*Burmoniscus* sp. nov.	Order: Isopoda		EN							+					
580	*Caliphaea angka*	Order: Odonata		EN						+						
581	*Caridina annandalei*	Order: Decapoda		EN					+							
582	*Caridina apodosis*	Order: Decapoda	CR				+									
583	*Caridina breviata*	Order: Decapoda			VU		+									
584	*Caridina feixiana*	Order: Decapoda			VU		+									
585	*Caridina trifasciata*	Order: Decapoda			VU		+									
586	*Caryanda pieli*	Order: Orthoptera			VU		+									
587	*Caryanda quadrata*	Order: Orthoptera		EN			+									
588	*Ceratophysella* sp. nov.	Order: Collembola	CR								+					
589	*Chlorogomphus gracilis*	Order: Odonata			VU		+									

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590	*Chlorogomphus nakamurai*	Order: Odonata			VU						+					
591	*Criotettix triangularis*	Order: Orthoptera			VU		+									
592	*Cristaria truncata*	Order: Unionoida		EN							+					
593	*Cryptophaea saukra*	Order: Odonata	CR							+						
594	*Cryptopotamon anacoluthon*	Order: Decapoda			VU		+									
595	*Cuneopsis demangei*	Order: Unionoida	CR								ex?					
596	*Cyclophorus* sp. nov. 1	Order: Architaenioglossa		EN							+					
597	*Cyclophorus* sp. nov. 2	Order: Architaenioglossa		EN							+					
598	*Delamarephorura tami*	Order: Collembola	CR								ex?					
599	*Doimon doichiangdao*	Order: Decapoda		EN						+						
600	*Doimon doisutep*	Order: Decapoda		EN						+						
601	*Drepanosticta emtrai*	Order: Odonata		EN							+					
602	*Eostemmiulus caecus*	Order: Stemmiulida	CR								+					
603	*Euphaea pahyapi*	Order: Odonata			VU					+						
604	*Euploea andamanensis*	Order: Lepidoptera			VU				+							
605	*Eustra honchongensis*	Order: Coleoptera		EN							+					
606	*Euthygomphus parvus*	Order: Odonata			VU					?						
607	*Eutrichodesmus griseus*	Order: Polydesmida			VU						+					
608	*Folsomides* sp. nov.	Order: Collembola			VU						+					
609	*Gabbia alticola*	Order: Littorinimorpha	CR						+							
610	*Gnomulus bedoharvengorum*	Order: Opiliones		EN							+					
611	*Gomphidia kelloggi*	Order: Odonata		EN			+									
612	*Gyraulus bakeri*	Order: Hygrophila			VU					+						
613	*Hainanpotamon orientale*	Order: Decapoda		EN			+									

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614	*Harvengia vietnamita*	Order: Coleoptera		EN												
615	*Heterothelphusa fatum*	Order: Decapoda			VU					+						
616	*Hubendickia pellucida*	Order: Littorinimorpha			VU			+								
617	*Hydrorissoia munensis*	Order: Littorinimorpha			VU					+						
618	*Indochinamon bhumibol*	Order: Decapoda		EN						+						
619	*Indochinamon cua*	Order: Decapoda			VU						+					
620	*Indochinamon dangi*	Order: Decapoda			VU						+					
621	*Indochinamon guttum*	Order: Decapoda			VU			+								
622	*Indochinamon mieni*	Order: Decapoda			VU						+					
623	*Indochinamon villosum*	Order: Decapoda		EN				+								
624	*Iomon luangprabangense*	Order: Decapoda			VU			+								
625	*Iomon nan*	Order: Decapoda		EN						+						
626	*Isometrus deharvengi*	Order: Scorpiones		EN							+					
627	*Jullienia albaobscura*	Order: Littorinimorpha			VU			+								
628	*Jullienia costata*	Order: Littorinimorpha			VU			+								
629	*Jullienia flava*	Order: Littorinimorpha			VU	+		+								
630	*Jullienia minima*	Order: Littorinimorpha			VU			+								
631	*Jullienia prasongi*	Order: Littorinimorpha			VU					+						
632	*Kaliella hongkongensis*	Order: Stylommatophora			VU		+									
633	*Lacunopsis deiecta*	Order: Littorinimorpha			VU			+								
634	*Lacunopsis globosa*	Order: Littorinimorpha			VU	?		+		?	?					
635	*Lacunopsis minutarpiettei*	Order: Littorinimorpha			VU			+		+						
636	*Lacunopsis munensis*	Order: Littorinimorpha			VU					+						
637	*Lamelligomphus tutulus*	Order: Odonata			VU		+									
638	*Lamprotula blaisei*	Order: Unionoida			VU						+					

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639	*Lamprotula contritus*	Order: Unionoida		EN							+					
640	*Lamprotula crassa*	Order: Unionoida	CR				+				ex?					
641	*Lamprotula liedtkei*	Order: Unionoida	CR								ex?					
642	*Lamprotula nodulosa*	Order: Unionoida	CR								ex?					
643	*Lamprotula ponderosa*	Order: Unionoida		EN							+					
644	*Lanceolaria bilirata*	Order: Unionoida	CR								+					
645	*Macrobrachium elegantum*	Order: Decapoda			VU		+									
646	*Macrobrachium naso*	Order: Decapoda		EN					+							
647	*Macrochlamys* sp. nov.	Order: Stylommatophora		EN							+					
648	*Macromia katae*	Order: Odonata			VU		+	+								
649	*Margaritifera laosensis*	Order: Unionoida		EN				?			+					
650	*Matticnemis doi*	Order: Odonata	CR								+					
651	*Mekhongthelphusa kengsaphu*	Order: Decapoda			VU					+						
652	*Mekhongthelphusa tetragona*	Order: Decapoda			VU					+						
653	*Microblattellus lecongmani*	Order: Coleoptera			VU	+					+					
654	*Microcystina* sp. nov. 1	Order: Stylommatophora			VU						+					
655	*Microcystina* sp. nov. 2	Order: Stylommatophora		EN							+					
656	*Modellnaia siamensis*	Order: Unionoida	CR							+						
657	*Nemoron nomas*	Order: Decapoda			VU						+					
658	*Notharinia* sp. nov. 1	Order: Architaenioglossa	CR								+					
659	*Notharinia* sp. nov. 2	Order: Architaenioglossa	CR								+					
660	*Orthetrum poecilops*	Order: Odonata			VU		+									
661	*Oxynaia diespiter*	Order: Unionoida		EN							+					

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662	*Oxynaia micheloti*	Order: Unionoida		EN							+					
663	*Pachydrobia bertini*	Order: Littorinimorpha			VU	?		+		?						
664	*Pachydrobia levayi*	Order: Littorinimorpha			VU			+								
665	*Pachydrobia zilchi*	Order: Littorinimorpha		EN						+						
666	*Paludomus messageri*	Order: Sorbeoconcha		EN							+					
667	*Paraprososthenia lynnei*	Order: Littorinimorpha			VU			+								
668	*Petaliaeschna flavipes*	Order: Odonata			VU					+	+					
669	*Philosina alba*	Order: Odonata			VU		+	+								
670	*Phricotelphusa callianira*	Order: Decapoda			VU				+	+						
671	*Phricotelphusa elegans*	Order: Decapoda			VU				+							
672	*Phricotelphusa limula*	Order: Decapoda			VU					+						
673	*Phricotelphusa ranongi*	Order: Decapoda			VU					+						
674	*Physunio ferrugineus*	Order: Unionoida	CR						+							
675	*Planaeschna celia*	Order: Odonata			VU		+									
676	*Platyrhaphe* sp. nov.	Order: Architaenioglossa			VU						+					
677	*Plusioglyphiulus boutini*	Order: Spirostreptida			VU	+										
678	*Podolestes coomansi*	Order: Odonata			VU					+						
679	*Protosticta khaosoidaoensis*	Order: Odonata			VU					+	?					
680	*Protosticta satoi*	Order: Odonata			VU						+					
681	*Protunio messageri*	Order: Unionoida		EN							+					
682	*Pseudodon cumingii*	Order: Unionoida			VU					+						
683	*Pseudodon resupinatus*	Order: Unionoida		EN							+					
684	*Pupamon phrae*	Order: Decapoda			VU					+						
685	*Rhinocypha orea*	Order: Odonata		EN							+					

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686	*Salangathelphusa anophrys*	Order: Decapoda		EN						+						
687	*Sarasaeschna niisatoi*	Order: Odonata			VU		+				+					
688	*Saussurella acuticornis*	Order: Orthoptera			VU		+	+	+							
689	*Sayamia maehongsonensis*	Order: Decapoda			VU					+						
690	*Sayamia melanodactylus*	Order: Decapoda		EN						+						
691	*Sesara* sp. nov.	Order: Stylommatophora	CR								+					
692	*Siamthelphusa holthuisi*	Order: Decapoda		EN						+						
693	*Somanniathelphusa zanklon*	Order: Decapoda		EN			+									
694	*Stelomon erawanense*	Order: Decapoda			VU					+						
695	*Stelomon kanchanaburiense*	Order: Decapoda			VU					+						
696	*Stenothyra decollata*	Order: Littorinimorpha			VU			+								
697	*Stenothyra huaimoi*	Order: Littorinimorpha		EN				+								
698	*Stenothyra laotiensis*	Order: Littorinimorpha			VU			+								
699	*Stoliczia panhai*	Order: Decapoda			VU					+						
700	*Sumatrillo* sp. nov.	Order: Isopoda			VU						+					
701	*Tachypleus tridentatus*	Order: Xiphosura		EN			+				+					
702	*Thaksinthelphusa yongchindaratae*	Order: Decapoda		EN						+						
703	*Tiwaripotamon edostilus*	Order: Decapoda			VU						+					
704	*Tricula conica*	Order: Littorinimorpha			VU			+								
705	*Typhlocaridina lanceifrons*	Order: Decapoda			VU		+									
706	*Urothemis abbotti*	Order: Odonata			VU					+						
707	*Valiatrella multiprotubera*	Order: Orthoptera			VU		+									
708	*Watanabeopetalia uenoi*	Order: Odonata			VU						+					

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709	*Xizicus laminatus*	Order: Orthoptera		EN			+									
	PLANTS (not yet any comprehensive Red List assessment)		**116**	**234**	**239**	**48**	**253**	**69**	**90**	**189**	**269**					
710	*Abies yuanbaoshanensis*		CR				+									
711	*Abies ziyuanensis*			EN			+									
712	*Acanthephippium sinense*			EN			+									
713	*Acer calcaratum*				VU		+	+	+	+	+					
714	*Acer chiangdaoense*			EN						+						
715	*Acer crassum*				VU		+									
716	*Acer fenzelianum*				VU		+				+					
717	*Acer hilaense*		CR				+									
718	*Acer kungshanense*				VU		+									
719	*Acer kwangnanense*			EN			+				+					
720	*Acer oligocarpum*			EN			+									
721	*Acer paihengii*			EN			+				+					
722	*Acer pseudowilsonii*			EN						+						
723	*Acrorumohra hasseltii*			EN			+									
724	*Actinodaphne ellipticibacca*				VU						+					
725	*Actinodaphne mansonii*		CR						+							
726	*Aesculus wangii*				VU		+				+					
727	*Afzelia xylocarpa*			EN		+		+	+	+	+					
728	*Aglaia chittagonga*				VU					+						
729	*Aglaia dasyclada*				VU		+				+					

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730	*Aglaia perviridis*				VU		+			+	+					
731	*Aglaia pleuropteris*		CR			+					+					
732	*Aglaia tenuicaulis*				VU					+						
733	*Alleizettella rubra*				VU						+					
734	*Alphonsea hainanensis*			EN			+									
735	*Alphonsea monogyna*				VU		+									
736	*Alpinia scabra*			EN						+						
737	*Alpina velutina*			EN							+					
738	*Alseodaphne hainanensis*				VU		+				+					
739	*Alseodaphne rugosa*			EN			+									
740	*Alstonia annamensis*			EN							+					
741	*Amentotaxus poilanei*				VU						+					
742	*Amentotaxus yunnanensis*				VU		+	+			+					
743	*Amomum curtisii*			EN						+						
744	*Amomum dolichanthum*				VU		+									
745	*Amomum menglaense*				VU		+									
746	*Amomum odontocarpum*				VU		+	+			+					
747	*Amomum petaloideum*				VU		+	ex	+							
748	*Amorphophallus curvistylis*				VU					+						
749	*Amorphophallus interruptus*		CR								+					
750	*Amorphophallus kienluongensis*				VU						+					
751	*Amorphophallus lanuginosus*		CR								+					
752	*Amorphophallus synandrifer*		CR								+					

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753	*Amorphophallus verticillatus*				VU						+					
754	*Anisoptera costata*			EN		+		+	+	+	+					
755	*Anisoptera curtisii*				VU				+	+						
756	*Anisoptera laevis*				VU					+						
757	*Anisoptera scaphula*			EN				+	+	+						
758	*Apterosperma oblata*		CR				+									
759	*Aquilaria banaensae*				VU						+					
760	*Aquilaria crassna*		CR			+		+		+	+					
761	*Aquilaria hirta*				VU					+						
762	*Aquilaria malaccensis*		CR						+	+						
763	*Aquilaria rugosa*				VU					+	+					
764	*Aquilaria sinensis*				VU		+									
765	*Aquilaria yunnanensis*				VU		+									
766	*Arisaema maxwellii*				VU					+						
767	*Arisaema rostratum*		CR								+					
768	*Aristolochia hainanensis*				VU		+									
769	*Aristolochia thwaitesii*				VU		+									
770	*Aristolochia westlandii*			CR			+									
771	*Artocarpus hypargyreus*				VU		+									
772	*Begonia bataiensis*				VU						+					
773	*Begonia cavaleriei*				VU		+									
774	*Begonia hainanensis*			EN			+									
775	*Begonia peltatifolia*			EN			+									
776	*Beilschmiedia balansae*			EN							+					

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777	*Beilschmiedia clarkei*				VU			+	+	+						
778	*Beilschmiedia elegantissima*			EN					+	+						
779	*Beilschmiedia gallatlyi*		CR						+							
780	*Beilschmiedia macrocarpa*		CR								+					
781	*Beilschmiedia membranacea*			EN						+						
782	*Beilschmiedia penangiana*				VU	+				+	+					
783	*Beilschmiedia vidalii*			EN			+				+					
784	*Beilschmiedia wallichiana*				VU					+						
785	*Bennettiodendron cordatum*				VU						+					
786	*Bhesa sinica*		CR				+									
787	*Boesenbergia siphonantha*				VU					+	+					
788	*Boniodendron minus*				VU						+					
789	*Borassodendron machadonis*				VU					+						
790	*Bretschneidera sinensis*			EN			+				+					
791	*Bulbophyllum atrosanguineum*				VU						+					
792	*Bulbophyllum evrardii*			EN							+					
793	*Burretiodendron esquirolii*				VU		+		+	+						
794	*Burretiodendron hsienmu*				VU		+									
795	*Burretiodendron tonkinense*			EN			+				+					
796	*Bursera tonkinensis*				VU						+					
797	*Calamus egregius*				VU		+									
798	*Calocedrus rupestris*			EN			+	+			+					
799	*Calymmodon cucullatus*			EN			+									

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800	*Camellia amplexifolia*			EN			+									
801	*Camellia aurea*				VU						+					
802	*Camellia azalea*		CR				+									
803	*Camellia bugiamapensis*		CR								+					
804	*Camellia candida*			EN							+					
805	*Camellia capitata*		CR								+					
806	*Camellia cattienensis*				VU						+					
807	*Camellia chrysantha*				VU		+				+					
808	*Camellia chrysanthoides*			EN			+									
809	*Camellia corallina*			EN							+					
810	*Camellia crapnelliana*				VU		+									
811	*Camellia crassiphylla*		CR								+					
812	*Camellia cucphuongensis*		CR								+					
813	*Camellia dalatensis*		CR								+					
814	*Camellia dilinhensis*			EN							+					
815	*Camellia dongnaiensis*		CR								+					
816	*Camellia duyana*		CR								+					
817	*Camellia euphlebia*			EN			+				+					
818	*Camellia fangchengensis*		CR				+									
819	*Camellia fascicularis*		CR				+									
820	*Camellia flava*		CR								+					
821	*Camellia flavida*				VU		+									
822	*Camellia fleuryi*			EN							+					
823	*Camellia gaudichaudii*				VU		+				+					
824	*Camellia gilbertii*				VU						+					

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825	*Camellia gracilipes*				VU		+				+					
826	*Camellia granthamiana*				VU		+									
827	*Camellia hekouensis*		CR				+									
828	*Camellia hongkongensis*			EN			+									
829	*Camellia impressinervis*		CR				+									
830	*Camellia inusitata*		CR								+					
831	*Camellia ligustrina*			EN							+					
832	*Camellia longii*			EN							+					
833	*Camellia longipedicellata*			EN			+									
834	*Camellia longzhouensis*			EN			+									
835	*Camellia luteocerata*				VU						+					
836	*Camellia maiana*		CR								+					
837	*Camellia micrantha*			EN			+									
838	*Camellia nitidissima*			EN			+				+					
839	*Camellia oconoriana*		CR								+					
840	*Camellia parviflora*			EN			+									
841	*Camellia paucipunctata*			EN			+									
842	*Camellia petelotii*			EN							+					
843	*Camellia pingguoensis*			EN			+									
844	*Camellia piquetiana*		CR								+					
845	*Camellia ptilophylla*				VU		+									
846	*Camellia pubicosta*			EN							+					
847	*Camellia pubipetala*			EN			+									
848	*Camellia rosmannii*		CR								+					
849	*Camellia rubriflora*		CR								+					

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850	*Camellia stuartiana*				VU		+									
851	*Camellia szemaoensis*				VU		+									
852	*Camellia thailandica*			EN						+						
853	*Camellia tonkinensis*			EN							+					
854	*Camellia xanthochroma*			EN			+									
855	*Canarium pseudodecumanum*				VU					+						
856	*Carya sinensis*			EN			+				+					
857	*Castanopsis concinna*				VU		+									
858	*Cayratia pedate*				VU				+							
859	*Cephalomappa sinensis*				VU		+				+					
860	*Cephalotaxus hainanensis*			EN			+									
861	*Cephalotaxus lanceolata*			EN			+		+							
862	*Cephalotaxus mannii*				VU		+	+	+	+	+					
863	*Cephalotaxus oliveri*				VU		+									
864	*Chamaecyparis hodginsii*				VU		+	+			+					
865	*Chunia bucklandioides*				VU		+									
866	*Chuniophoenix hainanensis*			EN			+									
867	*Cinnamomum balansae*			EN							+					
868	*Cinnamomum bhamoensis*		CR						+							
869	*Cinnamomum birmanicum*			EN					+							
870	*Cinnamomum cambodianum*		CR			+		+								
871	*Cinnamomum cupulatum*		CR						+							
872	*Cinnamomum ellipticifolium*			EN					+							

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873	*Cinnamomum helferi*			EN					+							
874	*Cinnamomum hkinlumense*		CR						+							
875	*Cinnamomum lucens*			EN					+							
876	*Cinnamomum tavoyanum*			EN					+							
877	*Cleidiocarpon cavaleriei*				VU		+		+		+					
878	*Cleidiocarpon laurinum*			EN					+		+					
879	*Cleistanthus petelotii*				VU						+					
880	*Cosmostigma hainanense*				VU		+									
881	*Cotylelobium lanceolatum*				VU					+						
882	*Craibiodendron scleranthum*				VU						+					
883	*Craigia yunnanensis*			EN			+				+					
884	*Crinum thaianum*			EN						+						
885	*Crotalaria yaihsienensis*			EN			+									
886	*Croton phuquocensis*				VU						+					
887	*Croton touranensis*				VU						+					
888	*Crudia lanceolata*				VU					+						
889	*Cryptocarya biswasii*		CR						+							
890	*Cryptocarya calderi*		CR						+							
891	*Ctenolophon parvifolius*				VU					+						
892	*Cunninghamia konishii*			EN				+			+					
893	*Curcuma candida*				VU	+			+	+						
894	*Curcuma corniculata*			EN				+								
895	*Curcuma leonidii*		CR								+					
896	*Curcuma newmanii*		CR								+					

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			Critically Endangered	Endangered	Vulnerable	Cambodia	China	Lao PDR	Myanmar	Thailand	Vietnam	Indo-Burmese Population is Globally Signif.	Species-focused Action Required	Over-riding Need for Improved Info	Urgency for Conservation Action	Opportunity for Additional Investment
897	*Curcuma prasina*			EN						+						
898	*Curcuma pygmaea*		CR								+					
899	*Curcuma rhabdota*				VU	+		+		+						
900	*Curcuma sahuynhensis*			EN							+					
901	*Curcuma supraneeana*		CR							+						
902	*Curcuma vitellina*			EN							+					
903	*Cycas aculeata*				VU						+					
904	*Cycas bifida*				VU		+				+					
905	*Cycas chamaoensis*		CR							+						
906	*Cycas changjiangensis*			EN			+									
907	*Cycas collina*				VU		+	+	+		+					
908	*Cycas condaoensis*				VU						+					
909	*Cycas debaoensis*		CR				+									
910	*Cycas elephantipes*			EN						+						
911	*Cycas elongata*			EN							+					
912	*Cycas fugax*		CR								ex?					
913	*Cycas hainanensis*			EN			+									
914	*Cycas hoabinhensis*			EN							+					
915	*Cycas inermis*				VU						+					
916	*Cycas lindstromii*			EN							+					
917	*Cycas macrocarpa*				VU					+						
918	*Cycas micholitzii*				VU			+			+					
919	*Cycas multipinnata*			EN			+				+					
920	*Cycas nongnoochiae*				VU					+						
921	*Cycas pachypoda*		CR								+					

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922	*Cycas pectinata*				VU	+	+	+	+	+	+					
923	*Cycas pranburiensis*				VU					+						
924	*Cycas shanyaensis*				VU		+									
925	*Cycas siamensis*				VU	+		+	+	+	+					
926	*Cycas tansachana*		CR							+						
927	*Cymbidium nanulum*			EN			+									
928	*Cynometra inaequifolia*				VU					+						
929	*Cypripedium daweishanense*		CR				+									
930	*Cypripedium forrestii*			EN			+		+							
931	*Cypripedium lentiginosum*			EN			+				+					
932	*Cypripedium lichiangense*			EN			+		+							
933	*Cypripedium malipoense*		CR				+									
934	*Cypripedium subtropicum*			EN			+				+					
935	*Dacrydium pectinatum*			EN			+									
936	*Dalbergia annamensis*			EN							+					
937	*Dalbergia balansae*				VU		+				+					
938	*Dalbergia bariensis*			EN		+		+		+	+					
939	*Dalbergia cambodiana*			EN		+					+					
940	*Dalbergia cochinchinensis*				VU	+		+		+	+					
941	*Dalbergia mammosa*			EN							+					
942	*Dalbergia odorifera*				VU		+									
943	*Dalbergia oliveri*			EN					+	+	+					
944	*Dalbergia peishaensis*			EN			+									
945	*Dalbergia tonkinensis*				VU		+				+					

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946	*Dalzellia ranongensis*				VU					+						
947	*Damrongia cyanantha*				VU					+						
948	*Damrongia fulva*			EN						+						
949	*Dendrobium changjiangense*			EN			+									
950	*Dendrobium officinale*		CR				+									
951	*Dendrobium sinense*			EN			+									
952	*Dendropanax oligodontus*		CR				+									
953	*Desmodium harmsii*			EN							+					
954	*Dioscorea brevipetiolata*				VU	+				+	+					
955	*Diospyros mun*		CR					+			+					
956	*Diospyros vaccinioides*		CR				+									
957	*Diplopanax stachyanthus*				VU		+				+					
958	*Dipterocarpus acutangulus*			EN						+						
959	*Dipterocarpus alatus*				VU	+		+	+	+	+					
960	*Dipterocarpus baudii*				VU	+			+	+	+					
961	*Dipterocarpus chartaceus*			EN						+						
962	*Dipterocarpus costatus*				VU	+		+	+	+	+					
963	*Dipterocarpus crinitus*			EN						+						
964	*Dipterocarpus dyeri*			EN		+			+	+	+					
965	*Dipterocarpus gracilis*				VU	+			+	+						
966	*Dipterocarpus grandiflorus*			EN					+	+	+					
967	*Dipterocarpus hasseltii*			EN				+	+	+	+					
968	*Dipterocarpus intricatus*			EN		+		+		+	+					
969	*Dipterocarpus kerrii*			EN				+	+	+	+					

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970	*Dipterocarpus retusus*			EN		+	+	+	+	+	+					
971	*Dipterocarpus turbinatus*				VU	+		+	+	+	+					
972	*Dipteronia dyeriana*			EN			+									
973	*Dysosma versipellis*				VU		+									
974	*Elaeocarpus apiculatus*				VU						+					
975	*Eleiotis rottleri*				VU				+							
976	*Endiandra hainanensis*			EN			+				+					
977	*Endocomia canarioides*				VU					+	+					
978	*Eria bidupensis*			EN							+					
979	*Erythrophleum fordii*			EN			+				+					
980	*Etlingera corneri*				VU					+						
981	*Euonymus lanceifolia*				VU		+									
982	*Euryodendron excelsum*		CR				+									
983	*Fagus longipetiolata*				VU		+				+					
984	*Firmiana hainanensis*				VU		+									
985	*Fissistigma tungfangense*		CR				+									
986	*Fordia pauciflora*				VU					+						
987	*Garcinia paucinervis*			EN			+				+					
988	*Geostachys chayanii*			EN						+						
989	*Geostachys smitinandii*				VU					+						
990	*Globba bracteolata*			EN					+	+						
991	*Globba colpicola*			EN						+						
992	*Globba flagellaris*				VU				+	+						
993	*Globba laeta*			EN					+	+						
994	*Globba praecox*				VU					+						

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995	*Globba radicalis*			EN					+							
996	*Globba ranongensis*			EN						+						
997	*Globba spathulata*				VU				+							
998	*Glyptostrobus pensilis*		CR				+	+			+					
999	*Gmelina hainanensis*				VU		+				+					
1000	*Goniothalamus macrocalyx*				VU						+					
1001	*Habenaria holotricha*			EN				+		+						
1002	*Habenaria leptoloba*			EN			+									
1003	*Habenaria siamensis*				VU					+						
1004	*Halesia macgregorii*				VU		+									
1005	*Halophila beccarii*				VU		+		+	+	+					
1006	*Haniffia albiflora*				VU					+						
1007	*Hanseniella heterophylla*				VU					+						
1008	*Hapaline locii*		CR								+					
1009	*Helicia clivicola*			EN			+									
1010	*Helicia grandifolia*				VU						+					
1011	*Helicia shweliensis*			EN			+									
1012	*Henckelia smitinandii*			EN						+						
1013	*Heritiera fomes*			EN					+	+						
1014	*Heritiera parvifolia*				VU		+									
1015	*Hopea beccariana*				VU					+						
1016	*Hopea chinensis*		CR				+				+					
1017	*Hopea cordata*		CR								+					
1018	*Hopea exalata*				VU		+									

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1019	*Hopea ferrea*			EN		+		+		+	+					
1020	*Hopea griffithii*			EN					+	+						
1021	*Hopea hainanensis*			EN			+				+					
1022	*Hopea helferi*			EN		+			+	+						
1023	*Hopea hongayanensis*		CR								+					
1024	*Hopea mollissima*			EN			+				+					
1025	*Hopea odorata*				VU	+		+	+	+	+					
1026	*Hopea pedicellata*			EN						+						
1027	*Hopea pierrei*				VU	+		+		+	+					
1028	*Hopea recopei*			EN		+		+		+	+					
1029	*Hopea reticulata*		CR							+	+					
1030	*Hopea sangal*				VU					+						
1031	*Hopea sublanceolata*				VU					+						
1032	*Hopea thorelii*			EN		+		+		+						
1033	*Horsfieldia longiflora*				VU						+					
1034	*Horsfieldia pandurifolia*			EN			+									
1035	*Huodendron parviflorum*				VU						+					
1036	*Hydnocarpus annamensis*				VU		+	+			+					
1037	*Hydnocarpus hainanensis*				VU		+				+					
1038	*Ilex embelioides*				VU				+	+						
1039	*Ilex graciliflora*			EN			+									
1040	*Ilex shimeica*			EN			+									
1041	*Illicium griffithii*			EN					+							
1042	*Illicium ternstroemioides*				VU		+				+					
1043	*Impatiens adenioides*		CR							+						

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1044	*Impatiens angustisepala*		CR					+								
1045	*Indigofera litoralis*			EN			+									
1046	*Intsia bijuga*				VU	+			+	+	+					
1047	*Ixonanthes chinensis*				VU		+				+					
1048	*Keteleeria evelyniana*				VU		+	+			+					
1049	*Knema austrosiamensis*				VU					+						
1050	*Knema conica*				VU					+						
1051	*Knema hookerana*				VU					+						
1052	*Knema mixta*				VU						+					
1053	*Knema pachycarpa*				VU						+					
1054	*Knema pierrei*				VU						+					
1055	*Knema poilanei*				VU						+					
1056	*Knema saxatilis*				VU						+					
1057	*Knema sessiflora*				VU						+					
1058	*Knema squamulosa*				VU						+					
1059	*Knema tonkinensis*				VU			+			+					
1060	*Lagerstroemia intermedia*				VU		+			+						
1061	*Lanxangia capsiciformis*		CR				+		+							
1062	*Laportea urentissima*			EN			+				+					
1063	*Larix mastersiana*			EN			+									
1064	*Lastreopsis subrecedens*		CR				+									
1065	*Leptochilus cantoniensis*				VU		+									
1066	*Liparis bautingensis*			EN			+									
1067	*Liquidambar obovate*				VU		+									
1068	*Litsea dilleniifolia*			EN			+									

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1069	*Loropetalum subcordatum*				VU		+									
1070	*Madhuca hainanensis*				VU		+									
1071	*Madhuca pasquieri*				VU		+				+					
1072	*Magnolia albosericea*				VU		+				+					
1073	*Magnolia annamensis*				VU						+					
1074	*Magnolia aromatica*			EN			+				+					
1075	*Magnolia bidoupensis*			EN							+					
1076	*Magnolia blaoensis*				VU						+					
1077	*Magnolia cattienensis*			EN							+					
1078	*Magnolia coriacea*			EN			+				+					
1079	*Magnolia crassipes*			EN			+									
1080	*Magnolia fansipanensis*		CR								+					
1081	*Magnolia grandis*		CR				+									
1082	*Magnolia gustavii*		CR						+	+						
1083	*Magnolia hongheensis*				VU		+									
1084	*Magnolia kwangsiensis*				VU		+									
1085	*Magnolia lacei*			EN			+				+					
1086	*Magnolia lotungensis*			EN			+									
1087	*Magnolia lucida*			EN			+									
1088	*Magnolia nana*			EN							+					
1089	*Magnolia nitida*				VU		+		+							
1090	*Magnolia odora*				VU		+	+			+					
1091	*Magnolia odoratissima*			EN			+									
1092	*Magnolia ovoidea*		CR				+									
1093	*Magnolia rajaniana*				VU					+						

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1094	*Magnolia rostrata*			EN			+		+							
1095	*Magnolia rufibarbata*			EN			+				+					
1096	*Magnolia sapaensis*				VU						+					
1097	*Magnolia sargentiana*				VU		+									
1098	*Magnolia shiluensis*			EN			+									
1099	*Magnolia sinica*		CR				+									
1100	*Magnolia sirindhorniae*			EN						+						
1101	*Magnolia thailandica*				VU					+						
1102	*Magnolia tiepii*		CR								+					
1103	*Magnolia ventii*			EN			+									
1104	*Magnolia xanthantha*			EN			+									
1105	*Malania oleifera*				VU		+									
1106	*Mangifera collina*			EN						+						
1107	*Mangifera dongnaiensis*			EN							+					
1108	*Mangifera flava*				VU	+				+	+					
1109	*Mangifera minutifolia*			EN							+					
1110	*Mangifera macrocarpa*				VU					+						
1111	*Maytenus curtissii*				VU					+						
1112	*Meistera calcarata*				VU			+								
1113	*Meistera celsa*			EN				+			+					
1114	*Meistera stephanocolea*			EN				+								
1115	*Meistera yunnanensis*			EN			+									
1116	*Merrillia caloxylon*				VU					+						
1117	*Mezoneuron nhatrangense*				VU						+					

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1118	*Mouretia tonkinensis*				VU						+					
1119	*Musa coccinea*			EN			ex?				+					
1120	*Musa chunii*			EN			+		+							
1121	*Musa zaifui*		CR				+									
1122	*Myristica yunnanensis*		CR				+									
1123	*Nageia motleyi*				VU					+						
1124	*Nardostachys jatamansi*		CR						+							
1125	*Neobalanocarpus heimii*			EN						+						
1126	*Nepenthes suratensis*		CR							+						
1127	*Newmania gracilis*			EN							+					
1128	*Newmania orthostachys*			EN							+					
1129	*Newmania serpens*		CR								+					
1130	*Newmania sessilanthera*			EN							+					
1131	*Newmania sontraensis*			EN							+					
1132	*Nyssa yunnanensis*		CR				+									
1133	*Oleandra hainanensis*			EN			+									
1134	*Oncodostigma hainanense*				VU		+									
1135	*Oreocharis hirsuta*			EN						+						
1136	*Ornithoboea emarginata*		CR								+					
1137	*Palaquium impressinervium*				VU					+						
1138	*Palaquium maingayi*				VU					+						
1139	*Panisea yunnanensis*			EN			+				+					
1140	*Paphiopedilum appletonianum*			EN		+	+	+		+	+					
1141	*Paphiopedilum areeanum*			EN			+		+							

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1142	*Paphiopedilum armeniacum*			EN			+									
1143	*Paphiopedilum barbigerum*			EN			+			+	+					
1144	*Paphiopedilum bellatulum*			EN			+		+	+						
1145	*Paphiopedilum callosum*			EN		+		+		+	+					
1146	*Paphiopedilum canhii*		CR								+					
1147	*Paphiopedilum charlesworthii*			EN			+		+	+						
1148	*Paphiopedilum concolor*			EN		+	+	+	+	+	+					
1149	*Paphiopedilum delenatii*		CR				+				+					
1150	*Paphiopedilum dianthum*			EN			+	+								
1151	*Paphiopedilum emersonii*		CR				+				+					
1152	*Paphiopedilum exul*		CR							+						
1153	*Paphiopedilum godefroyae*			EN						+						
1154	*Paphiopedilum gratrixianum*		CR				+	+		+	+					
1155	*Paphiopedilum hangianum*		CR				+				+					
1156	*Paphiopedilum helenae*		CR				+				+					
1157	*Paphiopedilum henryanum*		CR				+				+					
1158	*Paphiopedilum hirsutissimum*				VU				+	+	+					
1159	*Paphiopedilum insigne*			EN			+		ex?	ex?						
1160	*Paphiopedilum malipoensis*			EN			+	ex?			+					
1161	*Paphiopedilum micranthum*		CR				+				+					
1162	*Paphiopedilum niveum*			EN						+						
1163	*Paphiopedilum parishii*			EN			+	+	+	+						

No.	Scientific Name	Common Name	Global Threat Status: Critically Endangered	Endangered	Vulnerable	Distribution by Country: Cambodia	China	Lao PDR	Myanmar	Thailand	Vietnam	Selection Criteria for Priority Species: Indo-Burmese Population is Globally Signif.	Species-focused Action Required	Over-riding Need for Improved Info	Urgency for Conservation Action	Opportunity for Additional Investment
1164	*Paphiopedilum purpuratum*		CR				+				+					
1165	*Paphiopedilum spicerianum*			EN			+		ex?							
1166	*Paphiopedilum sukhakulii*		CR							+						
1167	*Paphiopedilum thaianum*		CR							+						
1168	*Paphiopedilum tigrinum*			EN			+		+	+						
1169	*Paphiopedilum tranlienianum*		CR				+				+					
1170	*Paphiopedilum vietnamense*		CR								ex?					
1171	*Paphiopedilum villosum*				VU	+	+	+	+	+	+					
1172	*Paphiopedilum wardii*			EN			+		+							
1173	*Paraboea acaulis*				VU					+						
1174	*Paraboea albida*		CR							+						
1175	*Paraboea amplifolia*			EN						+						
1176	*Paraboea argentea*			EN						+						
1177	*Paraboea chiangdaoensis*			EN						+						
1178	*Paraboea glabra*			EN						+						
1179	*Paraboea glabrescens*			EN						+						
1180	*Paraboea glandulifera*				VU					+						
1181	*Paraboea longipetiolata*			EN						+						
1182	*Paraboea patens*			EN						+						
1183	*Paraboea rabilii*			EN						+						
1184	*Paraboea tarutaoensis*		CR							+						
1185	*Paraboea uniflora*		CR							+						
1186	*Paraboea vulpina*				VU					+						

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1187	*Paranephelium hainanensis*			EN			+									
1188	*Parashorea chinensis*			EN			+	+			+					
1189	*Parashorea stellata*				VU	+		+	+	+	+					
1190	*Pellacalyx yunnanensis*			EN			+									
1191	*Pentastelma auritum*		CR				+									
1192	*Petrocosmea bicolor*				VU					+						
1193	*Petrocosmea pubescens*				VU					+						
1194	*Phalaenopsis hainanensis*		CR				+									
1195	*Phoebe nanmu*			EN			+									
1196	*Phoebe poilanei*				VU						+					
1197	*Pholidocarpus macrocarpus*				VU					+						
1198	*Photinia lasiogyna*				VU		+									
1199	*Picea brachytyla*				VU		+		+							
1200	*Picea farreri*				VU		+		+							
1201	*Pinus cernua*		CR								+					
1202	*Pinus krempfii*				VU						+					
1203	*Pinus squamata*		CR				+									
1204	*Pinus wangii*			EN			+				+					
1205	*Pistacia cucphuongensis*				VU						+					
1206	*Platanus kerrii*				VU			+			+					
1207	*Podocarpus polystachyus*				VU					+						
1208	*Polyspora gioii*		CR								+					
1209	*Polyspora huongiana*				VU						+					
1210	*Potameia lotungensis*				VU		+				+					

No.	Scientific Name	Common Name	Global Threat Status			Distribution by Country						Selection Criteria for Priority Species				
			Critically Endangered	Endangered	Vulnerable	Cambodia	China	Lao PDR	Myanmar	Thailand	Vietnam	Indo-Burmese Population is Globally Signif.	Species-focused Action Required	Over-riding Need for Improved Info	Urgency for Conservation Action	Opportunity for Additional Investment
1211	*Premna szemaoensis*				VU		+									
1212	*Primulina modesta*		CR								+					
1213	*Pseudotaxus chienii*				VU		+									
1214	*Pterocarpus indicus*			EN		+	+	+	+	+	ex?					
1215	*Pterocarpus macrocarpus*			EN		+		+	+	+	+					
1216	*Pterocarya macroptera*				VU		+									
1217	*Pterocarya tonkinensis*				VU		+	+			+					
1218	*Pterospermum kingtungense*		CR				+									
1219	*Pterospermum menglunense*		CR				+									
1220	*Pterospermum yunnanense*		CR				+									
1221	*Pterostyrax psilophyllus*				VU		+									
1222	*Pyrenaria menglaensis*		CR				+									
1223	*Pyrenaria oblongicarpa*				VU		+									
1224	*Quercus austrocochinchinensis*				VU		+	+		+	+					
1225	*Reevesia rotundifolia*		CR				+									
1226	*Rhoiptelea chiliantha*				VU		+				+					
1227	*Richella hainanensis*				VU		+									
1228	*Saccopetalum prolificum*				VU		+									
1229	*Scaphophyllum speciosum*				VU		+									
1230	*Schefflera chapana*				VU		+				+					
1231	*Schefflera kontumensis*			EN							+					
1232	*Schefflera palmiformis*			EN							+					
1233	*Shistochila macrodonta*			EN			+									

No.	Scientific Name	Common Name	Global Threat Status			Distribution by Country						Selection Criteria for Priority Species				
			Critically Endangered	Endangered	Vulnerable	Cambodia	China	Lao PDR	Myanmar	Thailand	Vietnam	Indo-Burmese Population is Globally Signif.	Species-focused Action Required	Over-riding Need for Improved Info	Urgency for Conservation Action	Opportunity for Additional Investment
1234	*Shorea bracteolata*			EN						+						
1235	*Shorea faguetiana*			EN						+						
1236	*Shorea falcata*		CR								+					
1237	*Shorea farinosa*			EN		+			+	+						
1238	*Shorea foxworthyi*				VU					+						
1239	*Shorea glauca*			EN						+						
1240	*Shorea gratissima*			EN					+	+						
1241	*Shorea guiso*				VU	+		+		+	+					
1242	*Shorea hemsleyana*				VU					+						
1243	*Shorea henryana*			EN		+		+	+	+	+					
1244	*Shorea hypochra*			EN		+		+		+	+					
1245	*Shorea laevis*				VU				+	+						
1246	*Shorea leprosula*			EN						+						
1247	*Shorea roxburghii*				VU	+		+	+	+	+					
1248	*Shorea singkawang*				VU					+						
1249	*Shorea sumatrana*			EN						ex?						
1250	*Shorea thorelii*				VU	+		+	+	+	+					
1251	*Siamanthus siliquosus*				VU					+						
1252	*Siliquamomum alcicorne*			EN							+					
1253	*Siliquamomum oreodoxa*			EN							+					
1254	*Siliquamomum phamhoangii*			EN							+					
1255	*Siliquamomum tonkinense*				VU		+				+					
1256	*Sonneratia griffithii*		CR						+	+						
1257	*Sonneratia hainanensis*		CR				+									

No.	Scientific Name	Common Name	Global Threat Status			Distribution by Country						Selection Criteria for Priority Species				
			Critically Endangered	Endangered	Vulnerable	Cambodia	China	Lao PDR	Myanmar	Thailand	Vietnam	Indo-Burmese Population is Globally Signif.	Species-focused Action Required	Over-riding Need for Improved Info	Urgency for Conservation Action	Opportunity for Additional Investment
1258	*Stenochlaena hainanensis*			EN			+									
1259	*Styrax litseoides*				VU						+					
1260	*Taiwania cryptomerioides*				VU		+		+		+					
1261	*Tapiscia sinensis*				VU		+									
1262	*Taxus chinensis*			EN			+				+					
1263	*Taxus wallichiana*			EN			+	+	+	+	+					
1264	*Terniopsis chanthaburiensis*			EN						+						
1265	*Terniopsis ubonensis*		CR							+						
1266	*Tetraphyllum roseum*			EN						+						
1267	*Trigonobalanus doichangensis*			EN						+						
1268	*Trigonostemon fragilis*				VU						+					
1269	*Typhonium circinnatum*			EN		+					+					
1270	*Typhonium lineare*		CR								+					
1271	*Typhonium penicillatum*		CR								+					
1272	*Vatica diospyroides*			EN						+						
1273	*Vatica guangxiensis*			EN			+				+					
1274	*Vatica lanceaefolia*		CR						+							
1275	*Vatica mangachapoi*				VU		+									
1276	*Vatica pauciflora*				VU					+	+					
1277	*Vatica philastraena*			EN		+		+		+	+					
1278	*Vatica stapfiana*				VU					+						
1279	*Vatica subglabra*			EN							+					
1280	*Vatica xishuangbannaensis*		CR				ex?									
1281	*Vitex ajugaeflora*				VU						+					

No.	Scientific Name	Common Name	Global Threat Status			Distribution by Country						Selection Criteria for Priority Species				
			Critically Endangered	Endangered	Vulnerable	Cambodia	China	Lao PDR	Myanmar	Thailand	Vietnam	Indo-Burmese Population is Globally Signif.	Species-focused Action Required	Over-riding Need for Improved Info	Urgency for Conservation Action	Opportunity for Additional Investment
1282	*Wurfbainia quadratolaminaris*				VU		+									
1283	*Wrightia lanceolata*				VU					+						
1284	*Wrightia lecomtei*				VU	+				+						
1285	*Wrightia viridifolia*				VU					+						
1286	*Xanthocyparis vietnamensis*			EN			+				+					
1287	*Xylopia pierrei*				VU	+					+					
1288	*Zelkova schneideriana*				VU		+									
1289	*Zingiber atroporphyreum*			EN							+					
1290	*Zingiber cardiocheilum*				VU						+					
1291	*Zingiber collinsii*				VU	+					+					
1292	*Zingiber jiewhoei*				VU			+								
1293	*Zingiber lecongkietii*			EN							+					
1294	*Zingiber mellis*			EN							+					
1295	*Zingiber microcheilum*			EN							+					
1296	*Zingiber monophyllum*			EN							+					
1297	*Zingiber niveum*			EN				+								
1298	*Zingiber yersinii*		CR								+					
	Total		**227**	**471**	**600**	**191**	**490**	**282**	**273**	**467**	**611**					

Notes: Bold denotes priority species; † = includes *Chitra vandijki*, which is not recognized as a separate species by IUCN (2020); *C. indica sensu stricto* does not occur in the hotspot; ‡ = includes *Cuora cyclornata,* which is not recognized as a separate species by IUCN (2020); *C. trifasciata sensu stricto* also occurs in the hotspot; + = species extant in the country (or part of the country within the hotspot, in the case of China); ? = species presence uncertain in the country (or part of the country within the hotspot, in the case of China); ex = species extinct in the country (or part of the country within the hotspot, in the case of China); ex? = species possibly extinct in the country (or part of the country within the hotspot, in the case of China); v = species occurring only as a vagrant in the country (or part of the country within the hotspot, in the case of China); * = species believed to be extinct within the hotspot; should a population be found, conservation action would be of immense urgency; ** = species believed to be extinct within the hotspot but to have high potential for reintroduction.

Appendix 2. Key Biodiversity Areas in the Indo-Burma Hotspot

Code	Key Biodiversity Area	Mammals	Birds	Reptiles	Amphibians	Fishes	Inverts	Plants	Protected Area*	Conservation Corridor
KMH	**CAMBODIA**									
1	Ang Tropeang Thmor	+	+	+					PA	Tonle Sap Lake and Inundation Zone
2	Bakan		+							Tonle Sap Lake and Inundation Zone
3	Bassac Marsh		+							North-western Mekong Delta Wetlands
4	Boeung Chhmar/Moat Khla		+	+		+			PA	Tonle Sap Lake and Inundation Zone
5	Boeung Prek Lapouv		+						PA	North-western Mekong Delta Wetlands
6	Central Cambodia Lowlands	+								none
7	Central Cardamoms	+	+	+				+	PA	Cardamom and Elephant Mountains
8	Central Oddar Meanchey	+	+	+						none
9	Chhep	+	+	+				+	PA	Northern Plains Seasonally Inundated Forests
10	Chhnuck Tru		+	+					PA	Tonle Sap Lake and Inundation Zone
11	Dei Roneat		+	+					PA	Tonle Sap Lake and Inundation Zone
12	Kampong Laeng					+				Tonle Sap Lake and Inundation Zone
13	Kampong Trach		+						PA	North-western Mekong Delta Wetlands
14	Kirirom	+	+	+				+	PA	Cardamom and Elephant Mountains
15	Koh Kapik		+						PA	none
16	Koh Tang Archipelago		+							none
17	Lomphat	+	+	+					PA	Eastern Plains Dry Forests
18	Lower Stung Sen		+	+					PA	Tonle Sap Lake and Inundation Zone
19	Mekong River from Kratie to Lao PDR	+	+	+		+		+	PA	Mekong River and Major Tributaries
20	Mondulkiri-Kratie Lowlands	+	+	+					PA	Eastern Plains Dry Forests
21	O Skach	+	+	+						Northern Plains Seasonally Inundated Forests
22	Phnom Aural	+	+					+	PA	Cardamom and Elephant Mountains

Code	Key Biodiversity Area	Mammals	Birds	Reptiles	Amphibians	Fishes	Inverts	Plants	Protected Area*	Conservation Corridor
23	Phnom Bokor	+	+		+			+	PA	Cardamom and Elephant Mountains
24	Phnom Samkos	+	+						PA	Cardamom and Elephant Mountains
25	Preah Net Preah/Kra Lanh/Pourk		+							Tonle Sap Lake and Inundation Zone
26	Prek Chhlong				+					None
27	Prek Toal	+	+			+			PA	Tonle Sap Lake and Inundation Zone
28	Sekong River		+	+		+				Mekong River and Major Tributaries
29	Sesan River		+	+		+				Mekong River and Major Tributaries
30	Snoul/Keo Sema/O Reang	+	+	+					PA	Southern Annamites Western Slopes
31	Southern Cardamoms	+	+	+		+			PA	Cardamom and Elephant Mountains
32	Sre Ambel	+	+	+					PA	none
33	Srepok River		+	+		+			PA	Mekong River and Major Tributaries
34	Stung Kampong Smach		+							none
35	Stung Sen/Santuk/Baray		+							Tonle Sap Lake and Inundation Zone
36	Stung/Chi Kreng/Kampong Svay		+							Tonle Sap Lake and Inundation Zone
37	Stung/Prasat Balang		+	+						none
38	Thala Stueng Treng						+			Mekong River and Major Tributaries
39	Upper Srepok Catchment	+	+	+					PA	Eastern Plains Dry Forests
40	Upper Stung Sen Catchment	+	+	+				+	PA	Northern Plains Seasonally Inundated Forests
41	Veal Srongae		+						PA	Tonle Sap Lake and Inundation Zone
42	Virachey	+	+	+				+	PA	Cambodia-Lao PDR-Vietnam Tri-border Forests
43	Western Siem Pang	+	+	+					PA	Mekong River and Major Tributaries
CHN	**CHINA**									
1	Ailaoshan	+	+						PA	Ailao/Hoang Lien Mountains
2	Babianjiang	+						+		Nam Ha-Xishuangbanna-Phou Dendin
3	Baimaling-Huishan		+						PA	Hainan Mountains

Code	Key Biodiversity Area	Mammals	Birds	Reptiles	Amphibians	Fishes	Inverts	Plants	Protected Area*	Conservation Corridor
4	Baixu-Qinpai		+							Damingshan Range
5	Bajianjing					+				none
6	Bangliang	+							PA	Sino-Vietnamese Limestone
7	Bawangling	+	+	+	+			+	PA	Hainan Mountains
8	Beili Wan Sigeng		+							none
9	Caiyanghe	+	+	+				+	PA	Nam Ha-Xishuangbanna-Phou Dendin
10	Chongzuo	+	+					+	PA	Sino-Vietnamese Limestone
11	Damingshan	+	+			+		+	PA	Damingshan Range
12	Datian	+							PA	Hainan Mountains
13	Daweishan	+						+	PA	Sino-Vietnamese Limestone
14	Dawuling	+			+			+	PA	Yunwushan Range
15	Dehong Zizhizhou		+						PA	Tongbiguan-Gaoligongshan
16	Diaoluoshan	+	+	+	+			+	PA	Hainan Mountains
17	Diding	+							PA	Sino-Vietnamese Limestone
18	Dinghushan			+					PA	None
19	Dongzhaigang		+						PA	Hainan Coastal Zone
20	Ehuangzhang							+	PA	Yunwushan Range
21	Exianling and Changhuajiang		+					+	PA	Hainan Mountains
22	Fangcheng		+						PA	South China Shorebird Flyway
23	Fangcheng Shangyue							+	PA	Shiwandashan Range
24	Fanjia			+				+	PA	Hainan Mountains
25	Fenshuiling	+		+	+			+	PA	Ailao/Hoang Lien Mountains
26	Funing Niaowangshan		+							Sino-Vietnamese Limestone
27	Fuping-Gula-Dingye							+		Sino-Vietnamese Limestone
28	Futian		+						PA	South China Shorebird Flyway
29	Ganshiling		+					+	PA	Hainan Mountains

Code	Key Biodiversity Area	Mammals	Birds	Reptiles	Amphibians	Fishes	Inverts	Plants	Protected Area*	Conservation Corridor
30	Gaoligongshan	+	+						PA	Tongbiguan-Gaoligongshan
31	Gongping Dahu		+						PA	None
32	Guangtouling		+							South China Shorebird Flyway
33	Gudoushan							+	PA	None
34	Gulongshan		+					+	PA	Sino-Vietnamese Limestone
35	Gutian				+				PA	None
36	Heishiding			+					PA	None
37	Heweishan							+		Yunwushan Range
38	Hong Kong Island and Associated Islands			+	+			+	PA	Hong Kong-Shenzhen Mountains
39	Houmiling		+					+	PA	Hainan Mountains
40	Houshui Wan		+							Hainan Coastal Zone
41	Huanglianshan	+	+		+			+	PA	Ailao/Hoang Lien Mountains
42	Inland New Territories		+	+	+			+	PA	Hong Kong-Shenzhen Mountains
43	Jianfengling		+	+	+			+	PA	Hainan Mountains
44	Jianling							+	PA	Hainan Mountains
45	Jiaxi		+	+	+			+	PA	Hainan Mountains
46	Lantau Island and Associated Islands			+	+			+	PA	Hong Kong-Shenzhen Mountains
47	Ledong							+		Hainan Mountains
48	Leizhou Peninsula		+							South China Shorebird Flyway
49	Liji							+	PA	Hainan Mountains
50	Limushan		+		+			+	PA	Hainan Mountains
51	Longhua		+						PA	Sino-Vietnamese Limestone
52	Longhushan		+						PA	Sino-Vietnamese Limestone
53	Longshan section of Nonggang							+	PA	Sino-Vietnamese Limestone
54	Mai Po and Inner Deep Bay		+	+				+	PA	South China Shorebird Flyway

Code	Key Biodiversity Area	Mammals	Birds	Reptiles	Amphibians	Fishes	Inverts	Plants	Protected Area*	Conservation Corridor
55	Malipo	+						+		Sino-Vietnamese Limestone
56	Nangunhe	+	+	+	+			+	PA	Nangunhe-Yongde Daxueshan
57	Nangliujiang Hekou		+						PA	South China Shorebird Flyway
58	Nanmaoling		+	+						Hainan Mountains
59	Nanweiling		+						PA	Hainan Mountains
60	Nonggang	+	+					+	PA	Sino-Vietnamese Limestone
61	Paiyangshan				+					Sino-Vietnamese Limestone
62	Qinglangang		+						PA	Hainan Coastal Zone
63	Qixingkeng							+	PA	Yunwushan Range
64	Sanya							+		Hainan Mountains
65	Sanya Seagrass Beds							+		Hainan Coastal Zone
66	Shangsi-Biannian		+						PA	Sino-Vietnamese Limestone
67	Shangxi				+			+	PA	Hainan Mountains
68	Shankou		+						PA	South China Shorebird Flyway
69	Shenzhen Wutongshan							+	PA	none
70	Shiwandashan	+	+	+				+	PA	Shiwandashan Range
71	Taipa-Coloane		+					+		South China Shorebird Flyway
72	Tongbiguan	+	+					+	PA	Tongbiguan-Gaoligongshan
73	Tongguling				+				PA	Hainan Coastal Zone
74	Tongtieling	+						+	PA	Hainan Mountains
75	Weiyuanjiang		+						PA	none
76	Weizhou Dao		+						PA	none
77	Wuliangshan	+	+						PA	Ailao/Hoang Lien Mountains
78	Wuzhishan	+	+		+			+	PA	Hainan Mountains
79	Xianhu Reservoir		+							Damingshan Range
80	Xidamingshan		+						PA	Sino-Vietnamese Limestone

Code	Key Biodiversity Area	Mammals	Birds	Reptiles	Amphibians	Fishes	Inverts	Plants	Protected Area*	Conservation Corridor
81	Xieyang Dao		+						PA	none
82	Xijin Reservoir		+							none
83	Xishuangbanna	+	+		+			+	PA	Nam Ha-Xishuangbanna-Phou Dendin
84	Yangchun Baiyong			+					PA	Yunwushan Range
85	Yinggehai Salt Pans		+							none
86	Yinggeling		+	+	+			+	PA	Hainan Mountains
87	Yiwa							+		Nam Ha-Xishuangbanna-Phou Dendin
88	Yongde Daxueshan	+	+		+				PA	Nangunhe-Yongde Daxueshan
89	Youluoshan							+		Nam Ha-Xishuangbanna-Phou Dendin
90	Yunlong Tianchi		+						PA	none
LAO	**LAO PDR**									
1	Bolaven Northeast	+							PA	Bolaven Plateau
2	Chonabuly	+							PA	none
3	Dakchung Plateau	+	+	+						none
4	Dong Ampham	+	+					+	PA	Cambodia-Lao PDR-Vietnam Tri-border Forests
5	Dong Hua Sao	+		+					PA	Bolaven Plateau
6	Dong Khanthung	+	+	+				+		Northern Plains Seasonally Inundated Forests
7	Dong Phou Vieng	+		+					PA	none
8	Eastern Bolikhamxay Mountains	+	+						PA	Northern Annamites
9	Hin Namno	+	+	+				+	PA	Central Indochina Limestone
10	Khammouan Limestone	+	+	+		+		+	PA	Central Indochina Limestone
11	Laving-Laveun	+							PA	Quang Binh-Quang Tri-Xe Bangfai Lowlands
12	Lower Nam Ou					+				Mekong River and Major Tributaries
13	Mekong Confluence with Nam Kading					+				Mekong River and Major Tributaries
14	Mekong Confluence with Xe Bangfai					+				Mekong River and Major Tributaries

Code	Key Biodiversity Area	Mammals	Birds	Reptiles	Amphibians	Fishes	Inverts	Plants	Protected Area*	Conservation Corridor
15	Mekong River from Louangphabang to Vientiane		+			+				Mekong River and Major Tributaries
16	Mekong River from Phou Xiang Thong to Siphandon		+			+				Mekong River and Major Tributaries
17	Nakai Plateau	+	+	+				+	PA	Northern Annamites
18	Nakai-Nam Theun	+	+	+				+	PA	Northern Annamites
19	Nam Et	+		+					PA	Nam Et-Phou Louey
20	Nam Ghong	+		+					PA	Cambodia-Lao PDR-Vietnam Tri-border Forests
21	Nam Ha	+							PA	Nam Ha-Xishuangbanna-Phou Dendin
22	Nam Kading	+		+					PA	none
23	Nam Kan	+							PA	Nam Ha-Xishuangbanna-Phou Dendin
24	Nam Ngum Reservoir					+				none
25	Nam Noa						+			none
26	Nam Ou Headwaters					+	+			Nam Ha-Xishuangbanna-Phou Dendin
27	Nam Phoun	+							PA	Doi Phuka-Mae Yom
28	Nam Xam	+	+						PA	none
29	Nong Khe Wetlands			+						Xe Khampho-Xe Pian
30	Pakxan Wetlands		+							none
31	Phou Ahyon	+	+							Central Annamites
32	Phou Dendin	+	+						PA	Nam Ha-Xishuangbanna-Phou Dendin
33	Phou Kathong	+								none
34	Phou Khaokhoay	+	+	+					PA	none
35	Phou Loeuy	+	+						PA	Nam Et-Phou Louey
36	Phou Xang He	+		+				+	PA	none
37	Phou Xiang Thong	+	+	+					PA	none
38	Siphandon	+	+	+		+				Mekong River and Major Tributaries
39	Upper Lao Mekong		+			+				Mekong River and Major Tributaries

Code	Key Biodiversity Area	Mammals	Birds	Reptiles	Amphibians	Fishes	Inverts	Plants	Protected Area*	Conservation Corridor
40	Upper Xe Bangfai	+	+			+			PA	Quang Binh-Quang Tri-Xe Bangfai Lowlands
41	Upper Xe Kaman		+			+			PA	Mekong River and Major Tributaries
42	Xe Bang-Nouan	+		+					PA	none
43	Xe Bangfai Cave System					+				Central Indochina Limestone
44	Xe Champhon			+					PA	Mekong River and Major Tributaries
45	Xe Khampho-Xe Pian		+							Xe Khampho-Xe Pian
46	Xe Pian	+	+	+				+	PA	Xe Khampho-Xe Pian
47	Xe Sap	+	+	+	+				PA	Central Annamites
MMR	**MYANMAR**									
1	Alaungdaw Kathapa	+	+	+					PA	Lower Chindwin Forest
2	Ataran Taung Karst			+						none
3	Ayeyarwady River: Bagan Section		+	+						Ayeyarwady River
4	Ayeyarwady River: Bhamo Section	+	+	+						Ayeyarwady River
5	Ayeyarwady River: Myitkyina to Sinbo Section		+	+						Ayeyarwady River
6	Ayeyarwady River: Shwegu Section	+	+	+						Ayeyarwady River
7	Ayeyarwady River: Sinbyugyun to Minbu Section		+	+						Ayeyarwady River
8	Ayeyarwady River: Singu Section	+	+	+						Ayeyarwady River
9	Babulon Htan	+	+							Ayeyarwady Catchment
10	Bayin Nyi Karst			+			+			none
11	Bumphabum	+	+	+					PA	Ayeyarwady Catchment
12	Bwe Pa		+							Chin Hills Complex
13	Central Bago Yoma	+		+						Bago Yoma Range
14	Central Tanintharyi Coast	+		+				+		Tanintharyi Range
15	Chatthin	+	+	+					PA	Lower Chindwin Forest

Code	Key Biodiversity Area	Mammals	Birds	Reptiles	Amphibians	Fishes	Inverts	Plants	Protected Area*	Conservation Corridor
16	Chaungmagyi Reservoir		+							none
17	Chaungmon-Wachaung		+	+						Tanintharyi Range
18	Dawna Range			+						none
19	Dhammata Karst			+			+			none
20	Fen-shui-ling Valley							+		Ayeyarwady Catchment
21	Gayetgyi Island	+		+				+		none
22	Great Coco Island		+	+						none
23	Gulf of Mottama	+	+							Sittaung River
24	Gyobin		+							Rakhine Yoma Range
25	Himeinkanein Karst						+			none
26	Hkakaborazi	+	+					+	PA	Ayeyarwady Catchment
27	Hlawga Park	+	+						PA	none
28	Hlawga Reservoir	+						+		none
29	Hpa-an			+			+			none
30	Hponkanrazi	+	+	+				+	PA	Ayeyarwady Catchment
31	Hpruso Karst					+				none
32	Htamanthi	+	+	+				+	PA	Chindwin Catchment
33	Htaung Pru	+	+	+						Tanintharyi Range
34	Hukaung Valley	+	+	+				+	PA	Chindwin Catchment
35	Hukaung Valley extension	+	+	+				+	PA	Chindwin Catchment
36	Indawgyi Grassland and Indaw Chaung Wetland		+					+		Ayeyarwady Catchment
37	Indawgyi Wildlife Sanctuary	+	+	+				+	PA	Ayeyarwady Catchment
38	Inle Lake		+	+		+			PA	none
39	Irrawaddy Dolphin	+		+					PA	Ayeyarwady River
40	Kadongalay Island	+		+				+		none
41	Kadonkani		+	+						none

Code	Key Biodiversity Area	Mammals	Birds	Reptiles	Amphibians	Fishes	Inverts	Plants	Protected Area*	Conservation Corridor
42	Kaladan River	+	+	+						Rakhine Yoma Range
43	Kamaing	+	+	+						Ayeyarwady Catchment
44	Karathuri		+	+						Tanintharyi Range
45	Kawthaung District Lowlands		+	+						Tanintharyi Range
46	Kayin Linno Karst	+		+			+			Thanlwin River
47	Kayon Karst			+			+			none
48	Kelatha			+					PA	Western Shan Yoma Range
49	Kennedy Peak		+							Chin Hills Complex
50	Khaing Thaung Island		+	+						none
51	Kyaikhtiyoe			+					PA	Western Shan Yoma Range
52	Kyauk Nagar	+								none
53	Kyauk Pan Taung	+	+	+						Chin Hills Complex
54	Kyaukphyu (Wunbike)			+				+		Rakhine Yoma Range
55	Kyee-ni Inn		+							none
56	Lampi Island	+	+	+				+	PA	Tanintharyi Range
57	Lenya	+	+	+						Tanintharyi Range
58	Loimwe			+					PA	none
59	Lwoilin/Ginga Mountain		+							none
60	Mahamyaing	+	+	+				+		Lower Chindwin Forest
61	Mahanandar Kan		+	+						none
62	Maletto Inn		+							none
63	Mali Hka Area	+	+					+		Ayeyarwady Catchment
64	Man Chaung			+						none
65	Manaung Kyun	+		+						Rakhine Yoma Range
66	Maw She	+		+						none
67	Mawlamyine			+						none

Code	Key Biodiversity Area	Mammals	Birds	Reptiles	Amphibians	Fishes	Inverts	Plants	Protected Area*	Conservation Corridor
68	May Hka Area	+	+	+				+		Ayeyarwady Catchment
69	May Yu	+								Rakhine Yoma Range
70	Mehon (Doke-hta Wady River)		+	+						none
71	Meinmahla Kyun	+	+	+				+	PA	Ayeyarwady River
72	Minzontaung			+					PA	none
73	Momeik-Mabein	+		+						Ayeyarwady Catchment
74	Mone Chaung			+						none
75	Montawa Cave			+			+			none
76	Moscos Kyun	+		+				+	PA	none
77	Moyingyi		+	+					PA	none
78	Myaleik Taung			+						none
79	Myebon	+	+	+						Rakhine Yoma Range
80	Myeik Archipelago	+	+	+						none
81	Myinmoletkhat	+						+		Tanintharyi Range
82	Myitkyina-Nandebad-Talawgyi	+	+	+				+		Ayeyarwady Catchment
83	Myittha Lakes		+							none
84	Nadi Kan		+							none
85	Nam Sam Chaung		+	+						Ayeyarwady Catchment
86	Nam San Valley		+							none
87	Nantha Island		+							Rakhine Yoma Range
88	Nat-yekan	+	+	+						Rakhine Yoma Range
89	Natmataung (Mount Victoria)	+	+	+					PA	Chin Hills Complex
90	Naung Ka Myaing Karst			+			+			none
91	Ngawun (Lenya extension)		+							Tanintharyi Range
92	Ngwe Saung	+		+						none
93	Ngwe Taung		+							Rakhine Yoma Range

Code	Key Biodiversity Area	Mammals	Birds	Reptiles	Amphibians	Fishes	Inverts	Plants	Protected Area*	Conservation Corridor
94	Ninety-six Inns		+							Ayeyarwady Catchment
95	North Zarmayi		+					+		Bago Yoma Range
96	North Zarmayi Elephant Range	+		+						Bago Yoma Range
97	Northern Rakhine Yoma	+		+						Rakhine Yoma Range
98	Nyaung Kan-Minhla Kan		+							none
99	Oyster Island			+						none
100	Pachan		+	+						Tanintharyi Range
101	Padamyar Karst			+						none
102	Panlaung-Pyadalin Cave	+		+			+		PA	Western Shan Yoma Range
103	Parpant Caves			+			+			none
104	Pathein Karst						+			none
105	Pauk Area							+		Lower Chindwin Forest
106	Paunglaung Catchment Area	+		+						Western Shan Yoma Range
107	Payagyi		+							none
108	Peleik Inn		+	+						none
109	Pharbaung Karst						+			none
110	Phokyar Elephant Camp		+	+						Bago Yoma Range
111	Pidaung	+		+				+	PA	Ayeyarwady Catchment
112	Popa	+		+					PA	none
113	Pyaungbya River		+							Rakhine Yoma Range
114	Pyin-ah-lan		+	+						none
115	Pyindaye		+	+				+		none
116	Rakhine Yoma Elephant Range	+	+	+					PA	Rakhine Yoma Range
117	Sabel Karst			+			+			none
118	Saramati Taung	+	+							Chindwin Catchment
119	Sheinmaga Tawyagyi	+		+						Ayeyarwady River

Code	Key Biodiversity Area	Mammals	Birds	Reptiles	Amphibians	Fishes	Inverts	Plants	Protected Area*	Conservation Corridor
120	Shinmataung	+	+							none
121	Shwe U Daung	+		+					PA	Ayeyarwady Catchment
122	Shwesettaw	+	+	+				+	PA	Lower Chindwin Forest
123	Tanai River		+	+						Chindwin Catchment
124	Tanintharyi National Park			+						Tanintharyi Range
125	Tanintharyi Nature Reserve	+		+				+	PA	Tanintharyi Range
126	Tar Tar Karst			+						Western Shan Yoma Range
127	Taung Kan at Sedawgyi		+							none
128	Taunggyi			+					PA	none
129	Taungtaman Inn		+							none
130	Thamihla Kyun			+					PA	none
131	Thaungdut			+						Lower Chindwin Forest
132	U-do		+							none
133	Upper Chindwin River: Kaunghein to Padumone Section	+	+	+						Chindwin River
134	Upper Mogaung Chaung Basin		+	+				+		Ayeyarwady Catchment
135	Uyu River		+	+						Chindwin Catchment
136	Waiponla Karst						+			none
137	Weibyan Karst			+						Thanlwin River
138	Yathae Pyan Karst			+			+			none
139	Yelegale		+							none
140	Yemyet Inn		+	+						none
141	Ywangan Karst			+			+			none
142	Zeihmu Range		+							Chin Hills Complex
THA	**THAILAND**									
1	Ao Bandon		+							none

Code	Key Biodiversity Area	Mammals	Birds	Reptiles	Amphibians	Fishes	Inverts	Plants	Protected Area*	Conservation Corridor
2	Ao Pattani		+							none
3	Ao Phang-nga	+						+	PA	Mu Ko Similan-Phi Phi-Andaman
4	Ban Khlong Marakor Tai		+							none
5	Bang Lang	+	+	+				+	PA	Hala-Bala
6	Bu Do-Sungai Padi		+					+	PA	Hala-Bala
7	Bung Boraphet	+	+						PA	none
8	Bung Khong Lhong		+					+	PA	none
9	Chaloem Pra Kiet (Pa Phru To Daeng)	+	+	+				+	PA	Hala-Bala
10	Chao Phraya River from Nonthaburi to Nakon Sawan					+				none
11	Doi Chiang Dao	+	+	+				+	PA	Lum Nam Pai-Salawin
12	Doi Inthanon	+	+	+				+	PA	Lum Nam Pai-Salawin
13	Doi Pha Chang	+	+						PA	Doi Phuka-Mae Yom
14	Doi Phu Nang		+					+	PA	Doi Phuka-Mae Yom
15	Doi Phukha		+					+	PA	Doi Phuka-Mae Yom
16	Doi Suthep-Pui	+	+	+				+	PA	Lum Nam Pai-Salawin
17	Erawan	+						+	PA	Western Forest Complex
18	Hala-Bala	+	+	+				+	PA	Hala-Bala
19	Hat Chao Mai	+	+					+	PA	Mu Ko Similan-Phi Phi-Andaman
20	Hat Nopharat Thara-Mu Ko Phi Phi		+					+	PA	Mu Ko Similan-Phi Phi-Andaman
21	Huai Kha Khaeng	+	+	+				+	PA	Western Forest Complex
22	Huai Nam Dang							+	PA	Lum Nam Pai-Salawin
23	Inner Gulf of Thailand		+							Inner Gulf of Thailand
24	Kaeng Krachan	+	+	+				+	PA	Kaeng Krachan
25	Kaeng Krung	+						+	PA	Khlong Saeng-Khao Sok
26	Khao Ang Ru Nai	+	+	+					PA	Lower Eastern Forest Complex

Code	Key Biodiversity Area	Mammals	Birds	Reptiles	Amphibians	Fishes	Inverts	Plants	Protected Area*	Conservation Corridor
27	Khao Banthad	+	+	+	+			+	PA	Khao Banthad
28	Khao Chamao-Khao Wong	+						+	PA	Lower Eastern Forest Complex
29	Khao Chong				+					none
30	Khao Khitchakut	+						+	PA	Lower Eastern Forest Complex
31	Khao Laem	+	+					+	PA	Western Forest Complex
32	Khao Lak-Lam Ru			+	+			+	PA	Khlong Saeng-Khao Sok
33	Khao Luang	+	+	+				+	PA	Khao Luang
34	Khao Nam Khang							+	PA	Hala-Bala
35	Khao Nor Chuchi	+	+	+				+	PA	Mu Ko Similan-Phi Phi-Andaman
36	Khao Phanom Bencha	+						+	PA	Mu Ko Similan-Phi Phi-Andaman
37	Khao Pu-Khao Ya	+						+	PA	Khao Banthad
38	Khao Sabab-Namtok Phlew			+				+	PA	Lower Eastern Forest Complex
39	Khao Sam Roi Yot	+	+					+	PA	Inner Gulf of Thailand
40	Khao Soi Dao	+	+	+				+	PA	Lower Eastern Forest Complex
41	Khao Sok	+						+	PA	Khlong Saeng-Khao Sok
42	Khao Yai	+	+					+	PA	Upper Eastern Forest Complex
43	Khlong Lan	+		+				+	PA	Western Forest Complex
44	Khlong Nakha	+			+			+	PA	Khlong Saeng-Khao Sok
45	Khlong Saeng	+		+	+			+	PA	Khlong Saeng-Khao Sok
46	Ko Li Bong		+					+	PA	Mu Ko Similan-Phi Phi-Andaman
47	Ko Phra Tong		+							Khlong Saeng-Khao Sok
48	Kuiburi	+						+	PA	Kaeng Krachan
49	Laem Pakarang		+							Mu Ko Similan-Phi Phi-Andaman
50	Lam Khlong Ngu							+	PA	Western Forest Complex
51	Lower Central Basin		+							none
52	Lum Nam Pai	+				+			PA	Lum Nam Pai-Salawin

Code	Key Biodiversity Area	Mammals	Birds	Reptiles	Amphibians	Fishes	Inverts	Plants	Protected Area*	Conservation Corridor
53	Mae Fang		+						PA	none
54	Mae Jarim NP		+						PA	Doi Phuka-Mae Yom
55	Mae Jarim WS		+						PA	Doi Phuka-Mae Yom
56	Mae Klong Basin			+		+				none
57	Mae Lao-Mae Sae	+	+						PA	Lum Nam Pai-Salawin
58	Mae Ping							+	PA	Mae Ping-Om Koi
59	Mae Tuen	+							PA	Mae Ping-Om Koi
60	Mae Wong	+	+					+	PA	Western Forest Complex
61	Mae Yom	+	+	+				+	PA	Doi Phuka-Mae Yom
62	Mekong Channel near Pakchom		+			+				Mekong River and Major Tributaries
63	Mu Ko Chang							+	PA	none
64	Mu Ko Similan		+					+	PA	Mu Ko Similan-Phi Phi-Andaman
65	Mu Ko Surin		+					+	PA	none
66	Na Muang Krabi		+							Mu Ko Similan-Phi Phi-Andaman
67	Nam Nao	+	+	+				+	PA	Phu Khieo-Nam Nao
68	Nam River					+				none
69	Namtok Huai Yang							+	PA	Chumphon
70	Namtok Khlong Kaew							+	PA	none
71	Namtok Sai Khao							+	PA	Hala-Bala
72	Namtok Yong							+	PA	Khao Luang
73	Nanthaburi		+					+	PA	Doi Phuka-Mae Yom
74	Nong Bong Kai		+			+			PA	none
75	Om Koi	+	+						PA	Mae Ping-Om Koi
76	Pak Nam Prasae		+							none
77	Palian Lang-ngu		+							Mu Ko Similan-Phi Phi-Andaman
78	Pang Sida	+		+				+	PA	Upper Eastern Forest Complex
79	Phu Jong Na Yoi			+				+	PA	Phanom Dongrak-Pha Tam

Code	Key Biodiversity Area	Mammals	Birds	Reptiles	Amphibians	Fishes	Inverts	Plants	Protected Area*	Conservation Corridor
80	Phu Khieo	+	+	+				+	PA	Phu Khieo-Nam Nao
81	Phu Kradung	+		+				+	PA	Phu Khieo-Nam Nao
82	Phu Luang	+		+				+	PA	Phu Khieo-Nam Nao
83	Phu Miang-Phu Thong	+						+	PA	Phu Miang-Phu Thong
84	Phu Phan	+						+	PA	none
85	Phu Rua						+		PA	Phu Khieo-Nam Nao
86	Prince Chumphon Park	+	+					+	PA	Chumphon
87	Sai Yok	+		+		+		+	PA	Western Forest Complex
88	Sakaerat			+				+	PA	Upper Eastern Forest Complex
89	Salak Phra	+		+					PA	Western Forest Complex
90	Salawin	+							PA	Lum Nam Pai-Salawin
91	San Kala Khiri							+	PA	Hala-Bala
92	Sanambin		+						PA	none
93	Sri Lanna							+	PA	Sri Lanna-Khun Tan
94	Sri Nakarin	+	+					+	PA	Western Forest Complex
95	Sri Nan		+					+	PA	Doi Phuka-Mae Yom
96	Sri Phang-nga	+						+	PA	Khlong Saeng-Khao Sok
97	Sub Langkha	+						+	PA	Phu Khieo-Nam Nao
98	Tai Rom Yen	+						+	PA	Khao Luang
99	Tarutao	+						+	PA	Mu Ko Similan-Phi Phi-Andaman
100	Tha Tum Nam Mun						+			none
101	Tha Yang		+							none
102	Thab Lan	+						+	PA	Upper Eastern Forest Complex
103	Thale Noi		+						PA	none
104	Thale Sap Songkhla		+					+	PA	none
105	Thaleban	+	+					+	PA	Khao Banthad
106	Tham Ba Dan					+				Western Forest Complex

Code	Key Biodiversity Area	Mammals	Birds	Reptiles	Amphibians	Fishes	Inverts	Plants	Protected Area*	Conservation Corridor
107	Thung Kha		+						PA	none
108	Thung Salaeng Luang	+						+	PA	Phu Miang-Phu Thong
109	Thung Tha Laad		+							none
110	Thung Yai-Naresuan	+	+	+				+	PA	Western Forest Complex
111	Ton Nga Chang	+		+				+	PA	Khao Banthad
112	Tonpariwat		+						PA	Khlong Saeng-Khao Sok
113	Trat Wetlands					+				none
114	Ubon Nam Mun						+			Mekong River and Major Tributaries
115	Umphang	+	+	+					PA	Western Forest Complex
116	Wiang Lo		+						PA	Doi Phuka-Mae Yom
117	Yot Dom			+					PA	Phanom Dongrak-Pha Tam
VNM	**VIETNAM**									
1	A Luoi-Nam Dong	+		+					PA	Central Annamites
2	A Yun Pa	+	+					+		none
3	An Hai		+							Red River Delta Coastal Zone
4	Ba Be	+			+			+	PA	Sino-Vietnamese Limestone
5	Ba Tri		+							Mekong Delta Coastal Zone
6	Bac Lieu		+						PA	Mekong Delta Coastal Zone
7	Bach Ma	+	+					+	PA	Central Annamites
8	Bai Boi		+							Mekong Delta Coastal Zone
9	Ban Bung	+	+	+				+	PA	Sino-Vietnamese Limestone
10	Ban Thi-Xuan Lac	+	+	+					PA	Sino-Vietnamese Limestone
11	Bao Loc-Loc Bac	+								Lowland Dong Nai Watershed
12	Bat Dai Son							+	PA	Sino-Vietnamese Limestone
13	Ben En	+						+	PA	none
14	Bi Dup-Nui Ba	+	+					+	PA	Southern Annamites Main Montane Block

Code	Key Biodiversity Area	Mammals	Birds	Reptiles	Amphibians	Fishes	Inverts	Plants	Protected Area*	Conservation Corridor
15	Bien Lac-Nui Ong	+							PA	Di Linh
16	Bim Son	+								Northern Indochina Limestone
17	Binh An	+								Sino-Vietnamese Limestone
18	Binh Dai		+							Mekong Delta Coastal Zone
19	Binh Khuong			+						none
20	Bu Gia Map	+							PA	Southern Annamites Western Slopes
21	Ca Mau		+							none
22	Can Gio		+							Mekong Delta Coastal Zone
23	Cat Ba	+						+	PA	none
24	Cat Loc	+	+						PA	Lowland Dong Nai Watershed
25	Cham Chu	+								Sino-Vietnamese Limestone
26	Che Tao	+	+					+	PA	Ailao/Hoang Lien Mountains
27	Chu Prong	+	+	+				+		Eastern Plains Dry Forests
28	Chu Yang Sin	+	+					+	PA	Southern Annamites Main Montane Block
29	Chua Hang		+							Mekong Delta Coastal Zone
30	Chua Huong	+							PA	Northern Indochina Limestone
31	Co Nhi River			+						none
32	Cong Troi		+							Southern Annamites Main Montane Block
33	Cu Jut	+								Eastern Plains Dry Forests
34	Cuc Phuong	+	+	+				+	PA	Northern Indochina Limestone
35	Dak Dam		+							Eastern Plains Dry Forests
36	Dak Poko Headwaters					+				Central Annamites
37	Dakrong	+	+					+	PA	Central Annamites
38	Dat Mui		+						PA	Mekong Delta Coastal Zone
39	Deo Ca-Hon Nua			+					PA	Southern Annamites Main Montane Block
40	Deo Nui San	+								Di Linh
41	Dong Mo Lake			+						none

Code	Key Biodiversity Area	Mammals	Birds	Reptiles	Amphibians	Fishes	Inverts	Plants	Protected Area*	Conservation Corridor
42	Du Gia	+	+		+				PA	Sino-Vietnamese Limestone
43	Ea So	+	+						PA	none
44	Fan Si Pan	+	+		+			+	PA	Ailao/Hoang Lien Mountains
45	Ha Nam		+							Red River Delta Coastal Zone
46	Ha Tien		+							North-western Mekong Delta Wetlands
47	Ho Earal							+		none
48	Hoa Lu-Tam Coc-Bich Dong	+							PA	Northern Indochina Limestone
49	Huong Son	+								Northern Annamites
50	Ke Bang	+	+					+	PA	Central Indochina Limestone
51	Ke Go	+	+						PA	Ke Go and Khe Net Lowlands
52	Khau Ca	+								Sino-Vietnamese Limestone
53	Khe Net	+	+					+		Ke Go and Khe Net Lowlands
54	Kien Giang						+			none
55	Kien Luong		+							North-western Mekong Delta Wetlands
56	Kon Cha Rang-An Toan	+	+	+	+			+	PA	Central Annamites
57	Kon Ka Kinh	+	+	+	+			+	PA	Central Annamites
58	Kon Plong	+	+	+				+		Central Annamites
59	Lac Thuy-Kim Bang	+								Northern Indochina Limestone
60	Lam Binh	+								Sino-Vietnamese Limestone
61	Lang Sen		+					+		North-western Mekong Delta Wetlands
62	Lo Go-Xa Mat	+	+						PA	none
63	Lo Xo Pass	+	+					+	PA	Central Annamites
64	Macooih	+								Central Annamites
65	Mom Ray	+				+	+		PA	Cambodia-Lao PDR-Vietnam Tri-border Forests
66	Na Chi	+			+					Sino-Vietnamese Limestone
67	Nam Cat Tien	+	+	+		+		+	PA	Lowland Dong Nai Watershed
68	Nam He						+			none

Code	Key Biodiversity Area	Mammals	Birds	Reptiles	Amphibians	Fishes	Inverts	Plants	Protected Area*	Conservation Corridor
69	Nghia Hung		+							Red River Delta Coastal Zone
70	Ngoc Linh	+	+		+			+	PA	Central Annamites
71	Ngoc Son	+							PA	Northern Indochina Limestone
72	Northern Hien	+							PA	Central Annamites
73	Nui Boi Yao	+								Northern Indochina Limestone
74	Nui Chua	+							PA	none
75	Nui Giang Man	+								Northern Annamites
76	Phong Dien	+	+					+	PA	Central Annamites
77	Phong Nha	+	+					+	PA	Central Indochina Limestone
78	Phu Ninh	+								Central Annamites
79	Phuoc Binh	+	+					+		Southern Annamites Main Montane Block
80	Pu Huong	+						+	PA	Upper Chu River Watershed
81	Pu Luong	+							PA	Northern Indochina Limestone
82	Pu Mat	+	+	+				+	PA	Northern Annamites
83	Que Son	+								Central Annamites
84	Sinh Long	+						+		Sino-Vietnamese Limestone
85	Son Tra	+							PA	Central Annamites
86	Song Hinh			+						Southern Annamites Main Montane Block
87	Song Thanh	+		+				+	PA	Central Annamites
88	Ta Dung				+				PA	Lowland Dong Nai Watershed
89	Tam Dao				+				PA	none
90	Tat Ke	+						+	PA	Sino-Vietnamese Limestone
91	Tay Con Linh		+		+				PA	Sino-Vietnamese Limestone
92	Tay Yen Tu				+				PA	none
93	Thai Thuy		+							Red River Delta Coastal Zone
94	Than Xa	+							PA	Sino-Vietnamese Limestone
95	Thiet Ong	+								Northern Indochina Limestone

Code	Key Biodiversity Area	Mammals	Birds	Reptiles	Amphibians	Fishes	Inverts	Plants	Protected Area*	Conservation Corridor
96	Tien Hai		+						PA	Red River Delta Coastal Zone
97	Tien Lang		+							Red River Delta Coastal Zone
98	Tien Phuoc	+								Central Annamites
99	Tra Co		+							none
100	Tra Cu		+							Mekong Delta Coastal Zone
101	Tram Chim		+						PA	North-western Mekong Delta Wetlands
102	Tram Lap-Dakrong	+								Central Annamites
103	Trung Khanh	+						+	PA	Sino-Vietnamese Limestone
104	Truong Son	+	+						PA	Quang Binh-Quang Tri-Xe Bangfai Lowlands
105	Tung Vai	+		+						Sino-Vietnamese Limestone
106	Tuyen Lam	+	+							Southern Annamites Main Montane Block
107	U Minh Thuong	+	+	+					PA	none
108	Vam Nao Confluence					+				none
109	Van Ban	+	+	+	+			+		Ailao/Hoang Lien Mountains
110	Van Long	+							PA	Northern Indochina Limestone
111	Vinh Cuu	+				+			PA	Lowland Dong Nai Watershed
112	Vu Quang	+	+	+				+	PA	Northern Annamites
113	Xuan Lien	+						+	PA	Upper Chu River Watershed
114	Xuan Thuy		+						PA	Red River Delta Coastal Zone
115	Ya Lop	+	+							Eastern Plains Dry Forests
116	Yok Don	+	+	+	+				PA	Eastern Plains Dry Forests

Notes: * = KBA is wholly or partly included within a gazetted protected area.

Appendix 3. Conservation Corridors in the Indo-Burma Hotspot

No.	Conservation Corridor	Key Biodiversity Areas	Countries	Area (km²)	Selection Criteria for Priority Corridors: Globally Significant Populations of CR and EN Species	Globally Significant Populations of Landscape Species	Unique or Exceptional Ecological & Evolutionary Processes	Urgency for Conservation Action	Opportunity for Additional Investment
1	Ailaoshan/Hoang Lien Mountains	Ailaoshan; Che Tao; Fan Si Pan; Fenshuiling; Huanglianshan; Van Ban; Wuliangshan	China and Vietnam	28,076	*Amolops cucae; Amolops minutus; Calamaria yunnanensis; Leptobrachella alpina; Leptobrachella botsfordi; Leptobrachella pluvialis; Leptobrachium echinata; Nanorana unculuanus; Nanorana yunnanensis; Nomascus concolor; Oreolalax sterlingae; Pavo muticus; Quasipaa boulengeri; Rimator pasquieri; Theloderma bicolor*		altitudinal migration	High	Medium
2	Ayeyarwady Catchment	Babulon Htan; Bumphabum; Fen-shui-ling Valley; Hkakaborazi; Hponkanrazi; Indawgyi Grassland and Indaw Chaung Wetland; Indawgyi Wildlife Sanctuary; Kamaing; Mali Kha Area; May Kha Area; Momeik-Mabein; Myitkyina-Nandebad-Talawgyi; Nam Sam Chaung; Ninety-six Inns; Pidaung; Shwe U Daung; Upper Mogaung Chaung Basin	Myanmar	101,382	*Ailurus fulgens; Ardea insignis; Asarcornis scutulata; Axis porcinus; Chitra indica; Cuora mouhotii; Elephas maximus; Gyps bengalensis; Gyps tenuirostris; Indotestudo elongata; Manis pentadactyla; Moschus fuscus; Nilssonia formosa; Trachypithecus shortridgei; Viverra megaspila*	Rufous-necked Hornbill; Takin; White-bellied Heron	altitudinal migration of birds	High	Medium
3	Ayeyarwady River	Ayeyarwady River: Bagan Section; Ayeyarwady River: Bhamo Section; Ayeyarwady River: Myitkyina to Sinbo Section; Ayeyarwady River: Shwegu Section; Ayeyarwady River: Sinbyugyun to Minbu Section; Ayeyarwady River: Singu Section; Irrawaddy Dolphin; Meinmahla Kyun; Sheinmaga Tawyagyi	Myanmar	19,758	*Ardea insignis; Chitra indica; Gyps bengalensis; Gyps tenuirostris; Orcaella brevirostris; Nilssonia formosa; Sterna acuticauda*	Irrawaddy Dolphin; sandbar-nesting birds; vultures; White-bellied Heron	migration of fish	High	Medium

No.	Conservation Corridor	Key Biodiversity Areas	Countries	Area (km^2)	Selection Criteria for Priority Corridors				
					Globally Significant Populations of CR and EN Species	Globally Significant Populations of Landscape Species	Unique or Exceptional Ecological & Evolutionary Processes	Urgency for Conservation Action	Opportunity for Additional Investment
4	Bago Yoma Range	Central Bago Yoma; North Zarmayi; North Zarmayi Elephant Range; Phokyar Elephant Camp	Myanmar	16,119	*Bos javanicus; Elephas maximus; Indotestudo elongata; Manis pentadactyla; Trachypithecus phayrei*	Asian Elephant		Medium	High
5	Bolaven Plateau	Bolaven Northeast; Dong Hua Sao	Lao PDR	4,411	*Elephas maximus; Pseudocalotes poilani*	Asian Elephant		Medium	High
6	Cambodia-Lao PDR-Vietnam Tri-border Forests	Dong Ampham; Mom Ray; Nam Ghong; Virachey	Cambodia, Lao PDR and Vietnam	10,617	*Elephas maximus; Leptobrachella melica; Nomascus gabriellae; Pygathrix nemaeus; Pygathrix nigripes*	Asian Elephant		Medium	Medium
7	Cardamom and Elephant Mountains	Central Cardamoms; Kirirom; Phnom Aural; Phnom Bokor; Phnom Samkos; Southern Cardamoms	Cambodia	17,660	*Crocodylus siamensis; Elephas maximus; Hylobates pileatus; Megophrys damrei; Philautus cardamonus; Scleropages formosus; Viverra megaspila*	Asian Elephant		High	Medium
8	Central Annamites	A Luoi-Nam Dong; Bach Ma; Dak Poko Headwaters; Dakrong; Kon Cha Rang-An Toan; Kon Ka Kinh; Kon Plong; Lo Xo Pass; Macooih; Ngoc Linh; Northern Hien; Phong Dien; Phou Ahyon; Phu Ninh; Que Son; Son Tra; Song Thanh; Tien Phuoc; Tram Lap-Dakrong; Xe Sap	Lao PDR and Vietnam	32,873	*Cuora bourreti; Gracixalus lumarius; Leptobrachella applebyi; Leptobrachella firthi; Leptobrachium ngoclinhense; Leptobrachium xanthops; Lophura edwardsi; Muntiacus vuquangensis; Nesolagus timminsi; Nomascus siki; Poropuntius consternans; Poropuntius lobocheiloides; Poropuntius solitus; Protobothrops sieversorum; Pseudoryx nghetinhensis; Pygathrix cinerea; Pygathrix nemaeus; Rheinardia ocellata; Sewellia breviventralis; Sewellia patella; Schistura bolavenensis; Schistura spiloptera; Theloderma nebulosum; Theloderma ryabovi; Trochalopteron ngoclinhensis*		altitudinal migration	High	Medium

No.	Conservation Corridor	Key Biodiversity Areas	Countries	Area (km^2)	Selection Criteria for Priority Corridors				
					Globally Significant Populations of CR and EN Species	Globally Significant Populations of Landscape Species	Unique or Exceptional Ecological & Evolutionary Processes	Urgency for Conservation Action	Opportunity for Additional Investment
9	Central Indochina Limestone	Hin Namno; Ke Bang; Khammouan Limestone; Phong Nha; Xe Bangfai Cave System	Lao PDR and Vietnam	7,990	*Cyrtodactylus jaegeri; Luciocyprinus striolatus; Nesolagus timminsi; Protobothrops sieversorum; Pygathrix nemaeus; Rheinardia ocellata; Schistura bairdi; Schistura bolavenensis; Schistura spiloptera; Schistura tenura; Terateleotris aspro; Trachypithecus hatinhensis*			Medium	Medium
10	Chin Hills Complex	Bwe Pa; Kennedy Peak; Kyauk Pan Taung; Natmataung (Mount Victoria); Zeihmu Range	Myanmar	36,013	*Gyps bengalensis; Hoolock hoolock; Indotestudo elongata; Manis pentadactyla; Sitta victoriae; Trachypithecus phayrei*	Rufous-necked Hornbill; vultures	altitudinal migration of birds	Medium	High
11	Chindwin Catchment	Htamanthi; Hukaung Valley; Hukaung Valley extension; Saramati Taung; Tanai River; Uyu River	Myanmar	50,072	*Ardea insignis; Asarcornis scutulata; Axis porcinus; Bubalus arnee; Cuora mouhotii; Elephas maximus; Hoolock hoolock; Gyps bengalensis; Gyps tenuirostris; Indotestudo elongata; Nilssonia formosa; Panthera tigris; Pavo muticus; Trachypithecus shortridgei*	Asian Elephant; Tiger; White-bellied Heron; sandbar-nesting birds	altitudinal migration of birds; migration of fish	High	Medium
12	Chindwin River	Upper Chindwin River: Kaunghein to Padumone Section	Myanmar	5,281	*Asarcornis scutulata; Batagur trivittata; Chitra indica; Hoolock hoolock; Indotestudo elongata; Nilssonia formosa*	sandbar-nesting birds and turtles	migration of fish	High	High
13	Chumphon	Namtok Huai Yang; Prince Chumphon Park	Thailand	1,740			migration of raptors	Medium	High
14	Damingshan Range	Baixu-Qinpai; Damingshan; Xianhu Reservoir	China	5,685	*Gorsachius magnificus; Trachypithecus francoisi*			High	Medium

No.	Conservation Corridor	Key Biodiversity Areas	Countries	Area (km^2)	Selection Criteria for Priority Corridors				
					Globally Significant Populations of CR and EN Species	Globally Significant Populations of Landscape Species	Unique or Exceptional Ecological & Evolutionary Processes	Urgency for Conservation Action	Opportunity for Additional Investment
15	Di Linh	Bien Lac-Nui Ong; Deo Nui San	Vietnam	5,166	*Pygathrix nigripes; Rhacophorus helenae*			Medium	High
16	Doi Phuka-Mae Yom	Doi Pha Chang; Doi Phukha; Doi Phu Nang; Mae Jarim NP; Mae Jarim WS; Mae Yom; Nam Phoun; Nanthaburi; Sri Nan; Wiang Lo	Lao PDR and Thailand	17,053	*Cuon alpinus; Elephas maximus; Pavo muticus*	Asian Elephant		Medium	High
17	Eastern Plains Dry Forests	Chu Prong; Cu Jut; Dak Dam; Lomphat; Mondulkiri-Kratie Lowlands; Upper Srepok Catchment; Ya Lop; Yok Don	Cambodia and Vietnam	21,160	*Bos javanicus; Bubalus arnee; Cuon alpinus; Crocodylus siamensis; Elephas maximus; Gyps bengalensis; Gyps tenuirostris; Heosemys annandalii; Indotestudo elongata; Pavo muticus; Pseudibis davisoni; Rucervus eldii; Sarcogyps calvus; Thaumatibis gigantea; Viverra megaspila*	Asian Elephant; vultures; large waterbirds	extreme seasonality, fire regime and other processes characteristic of dry forests	High	Medium
18	Hainan Coastal Zone	Dongzhaigang; Houshui Wan; Qinglangang; Sanya Seagrass Beds; Tongguling	China	8,311	*Amolops hainanensis; Platalea minor*		migration of shorebirds	Medium	High
19	Hainan Mountains	Baimaling-Huishan; Bawangling; Datian; Diaoluoshan; Exianling and Changhuajiang; Fanjia; Ganshiling; Houmiling; Jianfengling; Jianling; Jiaxi; Ledong; Liji; Limushan; Nanmaoling; Nanweiling; Sanya; Shangxi; Tongtieling; Wuzhishan; Yinggeling	China	17,452	*Amolops hainanensis; Cuora galbinifrons; Goniurosaurus bawanglingensis; Mauremys mutica; Neohylomys hainanensis; Nomascus hainanus; Platysternon megacephalum; Polyplectron katsumatae; Rucervus eldii; Sacalia quadriocellata; Tylototriton hainanensis; Urocissa whiteheadi*			High	Medium

No.	Conservation Corridor	Key Biodiversity Areas	Countries	Area (km^2)	Selection Criteria for Priority Corridors: Globally Significant Populations of CR and EN Species	Globally Significant Populations of Landscape Species	Unique or Exceptional Ecological & Evolutionary Processes	Urgency for Conservation Action	Opportunity for Additional Investment
20	Hala-Bala	Bang Lang; Bu Do-Sungai Padi; Chaloem Pra Kiat (Pa Phru To Daeng); Hala-Bala; Khao Nam Khang; Namtok Sai Khao; San Kala Khiri	Thailand	7,423	*Betta pi; Cynogale bennettii; Eudiscoderma thongareeae; Heosemys spinosa; Hylobates agilis; Leptobrachella sola; Murina balaensis; Panthera tigris; Parosphromenus paludicola; Pelochelys cantorii; Rhabdotorrhinus corrugatus; Rhinoplax vigil; Symphalangus syndactylus; Tapirus indicus*	Plain-pouched Hornbill, Rhinoceros Hornbill	near-intact lowland evergreen forest ecosystem	High	Low
21	Hong Kong-Shenzhen Mountains	Hong Kong Island and Associated Islands; Inland New Territories; Lantau Island and Associated Islands	China	1,337	*Amolops hongkongensis; Cuora trifasciata; Dibamus bogadeki; Indotyphlops lazelli; Liuixalus romeri; Mauremys reevesii; Megophrys brachykolos; Sacalia bealei*			Medium	Low
22	Inner Gulf of Thailand	Inner Gulf of Thailand; Khao Sam Roi Yot	Thailand	1,408	*Calidris pygmea; Dixonius kaweesaki; Tringa guttifer*		migration of shorebirds	Medium	High
23	Kaeng Krachan	Kaeng Krachan; Kuiburi	Thailand	5,479	*Crocodylus siamensis; Elephas maximus; Panthera tigris; Tapirus indicus*	Asian Elephant; Great Hornbill; Plain-pouched Hornbill		High	Medium
24	Ke Go and Khe Net Lowlands	Ke Go; Khe Net	Vietnam	1,011	*Nesolagus timminsi*			Medium	High
25	Khao Banthad	Khao Banthad; Khao Pu-Khao Ya; Thaleban; Ton Nga Chang	Thailand	4,064	*Cnemaspis niyomwanae; Manouria emys; Tapirus indicus*			Medium	High
26	Khao Luang	Khao Luang; Namtok Yong; Tai Rom Yen	Thailand	2,439	*Berenicornis comatus; Chloropsis sonnerati; Elephas maximus; Tapirus indicus*	Great Hornbill		Medium	High
27	Khlong Saeng-Khao Sok	Kaeng Krung; Khao Lak-Lam Ru; Khao Sok; Khlong Nakha; Khlong Saeng; Ko Pra Thong; Sri Phang-nga; Tonpariwat	Thailand	8,132	*Berenicornis comatus; Chloropsis sonnerati; Elephas maximus; Rhinoplax vigil*			Medium	Medium

No.	Conservation Corridor	Key Biodiversity Areas	Countries	Area (km^2)	Selection Criteria for Priority Corridors				
					Globally Significant Populations of CR and EN Species	Globally Significant Populations of Landscape Species	Unique or Exceptional Ecological & Evolutionary Processes	Urgency for Conservation Action	Opportunity for Additional Investment
28	Lower Chindwin Forest	Alaungdaw Kathapa; Chatthin; Mahamyaing; Pauk Area; Shwesettaw; Thaungdut	Myanmar	39,926	*Asarcornis scutulata; Bos javanicus; Elephas maximus; Geochelone platynota; Indotestudo elongata; Manis pentadactyla; Nilssonia formosa; Pavo muticus; Rucervus eldi*	Asian Elephant		Medium	High
29	Lower Eastern Forest Complex	Khao Ang Ru Nai; Khao Chamao-Khao Wong; Khao Khitchakut; Khao Sabab-Namtok Phlew; Khao Soi Dao	Thailand	4,139	*Bos javanicus; Elephas maximus; Hylobates pileatus*	Asian Elephant		Medium	High
30	Lowland Dong Nai Watershed	Bao Loc-Loc Bac; Cat Loc; Nam Cat Tien; Ta Dung; Vinh Cuu	Vietnam	8,293	*Kalophrynus cryptophonus; Pavo muticus; Pygathrix nigripes; Scleropages formosus*	Great Hornbill		Medium	Medium
31	Lum Nam Pai-Salawin	Doi Chiang Dao; Doi Inthanon; Doi Suthep-Pui; Huai Nam Dang; Lum Nam Pai; Mae Lao-Mae Sae; Salawin	Thailand	24,333	*Oreoglanis heteropogon; Platysternon megacephalum; Sitta magna*			Medium	High
32	Mae Ping-Om Koi	Mae Ping; Mae Tuen; Om Koi	Thailand	8,666				Medium	High
33	Mekong Delta Coastal Zone	Ba Tri; Bac Lieu; Bai Boi; Binh Dai; Can Gio; Chua Hang; Dat Mui; Tra Cu	Vietnam	3,933	*Tringa guttifer*		migration of shorebirds	High	Medium

No.	Conservation Corridor	Key Biodiversity Areas	Countries	Area (km^2)	Selection Criteria for Priority Corridors				
					Globally Significant Populations of CR and EN Species	Globally Significant Populations of Landscape Species	Unique or Exceptional Ecological & Evolutionary Processes	Urgency for Conservation Action	Opportunity for Additional Investment
34	Mekong River and Major Tributaries	Lower Nam Ou; Mekong Confluence with Nam Kading; Mekong Confluence with Xe Bangfai; Mekong Channel near Pakchom; Mekong River from Kratie to Lao PDR; Mekong River from Phou Xiang Thong to Siphandon; Mekong River from Louangphabang to Vientiane; Pakxan Wetlands; Sekong River; Sesan River; Siphandon; Srepok River; Thala Stueng Treng; Ubon Nam Mun; Upper Lao Mekong; Upper Xe Kaman; Western Siem Pang; Xe Champhon	Cambodia, Lao PDR and Thailand	19,435	*Aaptosyax grypus; Catlocarpio siamensis; Crocodylus siamensis; Datnioides pulcher; Fluvitrygon oxyrhyncha; Gyps bengalensis; Gyps tenuirostris; Hemitrygon laosensis; Laubuka caeruleostigmata; Orcaella brevirostris; Pangasianodon gigas; Pangasianodon hypophthalmus; Pangasius sanitwongsei; Pavo muticus; Pelochelys cantorii; Poropuntius consternans; Poropuntius lobocheiloides; Poropuntius solitus; Probarbus jullieni; Probarbus labeamajor; Pseudibis davisoni; Rucervus eldii; Sarcogyps calvus; Schistura bairdi; Tenualosa thibaudeaui; Thaumatibis gigantea; Urogymnus polylepis*	Irrawaddy Dolphin; migratory freshwater fish; sandbar-nesting birds	migration of fish species; migration of Manchurian Reed-warbler	High	High
35	Mu Ko Similan-Phi Phi-Andaman	Ao Phang-nga; Hat Chao Mai; Hat Nopharat Thara-Mu Ko Phi Phi; Khao Nor Chuchi; Khao Phanom Bencha; Ko Li Bong; Laem Pakarang; Mu Ko Similan; Na Muang Krabi; Palian Lang-ngu; Tarutao	Thailand	26,317	*Fregata andrewsi; Heosemys spinosa; Hydrornis gurneyi; Tringa guttifer*		migration of shorebirds	Medium	High
36	Nam Et-Phou Louey	Nam Et; Phou Louey	Lao PDR	4,391	*Panthera tigris*			Medium	High
37	Nam Ha-Xishuangbanna-Phou Dendin	Babianjiang; Caiyanghe; Nam Ha; Nam Kan; Nam Ou Headwaters; Phou Dendin; Xishuangbanna; Yiwa; Youluoshan	China and Lao PDR	21,523	*Elephas maximus; Luciocyprinus striolatus; Margaritifera laoensis; Nomascus concolor; Palea steindachneri; Panthera tigris; Platysternon megacephalum*	Asian Elephant		High	Medium

No.	Conservation Corridor	Key Biodiversity Areas	Countries	Area (km^2)	Selection Criteria for Priority Corridors				
					Globally Significant Populations of CR and EN Species	Globally Significant Populations of Landscape Species	Unique or Exceptional Ecological & Evolutionary Processes	Urgency for Conservation Action	Opportunity for Additional Investment
38	Nangunhe-Yongde Daxueshan	Nangunhe; Yongde Daxueshan	China	2,588	*Elephas maximus; Nomascus concolor; Palea steindachneri*	Asian Elephant		Medium	High
39	North-western Mekong Delta Wetlands	Bassac Marsh; Boeung Prek Lapouv; Ha Tien; Kampong Trach; Kien Luong; Lang Sen; Tram Chim	Cambodia and Vietnam	7,854		large waterbirds	seasonal flood regime; migration of large waterbirds	High	Medium
40	Northern Annamites	Eastern Bolikhamxay Mountains; Huong Son; Nakai-Nam Theun; Nakai Plateau; Nui Giang Man; Pu Mat; Vu Quang	Lao PDR and Vietnam	21,112	*Cuora galbinifrons; Cuora trifasciata; Elephas maximus; Gracixalus quyeti; Muntiacus vuquangensis; Nesolagus timminsi; Nomascus leucogenys; Oreoglanis lepturus; Panthera tigris; Platysternon megacephalum; Pterocryptis inusitata; Protobothrops sieversorum; Pseudoryx nghetinhensis; Pygathrix nemaeus; Rheinardia ocellata; Rhinogobius lineatus; Sacalia quadriocellata; Schistura nudidorsum*	Asian Elephant; Rufous-necked Hornbill		High	Medium
41	Northern Indochina Limestone	Bim Son; Chua Huong; Cuc Phuong; Hoa Lu-Tam Coc-Bich Dong; Lac Thuy-Kim Bang; Ngoc Son; Nui Boi Yao; Pu Luong; Thiet Ong; Van Long	Vietnam	6,793	*Cyrtodactylus otai; Trachypithecus delacouri*			Medium	Medium
42	Northern Plains Seasonally Inundated Forests	Chhep; Dong Khanthung; O Skach; Upper Stung Sen Catchment	Cambodia and Lao PDR	19,322	*Asarcornis scutulata; Gyps bengalensis; Gyps tenuirostris; Heosemys annandalii; Indotestudo elongata; Pavo muticus; Rucervus eldii; Sarcogyps calvus; Thaumatibis gigantea; Viverra megaspila*	vultures; large waterbirds	extreme seasonality fire regime and other processes typical of dry forests	High	High
43	Phanom Dongrak-Pha Tam	Phu Jong Na Yoi; Yot Dom	Thailand	3,510	*Elephas maximus; Hylobates pileatus*			High	Medium

No.	Conservation Corridor	Key Biodiversity Areas	Countries	Area (km^2)	Selection Criteria for Priority Corridors				
					Globally Significant Populations of CR and EN Species	Globally Significant Populations of Landscape Species	Unique or Exceptional Ecological & Evolutionary Processes	Urgency for Conservation Action	Opportunity for Additional Investment
44	Phu Khieo-Nam Nao	Nam Nao; Phu Khieo; Phu Kradung; Phu Luang; Phu Rua; Sub Langkha	Thailand	13,395	*Asarcornis scutulata; Elephas maximus; Hylobates lar; Indochinamon bhumibol; Panthera tigris; Platysternon megacephalum; Trachypithecus phayrei*	Asian Elephant		High	Low
45	Phu Miang-Phu Thong	Phu Miang-Phu Thong; Thung Salaeng Luang	Thailand	9,944				Medium	High
46	Quang Binh-Quang Tri-Xe Bangfai Lowlands	Laving-Laveun; Truong Son; Upper Xe Bangfai	Lao PDR and Vietnam	3,819	*Nesolagus timminsi; Nomascus siki; Protobothrops sieversorum; Pseudoryx nghetinhensis; Pygathrix nemaeus; Rheinardia ocellata*			High	Medium
47	Rakhine Yoma Range	Gyobin; Kaladan River; Kyaukphyu (Wunbike); Manaung Kyun; May Yu; Myebon; Nantha Island; Nat-yekan; Ngwe Taung; Northern Rakhine Yoma; Pyaungbya River; Rakhine Yoma Elephant Range	Myanmar	47,614	*Batagur trivittata; Bos javanicus; Chitra indica; Elephas maximus; Heosemys depressa; Hoolock hoolock; Indotestudo elongata; Leptobrachium rakhinensis; Manouria emys; Nilssonia formosa; Pavo muticus*	Asian Elephant; Rufous-necked Hornbill	migration of shorebirds; recruitment of fish	Medium	High
48	Red River Delta Coastal Zone	An Hai; Ha Nam; Nghia Hung; Thai Thuy; Tien Hai; Tien Lang; Xuan Thuy	Vietnam	2,255	*Calidris pygmea; Platalea minor; Tringa guttifer*	Black-faced Spoonbill	migration of shorebirds	High	Medium
49	Shiwandashan Range	Fangchen Shanue; Shiwandashan	China	2,458	*Sacalia quadriocellata*			Medium	High

No.	Conservation Corridor	Key Biodiversity Areas	Countries	Area (km²)	Selection Criteria for Priority Corridors				
					Globally Significant Populations of CR and EN Species	**Globally Significant Populations of Landscape Species**	**Unique or Exceptional Ecological & Evolutionary Processes**	**Urgency for Conservation Action**	**Opportunity for Additional Investment**
50	Sino-Vietnamese Limestone	Ba Be; Ban Bung; Ban Thi-Xuan Lac; Bangliang; Bat Dai Son; Binh An; Cham Chu; Chongzuo; Daweishan; Diding; Du Gia; Funing Niaowangshan; Fuping-Gula-Dingye; Gulongshan; Khau Ca; Lam Binh; Longhua; Longhushan; Longshan section of Nonggang; Malipo; Na Chi; Nonggang; Paiyangshan; Shangsi-Biannian; Sinh Long; Tat Ke; Tay Con Linh; Than Xa; Trung Khanh; Tung Vai; Xidamingshan	China and Vietnam	58,502	*Gorsachius magnificus; Nomascus nasutus; Protobothrops trungkhanhensis; Ptychidio jordani; Quasipaa boulengeri; Rhinopithecus avunculus; Trachypithecus francoisi; Trachypithecus poliocephalus*			High	High
51	Sittaung River	Gulf of Mottama	Myanmar	47,614	*Calidris pygmea; Tringa guttifer*	sandbar-nesting birds	migration of fish and shorebirds	Medium	High
52	South China Shorebird Flyway	Fangcheng; Futian; Guangtouling; Leizhou Peninsula; Mai Po and Inner Deep Bay; Nangliujiang Hekou; Shankou; Taipa-Coloane	China	22,665	*Platalea minor; Tringa guttifer*	Black-faced Spoonbill	migration of raptors and shorebirds	High	Medium
53	Southern Annamites Main Montane Block	Bi Dup-Nui Ba; Chu Yang Sin; Cong Troi; Deo Ca-Hon Nua; Phuoc Binh; Song Hinh; Tuyen Lam	Vietnam	11,976	*Cuora picturata; Hylarana montivaga; Laniellus langbianis; Leptobrachella bidoupensis; Microhyla pulchella; Rhacophorus calcaneus; Rhacophorus vampyrus; Rheinardia ocellata; Theloderma palliatum; Trochalopteron yersini*		altitudinal migration	Medium	Medium
54	Southern Annamites Western Slopes	Bu Gia Map; Snoul-Keo Sema-O Reang	Cambodia and Vietnam	3,945	*Pygathrix nigripes*			High	Medium
55	Sri Lanna-Khun Tan	Sri Lanna	Thailand	20,164	*Cyrtodactylus khelangensis*			Medium	High

No.	Conservation Corridor	Key Biodiversity Areas	Countries	Area (km^2)	Selection Criteria for Priority Corridors				
					Globally Significant Populations of CR and EN Species	Globally Significant Populations of Landscape Species	Unique or Exceptional Ecological & Evolutionary Processes	Urgency for Conservation Action	Opportunity for Additional Investment
56	Tanintharyi Range	Central Tanintharyi Coast; Chaungmon-Wachaung; Htaung Pru; Karathuri; Kawthaung District Lowlands; Lampi Island; Lenya; Myinmoletkhat; Ngawun (Lenya extension); Pachan; Tanintharyi National Park; Tanintharyi Nature Reserve	Myanmar	42,912	*Ansonia thinthinae; Chloropsis sonnerati; Ciconia stormi; Cuon alpinus; Elephas maximus; Heosemys spinosa; Hydrornis gurneyi; Hylobates lar; Manis pentadactyla; Panthera tigris; Tapirus indicus; Viverra megaspila*	Asian Elephant; Plain-pouched Hornbill; Tiger	migration of shorebirds; recruitment of fish	High	Medium
57	Thanlwin River	Kayin Linno Karst; Weibyan Karst	Myanmar	7,696		sandbar-nesting birds	migration of fish	High	Medium
58	Tongbiguan-Gaoligongshan	Dehong Zizhizhou; Gaoligongshan; Tongbiguan	China	11,216	*Elephas maximus; Hoolock tianxing; Leptobrachella tengchongensis; Pavo muticus*	Asian Elephant		High	Medium
59	Tonle Sap Lake and Inundation Zone	Ang Tropeang Thmor; Bakan; Boeung Chhmar-Moat Khla; Chhnuk Tru; Dei Roneat; Kampong Laeng; Lower Stung Sen; Preah Net Preah-Kra Lanh-Pourk; Prek Toal; Stung-Chi Kreng-Kampong Svay; Stung Sen-Santuk-Baray; Veal Srongae	Cambodia	17,547	*Catlocarpio siamensis; Datnioides pulcher; Emberiza aureola; Fluvitrygon oxyrhyncha; Houbaropsis bengalensis; Leptoptilos dubius; Pangasianodon gigas; Pangasianodon hypophthalmus; Pangasius sanitwongsei; Probarbus jullieni; Probarbus labeamajor; Urogymnus polylepis*	migratory freshwater fish; large waterbirds	seasonal flood regime; migration of large waterbird and fish species	High	High
60	Upper Chu River Watershed	Pu Huong; Xuan Lien	Vietnam	4,505	*Nomascus leucogenys*			Medium	High
61	Upper Eastern Forest Complex	Khao Yai; Pang Sida; Sakaerat; Thab Lan	Thailand	9,685	*Bos javanicus; Elephas maximus; Hylobates lar; Hylobates pileatus; Indotestudo elongata; Niviventer hinpoon; Panthera tigris; Viverra megaspila*	Asian Elephant; Great Hornbill	contact zone of Pileated and White-handed Gibbons	High	Medium

No.	Conservation Corridor	Key Biodiversity Areas	Countries	Area (km^2)	Selection Criteria for Priority Corridors				
					Globally Significant Populations of CR and EN Species	Globally Significant Populations of Landscape Species	Unique or Exceptional Ecological & Evolutionary Processes	Urgency for Conservation Action	Opportunity for Additional Investment
62	Western Forest Complex	Erawan; Huai Kha Khaeng; Khao Laem; Khlong Lan; Lam Khlong Ngu; Mae Wong; Sai Yok; Salak Phra; Sri Nakarin; Tham Ba Dan; Thung Yai-Naresuan; Umphang	Thailand	24,112	*Asarcornis scutulata; Bos javanicus; Bubalus arnee; Elephas maximus; Indotestudo elongata; Manouria emys; Manouria impressa; Panthera tigris; Pavo muticus; Tapirus indicus*	Asian Elephant; Plain-pouched Hornbill; Rufous-necked Hornbill		Medium	Low
63	Western Shan Yoma Range	Kelatha; Kyaikhtiyoe; Panlaung Pyadalin Cave; Paunglaung Catchment Area; Tar Tar Karst	Myanmar	27,732	*Gymnostomus horai; Indotestudo elongata; Platysternon megacephalum*			Medium	High
64	Xe Khampho-Xe Pian	Nong Khe Wetlands; Xe Khampho; Xe Pian	Lao PDR	4,723	*Asarcornis scutulata; Crocodylus siamensis; Elephas maximus; Pavo muticus*	Asian Elephant; Great Hornbill		High	Medium
65	Yunwushan Range	Dawuling; Ehuangzhang; Heweishan; Qixingkeng; Yangchun Baiyong	China	8,408	*Manis pentadactyla*			High	Medium

Appendix 4. Provisional Priority Species for CEPF Investment in the Indo-Burma Hotspot*

Species Name and Red List Category on 1 June 2020	Conservation Need(s) Requiring Species-focused Action	Over-Riding Need for Greatly Improved Information
MAMMALS		
Lao Giant Flying Squirrel *Biswamoyopterus laoensis*, DD		Yes
Puhoat Muntjac *Muntiacus puhoatensis*, DD	Control of overexploitation	Yes
Leaf Muntjac *Muntiacus putaoensis*, DD	Control of overexploitation	Yes
Roosevelts' Muntjac *Muntiacus rooseveltorum*, DD	Control of overexploitation	Yes
Annamite Muntjac *Muntiacus truongsonensis*, DD	Control of overexploitation	Yes
Walston's Tube-nosed Bat *Murina walstoni*, NE		Yes
Wroughton's Free-tailed Bat *Otomops wroughtoni*, DD		Yes
Heude's Pig *Sus bucculentus*, DD	Taxonomic clarification	Yes
Tenasserim Leaf Monkey *Trachypithecus barbei*, DD	Possible control of overexploitation	Yes
Silver-backed Chevrotain *Tragulus versicolor*, DD	Possible control of overexploitation	Yes
Northern Chevrotain *Tragulus williamsoni*, DD	Possible control of overexploitation	Yes
BIRDS		
Large-billed Reed Warbler *Acrocephalus orinus*, DD		Yes
Black-necked Stork *Ephippiorhynchus asiaticus*, NT	Control of overexploitation	
AMPHIBIANS		
Ailao Toad *Bufo ailaoanus*, DD		Yes
Balloon Frog *Glyphoglossus molossus*, NT	Control of overexploitation	
Yellow-strip Caecilian *Ichthyophis bannanicus*, LC	Control of overexploitation	
Ailao Spiny Toad *Leptobrachium ailaonicum*, NT	Control of overexploitation	
Dawei Spiny Toad *Leptobrachium promustache*, DD	Control of overexploitation	
Pointed-tongued Floating Frog *Occidozyga lima*, NE**		Yes

Species Name and Red List Category on 1 June 2020	Conservation Need(s) Requiring Species-focused Action	Over-Riding Need for Greatly Improved Information
FISH		
Hong Kong Black Paradise Fish *Macropodus hongkongensis*, NE		Yes
White Cloud Mountain Minnow *Tanichthys albonubes*, DD		Yes
Panda Goby *Protomyzon pachychilus*, LC	Control of overexploitation	
Yunnan Loach *Yunnanilus macrogaster*, DD		Yes

Notes: * = Any of these species could become eligible for CEPF investment if their global threat status is reassessed as globally threatened during the five-year investment period. ** = The species as a whole is Least Concern but if suspicions that the southern Chinese taxon is a distinct species are confirmed, it would warrant serious consideration as a priority species. The process did not systematically consider as-yet-unproposed splits from species as currently accepted on the Red List.

Appendix 5. List of Climate Change Mitigation Projects with a Focus on Carbon Sequestration in the Indo-Burma Hotspot

Country	Agency	Target	Donor	Year	Project title	Approach / Activities	Source
Cambodia	Department of Fisheries Conservation; Fisheries Administration	Multi-sectoral	FCPF	2019-2020	Flooded Forest Rehabilitation and Management to Sustain Landscape Management of the Tonle Sap Great Lake	Promote integrated and sustainable flooded forest rehabilitation and management in the Tonle Sap Great Lake, which attains simultaneously to biodiversity, food security/fisheries/agriculture/livelihoods, and climate change.	1
Cambodia	General Department of Administration for Nature Protection and Conservation/ Ministry of Environment	Multi-sectoral	FCPF	2019-2020	REDD+ Pilot Project in Kulen, Siem Reap	Reduce forest loss and degradation while promoting environmentally sustainable livelihoods and conservation of natural resources and cultural heritage in Phnom Kulen National Park.	2
Cambodia	Forestry Administration	Multi-sectoral	FCPF	2019-2020	Strengthening Implementation of Partnership Forestry (PF) in Samroang Commune	Reduce forest loss and degradation through strengthening implementation of sustainable forest management while promoting environmentally sustainable livelihoods and protection of forest resources in Samoang Commune, Pursat.	3
Cambodia	UNDP	Multi-sectoral	FCPF	2017-2020	Forest Carbon Partnership Facility REDD+ Readiness Project - Phase II	Develop and enhance the Cambodian Government's capacities for tackling deforestation and forest degradation as well as for measuring, reviewing and verifying emission reduction.	4
Cambodia	UNIDO	Govt.	GEF; AF	2014-present	Reduction of GHG Emission through Promotion of Commercial Biogas Plants	Promote investments in biogas based rural electricity enterprises for increasing rural electrification.	5
Cambodia	UNEP	Multi-sectoral	GEF; AF	2013-present	Strengthening National Biodiversity and Forest Carbon Stock Conservation Through Landscape-based Collaborative Management of Cambodia's Protected Area System as Demonstrated in the Eastern Plains Landscape	Enhance Cambodia's protected area system management effectiveness and secure forest carbon through improving inter-sectoral collaboration, landscape connectivity and sustainable forest management.	6

Country	Agency	Target	Donor	Year	Project title	Approach / Activities	Source
Cambodia	FAO	Multi-sectoral	Korea Forest Service; FMM	2016-2020	The Forest and Landscape Restoration Mechanism	Assess micro-level field FLR options including developing maps of land use. Develop an FLR intervention implementation plan, budget, and monitoring indicator for results-based FLR interventions.	7
Cambodia	Ministry of Agriculture, Forestry and Fisheries	Govt.	UNDP; GEF	2017-2020	Collaborative Management for Watershed and Ecosystem	Restore and maintain forest cover and watershed stability functions while providing for sustainable livelihoods and ecosystem services in the Upper Prek Thnot Watershed.	8
Cambodia	WCS	Multi-sectoral	WCS	?	REDD activities	Implement REDD activities at two demonstration sites. Prepare Project Design Documents in Seima Forest and undertake a REDD feasibility study in the Northern Plains. The results from these demonstration sites will contribute to the development of a national REDD strategy.	9
China	ADB	Multi-sectoral	Clean Energy Financing Partnership Facility	2014-present	Promoting Carbon Capture and Storage in the People's Republic of China and Indonesia	Technical assistance.	10
China	FAO	Multi-sectoral	GEF: AF	2013-present	Sustainable Forest Management to Enhance the Resilience of Forests to Climate Change	Enable local communities in several Chinese provinces, including Guangxi and Hainan Island, to effectively employ incentive-based sustainable forest management practices in reforestation and forest restoration activities, enhancing carbon storage and sequestration as well as biodiversity conservation.	11
Lao PDR	WCS	Multi-sectoral	CEPF	2016-2021	Establishing and Piloting a Payment for Ecosystem Services Model in Lao PDR	Promote payment for ecosystem services as a mechanism for financing reforestation and forest protection in the catchment and offset areas of hydropower projects in Lao PDR through the demonstration of pilot activities in Nam Gnouang South protection forest.	12
Lao PDR	ADB	Govt.	CIF	2016-present	Protecting Forests for Sustainable Ecosystem Services	Address key drivers of deforestation and forest degradation, including forest clearance.	13
Lao PDR	IBRD	Govt.	CIF	2013-present	Scaling-up Participatory Sustainable Forest Management	Contribute to national REDD+ efforts to reduce carbon emissions from forests by expanding the national program of Participatory Sustainable Forest Management in Production Forest Areas and developing and piloting Landscape- Participatory Sustainable Forest Management in four provinces.	14

Country	Agency	Target	Donor	Year	Project title	Approach / Activities	Source
Lao PDR	Private Sector	Multi-sectoral	CIF	2013-present	Smallholder Forestry Program	Invest in development and direct management by farmers and the private sector forestry companies of forests outside state forest areas, including tree plantations and smallholder woodlots. The aim is that grassroots forest managers will be vigilant in protecting their forests in their areas from the various agents of deforestation and degradation and will rehabilitate degraded lands using land management systems that will provide them with benefits while enhancing carbon stocks.	15
Lao PDR	?	Multi-sectoral	FCPF; FAO; UN-REDD	2014-present	Forest Carbon Partnership Facility REDD+ Readiness Project	Build capacity of national and provincial authorities on forest land and resource governance and participatory forest management.	16
Lao PDR	Ministry of Agriculture and Forestry	Govt.	GEF; UNDP	2016-2022	Sustainable Forest and Land Management	Facilitate a transformative shift towards sustainable land and forest management in the forested landscape of Savannakhet province.	17
Lao PDR	GIZ	Govt.	GIZ	2019-2021	Protection and Sustainable Use of Forest Ecosystems and Biodiversity	Improve conditions for sustainable management of forest resources and biodiversity.	18
Lao PDR	GIZ	Govt.	GIZ; Green Climate Fund	2019-2024	Climate Protection through Avoided Deforestation	Implement the emission reduction program in Lao PDR through improved forest governance.	19
Lao PDR	World Bank	Multi-sectoral	IDA; Strategic Climate Fund; AF	2013-2021	Scaling-up Participatory Sustainable Forest Management	Execute REDD+ activities through participatory sustainable forest management in priority areas and to pilot forest landscape management in four provinces.	20
Lao PDR	JICA	Govt.	JICA	2014-2020	Sustainable Forest Management and REDD+ Support	Strengthen capacity for sustainable forest management through incorporation of REDD+ into the sector strategy and improved forest resource information.	21
Myanmar	IUCN	Multi-sectoral	GEF; AF	2016-present	The Restoration Initiative	Reverse forest degradation and deforestation and restore forested landscapes through local multi-stakeholder management.	22
Myanmar	FAO	Multi-sectoral	GEF; FAO	2013-2021	Sustainable Cropland and Forest Management in Priority Agro-ecosystems of Myanmar	Build the capacity of farming and forestry stakeholders to mitigate climate change and improve land condition by adopting climate smart agriculture and sustainable forest management policies and practices.	23
Myanmar	GIZ	Govt.	Germany; and others	2013-2020	REDD+ Himalaya: Capacity Building for Using REDD+ to Conserve Natural Biodiverse Carbon Sinks in the Himalayas	Prepare project partners in the Himalayas for results-based REDD+ approaches and support them in the fields of ecological restoration and sustainable use of biodiverse forest ecosystems.	24

Country	Agency	Target	Donor	Year	Project title	Approach / Activities	Source
Myanmar	FAO	Govt.	Multiple	2016-2020	Myanmar UN-REDD National Programme	Develop national capacity for the implementation of REDD+ under the UNFCCC enhanced and relevant (technical, legal, social) systems.	25
Myanmar	UNDP	Multi-sectoral	UN-REDD	2016-2020	UN-REDD Programme National Programme, Myanmar	Enhance national capacity for the implementation of REDD+ under the UNFCCC and develop relevant (technical, legal, social) systems.	26
Thailand	FAO	Multi-sectoral	FCPF	2018-2020	Technical Assistance for the Development of REDD+ MRV System and Forest Reference Level for Thailand (a Sub-component of the FCPF REDD+ Readiness Project)	Develop the Forest Reference Level so Thailand can set a benchmark against which it can measure the emissions reduced from implementing a national REDD+ program. Improve and update Thailand's National Forest Monitoring System as a practical tool for national forest policy and planning.	27
Thailand	Department of National Parks of the Royal Thai Government	Multi-sectoral	FCPF	2016-2020	Forest Carbon Partnership Facility REDD+ Readiness Project	Support the government in REDD+ readiness.	28
Thailand	UNDP	Govt.	GEF: AF	2013-present	Maximizing Carbon Sink Capacity and Conserving Biodiversity through Sustainable Conservation, Restoration, and Management of Peat-Swamp Ecosystems	Conserve and restore peatlands to increase their capacity to act a carbon sinks, as habitats for globally important species, and as sources of ecosystem services for improved livelihoods.	29
Thailand	JICA	Govt.	JICA	2017-2022	Strengthening Institutional Capacity for the Implementation of Bangkok Master Plan on Climate Change	Foster the transition of the Bangkok Metropolitan Administration toward a low-carbon and climate-change-resilient city.	30
Vietnam	Ministry of Agriculture and Rural Development	Govt.	ADB	2012-2020	Low Carbon Agricultural Support Project	Fund biogas plants to process agricultural and rural household waste into biogas and bio-slurry, a clean organic fertilizer. Help to reduce GHG emissions and promote environmentally safe, climate-friendly waste management practices.	31
Vietnam	World Bank	Multi-sectoral	AusAID; ADA; Carbon Fund; AF	2013-2021	Vietnam Renewable Energy Development Project	Scale-up the implementation of Carbon Finance in the renewable energy sector, focusing on renewable non-fossil energy sources such as wind, solar, geothermal, hydropower, and biomass.	32

Country	Agency	Target	Donor	Year	Project title	Approach / Activities	Source
Vietnam	FFI	Multi-sectoral	EU; AF	2012-present	Fauna & Flora International's Asia-Pacific Community Carbon Pools and REDD+ Programme	Contribute to reducing deforestation and forest degradation through improved forest governance and the development of finance/incentive mechanisms that provide benefits to forest-dependent local and indigenous people.	33
Vietnam	FAO	Multi-sectoral	FAO; Finland	2011-present	Sustainable Resource Management in Vietnam	Provide funding and expertise to allow Vietnam to build on its successes in sustainable forestry in recent years, and to expand their sustainable and profitable forest management, including via expanding legal land tenure.	34
Vietnam	FCPF	Multi-sectoral	FCPF	?	Forest Carbon Partnership Facility REDD+ Readiness Project	Build capacity of national and provincial authorities on forest land and resource governance and participatory forest management.	35
Vietnam	Institute of Strategy and Policy on Natural Resources and Environment; Biodiversity Conservation Agency	Multi-sectoral	GEF; UNDP	2015-2020	Conservation of Critical Wetland Protected Area	Establish new wetland protected areas and to create capacities for their effective management to mitigate existing and emerging threats from connected landscapes.	36
Vietnam	SNV Netherlands Development Organisation - Vietnam	Multi-sectoral	Germany	2018-2021	Operationalizing REDD+ through Public-Private Partnerships for Sustainable Landscapes in Lam Dong	Reduce deforestation and forest degradation by addressing the conversion of forest to agriculture in a priority conservation landscape in the Central Highlands.	37
Vietnam	Various	Multi-sectoral	Germany	2019-2023	NDC Action - Facilitating Implementation of Climate-resilient and Low-carbon Development Aligned with National and Global Goals	Support partner countries to translate their Nationally Determined Contributions into strategies and actions ready for financing and implementation. Depending on the individual country needs, support will focus on mitigation and/or adaptation.	38
Vietnam	SNV Netherlands Development Organisation - Vietnam	Govt.	Germany	2015-2020	Operationalizing National Safeguards for Results-Based Payments from REDD+	Establish a Safeguards Information System, to mitigate potential negative impacts of REDD+ projects and ensure that REDD+ will be implemented in a transparent and inclusive manner.	39

Country	Agency	Target	Donor	Year	Project title	Approach / Activities	Source
Vietnam	SNV Netherlands Development Organisation - Vietnam	Multi-sectoral	Germany	2018-2021	Coffee Agroforestry and Forest Enhancement for REDD+ (CAFÉ-REDD)	Reduce deforestation and forest degradation by addressing the conversion of forest to agriculture in a priority conservation landscape, the Lang Bian landscape (comprising Bi Doup-Nui Ba National Park and buffer zone).	40
Vietnam	GIZ	Govt.	GIZ	2018-2020	Conservation and Sustainable Use of Biodiversity and Ecosystem Services of Forests in Vietnam	National and provincial government institutions responsible for the management of protected areas implement mechanisms that provide local biodiversity and sustainable forest management services to local populations	41
Vietnam	GIZ	Multi-sectoral	GIZ	2012-present	GIZ: Provincial Government Support for the Preparation and Implementation of REDD+ Pilot Activities in Quang Binh	Support the provincial government in its efforts regarding REDD+ Readiness.	42
Vietnam	Vietnam REDD	Govt.	JICA	2015-2020	Sustainable Natural Resource Management Project	Enhance national capacity for sustainable natural resource management by focusing on SFM, REDD+, Biodiversity Conservation and the people who depend on these natural resources for their livelihoods.	43
Vietnam	Vietnam Administration of Forestry	Govt.	UNDP	2013-2020	Programme on Reducing Emissions from Deforestation and Forest Degradation - Phase 2	Implement a REDD program in Vietnam.	44
Vietnam	FAO	Govt.	?	?	Mitigation of Climate Change in Agriculture	Provide technical support to the Ministry of Agriculture and Rural Development to build preparedness for nationally appropriate mitigation actions in integrated food-energy systems; measuring GHG emissions from a pilot system of rice production and rice residue utilization for energy generation.	45
Regional	European Union	Multi-sectoral	EU	2016-2021	Strengthening Non-state Actors Voices for Improved Forest Governance in the Mekong Region	Strengthen the voices of non-state actors, including civil society, Indigenous Peoples and local community groups, to improve forest governance, sustainable forest management and the contribution of forests to development of Mekong countries	46
Regional	FAO and EU	Multi-sectoral	FAO; EU; Sweden; UKaid	2003-present	The FAO-EU Forest Law Enforcement, Governance and Trade (FLEGT) Programme	Reduce and eventually eliminate illegal logging, by improving governance and promote legal production and consumption of timber.	47

Country	Agency	Target	Donor	Year	Project title	Approach / Activities	Source
Regional	IUCN	Multi-sectoral	GEF; AF	2016-present	Sustainable Management of Peatland Ecosystems in Mekong Countries	Sustainably manage peatland ecosystems in targeted countries and to conserve biodiversity and reduce GHG emissions.	48
Regional	Regional Community Forestry Training Center for Asia and the Pacific (RECOFTC)	Multi-sectoral	Germany	2018-2022	Production Driven Forest Landscape Restoration under REDD+ through Private Sector-Community Partnerships as Asian Regional Learning Exchange	Develop measures to mitigate and adapt to climate change using REDD+, with a central component being cooperation between the private sector and village groups.	49
Regional	SNV Netherlands Development Organisation - Vietnam	Multi-sectoral	Germany	2015-2018	Advancing Understanding of Natural Forest Carbon Stock Enhancement as part of REDD+ (ENRICH I&II)	Advance understanding of forest carbon stock enhancement as part of any future REDD+ agreement. Forest carbon stock enhancement focuses on the creation or improvement of carbon pools and their capacity to store carbon.	50
Regional	WWF	Multi-sectoral	Germany; WWF	2018-2024	Carbon & Biodiversity (Carbi) Project	Improve the management of four protected areas and two connecting forest corridors, including by providing training and capacity building to provincial-level government officials in REDD concepts as well as assessing the carbon stocks of the forests.	51
Regional	?	Multi-sectoral	IIED; FAO; IUCN: Agricord	2018-2023	Forest and Farm Facility Phase II	Strengthen the organizations of forest and farm producers to deliver climate-resilient landscapes and improved livelihoods.	52

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Key: AF = Additional Funds, mainly from government's own budget or loans; ADB = Asian Development Bank; AusAID = Australian Agency for International Development; CEPF = Critical Ecosystem Partnership Fund; CIF = Climate Investment Fund; EU = European Union; FAO = Food and Agriculture Organization of the United Nations; FCPF = Forest Carbon Partnership Facility; FFI = Fauna &

Flora International; GEF = Global Environment Facility; GIZ = Deutsche Gesellschaft für Internationale Zusammenarbeit (German Development Agency); IBRD = International Bank for Reconstruction and Development; IDA = International Development Association; IIED = International Institute for Environment and Development; IUCN = International Union for Conservation of Nature; JICA = Japan International Cooperation Agency; NDC = Nationally Determined Contributions; RECOFTC = The Center for People and Forests; REDD+ = Reducing Emissions from Deforestation and Forest Degradation; SNV = Netherlands Development Organisation; UKaid = United Kingdom aid fund; UNDP = United Nations Development Programme; UNIDO = United Nations Industrial Development Organization; UN-REDD = United Nations Programme on Reducing Emissions from Deforestation and Forest Degradation; WCS = Wildlife Conservation Society; WWF = World Wide Fund for Nature.

Appendix 6. List of Climate Change Adaptation Projects in the Indo-Burma Hotspot

Country	Agency	Target	Donor	Year	Project title	Approach / Activities	Source
Cambodia	MAFF; National Committee for Sub-National Democratic Development Secretariat	Govt.	ADB; Finland; IFAD	2017-present	The Tonle Sap Poverty Reduction and Smallholder Development Project	Foster community-driven development through investments in productivity improvement, rural infrastructure, and capacity development.	1
Cambodia	MOWRAM	Govt.	ADB; High Level Technology Fund	2019-2025	Irrigated Agriculture Improvement Project	Assist the Government of Cambodia to modernize and improve the climate and disaster resilience; strengthening the institutional and financial capacity; improve farming practices; and establish a national water resources data management center.	2
Cambodia	MOWRAM	Govt.	ADB; OPEC Fund for Int. Devt.; Australia; Nordic Devt. Fund	2010-present	Water Resources Management Sector Development Program	Strengthen the capacity of the Government and empower beneficiary communities to sustainably manage water resources; increase agricultural production in a sustainable and participatory way; and enhance beneficiary livelihoods.	3
Cambodia	FAO	Govt.	CBIT; GEF; AF	2017-present	Strengthening Capacity in the Agriculture and Land-use Sectors for Enhanced Transparency in Implementation and Monitoring of Cambodia's Nationally Determined Contribution	Establish regular and systematic data collection, documentation and archiving processes for GHG inventories in the agriculture and land-use sectors.	4
Cambodia	CI	Multi-sectoral	CI; AF	2016-present	Central Cardamom Mountains National Park Trust Fund	Help the Cambodian government to develop the legal frameworks and the on-ground strategies needed for effective, long-term conservation. This includes reducing deforestation and conducting research into biodiversity, climate change mitigation properties and fresh water.	5
Cambodia	ADB	Govt.	CIF; AF	2013-present	Climate Proofing of Agricultural Infrastructure and Business-focused Adaptation	Part of the 'Climate Resilience Rice Commercialization Sector Development Program for Cambodia.	6
Cambodia	ADB	Govt.	CIF; AF	2011-present	Climate Proofing of Roads	Part of the Provincial Roads Improvement Project, in Prey Veng, Svay Rieng, Kampoong Chhnang and Kampong Speu Provinces.	7

Country	Agency	Target	Donor	Year	Project title	Approach / Activities	Source
Cambodia	ADB	Govt.	CIF; AF	2015-present	Climate Resilient Rural Infrastructure in Kampong Cham Province	Part of Rural Roads Improvement Project.	8
Cambodia	ADB	Govt.	CIF; AF	2012-present	Enhancement of Flood and Drought Management in Pursat Province	Support the Government of Cambodia to undertake structural and non-structural measures to prepare for and manage disaster risks linked to floods and droughts. Part of the Greater Mekong Subregion Flood and Drought Risk Management and Mitigation Project.	9
Cambodia	ADB	Govt.	CIF; AF	2014-present	Flood-resilient Infrastructure Development in Pursat and Kampong Chhnang Towns	Part of the Integrated Urban Environmental Management in the Tonle Sap Basin Project.	10
Cambodia	ADB	Govt.	CIF; AF	2015-present	Promoting Climate-Resilient Agriculture in Koh Kong and Mondulkiri Provinces	Part of the Greater Mekong Subregion Biodiversity Conservation Corridors Project.	11
Cambodia	National Council for Sustainable Development	Govt.	EU; SIDA; UNDP	2019-2024	Climate Change Alliance - Phase 3	Contribute to a Cambodia development path that is increasingly climate-resilient and low carbon, with a focus on coordinating institutions, and selected strategic sector ministries.	12
Cambodia	ADB	Govt.	GAFSP	?	Climate Resilience Rice Commercialization Sector Development Program (Rice-SDP)	Support the government of Cambodia's policy on the promotion of paddy production and rice export to improve household and national food security and to expand rice export, by enhancing rice value chain support services, and by addressing the risks associated with climate change through mitigation and adaptation.	13
Cambodia	MAFF	Govt.	Green Climate Fund; ADB	2018-2025	Cambodia: Climate-Friendly Agribusiness Value Chains Sector Project	Increase climate resilience for critical rural infrastructure, strengthen technical and institutional capacity for climate-smart agriculture, and create an enabling policy environment for climate-friendly agribusiness.	14
Cambodia	ADB	Govt.	JFPR	2020-2022	Building Disaster-Resilient Infrastructure through Enhanced Knowledge	Technical assistance	15
Cambodia	UNDP	Govt.	LDCF; AF	2014-present	Reducing the Vulnerability of Cambodian Rural Livelihoods through Enhanced Sub-national Climate Change Planning and Execution of Priority Actions	Sub-national administration systems affecting investments in rural livelihoods are improved through climate sensitive planning, budgeting and execution.	16

Country	Agency	Target	Donor	Year	Project title	Approach / Activities	Source
Cambodia	UNDP	Govt.	LDCF; AF	2014-2020	Strengthening Climate Information and Early Warning Systems in Cambodia to Support Climate Resilient Development and Adaptation to Climate Change	Strengthen climate observing infrastructure and increase capacity to utilize climate and environmental information for responding to climate hazards and planning adaptation to climate change.	17
Cambodia	FAO	Multi-sectoral	LDCF; GEF, AF	2014-2019	Strengthening the Adaptive Capacity and Resilience of Rural Communities Using Micro Watershed Approaches to Climate Change and Variability to Attain Sustainable Food security	Build adaptive capacity of rural communities and reduce vulnerability to climate change and variability through integrated micro watershed management and climate resilient agriculture practices to ensure food security in Cambodia.	18
Cambodia	UNDP; National Council for Sustainable Development	Multi-sectoral	SIDA; UNDP; AF	2019-2020	Towards Environmental Sustainability in Cambodia	CBNRM institutions strengthened and financial resources mobilized for sustainable NRM; Waste reduced, recycled and reused through application of circular economy models; Improved access to clean, affordable, and sustainable energy for the rural poor.	19
Cambodia	IFAD	Govt.	Special Climate Change Fund; AF	2015-present	Building Adaptive Capacity through the Scaling-up of Renewable Energy Technologies in Rural Cambodia	Achieve a large-scale adoption of renewable energy technologies in the agricultural sector of Cambodia.	20
Cambodia	MOWRAM	Govt.	Strategic Climate Fund; ADB	2012-2021	Cambodia: Greater Mekong Subregion Flood and Drought Risk Management and Mitigation Project	Strengthen disaster risk management and raise the ability of vulnerable communities to cope with floods and droughts. The project will upgrade irrigation systems and other infrastructure, enhance the national flood forecasting center, and provide training and support to farmers for community-based disaster risk management and climate change adaptation.	21
Cambodia	Ministry of Public Works and Transport	Govt.	Strategic Climate Fund; ADB	2015-2023	Integrated Urban Environmental Management in the Tonle Sap Basin	Increase economic growth and environmental protection in towns around the Tonle Sap Lake. The project is improving urban environments, promoting climate change resilience and helping to better manage services in towns around the Tonle Sap.	22

Country	Agency	Target	Donor	Year	Project title	Approach / Activities	Source
Cambodia	Ministry of Environment	Govt.	Strategic Climate Fund; Nordic Development Fund	2012-2021	Mainstreaming Climate Resilience into Development Planning	Technical assistance.	23
Cambodia	FFI	Multi-sectoral	United Kingdom	2018-2021	Enabling Ecosystems to Deliver Sustainable Development Goals at Lake Indawgyi	Protect forest and wetland biodiversity including habitat for more than 20,000 birds and numerous threatened species in the globally important Indawgyi Lake Biosphere Reserve. Adopt an ecosystem approach at watershed scale, building capacity for collaborative conservation management and improving natural resource management and local livelihoods.	24
Cambodia	Sansom Mlup Prey	Multi-sectoral	United Kingdom	2017-2021	Future-proofing Cambodian Wildlife-friendly Farming: Securing Conservation and Livelihoods	Work with wildlife-friendly Ibis Rice farmers to switch to a drought-resilient organic, rice strain and adopt new soil conservation techniques. Improve food security and income of local households, reduce habitat loss and protect threatened species.	25
Cambodia	WWF Cambodia	Multi-sectoral	United Kingdom	2017-2020	Safeguarding a Critical Biodiversity Conservation Corridor in Cambodia's Eastern Plains	Ensure that the biodiversity corridor connecting the core zones of Phnom Prich Wildlife Sanctuary is maintained, by improving the livelihoods of vulnerable forest communities through sustainable and forest-friendly agricultural practices and by achieving legal protection of biodiversity corridors at national and provincial levels.	26
Cambodia	IUCN; UNDP	Multi-sectoral	NORAD; SIDA; Danida	2012-present	Mangroves for the Future – Cambodia	Promote investment in coastal ecosystems for sustainable development. Work towards achieving the vision of a healthier, more prosperous and secure future for all coastal communities.	27
China	Ministry of Housing and Urban-Rural Development	Govt.	ADB	2017-2020	Mainstreaming Urban Climate Change Adaptation in the People's Republic of China	Technical assistance.	28
China	UNDP	Multi-sectoral	GEF	2018-2020	Project Preparation Grant on Invasive Alien Species	Strengthen intersectoral coordination mechanisms, approaches and technical capacity for more effective prevention, control and management of invasive alien species threats to agrobiodiversity in China, Hainan Island.	29
China	GIZ	Govt.	GIZ	2017-2020	Sino-German Climate Partnership Phase III	Develop a comprehensive climate governance system and slime-smart development strategies.	30

Country	Agency	Target	Donor	Year	Project title	Approach / Activities	Source
Lao PDR	ADB	Govt.	ADB	2018-2025	Lao PDR: Climate-Friendly Agribusiness Value Chains Sector Project	Support the implementation of the Lao government's Agriculture Development Strategy to 2025 by boosting the competitiveness of rice and vegetable value chains. Improve the climate resilience of agricultural infrastructure, and enhance crop productivity, diversification, and commercialization.	31
Lao PDR	MAF	Govt.	ADB	2013-2022	Lao PDR: Greater Mekong Subregion East-West Economic Corridor Agriculture Infrastructure Sector Project	Improve irrigation in Savannakhet and Salavan provinces. Revive and update irrigation schemes, construct rural roads and improve access to markets, increase the capacity of farmers to manage and use agriculture infrastructure efficiently, and create jobs.	32
Lao PDR	MAF	Govt.	ADB; EU	2019-2027	Sustainable Rural Infrastructure and Watershed Management Sector Project 2	Address issues of Productive Rural Infrastructure schemes and watershed management in mountainous provinces of Northern Lao PDR by using integrated land use planning approach that integrates efficient, sustainable and climate resilient rural infrastructure, and feasible watershed protection measures.	33
Lao PDR	World Bank	Govt.	GEF; AF	2012-present	GMS-FBP: Strengthening Protection and Management Effectiveness for Wildlife and Protected Areas	Strengthen the management systems for national protected areas conservation and for enforcement of wildlife laws.	34
Lao PDR	World Bank	Govt.	GEF; IDA	2014-present	Second Lao Environment and Social Project (formerly the Protected Area and Wildlife Project)	Strengthen the management systems for national protected areas conservation and for enforcement of wildlife laws.	35
Lao PDR	GIZ	Govt.	GIZ	2019-2021	Protection and Sustainable Use of Forest Ecosystems and Biodiversity	Conditions for sustainable management of forest resources and biodiversity are improved.	36
Lao PDR	World Bank	Govt.	IDA	2012-2020	TA for Capacity Development in Hydropower and Mining Sector	Increase human capacity and improve the performance of Government oversight institutions for the hydropower and mining sectors.	37
Lao PDR	World Bank	Govt.	IDA; AF	2015-present	Second Lao Environment and Social Project (Additional Financing to the Protected Area and Wildlife Project)	Strengthen selected environmental protection management systems, specifically for protected areas conservation, enforcement of wildlife laws and environmental assessment management.	38

Country	Agency	Target	Donor	Year	Project title	Approach / Activities	Source
Lao PDR	MAF	Govt.	JFPR; ADB; Climate Change Fund; ATF - Netherlands	2017-2020	Sustainable Rural Infrastructure and Watershed Management Sector Project 1	Technical assistance.	39
Lao PDR	UNDP	Govt.	LDCF: AF	2012-present	Effective Governance for Small Scale Rural Infrastructure and Disaster Preparedness in a Changing Climate	Improve local administrative systems affecting the provision and maintenance of small-scale rural infrastructure through participatory decision making that reflects the genuine needs of communities and natural systems vulnerable to climate risk.	40
Lao PDR	FAO; IUCN	Multi-sectoral	LDCF; GEF; AF	2016-2021	Climate Adaptation in Wetlands Areas (CAWA)	Reduce climate change vulnerability of communities and the fragile wetland eco-systems upon which they depend in two Ramsar-designated wetlands.	41
Lao PDR	FAO	Govt.	LDCF; GEF; AF	2016-2020	Strengthening Agro-climatic Monitoring and Information Systems to Improve Adaptation to climate Change and Food Security in Lao PDR	Enhance monitoring, analysis, communications and use of agro-meteorological data and information for decision making in relation to agriculture and food security at national and provincial levels.	42
Lao PDR	WCS	Multi-sectoral	United Kingdom	2017-2021	Conservation and Poverty Alleviation through Scalable Agro-biodiversity Practice in Laos	Deliver sustainable climate-smart forest resource use through promoting scalable agro-biodiversity practices that are successfully adopted by local communities bordering Lao PDR's second largest and most biodiverse protected area, Nam Et Phou Louey National Protected Area: leading to greater biodiversity protection, reduced deforestation and improved welfare of vulnerable communities.	43
Myanmar	Department of Rural Development; MOALI	Govt.	ADB; Climate Change Fund	2017-2020	Resilient Community Development Project - 1	Technical assistance.	44
Myanmar	MOALI	Govt.	ADB; GAFSP	2018-2026	Myanmar: Climate-Friendly Agribusiness Value Chains Sector Project	Increase climate resilience for critical rural infrastructure, promote quality and safety testing capacity, strengthen technical and institutional capacity for climate-smart agriculture, and create an enabling policy environment for climate-friendly agribusiness.	45
Myanmar	MOALI	Govt.	ADB; GAFSP	2018-2026	Myanmar - Impact Evaluation of the Climate-Friendly Agribusiness Value Chains Sector Project	Technical assistance.	46

Country	Agency	Target	Donor	Year	Project title	Approach / Activities	Source
Myanmar	MOALI	Govt.	Asia Investment Facility; ADB; AFD; GEF	2016-2024	Irrigated Agriculture Inclusive Development Project	Strengthen agriculture production and value chain development by improving and modernizing irrigation systems in three regions of the country's Central Dry Zone.	47
Myanmar	Department of Rural Development; MOALI	Govt.	Climate Change Fund; ADB	2017-2020	Resilient Communities Development Project	Technical assistance.	48
Myanmar	Multiple	Govt.	DFID	2011-2023	Forest Governance, Markets and Climate	Support governance and market reforms aimed at reducing the illegal use of forest resources, benefiting poor forest-dependent people and promoting sustainable growth in developing countries.	49
Myanmar	Oxford Policy Management; UNOPS	Multi-sectoral	DFID	2010-2020	Livelihoods and Food Security Trust Fund for Burma	Improve the incomes and nutritional status of over 1.63million poor people in Myanmar by promoting resilient livelihoods and food security through agricultural commercialization and climate smart agriculture, financial inclusion, business and skills development, and targeted nutrition support.	50
Myanmar	FAO	Multi-sectoral	FAO	2019-2021	Developing System(s) and Capacities for Ecosystem-based Climate Investment, Decision making and Monitoring	Develop a decision-support system with information, tools, capacities and institutional coordination for ecosystem-based climate investment and monitoring in the Agriculture, Forest and Other Land Use sector.	51
Myanmar	FAO	Govt.	FAO	2019-2020	Preparation of a Project Proposal to Support the Implementation of National Land Use Policy Aimed to Access EU Funds	Develop a project proposal to support the implementation of the National Land Use Policy with respect to sustainable land use Planning and Management for submission to the EU.	52
Myanmar	FAO	Multi-sectoral	FAO	2019-2021	Scaling-up Agroforestry in the ASEAN Region for Food Security and Environmental Benefits	Provide technical support on agroforestry and cross-sectoral approaches, especially in bringing agriculture and forestry together as part on integrated landscape management.	53
Myanmar	FAO	Multi-sectoral	FAO	2019-2020	Support to the Formulation of Full GCF Proposal	Promote climate-resilient and sustainable agriculture, forestry and land use across the Chindwin River Basin.	54
Myanmar	WCS	Multi-sectoral	GEF	2015-2020	Strengthening Sustainability of Protected Area Management in Myanmar	Reduced vulnerability to natural disasters and climate change; improved environmental and natural resource management; promotion of energy conservation through access to affordable and renewable energy, particularly in off-grid local communities.	55

Country	Agency	Target	Donor	Year	Project title	Approach / Activities	Source
Myanmar	UNEP	Govt.	GEF; AF	2012-present	Umbrella Program for National Communication to the UNFCCC	Provide financial and technical support for the preparation of National Communications to the UNFCCC.	56
Myanmar	FAO	Multi-sectoral	GEF; FAO	2013-2021	Sustainable Cropland and Forest Management in Priority Agro-ecosystems of Myanmar	Build the capacity of farming and forestry stakeholders to mitigate climate change and improve land condition by adopting climate smart agriculture and sustainable forest management policies and practices.	57
Myanmar	UNDP	Multi-sectoral	GEF; UNDP	2017-2023	Integrated Protected Area Land and Seascape Management in Tanintharyi	Conservation and sustainable use of the marine, coastal and terrestrial resources of Tanintharyi Region.	58
Myanmar	World Bank	Multi-sectoral	IDA	2015-2022	Agricultural Development Support Project	Increase crop yields and cropping intensity in selected existing irrigation sites.	59
Myanmar	FAO	Multi-sectoral	LDCF; GEF; AF	2017-2021	FishAdapt	Strengthening the adaptive capacity and resilience of fisheries and aquaculture dependent livelihoods.	60
Myanmar	UNDP	Govt.	UNDP; Norway; EU; Japan; Austria	2018-2022	Governance for Resilience and Sustainability Project	Supports more inclusive, resilient and sustainable growth by mainstreaming environment, climate change and DDR I target sectors; promoting green investment; and strengthening national and sub-national institutional capacities and implementation.	61
Thailand	UNDP	Multi-sectoral	GEF; AF	2012-present	GEF SGP Fifth Operational Phase - Implementing the Program Using STAR Resources I	Secure global environmental benefits through community-based initiatives and actions.	62
Thailand	UNDP	Govt.	GEF; AF	2012-present	GMS-FBP: Strengthening Capacity and Incentives for Wildlife Conservation in the Western Forest Complex	Improve management effectiveness and sustainable financing for HKK-TY WHS and incentivize local community stewardship.	63
Thailand	UNDP	Multi-sectoral	GEF; AF	2018-present	Sixth Operational Phase of the GEF Small Grants Programme in Thailand	Enable community organizations in four diverse regions of Thailand to take collective action for adaptive landscape and seascape management for socio-ecological resilience.	64
Thailand	UNDP	Govt.	GEF; AF	2019-present	Thailand's Fourth National Communication and Third BUR to the UNFCCC	Enabling activity.	65
Thailand	JICA	Govt.	JICA	2017-2022	Strengthening Institutional Capacity for the Implementation of Bangkok Master Plan on Climate Change	Foster transition of Bangkok Metropolitan Administration towards a low-carbon and climate-change-resilient city.	66

Country	Agency	Target	Donor	Year	Project title	Approach / Activities	Source
Thailand	Mangroves for the Future, Department of Marine and Coastal Resources; Mai Khao Marine Turtle Foundation	Multi-sectoral	Marriott Hotels & Resorts Thailand	2013-present	Marriott Partnership	Promote mangrove restoration and support coastal communities through the use of sustainable seafood sources and local procurement practices in Bang Krachao and areas in the south.	67
Vietnam	ADB	Govt.	ADB	2018-2021	Strengthening Knowledge and Actions for Air Quality Improvement	Technical assistance.	68
Vietnam	MARD	Govt.	ADB	2014-2020	Viet Nam - Integrated Rural Development Sector Project in the Central Provinces - Additional Financing	Improved livelihoods, incomes, and standards of living for the region's rural population through increased agricultural productivity, wider employment opportunities, improved health and education levels, and reduced exposure to natural disasters.	69
Vietnam	AFD	Govt.	AFD	2016-2020	Controlling Rising Water Levels in the Provinces of Ninh Binh, Ha Tinh and Can Tho	Secure the economy, and in particular the agricultural economy; ensure the security of people and goods; and improve health conditions, through construction of a sluice dam; rehabilitation of the irrigation-drainage system; and surfacing the bank of the Can Tho River.	70
Vietnam	AFD	Govt.	AFD	2015-2020	Supporting Rural Development in the Provinces of Binh Dinh and Hung Yen	Increase agricultural production in the two provinces of Binh Dinh and Hung Yen by financing the construction of water networks and building the water resources management capacity of local authorities.	71
Vietnam	AFD	Govt.	AFD; ADB; AF	2011-2018	Sharing and Better Distributing the Capricious Waters of the Red River	Address the devastating dangers of climate change in the Mekong Delta regions by helping the region better protect densely populated territories from climate excesses, particularly floods, increase crop productivity by modernizing irrigation systems and creating new infrastructure, and bring about a spirit of cooperation and solidarity on water use in the basin.	72
Vietnam	MARD	Multi-sectoral	Climate Change Fund; ADB; ATF - Netherlands	2018-2026	Viet Nam: Water Efficiency Improvement in Drought-Affected Provinces Project	Implement eight irrigation-modernization sub-projects.	73

Country	Agency	Target	Donor	Year	Project title	Approach / Activities	Source
Vietnam	Provincial People's Committees; IUCN, Coca Cola	Multi-sectoral	Coca Cola Foundation	2017-2020	Monkey Cheeks Project - Piloting Flood-Based Livelihoods in Support of a Water Retention Strategy in the Mekong Delta, Vietnam	Adapt to the changes occurring due to climate change, like extreme floods and drought events, by restoring the flood retention function of the delta through new approaches to land and water management, including by investing in profitable but low risk flood-based farming systems that will conserve or restore flood-retention capacity.	74
Vietnam	AFD	Govt.	EU; AFD	2019-2020	Climate Variability in Indonesia and Vietnam	Provide policy makers with a substantial evidence base to target social equity and equality interventions effectively. Strategically inform the enforcement of social protection policies that are able to capture the climate-inequality nexus while maintaining a high degree of climate and poverty sensitivity and responsiveness.	75
Vietnam	World Bank	Govt.	GEF	2018-2022	Mekong Delta Integrated Climate Resilience and Sustainable Livelihoods Project for Vietnam	Enhance tools for climate-smart planning and improve climate resilience of land and water management practices in selected provinces of the Mekong Delta in Vietnam.	76
Vietnam	ADB	Govt.	GEF; AF	2016-present	Integrated Approaches for Sustainable Cities in Vietnam	Climate change mitigation, resilience and environmental protection mainstreamed into integrated urban planning in secondary cities in Vietnam.	77
Vietnam	ADB	Govt.	GEF; AF	2013-present	Integrating Biodiversity Conservation, Climate Resilience and Sustainable Forest Management in Trung Truong Son Landscapes	Strengthen the management and ecological integrity of the protected area network in the Trung Truong Son region of Vietnam.	78
Vietnam	UNEP	Govt.	GEF; AF	2018-present	Umbrella Programme for Preparation of National Communications and Biennial Update Reports to the UNFCCC	Support 13 developing countries prepare and submit National Communications and Biennial Update Reports that comply with the UNFCCC reporting requirements while responding to national development goals.	79
Vietnam	Provincial People's Committees	Govt.	GEF; Urban Financing Partnership Facility; ADB	2017-present	Secondary Green Cities Development Project	Technical assistance.	80

Country	Agency	Target	Donor	Year	Project title	Approach / Activities	Source
Vietnam	UNIQUE forestry and land use	Multi-sectoral	Germany	2018-2022	Ecosystem-based Adaptation on the Northern Central Coast of Vietnam: Restoration and Co-management of Degraded Dunes and Mangroves	Together with selected local communities, restore the dune and mangrove forests that have been destroyed due to climate change and degradation. Demonstrate the feasibility of ecosystem-based measures, which not only protect the population but also bolster livelihoods through sustainable business models that use the restored mangroves.	81
Vietnam	SNV; IUCN	Multi-sectoral	Germany	2016-2020	MAM-II: Scaling up Ecosystem-Based Adaptation in the Mekong Delta	Support mangrove restoration and protection in the Mekong Delta in Vietnam, while strengthening the livelihoods and resilience of smallholder shrimp farmers and their families.	82
Vietnam	Various	Govt.	Germany	2019-2023	NDC Action: Facilitating Implementation of Climate-resilient and Low-carbon Development Aligned with National and Global Goals	Support partner countries to translate their NDCs into strategies and actions ready for financing and implementation. Depending on the individual country needs, support will focus on mitigation and/or adaptation.	83
Vietnam	WWF Germany	Multi-sectoral	Germany	2019-2023	Where Sand is Essential: towards Sustainable Sand Mining in the Lower Mekong	Contribute to maintaining key ecological functions and reducing socio-economic vulnerability to climate change in the Mekong Delta. Establish a basin-wide sand-and-gravel-budget to create a uniformly agreed understanding of the scope and impact of unsustainable extraction rates.	84
Vietnam	GIZ	Govt.	Germany	2019-2022	Policy Advice for Climate Resilient Economic Development	Pilot methods and instruments for modelling the economic impacts of climate change to the benefit of policy design for governments and development actors.	85
Vietnam	GIZ	Multi-sectoral	GIZ	2019-2021	Mekong Delta Climate Resilience Programme	Ensure that the management of natural resources in the Mekong Delta takes climate change into account (climate-resilient management) and greater resilience to the impacts of climate change improves sustainable development in the region.	86
Vietnam	GIZ	Govt.	GIZ	2018-2022	Support to Vietnam for the Implementation of the Paris Agreement	Create the human resources and institutional framework conditions necessary for the implementation of the NDC and the Paris Agreement.	87
Vietnam	Vietnam Disaster Management Authority	Govt.	Green Climate Fund; UNDP	2017-2022	GCF-Resilient Development in Coastal Zones	Strengthening capacity and institution for resilient development in coastal zones, including via mangrove regeneration.	88
Vietnam	World Bank	Multi-sectoral	Infodev; AF	2015-2020	Vietnam Climate Innovation Center (CIC) RETF	Increase green growth business innovations by supporting entrepreneurs and small-and-middle sized enterprises involved in technological solutions.	89

Country	Agency	Target	Donor	Year	Project title	Approach / Activities	Source
Vietnam	JICA	Govt.	JICA	2015-2020	Project for Sustainable Natural Resource Management	National capacity for sustainable natural resource management is enhanced.	90
Vietnam	UNDP	Multi-sectoral	Norway	2019-2020	International Conference on Sustainable Ocean Economy and Climate Change Adaptation	Organize a conference on sustainable ocean economy and climate change adaptation with the aim to accelerate climate actions.	91
Vietnam	FAO	Multi-sectoral	Not provided	2019-2021	Accessing Adaptation Fund and Assessing Plastic Pollution in Agriculture Sector	Improved resilience of food security, agriculture and ecosystems towards negative impacts from climate change on agriculture, and reduction of environmental pollution from plastic use.	92
Vietnam	FAO	Multi-sectoral	Not provided	2019-2021	Improving Livelihoods and Climate Resilience through Climate-smart Agriculture and Agroforestry Best practices in Northern Mountainous Region of Vietnam	Enhance capacities of government and upland communities to scale up Climate Smart Agriculture/ Agroforestry best practices in the northern mountainous region of Vietnam.	93
Vietnam	ADB	Govt.	Special Climate Change Fund; AF	2015-present	Promoting Climate Resilience in Vietnamese Cities Management	Mainstream climate resilience and environmental protection into integrated urban planning in secondary cities in Vietnam.	94
Vietnam	MoNRE; MARD	Govt.	UNDP; Germany	2014-2020	Capacity Building for Implementation National Climate Change Strategy Project	Support the building of awareness, institutional, scientific and technical capacity for the effective implementation of the National Strategy on Climate Change at some ministries and localities.	95
Vietnam	ADB	Govt.	Urban Financing Partnership Facility; ADB	2015-2023	Urban Environment and Climate Change Adaptation Project	Improve the environments of three coastal cities (Dong Hoi, Hoi An, and Sam Son) which are vulnerable to flooding and typhoons. Upgrade and build new sewerage, water supply facilities and flood protection systems, to improve the cities' physical environments and strengthen their resilience to climate change.	96
Vietnam	SNV	Multi-sectoral	USAID	2016-2020	USAID Green Annamites Project	Assist Vietnam's transition to climate-smart, low emission, and resilient development that protects people, landscapes, and biodiversity in Vietnam's priority forested provinces.	97

Country	Agency	Target	Donor	Year	Project title	Approach / Activities	Source
Vietnam	Winrock International	Govt.	USAID	2012-2021	Vietnam Forests and Deltas Program	Support Vietnam's transition to more resilient and sustainable development. The first phase helped put national policies and strategies into practice to respond to climate change. The second phase focuses on supporting the government ensure that the payment for forest environmental services in an effective tool in accomplishing the country's environmental and socio-economic goals.	98
Vietnam	World Bank	Govt.	World Bank	2018-2023	Dynamic City Integrated Development Project	Improve integrated urban planning and management, with a climate change adaptation component.	99
Regional	ADB	Govt.	ADB	2019-2025	Greater Mekong Subregion Climate Change and Environmental Sustainability Program	Technical assistance aligned with the following impact: environment sustainability and climate-compatibility of economic growth and propensity in the Greater Mekong Subregion improved. The technical assistance will have the following outcome: enhanced climate resilience, green growth, and environmental quality in the Greater Mekong Subregion.	100
Regional	ADB	Govt.	ADB	2018-2021	Strengthening Integrated Flood Risk Management	Technical assistance.	101
Regional	ADB	Govt.	ADB	2017-2020	Support for Implementation of the Asia-Pacific Finance Fund	Technical assistance.	102
Regional	MAF-Irrigation Department	Govt.	ADB; Australia; Integrated Disaster Risk Manage-ment Fund	2012-2020	Greater Mekong Subregion Flood and Drought Risk Management and Mitigation Project	Reduce economic losses resulting from floods and droughts. Pair upgrades in water management infrastructure with community-based disaster risk management and enhanced regional forecasting to improve disaster preparedness.	103
Regional	ADB	Govt.	ADB; China	2019-2025	Greater Mekong Subregion Sustainable Agriculture and Food Security Program	Technical assistance to enhance investments and capacities for climate friendly, safe and sustainable agri-food value chains increased, via climate-smart agriculture, pilot innovative technologies and mobilize financing for agribusinesses.	104
Regional	ADB	Govt.	ADB; Strategic Climate Fund	2010-2020	Greater Mekong Subregion Biodiversity Conservation Corridors Project	Enhance transboundary cooperation for preventing and mitigating fragmentation of biodiversity rich forest landscapes of the Cardamom Mountains and Eastern Plains Dry Forest in Cambodia, Triborder Forest areas located in southern Lao PDR, and the Central Annamites in Vietnam.	105

Country	Agency	Target	Donor	Year	Project title	Approach / Activities	Source
Regional	AFD; WANASEA; IRD	Multi-sectoral	AFD; EU	2019-2020	Inequalities and Environmental Changes in the Lower Mekong River Basin	Undertake a systematic analysis of the inequality-environmental change nexus in the Lower Mekong River Basin Region. Build scientific base for policy action as well as identifying uninvestigated research questions.	106
Regional	ADB	Govt.	Climate Change Fund; ADB; GEF; Republic of Korea	2017-2021	Protecting and Investing in Natural Capital in Asia and the Pacific	Technical assistance.	107
Regional	MRC	Multi-sectoral	EU	2012-2017	Global Climate Change Alliance in the Lower Mekong Lower Basin	The Climate Change Adaptation Initiative focuses on developing climate change impact assessment and adaptation planning as well as on the implementation of these in the Lower Mekong Basin.	108
Regional	FAO	Govt.	FAO	2020-2020	Building Capacities by the Application of Tool for Agroecology Performance Evaluation for Sustainable Development of Agriculture Sector	Build the capacities of national technical departments and piloting the application of Tool for Agroecology Performance Evaluation. Help the governments of Laos PDR and Vietnam make evidence-based decisions in the planning and management of the agricultural sectors and natural resources to support the transition to sustainable agricultural sector production systems.	109
Regional	FAO; UNDP	Govt.	FAO	?	Integrating Agriculture in National Adaptation Plans	Mainstream adaptation in the agricultural sector's planning processes and contribute to the achievement of the countries' Nationally Determined Contributions.	110
Regional	UNDP	Int. Agency	GEF; AF	2013-present	GEF SGP Fifth Operational Phase - Implementing the Program Using STAR Resources II	Global environmental benefits secured through community-based initiatives and actions.	111
Regional	UNDP	Multi-sectoral	GEF; AF	2014-present	GEF SGP Fifth Operational Phase - Implementing the Program Using STAR Resources III	Global environmental benefits secured through community-based initiatives and actions.	112
Regional	ADB	Multi-sectoral	GEF; AF	2104-present	Greater Mekong Subregion Forest and Biodiversity Program	Strengthen transboundary cooperation for the sustainable management of a network of priority conservation landscapes in the Greater Mekong Subregion.	113
Regional	UNEP	Govt.	GEF; AF	2015-present	Umbrella Programme for Biennial Update Report to the UNFCCC	Support 39 Least Developed Countries and Small Islands Developing States prepare and submit good quality initial biennial update reports to the UNFCCC that comply with the convention's reporting obligation.	114

Country	Agency	Target	Donor	Year	Project title	Approach / Activities	Source
Regional	UNDP	Int. Agency	GEF; AF	2018-present	GEF SGP Sixth Operational Phase - Using Star Resources, Tranche 2	Support the creation of global environmental benefits and the safeguarding of the global environment through community and local solutions that complement and add value to national and global level action.	115
Regional	World Meteorological Organization	Govt.	Germany	2018-2022	Applying Seasonal Climate Forecasting and Innovative Insurance Solutions to Climate Risk Management in the Agriculture Sector in Southeast Asia	Develop resilient climate risk management systems, best practices, and insurance products that will shield smallholder farmers and businesses across the value chain from physical and financial disaster associated with climate change.	116
Regional	IUCN; SANBI; relevant institutions in the partner countries	Multi-sectoral	Germany	2015-2022	Mainstreaming Ecosystem-based Adaptation: Strengthening Ecosystem-based Adaptation in Decision-making Processes	Ecosystem-based adaptation to climate change and the integration of climate risks are becoming more and more central component of planning and implementation processes at international, national and local level. The global project offers support for exchange of learning experiences.	117
Regional	National Ramsar Administrative Authorities	Multi-sectoral	Germany	2017-2020	Mekong WET: Building Resilience of Wetlands in the Lower Mekong Regions through a Ramsar Regional Initiative	Establish an effective and replicable framework for delivery of ecosystem-based adaptation and mitigation benefits from existing and planned Ramsar sites (or wetlands of international importance) in the region, including through transboundary collaboration.	118
Regional	RECOFTC	Multi-sectoral	Germany	2018-2022	Production-driven Forest Landscape Restoration under REDD+ through Private Sector - Community Partnerships as Asian Regional Learning Exchange	Develop measures to mitigate and adapt to climate change using REDD+, with a central component being cooperation between the private sector and village groups.	119
Regional	Agricord; IIED; IUCN	Multi-sectoral	FAO	2018-2023	Forest and Farm Facility Phase II	Strengthen the organizations of forest and farm producers to deliver climate-resilient landscapes and improved livelihoods.	120
Regional	ADB	Govt.	Integrated Disaster Risk Manage-ment Fund	2019-2020	Integrating Disaster Risk Management Fund: Sharing Lessons, Achievements, and Best Practices	Technical assistance.	121
Regional	UNEP	Multi-sectoral	LDCF; AF	2015-present	Building Climate Resilience of Urban Systems through Ecosystem-Based Adaptation in the Asia-Pacific Region	Reduce the vulnerability of poor urban communities in Asia-Pacific LDCs to climate change impacts using ecosystem-based adaptation.	122

Country	Agency	Target	Donor	Year	Project title	Approach / Activities	Source
Regional	UNDP	Govt.	LDCF; AF	2016-present	Building Resilience of Health Systems in Asian LDCs to Climate Change	Increase the adaptive capacity of national health systems and institutions, and sub-national level actors, to respond to and manage long-term climate-sensitive health risks in six Asian LDCs.	123
Regional	ADB	Govt.	Nordic Develop-ment Fund	2015-2020	Strengthening Resilience to Climate Change in the Health Sector in the Greater Mekong Subregion	Technical assistance.	124
Regional	FAO; UNICEF; WFP; UN Women; UNISDR; the Red Cross and Red Crescent Society and NGOs	Govt.	Not provided	2019-2021	Scaling up Forecast based Financing/Early Warning Early Action and Shock Responsive Social Protection with Innovative Use of Climate Risk Information for Disaster Resilience in ASEAN	Strengthened capacity of ASEAN Member States and regional cooperation to implement Forecast based Financing/Early Warning Early Action and Shock Responsive Social Protection, enabled by accelerating the use of innovative technologies in climate risk analysis and forecasting.	125
Regional	WWT	Multi-sectoral	United Kingdom	2019-2022	Enhancing Wetland Resilience for Improved Biodiversity and Livelihoods in Cambodia	Conserve two internationally important protected areas in the Cambodian Lower Mekong Delta and enhance their connectivity to a healthier wider wetland landscape. The project will promote resilient sustainable livelihoods, restore wildlife habitat and establish multiple-use zoning schemes in the protected areas.	126
Regional	ADB	Govt.	Urban Financing Partnership Facility	2015-present	Promoting Urban Climate Change Resilience in Selected Asian Cities	Technical assistance.	127
Regional	ADB	Govt.	Urban Financing Partnership Facility	2015-2021	Promoting Urban Climate Change Resilience in Selected Asian Cities - Subproject 1	Technical assistance.	128

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Key: AF = Additional Funds, mainly from government's own budget or loans ; AFD = Agence Francaise de Developpement; ADB = Asian Development Bank; ASEAN = Association of Southeast Asian Nations; CBIT = Capacity-building Initiative for Transparency; CI = Conservation International; CIF = Climate Investment Fund; Danida = Danish International Development Agency; DFID = Department for International Development; EU = European Union; FAO = Food and Agriculture Organization of the United Nations; FFI = Fauna & Flora International; GAFSP = Global Agriculture and Food Security Program; GEF = Global Environment Facility; GIZ = The Deutsche Gesellschaft für Internationale Zusammenarbeit (German Development Agency); IDA = International Development Association; IFAD = International Fund for Agricultural Development; IIED = International Institute for Environment and Development; IRD = Insitut de Recherche pour le Devéloppement; IUCN = International Union for Conservation of Nature; JICA = Japan International Cooperation Agency; JFPR = Japan Fund for Poverty Reduction; LDCF = Least Developed Countries Fund; MAF = Ministry of Agriculture and Forestry (Lao PDR); MAFF = Ministry of Agriculture and Rural Development (Cambodia); MARD = Ministry of Agriculture and Rural Development (Vietnam); MOALI = Ministry of Agriculture, Livestock and Irrigation (Myanmar); MoNRE = Ministry of Natural Resources and Environment (Vietnam); MOWRAM = Ministry of Water Resources and Meteorology (Cambodia); MRC = Mekong River Commission; NDC = Nationally Determined Contributions; NGO = non-governmental organization; NORAD = Norwegian Agency for Development Cooperation; OPEC = Organization of the Petroleum Exporting Countries; RECOFTC = The Center for People and Forests; REDD+ = Reducing Emissions from Deforestation and Forest Degradation; SANBI = South African National Biodiversity Institute; SIDA = Swedish International Development Agency; SNV = Netherlands Development Organisation; UNDP = United Nations Development Programme; UNEP = United Nations Environment Programme; UNFCCC = United Nations Framework Convention on Climate Change; UNICEF = United Nations Children's Fund; UNISDR = United Nations Office for Disaster Risk Reduction; UNOPS = United Nations Office for Project Services; WCS = Wildlife Conservation Society; WFP = United Nations World Food Programme; WWF = World Wide Fund for Nature; WWT = Wildfowl and Wetlands Trust.

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