Anlung Pring management plan,

January 2014 – December 2018

Part 1: Description and Evaluation

CONTENTS

ACRONYMS AND ABBREVIATIONS USED

AP	Anlung Pring Management and Conservation Area for Sarus Crane and other birds
BL	BirdLife International in Indochina – Cambodia Programme
BMT	Anlung Pring Biodiversity Management Team
CAVAC	Cambodia Agricultural Value Chain Program
CBETG	Community-based Ecotourism Group
CCK	Chamroen Chiet Khmer
CEPF	Critical Ecosystem Partnership Fund
CI	Confidence Interval
CIRD	Cambodian Institute for Research and Rural Development
CLDMC	Community Livelihood Development Management Committee
FA	Forestry Administration
Ha	Hectares
HH	Household
IBA	Important Bird Area
ICF	International Crane Foundation
LCG	Local Conservation Group
LET	Anlung Pring Enforcement Team
MAFF	Ministry of Agriculture, Forestry & Fisheries
MB	Mlup Baitong
MP	Management Plan
NAV	Net Annual Value
NGO	Non-governmental Organisation
PRA	Participatory Rural Appraisal
SHG	Self-Help Group
Sp	Species
SRI	System of Rice Intensification
UTM	Universal Transverse Mercator
WWT	Wildfowl & Wetlands Trust

1. SUMMARY

Anlung Pring (AP) was created in 2011 as one of three Sarus Crane Conservation Areas established by the Royal Government of Cambodia to manage as Sarus Crane (*Grus antigone*) feeding areas during their non-breeding season. Although small, at 217 hectares, it holds around a third of the regional population of Sarus Cranes on an annual basis.

AP also provides important food and fuel provisioning ecosystem services to local communities. The estimated net annual value of wild goods (fish, firewood and grass collected as fodder for livestock) collected from AP is $423,472 and for the wider floodplain (including natural habitat surrounding AP) this is $1,004,474. Most of these natural resources are collected by four villages: Kaoh Chamkaar, Chrees, Preah Trohueng and Kaoh Tnaot. These villages are highly dependent on Anlung Pring and the surrounding floodplain for their livelihoods with on average 81% of households consuming and trading products derived from this area.

However, the small size of Anlung Pring makes it very vulnerable to external impacts and therefore a landscape scale approach is needed to prevent the degradation of this important site. The main current threat is from shrimp farming. Shrimp farms are rapidly being developed in the area and in February 2013 a shrimp farm was built adjacent to the reserve. There are strong concerns by conservation, government and community groups about the impact shrimp farming will have on hydrology, water quality and the environment in AP. Nearby, in a former Important Bird Area once heavily used by cranes, shrimp farms have extended over at least 40% of the area and communities report that they do not derive any food or fuel provisioning services from this area anymore.

Another key issue that needs addressing is human disturbance especially at the crane's roosting site, as well as upstream developments and land use activities in the basin that could impact on hydrology and water quality.

Sustainable long-term management of Anlung Pring presents a challenge, but this management plan sets out a comprehensive strategy that works towards the interim twenty year vision, recently expressed by stakeholders as:

"A healthy, vibrant wetland with lots of wildlife including many Sarus Crane, managed sustainably by local communities to support their livelihoods as well as the reserve. The site will be visited by many tourists and it will be used as a showcase for community-based wetland management in Cambodia"

Working to implement the government sub-decree awarded to AP in 2011 and towards this twenty year vision, this management plan, sets out the following over-arching aims:

- **To increase the use of AP by Sarus Cranes through appropriate management of hydrology and habitats**
- **To manage, maintain and enhance wetland biodiversity in AP to support human livelihoods**

If partners and stakeholders succeed in achieving these aims then the future of AP's people and wildlife will be more secure.

The high concentration of Sarus Cranes at Anlung Pring in the dry season is such a special sight that there is significant potential for tourism. In the last three years Mlup Baitong, in partnership with WWT and BirdLife International in Indochina, has facilitated the establishment of community groups to lead and deliver community-based ecotourism group in Anlung Pring and to start becoming involved in natural resource management. Although the first tourists started to arrive in 2012 and 2013, the project is still very much in a preliminary phase.

This management plan intends to build on this first community conservation initiative by increasing the capacity of communities to co-manage Anlung Pring with government partners and by developing new community conservation initiatives such as a handicraft workshop (with partner ICF) and sustainable farming.

To address the key threats and to reverse the trend in wetland degradation, an action plan is detailed which seeks to sustain the wetland for people and wildlife. A project approach is taken as this will aid fund-raising and clearly distinguish agencies responsible for leading implementation of activities. A summary description of the projects to be designed and implemented with the full participation of local communities is as follows:

Community-based ecotourism – establish community-based ecotourism as a means to provide further benefit to local communities from the conservation of BPL and a potential source of sustainable financing for conservation efforts**.**

Sustainable Agriculture – trial sustainable rice farming techniques (and other crops) that minimise the impact of agriculture on the natural environment and wetland values. This will be combined with taking the first steps in connecting to a premium market for produce coming from farms around Anlung Pring.

Wetland handicrafts – develop and sell products made from wetland resources, created by local communities

Reserve management – trial water management and various habitat management measures, monitor trends of selected variables (*e.g.* water quality, water levels, extent of wetlands) as well as conservation features (*e.g.* cranes and other biodiversity)

Floodplain management – assess services and threats in the river basin. Prepare a strategy for natural resource management in the basin.

Laws and regulations – FA working with local people to raise awareness of the reserve and its value and to reduce and ultimately eradicate illegal activities to benefit wildlife and those dependent on the wetland for their livelihoods

Awareness and capacity building - build capacity of local communities and government to protect AP and the wider floodplain together by raising awareness of the value of the wetland, how to implement sustainable management activities through the delivery of a bespoke training and events programme

Partners in delivery

Implementation of the management plan will need the active participation and support of various organisations and communities. Main implementers from the government will be the Ministry of Agriculture, Forestry and Fisheries through the Department of Wildlife & Biodiversity, FA. Other government agencies that will play an important role are local administrative and law enforcement groups (at provincial, district, commune and village levels), as well as provincial line agencies (e.g. water resources & meteorology, tourism, rural development).

International NGO partners planned to be involved in implementation will be the Wildfowl & Wetland Trust (WWT), responsible for leading on biodiversity and hydrology management and who will provide technical supervision in all projects together with BirdLife International Cambodia Programme. These partners will also carry

out fundraising in support of projects as necessary (*i.e.* any projects/activities not financially supported by the Royal Government of Cambodia or funded by local organisations).

The main local NGO partner will be MB which has an office in nearby Kampong Trach town, however other partners may also be invited to implement certain activities and independent consultants will also need to be recruited to provide additional technical expertise, training and supervision for certain activities.

Key partners to implementation of the management plan will be the local communities themselves, especially the members of the community livelihood development management committee and the community-based ecotourism group that were recently set up. It is envisaged that by the end of the plan period, local communities will be able to participate in co-management of the wetland alongside government and other agencies.

It is vital for all these partners to work closely together and to avoid unilateral decisions that run contrary to the aims and objectives of this management plan, which essentially supports implementation of the AP sub-decree. To this end, it is noted that co-operation and liaison are important themes and to assist with this an advisory panel and liaison panel will be constituted to ensure timely and co-ordinated delivery of the activities contained in the plan.

2. LEGISLATION AND POLICY

The Ministry of Agriculture, Forestry and Fisheries has the legal mandate to manage BPL in collaboration with other concerned ministries and local authorities to ensure the sustainable development of natural resources for local livelihoods in this area.

2.1. PRIME MINISTERIAL DECREE (SUB DECREE)

2.2. OTHER RELEVANT LEGISLATION AND POLICY

Ramsar convention

Cambodia signed up to the Ramsar Convention in 1999. The Ramsar Convention is an intergovernmental treaty that embodies the commitments of its member countries not only to maintain the ecological character of their Wetlands of International Importance but also to plan for the "wise use", or sustainable use, of all of the wetlands in their territories and to cooperate internationally concerning transboundary wetlands, shared wetland systems, shared species, and development projects that may affect wetlands.

3. DESCRIPTION OF ANLUNG PRING

3.1. BRIEF HISTORICAL TIMELINE[1]

<1965	Elderly villagers mention that there were White-shouldered Ibis and Vultures, cranes would fly over, but did not use the site. The floodplain was dominated by Nipa (Nypa fruticans) palms.
1984	Embankment (Koh Treak road) built across the river
2000	Huge floods destroyed the embankment. Around this time the vegetation changed to Eleocharis sedges.
2002	Small groups of cranes first seen using the site
2004	BL and FA establish a LCG to protect birds. One hundred plus cranes using the site.
2007	Embankment was repaired with sluice gates installed. Crane numbers start increasing year by year.
2010	WWT begins 3 year project funded by CEPF
2011	Anlung Pring officially established as Cambodia's third Sarus Crane conservation area

3.2. LOCATION

AP (217 ha) is located entirely within Boeung Sala Khang Tboung commune, Kampong Trach district, Kampot province, close to the border with Vietnam. Within Boeung Sala Khang Tboung there are two main villages using Anlung Pring[2]: Kaoh Chamkaar (809 households) and Chrees (537 households). In nearby Preaek Kroes commune there are another two villages that use Anlung Pring[2]: Preah Trohueng (229 households) and Kaoh Tnaot (220 households).

[1] Consolidated results from PRA sessions with a group of people from various villagers and separately, LCG members (Thien Huu Nguyen 2013)

[2] As determined by an ecosystem service assessment (see relevant section)

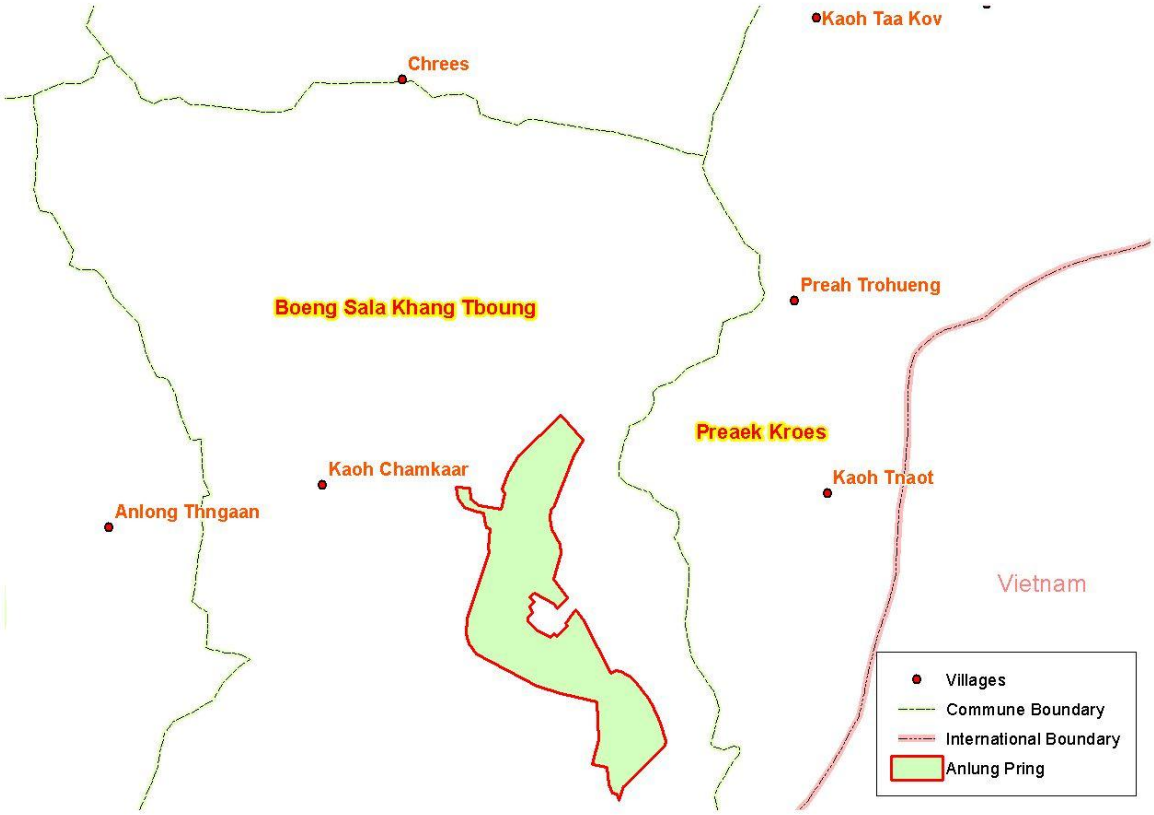


Figure 1. Map of AP showing administrative boundaries and surrounding villages

ENVIRONMENTAL INFORMATION

3.3. CLIMATE[3]

Climate is dominated by the change of the monsoons, which generate wet and dry seasons of more or less equal length (Table 1). The wet season usually lasts from May until late September or early October. There is usually heavy rainfall (> 5 mm) on one day in two over most of the Mekong basin. Later in the wet season, tropical cyclones occur over much of the area so that August and September and even October (in the delta) are the wettest months of the year. Annual rainfall in the delta generally ranges between 1,000 and 1,500 mm, with a long-term average of 1,200 to 1,300 mm.

Table 1. Generalised climate seasons in the Mekong Basin (source: Mekong River Commission 2005)

Cool/Dry			**Hot/Dry**		**Wet**					**Cool/Dry**	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
NE Monsoon			**Transition**		**SE Monsoon**					**NE Monsoon**	

The Northeast Monsoon, which sets in towards late October, initially brings lower temperatures. Rainfall during the months of the NE Monsoon is generally confined to Vietnam due to the buffering effect of the Annamite mountain range. Annual evaporation is generally between 1,500 and 1,700 mm.

3.3.1. CLIMATE CHANGE

Using a global climate circulation model researchers have predicted that over land conditions will generally become drier with reduced rainfall and increased evaporation (Arora and Boer 2001 in Mekong River Commission 2005). This means reduced annual discharge and flood levels. Due to reduced discharge, salinity intrusion is expected to increase in the coastal zone. This means that Anlung Pring is very likely to be affected although to what extent is not yet understood.

3.4. HYDROLOGY

Anlung Pring is located in a floodplain located along a shallow river meandering in a north-south direction towards the sea.

Water sources have not been properly determined, but based on topographical maps and other information[4], the catchment of the Toanhan River to which the Anlung Pring stream is linked in the wet season, seems to be hills in

[3] Climate information is taken from Mekong River Commission 2005

[4] PRAs with LCG and local community members (Nguyen Huu Thien 2013) and discussions between WWT and CAVAC staff

Kirivong district, Kampot province, hills in Banteay Meas and Angkor Chey districts in Kampot province, and further northwest - the eastern slopes of the Elephant mountain range. In the dry season water flow in to the Anlung Pring channel is much reduced and the connection with the Toanhan River severed. During the dry season the Toanhan receives water coming down the Vinh Thé canal (a 87 km long canal in Vietnam that runs along the border).

Several salinity barriers have been built across rivers and canals. The Vinh Thé, Toanhan River and Anlung Pring floodplain all have salinity barriers. The Anlung Pring embankment (Koh Treak road) runs perpendicular to the floodplain from Kaoh Chamkaar village to Kaoh Tnaot village, with three sluice gates placed to allow water through during peak flood periods. The sluice gates are operated by a community water management group and are kept closed throughout the year except at high water levels[4]. Further upstream there are a series of roads that have been built across the river to provide a connection between villages. Culverts and/or bridges have been placed in these roads to allow water to flow through in the wet season. In the dry season of 2013 there was no water flow through the culverts placed in the Koh Ko road four kilometres upstream from the AP embankment[5].

CAVAC, an AusAID initiative to rehabilitate irrigation channels and increase the rice growing season in parts of Cambodia is active in Kampong Trach and Banteay Meas districts. They expect to have completed channel rehabilitation in Prek Kreus commune (Kampong Trach) in August 2013. This includes placement of a water control structure (an embankment with a series of three sluice gates) where the rehabilitated channel flows in to the Anlung Pring riverbed near to Kaoh Taa Kov village (figure 2). The sluice gates will remain closed during the dry season and opened in the wet season during peak floods when agricultural pollution should be sufficiently diluted. Water quality on both sides of the sluice gate should be monitored to assess potential impacts on water resources.

The part of AP that lies upstream of the embankment is 33 hectares in size. The salinity barrier has resulted in this area becoming significantly less saline than the area below the embankment (see water quality section). It is believed that Sarus Cranes use the northern area periodically to drink fresh water and to some extent for forage (Nguyen Huu Thien 2013). However, the southern sector contains areas selected the most by cranes as foraging areas (Yav Net 2013).

The floodplain contains acid sulphate soils (see soil section) which need to be kept permanently moist to prevent leaching of acid into the water column. During the 2013 dry season, water levels dropped to such an extent that the ground became hard enough to walk across. This results in the formation of acidic compounds in the soil with acids leaching out when the soil is rewetted. To offset this and dilute acid leachate and/or maintain waterlogging in the soil column, water could be diverted from the Toanhan River, through the CAVAC channel near Kaoh Taa Kov, if it is of acceptable quality.

During the course of the WWT CEPF project (October 2010 – June 2013) water level staging boards were placed at the sluice gate to the north of the salinity barrier and in the southern sector near the LCG office. At the sluice gates, water levels are recorded at varying times often with several days in between readings, while in the south sector readings are taken daily although again not at fixed times. South/downstream of the embankment the floodplain is under the influence of the tidal regime. Water levels therefore fluctuate constantly as determined by the strength of incoming and outgoing tides (see figure 3). Anlung Pring is linked to the sea by another connection with the Toanhan River approximately 1.5 km south of the reserve. The last stretch of this river, approximately twenty five kilometres in length, is within Vietnam. The maximum difference in water levels recorded between consecutive days in the southern sector was half a metre. Maximum difference in water levels across the whole

[5] Field visit on 23 February 2013 as part of a rapid eco-hydrological assessment (Nguyen Huu Thien 2013)

recording period (22 February 2012 – 28 February 2013) was only one metre, with lowest levels recorded in April-July and highest in October-December.

In the northern sector water levels at the Koh Treak salinity barrier sluice gate in the reserve remained very stable as the sluice gate was kept closed most of the year and all water drains to this location (figure 4). The data shows there is virtually no surface flow along the river for much of the year. There is groundwater flow to this point, keeping water levels stable despite considerable seepage through the sluice gate. However, through water loss as a consequence of seepage and evapo-transpiration, soils were observed to be very dry in the northern sector in February 2013. The level of water recorded at the sluice gate is therefore not an accurate reflection of soil moisture conditions. Additional water monitoring (both quantity and quality) will need to be undertaken to understand site hydrology more fully.

There are periods in which large quantities of water are transported down the river. This occurred briefly in late July and then from late September to end of November 2012, with some continuation in to December. In such cases the sluice gate is opened until water levels return to normal. Maximum difference recorded at the sluice gate was around forty centimetres.

In order to manage water levels in the northern sector, apart from opening the CAVAC canal link to the Toanhan River, it may also be possible to close the Koh Treak sluice gate slightly earlier in the wet season but this will need to be done in collaboration with the community water management group. Maintaining very high water levels is not suitable for cranes as they can only feed in waterlogged soil or at most in very shallow water. The sluice gate will need repairing to prevent leakage and facilitate better water level management.

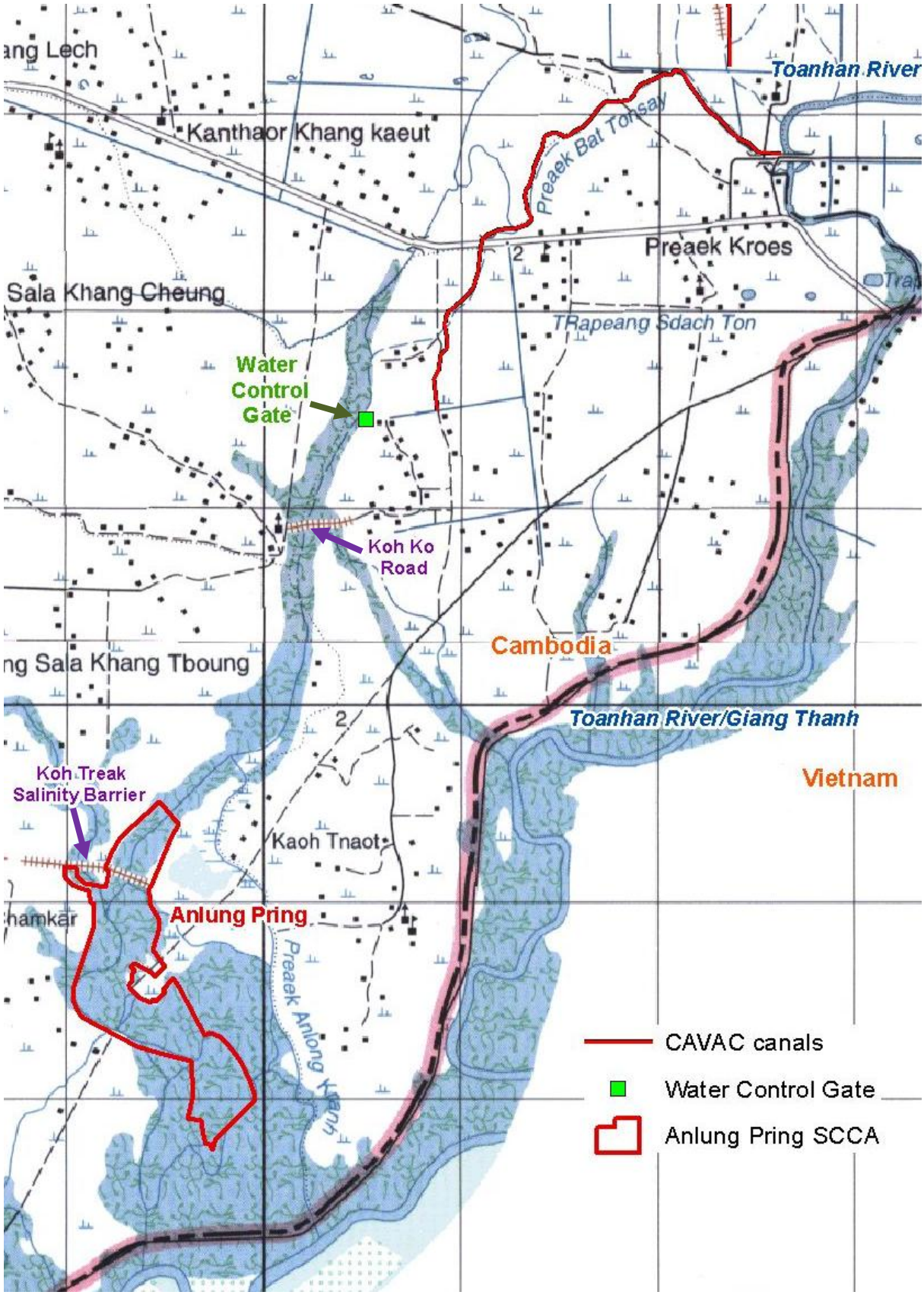


Figure 2. Map of Anlung Pring, hydrological connections and CAVAC canals

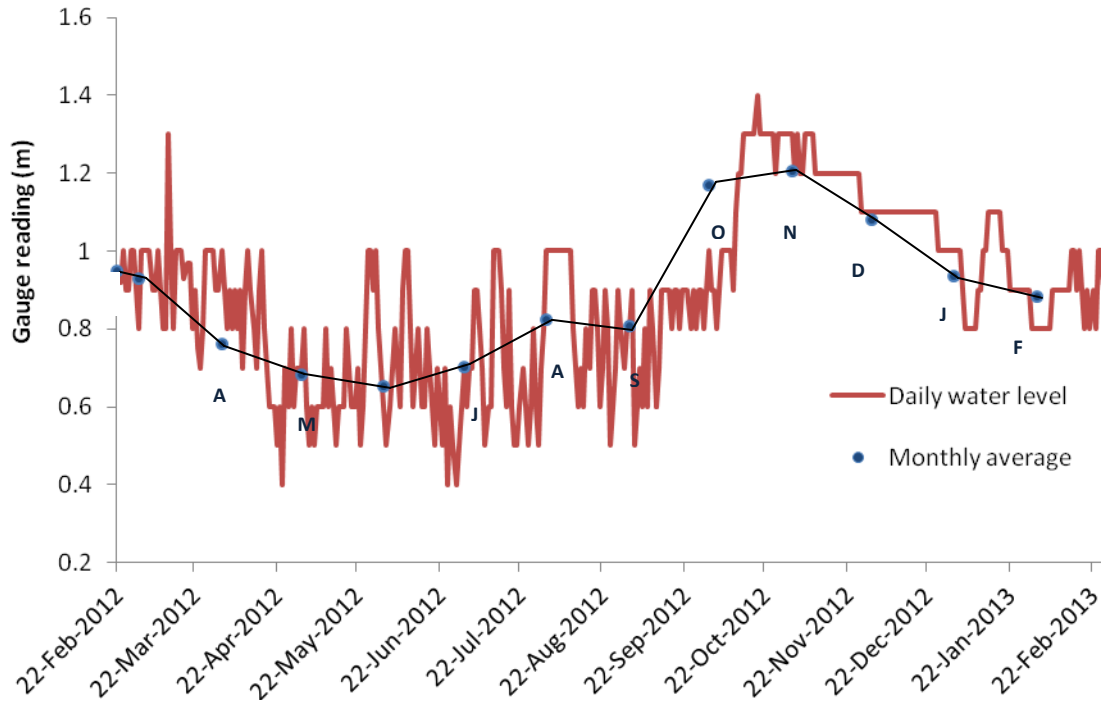


Figure 3. Daily water levels measured in the <u>southern</u> sector of AP (south of the salinity barrier) and monthly averages (note: water level readings are not benchmarked/not in metres above sea level; readings were taken once a day at variable times). Monthly averages in the graph are placed at the start of each month.

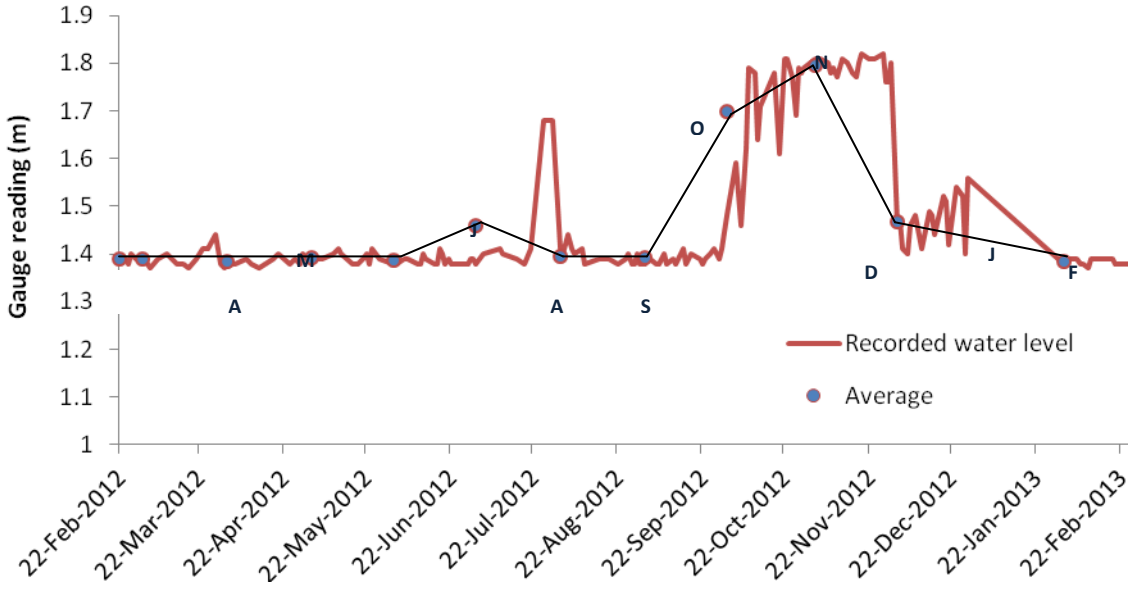


Figure 4.. Recorded water levels at the Koh Treak salinity barrier sluice gate in the <u>northern</u> sector of AP, with monthly averages (note: water level readings are not benchmarked/not in metres above sea level; readings were taken on random days and at variable times). Monthly averages in the graph are placed at the start of each month.

The gauge broke in late December 2013, in February measurements were resumed by placing a ruler against the remaining part of the gauge.

3.5. WATER QUALITY[6]

As Anlung Pring is divided by a salinity barrier, the two sectors are very different in water quality. Test results show that surface water in the northern part (the non-tidal area north of salinity barrier) is generally more acidic (pH range of 3.7 – 5.7 recorded from three measurements), whereas pH values in the tidal area south of the salinity barrier were 4.7 – 7.1. Salinity was considerably higher below the embankment where the water is brackish (measured salt content 2.2 – 3.4%).

Dissolved oxygen content of surface water in the downstream area is suitable for aquatic life (4.2 – 5.6 mg/l), whereas that of surface water in the northern part was low (1.4 – 3.9 mg/l). Water is largely stagnant in the northern sector.

3.6. SOILS[6]

All of Anlung Pring contains acid sulphate soils, either potential or actual. Potential acid soils have a sulfidic horizon that can oxidize if the soil layer is dried. Jarositic minerals (1/3 $KFe_3(SO)_2(OH)_6$) were identified in some soil profiles during surveys in February 2013 (Figure 5) revealing that oxidization had taken place. Acid is then released upon rewetting of the soil. Actual acid sulphate soils were found in the northern sector where soils had dried considerably by the time of the survey. There are fish-kills every year in Anlung Pring and this is thought to be related to release of acid from soils. Management should seek to ensure soils do not dry out and release acid into water bodies.

Figure 5. (a) A sulfuric horizon with jarosite minerals along root channels in an actual acid sulphate soil, and (b) sulfidic horizon with pyrite minerals present beneath the sulfuric horizon or within 50-100 cm from the soil surface (potential acid sulphate soil).

[6] Summary of data collected in February 2013 as part of an eco-hydrological assessment (Le Phat Quoi and Nguyen Huu Thien 2013)

3.7. FLORA[7]

Twenty-two species of plant from thirteen families were identified in a limited botanical survey conducted in February 2013. *Cyperaceae* is the largest family represented with eight species of which four belong to the genus *Eleocharis*. Around 80% of Anlung Pring was covered by plant communities in which *Eleocharis* sp. were found to be dominant (see table 2).

There are two main types of vegetative landcover in AP, grassland and Melaleuca scrub.

3.7.1. PLANT COMMUNITIES

The plant communities that have been described so far by habitat are:

Grasslands

Eleocharis spiralis occurs in single species stands, but also mixed with other species (figure 7). Communities where *E. spiralis* is dominant are: *E. spiralis - Eleocharis dulcis, E. spiralis - Cynodon dactylon, E. spiralis - Cynodon dactylon - Eleocharis philippinensis*.

Eleocharis dulcis is mainly distributed in relatively low-lying areas. *E. dulcis* communities were identified as: *E. dulcis – E. spiralis, E. dulcis - Cyperus* sp. *– C. dactylon, E. dulcis – C. dactylon, E. dulcis - Water lily*. It is also present as mono-dominant stands.

Eleocharis philippinensis, with 4-5 angular spikelets, is limited to the floodplain south of the salinity barrier. This species is either found in mono-dominant stands or in association with *C. dactylon*. It is the most abundant plant community in Anlung Pring (table 2).

Cynodon dactylon was found to be widespread in association with other plants in Anlung Pring. Mono-dominant stands of *C. dactylon* are only found in relatively higher parts of slopes.

Other non-Eleocharis dominated plant communities are limited to small areas of Anlung Pring. FIMBRISTYLIS *umbellatus* associated with *Cyperus difformis* was found on slopes of grey soils among the acid sulphate soils, whereas *Cyperus malaccensis* and *Scirpus littoralis* was found forming a thin band along channels in Anlung Pring.

Melaleuca scrub

Both *Melaleuca leucadendron* whose leaves have a very aromatic odour and from which essential oil (Tea Tree oil) is distilled for medicinal use, and *Melaleuca cajuputi* occur in area with acid sulphate soils in Anlung Pring and the surrounding floodplain. The stems are used in construction and for firewood.

In Anlung Pring both species can be found mixed together in stands consisting almost exclusively of Melaleuca trees.

[7] Summary of data collected in February 2013 as part of an eco-hydrological assessment (Le Phat Quoi and Nguyen Huu Thien 2013)

Table 2. Coverage (in hectares) of plant communities in Anlung Pring

Plant communities	Area (ha)
Seasonally Inundated Grass	
Eleocharis spiralis	23.92
Eleocharis spiralis - Eleocharis dulcis	17.04
Eleocharis spiralis - Cynodon dactylon	17.9
Eleocharis spiralis - Cynodon dactylon - Eleocharis philippinensis	4.28
Eleocharis dulcis - Eleocharis spiralis	37.58
Eleocharis dulcis - Cyperus sp.- Cynodon dactylon	1.19
Eleocharis dulcis - Water lily	2.96
Eleocharis dulcis - Cynodon dactylon	8.64
Eleocharis philippinensis	52.13
Eleocharis philippinensis - Cynodon dactylon	9.5
Cynodon dactylon	5.29
Cyperus sp.	1.22
Cyperus sp - Fimbristylis sp	0.32
Melaleuca Scrub	
Dense Melaleuca	8.29
Thin Melaleuca	0.54
Other habitats	
Riverine scrub	2.51
Water body	22.54
Bare land	1.22
Total area (ha)	**217.07**

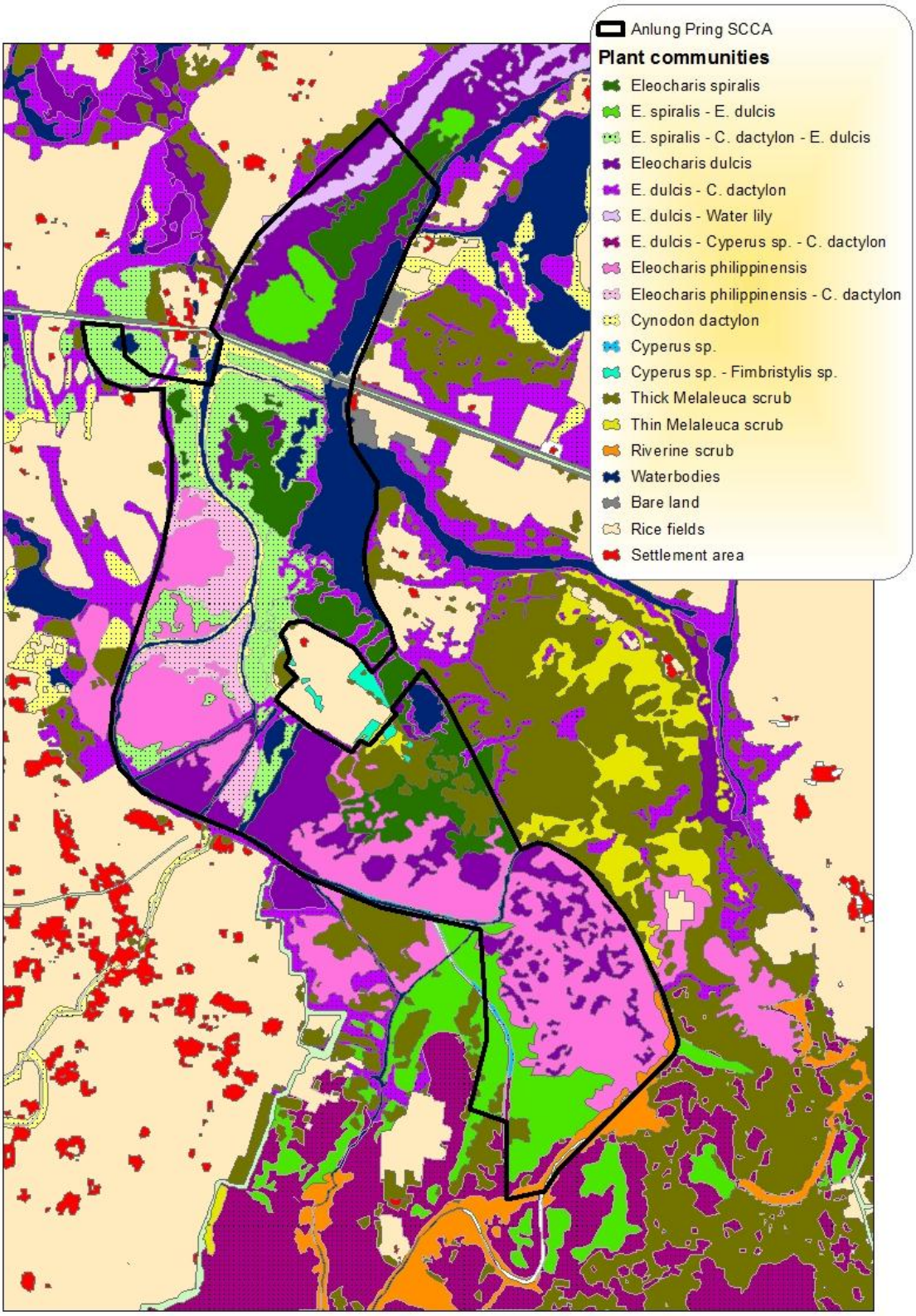


Figure 7. Distribution map of plant communities in Anlung Pring

3.8. FAUNA

Information on fauna is limited to birds. No work has as yet been conducted on assessing and monitoring the status of fish, reptiles, amphibians, mammals, invertebrates and soil organisms. Conducting baseline surveys of these taxa will be a priority for this plan.

To date 90 bird species have been recorded although the real number is likely to be higher as there are limitations in capacity of staff to identify all species and the main focus of monitoring has justifiably been the Sarus Crane, in the initial years of conservation work. The Sarus Crane (*Grus antigone*) is the only threatened bird species that uses AP on an annual basis and it does so in large numbers.

The maximum number of cranes counted at AP has increased year on year since 2004, except for a slight drop in 2011 (figure 7). The current maximum of cranes recorded at AP is 342 cranes (January 2013). The average annual maximum count for between 2008 and 2012 is 251 cranes. The average maximum for the entire Mekong delta (based on annual counts held in March) within the same period is 443 cranes and the average maximum count of the regional (Cambodia and Vietnam) population is 803 cranes (Tran Triet and van Zalinge 2012, van Zalinge *et al*. 2011). Thus AP holds, on average, 57% of the Mekong delta population and 31% of the total regional population counted during the non-breeding season.

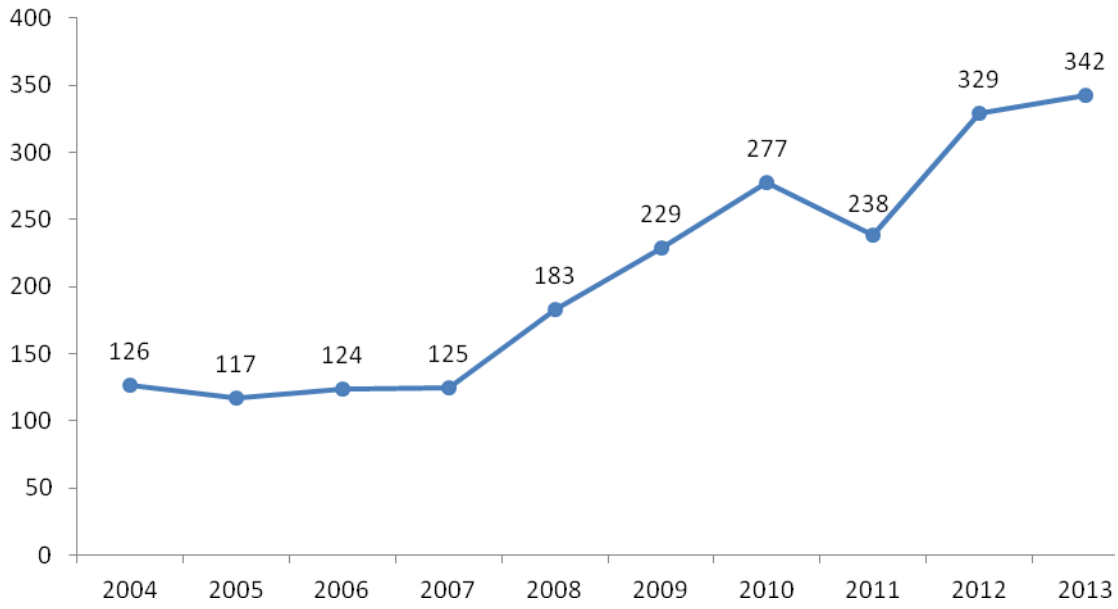


Figure 7. Maximum numbers of cranes present in AP per year (from March 2004 to March 2013)

Cranes start to arrive in AP around November in small groups, but in November and December water levels are generally still too high and numbers remain low (see figure 8). During this period cranes will often forage in harvested rice fields or may make temporary movements elsewhere. January to March, especially in February is the peak period for crane use of Anlung Pring. Cranes are usually still present in May, seldom June and after February numbers gradually drop. The gradual departure of cranes after a period of intensive use of this small wetland between January and March is most likely a reflection of food availability.

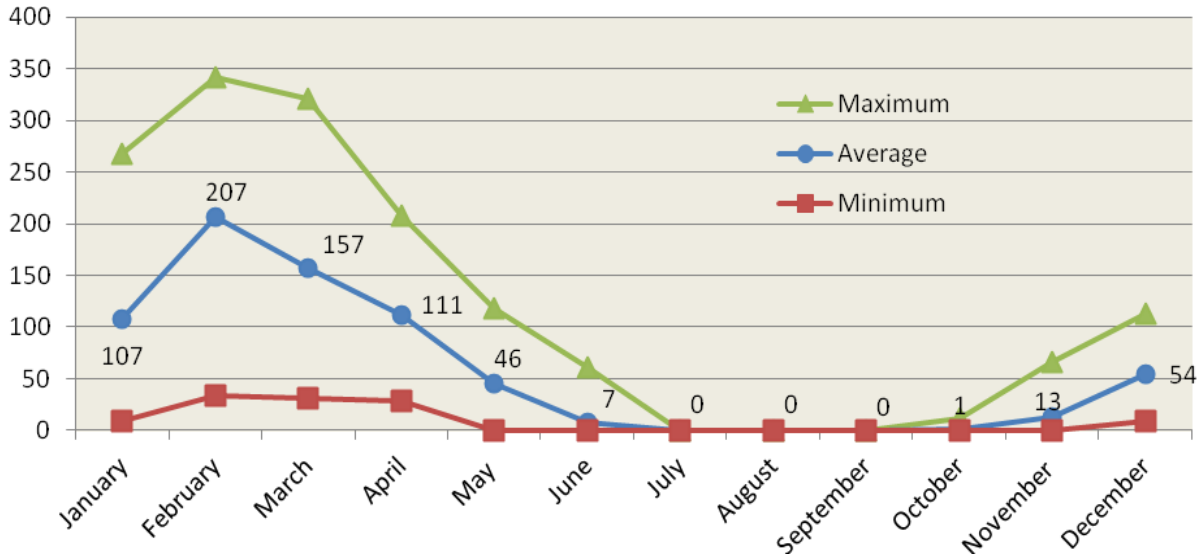


Figure 8. Monthly pattern of crane numbers at AP (based on maximum counts per month, March 2004 – March 2013).

Cranes are known to use certain areas of Anlung Pring more than others. The southeast which is dominated by *Eleocharis philippinensis* is currently unused, while an area with a radius of roughly 1.5 km south of the salinity barrier is the main feeding area. In this area *Eleocharis spiralis* is abundant. A study aimed at quantifying time spent by cranes in AP in February 2013 feeding in different types of vegetation found that cranes were selecting areas with *E. spiralis*, unbiased towards *E. dulchis* and avoiding areas where *E. philippinensis* was strongly dominant (Yav Net 2013). More research is needed on the ecological requirements of Sarus Cranes, but this preliminary research suggests that habitat for cranes in Anlung Pring could still be improved further.

Cranes roost at AP in an area where there is a large expanse of shallow water. This is one of the only consistently used roost sites in the wider area (including adjacent areas in Vietnam) and it is therefore crucial to keep this location safe for cranes. The area north of the Koh Treak salinity barrier is frequently used by cranes, though less so than the main feeding area described above. It is believed that cranes may be using this area particularly as a source of drinking water while spending some time foraging in areas dominated by *Eleocharis dulchis* with *Eleocharis spiralis* mixed in (Nguyen Huu Thien 2013). Observations of groups of cranes of variable size (*i.e.* different groups) briefly moving across to the north sector before returning, support this theory, but it requires further study.

PEOPLE – THE STAKEHOLDERS AT ANLUNG PRING

3.9. AP BOUNDARIES AND SURROUNDING LANDUSE

Anlung Pring is very small at 217 hectares and there is no buffer zone (figure 9). As such there are no limitations or guidelines regulating land use within the surrounding area. This can lead to development which is not compatible with conservation of AP. A case in point is the development of the former Important Bird Area (IBA) which was located in a floodplain to the southwest of AP. This IBA has now been largely converted to shrimp farm, the number of cranes using the IBA has dropped to such a degree that a small group of feeding cranes is a rare occurrence and local people are now prevented from harvesting wetland resources from this area (see ecosystem services section). Even if shrimp farms do not encroach in to AP itself, reserve hydrology is likely to be significantly affected. There are concerns that conversion to shrimp farming and other intensive land uses will lead to the ecological degradation of the reserve and remaining semi-natural habitats in the floodplain.

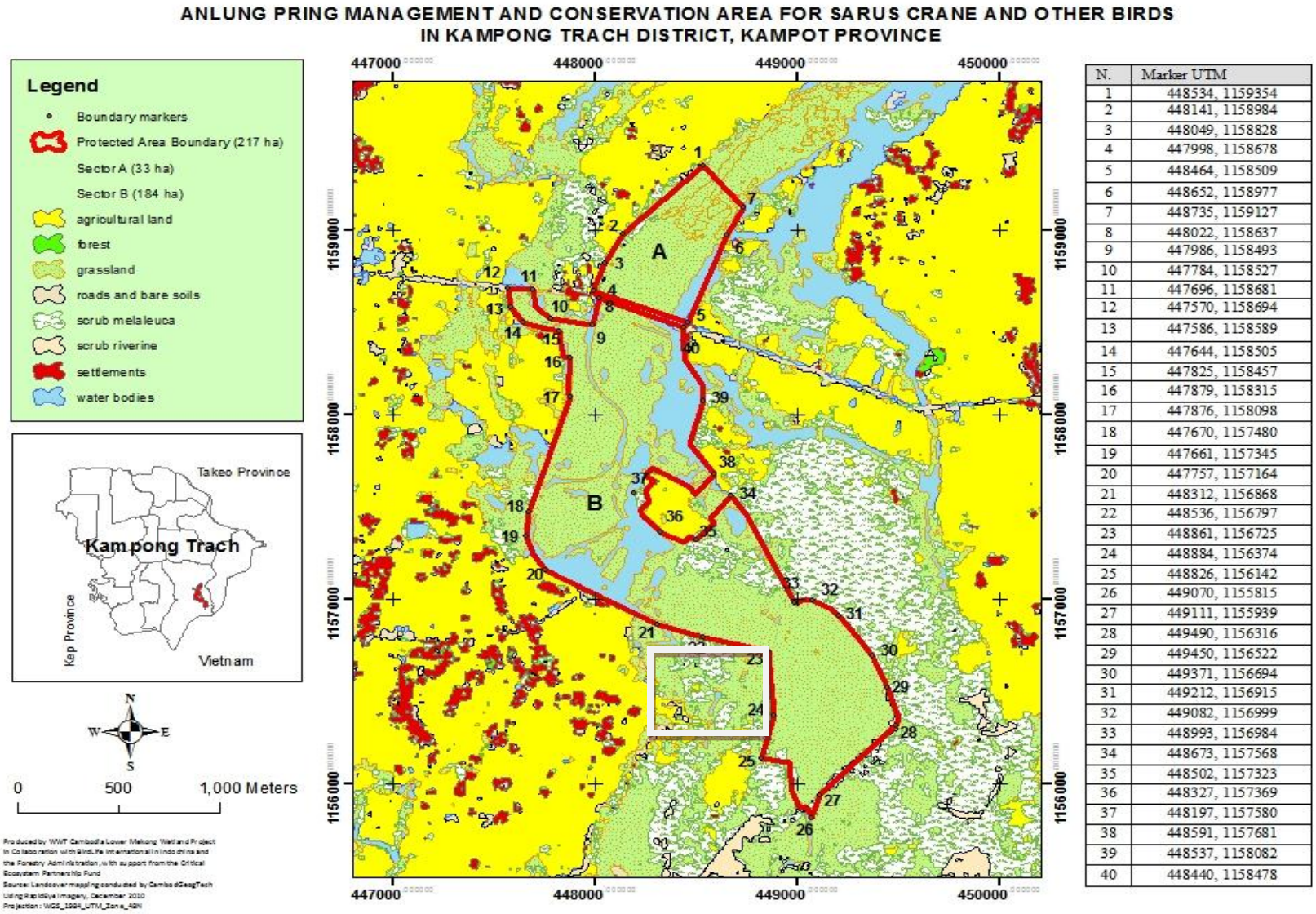
According to local government staff, all land surrounding AP, including that within the floodplain is thought to be privately owned. Local communities own the land they farm, but the land within the floodplain is probably owned by a handful of people from urban centres such as Phnom Penh, Kampot, *etc*[8]. Until recently the land adjacent to the reserve was left largely unused (although local people collect some wetland resources there), with shrimp farming occurring in an area of the floodplain one kilometre southwest of AP, but in late February 2013 one of the landowners started constructing a shrimp farm adjacent to the reserve (figure 9). It is thought that the intention is to lease this out to Vietnamese shrimp farmers (Bou Vorsak and Seng Kim Hout 2013). Although this type of shrimp farming may currently be extensive with few or no inputs, as is the case with most shrimp farming in the area (Nguyen Huu Thien 2013), there are no rules in place to control future development or management of shrimp farming or other such land uses within the floodplain and therefore no measures available to limit impacts on AP.

There is also a concern that there will be an increase in residential development adjacent to the reserve and in very close proximity to the roost site as has been witnessed during the project period (Eames 2011). Such settlements are likely to lead to increased disturbance and pollution. Most of the agriculture surrounding AP is wet season rice. The trend in the region, as for example promoted by the CAVAC project, is to switch to dry season rice cultivation and grow two or three crops per year using quick growing varieties. These types of crops require a much higher use of chemicals and are of inferior quality to wet season rice. However, there is strong demand within Cambodia and internationally for high quality fragrant rice varieties that are grown over a longer period within the wet season and demand is also growing for organic or simply pesticide-free food products. Prices are higher for these types of rice and it is reasonable to expect demand and price to increase further in future.

With this in mind, the agricultural NGO, CIRD conducted a study looking at the potential to increase income from rice cultivation in a sustainable way, tied in with conservation of AP. Following their assessment they recommended that by increasing local farmer skills in environmentally friendly production techniques and organizing them in to a cooperative with the purpose of marketing their rice under a pesticide-free label a sustainable farming project fully owned by the local community could be developed around Anlung Pring without causing negative impact on the wetland (Khouth Karun *et al.* 2012). CIRD also established a small SRI demonstration plot (of 16 m^2) and showed that normal yields could be improved by 36% by adhering to some of the steps advocated under the SRI method (CIRD 2012

[8] Reported by local government in rapid appraisal workshop as part of an ecosystem service assessment

However, further research will be required to fully understand the implications of establishing such an enterprise. Therefore, it is one of the proposed activities of this plan to initiate a further and larger scale demonstration of sustainable rice cultivation alongside other products.



N.	Marker UTM
1	448534, 1159354
2	448141, 1158984
3	448049, 1158828
4	447998, 1158678
5	448464, 1158509
6	448652, 1158977
7	448735, 1159127
8	448022, 1158637
9	447986, 1158493
10	447784, 1158527
11	447696, 1158681
12	447570, 1158694
13	447586, 1158589
14	447644, 1158505
15	447825, 1158457
16	447879, 1158315
17	447876, 1158098
18	447670, 1157480
19	447661, 1157345
20	447757, 1157164
21	448312, 1156868
22	448536, 1156797
23	448861, 1156725
24	448884, 1156374
25	448826, 1156142
26	449070, 1155815
27	449111, 1155939
28	449490, 1156316
29	449450, 1156522
30	449371, 1156694
31	449212, 1156915
32	449082, 1156999
33	448993, 1156984
34	448673, 1157568
35	448502, 1157323
36	448327, 1157369
37	448197, 1157580
38	448591, 1157681
39	448537, 1158082
40	448440, 1158478

Figure 9. Anlung Pring Sarus Crane Conservation Area boundary and position of boundary markers. Rectangular box indicates approximate location of the newly created shrimp farm.

3.10. ECOSYSTEM (FOOD AND FUEL PROVISIONING) SERVICE VALUES[9]

In August 2012, 260 household interviews (10% sample size) were conducted in 7 villages in and around AP and an "alternative state" (see section 3.10.1.) in order to assess the net annual value derived from harvesting wild goods (fish and other wetland resources). Detailed information was collected on amount of product harvested or foraged in a year, average price obtained and total cost incurred in the process of harvesting the product to enable calculation of the net annual value (income minus cost) for each specific product harvested.

It was found that only four villages use the wider floodplain around AP on a regular basis. These are, in order of importance of the value they receive from AP; Koh Chamkar and Chrees in Boeung Sala Khang Tboung commune and Preah Troheung and Koh Tnaot in Prek Kreus commune. The data presented below is based on these four villages.

Figure 10, below, shows the composition of a typical household's net annual income derived from the wider floodplain around AP. Non-cultivated, wild harvested goods make up 87.5% of the total. Fish alone represent over half of household net annual value (NAV). Further treatment of results therefore focuses on the value of wild harvested goods .

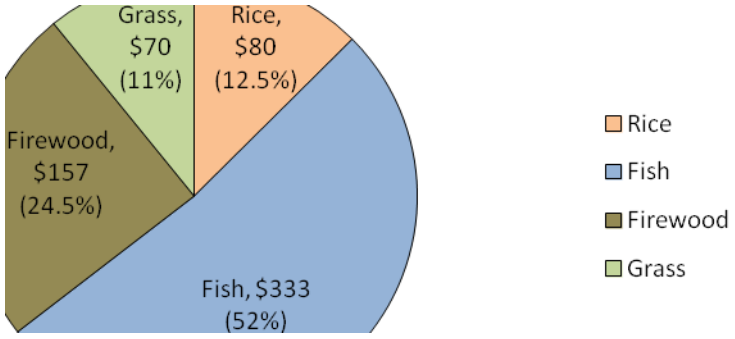


Figure 10. Relative average net annual values of different products harvested from AP for a typical household.

Figure 11 shows that total net annual value to local households for all wild goods collected from the wider floodplain is around one million US$ per year. The main wild goods are fish (60%), firewood (28%) and grass (12%). Domestic buffalo also graze in the reserve, but the value of the wider floodplain for grazing was not included because during the questionnaire survey people found it difficult to estimate the value.

[9] Consolidated results from an ecosystem service assessment carried out by CCK for the WWT project (van Zalinge 2013)

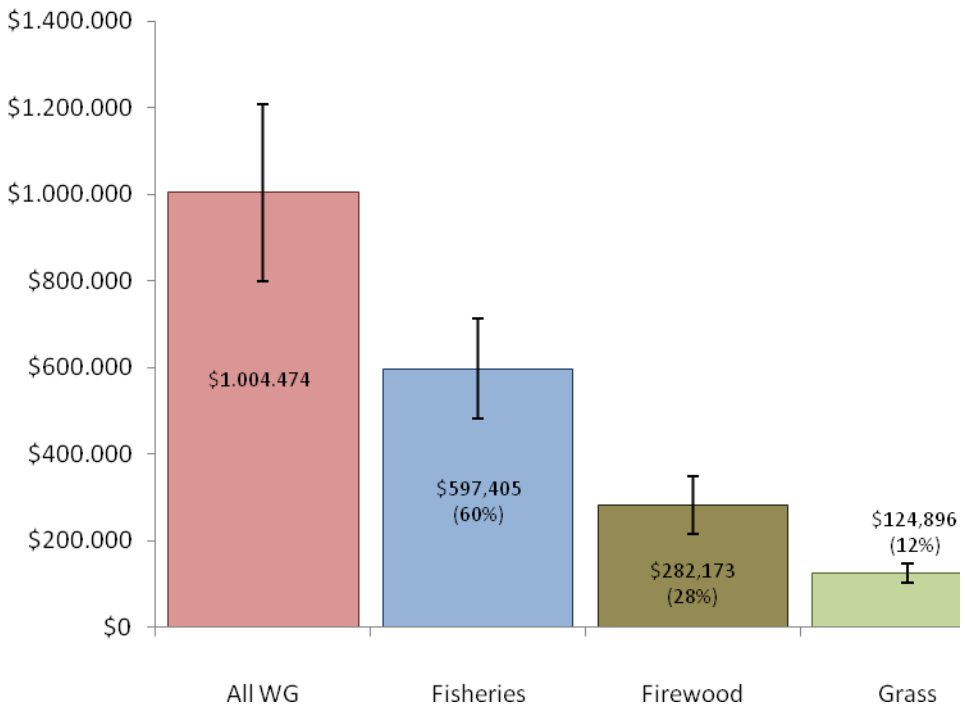


Figure 11. Total net annual value of wild goods (WG) for the wider floodplain surrounding AP

On average 42% of wild goods are collected from AP itself. The total NAV of wild goods collected from AP is $423,472 (Fisheries, $268,832; Firewood, $95,939; Grass, $58,701).

3.10.1. FUTURE ECOSYSTEM SERVICES SCENARIO IF SHRIMP FARMING EXPANDS ACROSS THE FLOODPLAIN

Part of the above study included conducting a rapid assessment of threats and predicting the state of AP in ten years time if current threats are not prevented. Based on these results, the former Important Bird Area (IBA) which used to have a similar floodplain to that ofAP with large numbers of cranes feeding there, was chosen as representative of the changes that could occur in ten years time (the so-called alternative or future state). In the former IBA, shrimp farming has now expanded to cover over 40% of the area. Although it was the intention of the study to work out a value for local community use of this alternative state, all respondents from the seven villages covered, including Anlong Thngaan and Kaoh Chamkaar which are located closest to the former IBA (see figure 12), answered that they did not derive any value from this area as the land was now in private ownership and they were now excluded from using the wetland resources. Although some rice fields can be seen inside the former IBA in the map our 10% sample did not find anyone who currently farms in this area. Therefore we can only conclude that the value of this area has been lost to most or all of the former beneficiaries within the local community.

Further development of shrimp farming (or other unsustainable land use practices) will almost certainly change the nature and distribution of ecosystem services provided by the floodplain including within AP itself. It follows that local communities will suffer a reduction in the net annual value they receive through direct replacement of

natural habitat by shrimp farms. There may also be further indirect losses due to changes in hydrology and water quality.

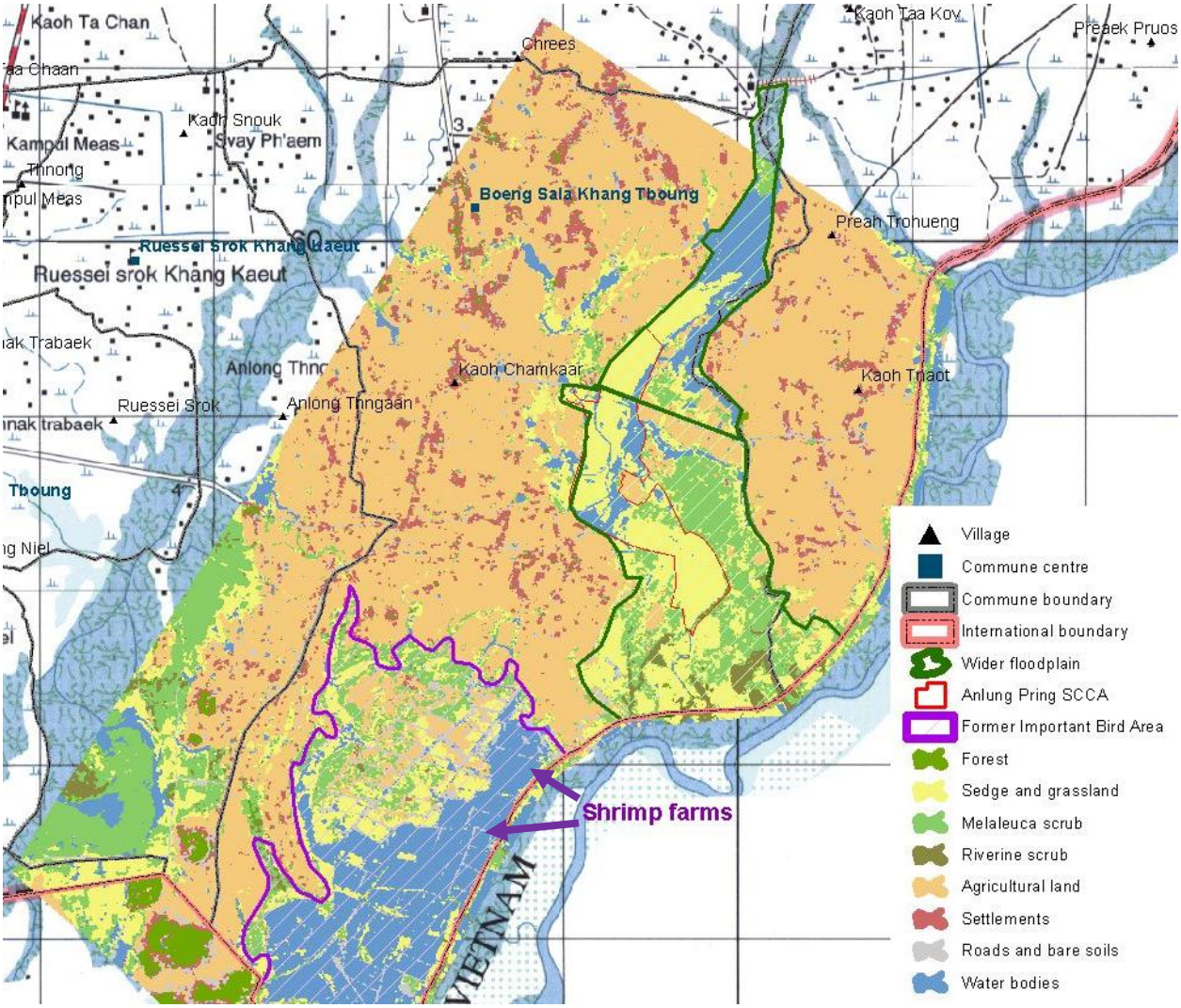


Figure 12. Location of ecosystem service assessment study areas (Wider floodplain surrounding AP and the former IBA considered as alternative state)

3.10.2. SUSTAINABILITY OF RESOURCE EXTRACTION

No assessment of the sustainability of resource use has as yet been conducted although it is intended that this will begin during this plan period.

3.10.3. OTHER ECOSYSTEM SERVICES

The ecosystem service assessment covered fish, firewood and grass collection, but left out grazing as it was difficult to calculate a value. Other wild goods excluded from this assessment are a range of aquatic vegetation used for food, fibre and medicine, mushrooms (growing on Melaleuca trees) and honey. Waterbodies in AP also provide transport and water provisioning services. As a largely brackish waterlogged wetland, AP also potentially

has high carbon deposits and therefore may provide climate regulation services (carbon sequestration). The wetland may also provide an important service in flood protection. As mentioned above, ecotourism is not yet fully developed and was not included in the assessment, but should be considered in any future evaluation. The nature and extent of these services and therefore the ways in which communities benefit from them will be changed if the wider floodplain around AP is converted to shrimp farms.

3.10.3. MOST WETLAND-DEPENDENT VILLAGES

As mentioned above there are four villages that mainly use the AP floodplain: Kaoh Chamkaar and Chrees in Boeung Sala Khang Tboung commune, Preah Troheung and Koh Tnaot in Prek Kreus. The table below shows the net annual value derived from both the wider floodplain and Anlung Pring for all villages considered in the ecosystem service assessment.

Table 3. Net annual value of wider floodplain and AP for all villages included in the ecosystem service assessment

Commune	Village Name	Total HHs	HHs Inter-viewed	Wild Good Collection				
				% HHs collecting wild goods	NAV	% of NAV from AP	NAV AP	Rank AP
Boeung Sala Kang Tboung	Kaoh Chamkaar	809	82	90%	$387,431	43%	$168,192	1
	Chrees	537	54	69%	$170,195	64%	$108,604	2
Prek Kreus	Preah Trohueng	229	23	65%	$121,352	41%	$49,226	3
	Kaoh Tnaot	220	22	100%	$327,141	13%	$43,083	4
	Kaoh Taa Kov	331	33	3%	$4,306	0%	$0	5
	Leak Chea	232	23	0%				
Boeung Sala Kang Cheung	Anlong Thngaan	228	23	0%				

3.11. ECOTOURISM[10]

Mlup Baitong (MB) is closely co-operating with WWT and authorities at all levels to provide administrative and technical support for the establishment of CBET by facilitating the formation of a Community Livelihood Development Management Committee (CLDMC) and a CBET Group (CBETG). It is intended that the CLDMC and CBETG will play an increasingly important role in managing AP and providing CBET services in AP. MB has so far provided training to them on management, administration, report writing, environment awareness, guiding skills

[10] This section is an updated summary of that reported in Mlup Baitong 2013

and has supported them in establishing CBET infrastructure such as an information centre, checkpoint, toilets and parking area. At the same time, MB has produced 1,000 leaflets and distributed them to NGOs, hotels and travel agencies to attract national and international tourists to encourage visits to the Anlong Pring Sarus Crane Reserve. Additionally, MB installed education signboards in participating villages to raise awareness of villagers about the importance of Sarus Crane conservation and environmental protection.

Both CLDMC and CBETG each consist of 7 men and women from Kaoh Chamkaar, Chrees and Kaoh Tnaot villages. The CLDMC oversees all community initiatives related to AP, conducts awareness raising activities and is the main link between communities and the government when it comes to matters related to AP. The CBETG is focused on implementing community-based ecotourism at AP.

The CBETG started providing a tourist guide service for bird watching to visitors in March 2012. So far the CBETG has received 89 visitors (50 Cambodian and 39 foreign visitors) and made US$ 255 income. This income is used for CBETG members' benefit, community development, maintenance of CBET facilities, and for Sarus Crane conservation activities.

MB has also overseen the creation of community self help groups or saving groups (SHGs) which now include 119 people. Any member of the community can become a member by purchasing shares in a SHG. The funds are then invested in loans to members who pay interest on the loan. The interest is then recapitalized in the SHG. Typical loans are for purchasing livestock, fertilizer and rice seed.

3.12. HANDICRAFTS

Recently, the International Crane Foundation (ICF) has started training local households in weaving mats made from Lepironia that they purchase from weavers to manufacture bags, hats and other handicrafts. Lepironia does not grow in the AP floodplain, but is harvested from a wetland across the border in Vietnam. Phu My, as the wetland is called, is also used by Sarus Cranes who move regularly between this site and AP. This new project marks a beginning in potential collaboration between managers of AP and Phu My to conserve such linked sites in the larger landscape.

4. EVALUATION

4.1. CONSERVATION FEATURES

Conservation features are the species, communities, habitats, *etc.* that will be the focus of management. For AP the main conservation features are:

1. Sarus Crane: the Sarus Crane is a key priority for management as AP is one of the main feeding sites for this species in the country. Maintaining the site's importance for Sarus Crane was the primary motivation behind establishing AP as a protected area along with acknowledging that there is also a need to manage AP to conserve wider wetland biodiversity and support local livelihoods
2. Wider wetland biodiversity: for wetland productivity, ecosystem health and functioning, it is important to maintain the overall biodiversity of AP (and also the wider floodplain). Protecting this resource will support local livelihoods and act as a reservoir of wetland wildlife for re-colonisation of the floodplain outside of AP

4.2. FACTORS

A factor is anything that has the potential to influence or change any of the above main conservation features, or the way in which the feature is managed (Alexander 2010). Table 4 below shows the factors that were identified through a series of stakeholder consultations and expert opinion. Management interventions will largely target these factors in order to produce favourable conservation outcomes.

Table 4. List of key factors affecting conservation features at AP

Factor	Description of influence of factor on features	Process of identification of factor	Impact
Disturbance caused by human activity within AP	Can limit use of AP by Sarus Cranes and other biodiversity . Potential impacts on Sarus Crane roost site is of extra concern.	Expert opinion	Moderate to high
Disturbance caused by traffic along embankment	Potential increases in traffic along the embankment road bisecting the reserve is of concern	Expert opinion	Low to moderate
Habitation along the AP boundary	Further settlement along the AP boundary will cause high disturbance and increased edge effects. Concerns are especially high for the roost site.	Expert opinion	Moderate to high

Factor	Description of influence of factor on features	Process of identification of factor	Impact
Hunting in AP and wider floodplain	Biodiversity loss	1. Community[11] 2. Provincial[12]	1. 1/2 groups 2. Top 5 threats
Land conversion in the wider floodplain	Loss of biodiversity and changes to ecosystem services and beneficiaries. Impacts all conservation features. Concerns are especially about shrimp farm expansion in the southern sector of the floodplain (which can affect water quality and hydrology of AP)	1. Community 2. Provincial	1. 1/2 groups 2. Top 5 threats + Based on absence of cranes and ecosystem services in former IBA impact will be very high
Obstructions to water flow	The sector of the AP wider floodplain north of the salinity barrier can be impacted on by increasing water diversion upstream resulting in lower water levels (especially impacting on soils, vegetation and biodiversity in the dry season). South of the salinity barrier there is concern about shrimp farms blocking the channel connecting AP to the sea or otherwise impacting on the tidal pattern of AP	2. Provincial	2. Top 5 threats
Water pollution	Use of chemicals (rice farming, esp. dry season rice, shrimp farming) can reduce water quality in AP.	2. Provincial	2. Top 5 threats
Waste pollution	Domestic refuse not properly disposed of and accumulating in wetland	1. Community 2. Provincial	1. 1/2 groups 2. Top 5
Obstructions to crane movements	For example trees planted on embankment road crossing through AP (electricity lines are of concern in future)	Expert opinion	High

[11] A community management plan consultation session was held in March 2013. Two equal sized groups were consulted.

[12] A provincial management plan consultation session was held with government staff in March 2013. During the meeting there was a plenary discussion of all threats followed by a listing of the top five.

4.3. OBJECTIVES

4.3.1. TWENTY-YEAR VISION

During the workshops attended by local community members and government officials, exercises were undertaken to try to establish a common vision for AP which stakeholders could agree upon and then work together to achieve. Whilst this plan is only for the first five years of that period, it represents the first step on the way to realising that vision. As a result of the suggestions, comments and views expressed in the workshop exercises, the following statement is proposed as an interim 20 year vision for AP:

"A healthy, vibrant wetland with lots of wildlife including many Sarus Crane, managed sustainably by local communities to support their livelihoods as well as the reserve. The site will be visited by many tourists and it will be used as a showcase for community-based wetland management in Cambodia"

Whilst this interim statement is useful in providing an end-point to aim for, it is intended that partners and stakeholders should agree a more detailed vision statement in the early part of this management planning period. However, the vision as it is provides a focus for management and it is with this in mind that the following management aims and objectives are presented.

4.3.2. MANAGEMENT PLAN OBJECTIVES

Key aims:

- **To increase the use of AP by Sarus Cranes by appropriate management of hydrology and habitats**
- **To manage, maintain and enhance wetland biodiversity in AP to support human livelihoods**

Meeting these key aims will underpin the delivery of the government sub-decree of 2007.

For this five-year management plan we set out the following objectives for the conservation features listed above (these are not in any priority order and should be seen as complimentary to each other):

Objective 1:

Sarus Cranes will have increased their use of AP by 2018 because appropriate grassland and hydrological management regimes have been identified and implemented

Performance indicators:

i) The total number of cranes that use AP (based on annual maximum counts) will on average have increased by at least 10% and the increase in numbers will be greater than any change (positive or negative) in the Sarus Crane population in the Mekong delta (based on results of annual regional counts conducted in late March/early April) for the years 2014-2018 in comparison to the average for 2004-2013

ii) Differences in the average day-count of cranes at AP between consecutive years will not see a temporary year - on-year decline of more than 20% from 2015 on

iii) The average number of days per year that cranes are present at AP will have increased by at least 10% for the years 2014-2018 in comparison to the average for 2004-2012

iv) Food selection by cranes has been determined and management actions are undertaken to increase availability of food items by 2018

v) Soil penetrability in all feeding areas is kept suitable for cranes until the end of May for the final two years of the plan (2017-2018)

vi) Cranes continue to roost at AP throughout the management plan period.vii) Extent of *Eleocharis spiralis* grassland is increased by 5% by end of plan period

Objective 2:

Ecological and hydrological integrity of AP is protected and enhanced by establishing and implementing a floodplain land-use plan that promotes sustainable land use activities in the wider floodplain and catchment as a whole

Performance indicators:

i) Floodplain land-use plan agreed and implemented by local stakeholders and government

ii) The existing tidal regime of site is maintained in the floodplain south of the salinity barrier

iii) No further conversion of floodplain to shrimp farming (or other intensive land uses)

iv) Factors causing disturbance to cranes, actual or potential, are reduced, removed or mitigated

Objective 3:

Wetland resources that support human livelihoods are maintained and enhanced in the reserve as a result of more sustainable management for the benefit of people and wildlife.

Rationale: The successful conservation of AP and its biological richness depends to a large extent on the ability of the reserve to provide ecosystem goods and services for local people. If livelihood activities are unsustainable then overall ecosystem health will decline with an associated reduction in benefits to local people. Managing existing activities and developing alternative ones to put in place more sustainable approaches will require the full participation of local people and, in the long-term, for them to be involved in the co-management of these activities alongside the government.

Performance indicators*:

i) Local communities actively co-managing CBET and sustainable farming initiatives by 2018

ii) Overall monetary value of food provisioning ecosystem services (wild harvested goods such as fish and plants) increased by 5% by 2018 (compared with 2012 values and taking into account price inflation)

iii) Populations of key indicator species are maintained or enhanced by end of plan compared with 2016

iv) Percentage of local people expressing the desire to conserve AP as a natural wetland increased by 25% between start and end of management plan period

v) current extent of wetland habitat maintained

vi) number of illegal activities occurring in the reserve identified by LCG patrols decline to zero in final year of plan

*these performance indicators will be reviewed throughout the duration of the plan as and when new data become available particularly with regards to biodiversity.

Objective 4:

Wider biodiversity at AP will be better understood and indicator species identified to permit long-term monitoring of ecosystem health

Rationale: current knowledge of the state of biodiversity at AP (except for Sarus cranes) is poor. However, understanding the status of wider biodiversity at the site is important for many reasons, but it is especially important as an indicator of a healthy, functioning wetland (which in turn indicates that it is able to support human livelihoods). Identifying species or communities of species that can give an early warning of threats to wetland biodiversity and allow timely interventions is therefore key to biodiversity conservation.

Performance indicators:

i) Baseline surveys conducted for fish, birds, mammals, invertebrates and plants by 2017

ii) Suitable "early-warning" indicator species or communities selected by 2017

iii) Annual monitoring plan produced and being implemented

iv) Report detailing status of biodiversity at AP produced by 2018

v) Suite of "early warning" species monitored in 2017 and 2018 (or before)

4.4. MANAGEMENT ISSUES

During stakeholder consultations a number of management issues were mentioned that need to be addressed in order to achieve the objectives of the management plan. Table 5 lists management issues identified during these consultations.

Table 5. List of management issues

Issue	Description	Source
AP community management groups need more authority	Communities need to be given more control over management of AP and recognized by government at provincial or ministerial level	Community
Lack of understanding of how landuse outside AP may impact on its ecology and values	Impact assessments need to be conducted for any planned developments in the floodplain and along the boundary of the reserve. When impacts cannot be mitigated development should not be permitted.	Government
Need to deepen understanding of wider catchment	Lack of knowledge of AP's eco-hydrological context may lead to inappropriate land use in the floodplain and river basin as a whole	Government
Lack of understanding of impacts of agricultural chemicals	Lack of knowledge may lead to decreasing water quality and impacts on wider ecosystem value	Government
Inadequate planning and provision for eco-tourism	May lead to failure of CBET initiative	Community and government
Incomplete awareness among stakeholders on environmental issues	This may lead to degradation of ecological quality of reserve and its surrounding floodplain	Community and government
Lack of inter- agency committee for management	Infrequent communication between government agencies and other stakeholders working in AP results in	Government

	inappropriate land use activities in and around AP	
Lack of alternative livelihood options means Anlung Pring resources may become over-exploited	Alternative resources (*e.g.* biogas, fish ponds) are needed to reduce pressure on AP	Community and government
Lack of financial resources to implement sustainable land management	Shortage of public and private sector funding hampers ability to undertake effective management interventions	Community and government

Anlung Pring management plan,

January 2014 – December 2018

Part 2: Action Plan and Projects

5. CO-DELIVERERS

A partnership between the FA, various government agencies, NGOs and community groups is necessary to achieve the aims of the management plan. Current and future partners are listed below along with their roles, although other partners may be involved during the course of implementing the management plan.

Government partners

Forestry Administration (FA): responsible for overall management of AP. Within FA the Department of Wildlife & Biodiversity oversees daily management activities in AP. The Kampot Forestry Department also has a role in handling any legal issues that need resolution. Also responsible for enforcing the Forestry Law and MAFF Wildlife Law.

Kampot provincial line agencies such as Department of Water Resources & Meteorology, Department of Agriculture, Department of Fisheries, Department of Land Management, Department of Rural Development and Department of Tourism will also be partners in implementing the management plan.

Kampot administrative authorities, such as provincial, district, commune and village authorities will also be regularly involved during the implementation of the plan and will be invited to attend meetings, including those of the inter-agency advisory panel.

Law enforcement agencies such as commune level policemen and border army personnel with bases near to AP will regularly be involved as part of the re-formed LCG (first formed in 2004 for the reserve which will deliver most law enforcement activities including regular patrols. This group consists of forestryand law enforcement personnel.

Non-governmental partners

The local communities in and around AP represent an important stake-holding group and will be integral in co-delivering most if not all planned activities. As such, facilitating their early participation in planning and designing activities will be crucial to the success of the plan.

Wildfowl & Wetlands Trust (WWT): UK based conservation organisation specialised in wetland management and species recovery programmes. Started work in AP in October 2010 and principle authors of this management plan. WWT will lead delivery of biodiversity and capacity-building activities (this latter one with MB) as well as provide expert advice on wetland management if financial resources are secured to fund the plan.

BirdLife International in Indochina (BL): UK based conservation organisation specialised in birds. Started work in AP in 2004. Maintains a regional office in Hanoi and Cambodia programme office in Phnom Penh.

Mlup Baitong: Cambodian NGO with a focus on rural development, including natural resource management and community-based tourism. Collaborating with BL and later WWT on project activities in AP since 2009.

Other partners not yet confirmed will be an agricultural NGO, universities and external facilitators to assist with the participatory planning processes required to foster widespread support for the plan

5.1. SUMMARY OF HUMAN RESOURCE REQUIREMENTS

To deliver the plans and projects detailed in the plan will require both human and financial resources. It is envisaged that many of the activities will be co-delivered by partner organisations together with wetland user communities (as described above). However, there will need to be a core team of staff employed throughout the duration of the plan to co-ordinate and steer management efforts and to ensure that all stakeholders are aware of their responsibilities and how they can participate effectively in delivering success.

As a minimum, delivering the plan will require an officer seconded from the Forestry Administration department together with two more staff employed by a lead NGO, probably WWT (one based with FA officer in Phnom Penh and another based full-time at AP). This team should not only perform a co-ordination role and steer delivery but also provide necessary technical inputs in particular with regards to sustainable wetland management. Sometimes, it will be necessary to employ external consultants for brief periods to perform discrete tasks, especially to facilitate participatory planning events. These instances are identified in the activities plan.

This team will also have some responsibility for delivering the management plan for Boeung Prek Lapouv.

Also, there is a requirement to continue with law enforcement activities performed up to now by the Local Conservation Group. Although this group is likely to be reformed somewhat, it is an essential part of plan delivery.

The role that wetland users will play is an important one too. The wetland supports the livelihoods of many people and so their knowledge and needs are crucial in making management interventions work. Building their capacity to participate in delivering sustainable wetland management is fundamental to success and this is acknowledged in the planned activities. The plan makes clear that for the future the only sustainable situation is likely to be one where wetland users are co-managing the reserve (especially through the CBET) with FA and others.

Therefore, before any of the following management tasks can be undertaken, project team members will need to be recruited and trained as the first step in delivering the plan.

5.2. ADVISORY AND LIAISON PANELS

An inter-agency advisory panel will be established to provide a forum for government departments and AP representatives to exchange ideas, update on policy and strategy developments affecting the reserve as well as to give legal and technical advice to a second panel, the AP liaison panel.

The inter-agency advisory panel will include FA, other government departments and provincial line agencies within Kampot, administrative authorities from Kampong Trach, WWT, MB and selected representatives from AP projects

The AP liaison panel will consist of wetland users, project representatives (*e.g.* from CBET), WWT, MB and the FA. Here, panel members will update colleagues on project progress, identify issues, propose solutions and otherwise liaise about management plan activities. Where required, this panel may ask for support and advice from the advisory panel.

Both panels will be constituted within the first 3 months of the plan commencing and will meet quarterly and circulate minutes of meetings to each other. FA will provide the link between the two panels together with WWT.

5.3. FINANCIAL REQUIREMENTS

In order to deliver the aims of the plan, adequate funding will need to be secured; without money, very little can be achieved. Co-deliverers and partners should endeavour to identify opportunities for funding the plan and wherever possible seek to commit funds from their own resources. The principal authors of this plan, WWT, commits to raising funds to enable the plan delivery to commence on time and looks to other partners to do the same.

Meeting the aims of the management plan requires that a number of activities need to be carried out. These are detailed below along with identifying those organisations which are likely to be involved in delivering them.

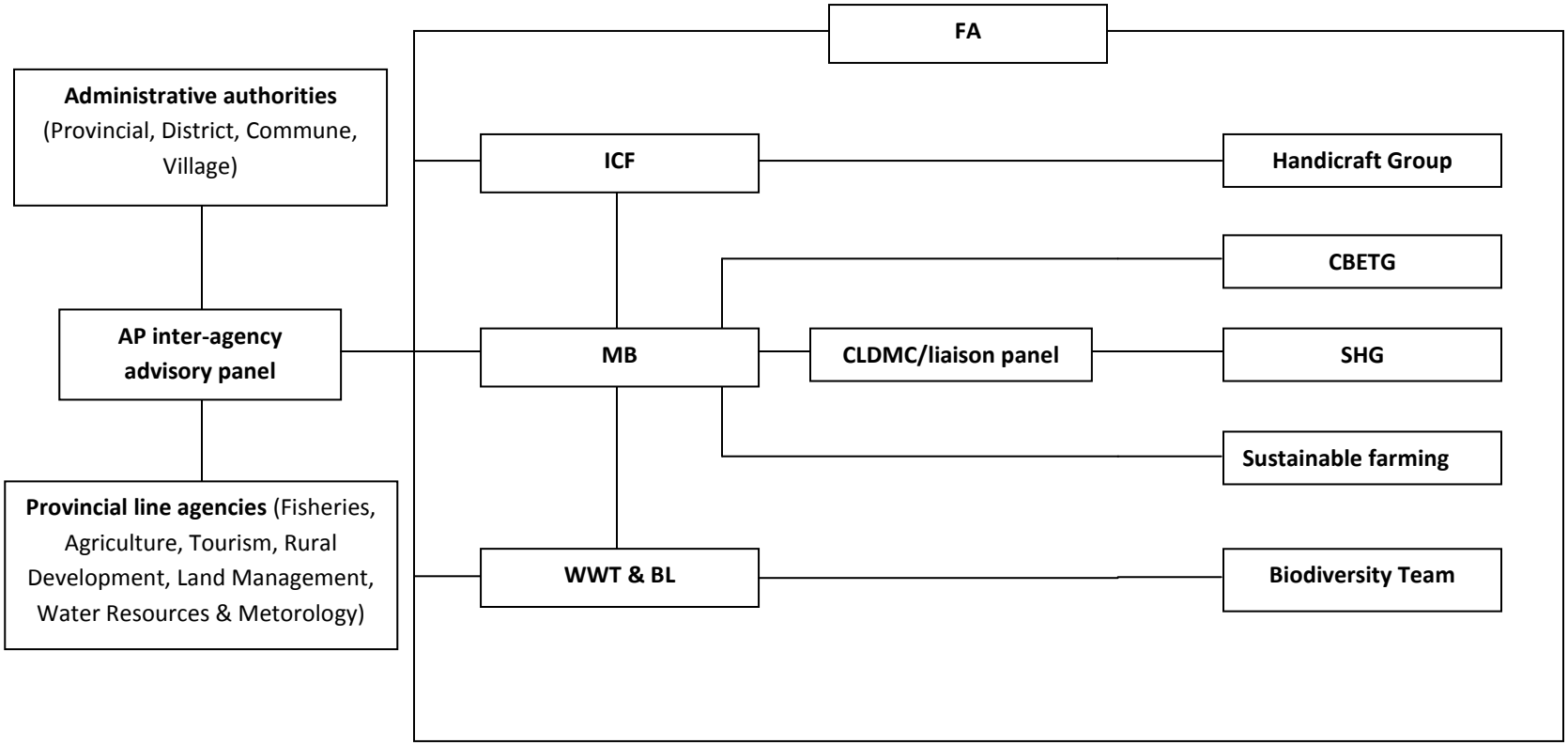


Figure 13. Linkages between various partners

6. ACTION PLAN

In order to achieve the objectives of the plan, a number of activities have been formulated that, if undertaken as described below will ensure success. These activities are grouped under projects, facilitating fundraising and clarifying stakeholders involved in implementation of the plan. Where co-deliverers are identified, these will include the partner likely to lead on co-ordination of the activity as well as being the organisation with the main responsibility for delivery.

6.1. COMMUNITY-BASED ECOTOURISM PROJECT

Project plan

Purpose: To develop community-based ecotourism in AP to provide a sustainable income source and employment opportunity and increase capacity of local communities to conserve AP. This initiative will be based on a participatory process that includes all stakeholders to develop widespread support for and long-term commitment to sustainable eco-tourism in the reserve.

Table 6. Activities to be undertaken under the community-based ecotourism project.

1. Develop and agree on final plan for community-based ecotourism development in AP (incl. activities, infrastructure, impact management, interpretation, training, marketing)	*					WWT/ MB, CBETG, CLDMC, FA, Kampot Tourism Dept.	Final strategic document
2. Implement eco-tourism plan; monitor	*	*	*	*	*	CBETG, MB, WWT	Quarterly reports
3. Construct tourism infrastructure as recommended in plan	*	*	*			WWT MB, CBETG, CLDMC, FA	Field check & map
4. Purchase equipment for CBETG as appropriate	*	*	*	*		WWT, MB, CEBTG	Receipts, inventory
5. Maintain infrastructure and equipment	*	*	*	*	*	CEBTG	Maintenance records
6. Design and deliver training/awareness programme for CBETG and others as appropriate	*	*	*	*	*	WWT, MB, CEBTG	Training events held
7. Review operation of benefit-sharing mechanism and amend as required			*			CEBTG	Review documents produced
8. CBETG to prepare quarterly reports and attend quarterly meetings of liaison panel	*	*	*	*	*	CBETG	Quarterly reports

Table - Approximate budget for activities listed above that require separate funding (excluding salaries, per diems)

Activity	Cost/yr ($)	Total ($)
1.Preparation of marketing strategy	n/a	5,000
3. Construct tourism infrastructure as recommended in plan	n/a	50,000
4. Purchase equipment for CBETG as appropriate	n/a	15,000
5. Maintain infrastructure and equipment	1,000	5,000
	Total ($)	75,000

6.2. WETLAND HANDICRAFTS PROJECT

Project plan

Purpose: To develop a wetland handicraft workshop in AP modelled on that set up by ICF in the nearby Phu My wetland in Vietnam. This initiative will be based on a participatory process that includes all stakeholders to develop widespread support for and long-term commitment to sustainable development.

Table 7. Activities to be undertaken under the wetland handicrafts project.

1. Review availability and potential for sustainable use of existing plant community in AP and wider floodplain[13]	*					ICF, WWT, CLDMC	Report produced
2. Develop sustainable production and use plan for target species	*					ICF, WWT, CLDMC	Plan produced
3. Identify and evaluate markets in-country and abroad	*					ICF	Report produced
4. Form AP handicrafts group (HG)	*					WWT, ICF, CLDMC	
5. Establish handicraft production facility	*					ICF, HG	Facilities allocated and in use
6. Train weavers	*	*	*	*	*	ICF	Regular training sessions held
7. Purchase equipment	*					ICF	Equipment in use, invoices
8. Maintain equipment	*	*	*	*	*	ICF, HG	Maintenance

[13] Do not introduce novel species to the plant community of AP or wider floodplain without prior biological impact assessment

							records
9. Develop a benefit-sharing structure with community groups to support conservation of AP	*					ICF	Bank account created, deposits made
10. Increase communication and collaborations between managers of AP and Phu My	*	*	*	*	*	WWT, ICF, BL, FA, Local authorities, Vietnamese authorities, local communities	
11. HG to prepare and disseminate quarterly reports and attend quarterly meetings of liaison panel	*	*	*	*	*	HG	Quarterly reports

Table - Approximate budget for activities listed above that require separate funding (excluding salaries, per diems)

Activity	Cost/yr ($)	Total ($)
5. Establish handicraft production facility		20,000
7. Purchase equipment		10,000
8. Maintain equipment	1,000	5,000
	Total ($)	35,000

6.3. SUSTAINABLE FARMING PROJECT

Project plan

Purpose: To encourage sustainable farming on farmland surrounding the reserve, using low inputs and applying soil & water conservation techniques. The project will work towards initiating a marketing scheme that gives financial rewards to participating farmers for adopting sustainable farming techniques advocated by the project. This initiative will be based on a participatory process that includes all stakeholders to develop widespread support for and long-term commitment to sustainable agriculture.

Table 8. Activities to be undertaken under the sustainable farming project.

1. Establish sustainable farming group (SFG)	*					MB, WWT, Agri Dept, CLDMC, Agri NGO	Membership agreed and publicised
2. Design trial of low-input/high biodiversity rice production with local farmers adjacent to reserve	*					SFG, WWT, Agri Dept, Agri NGO,	Report produced and disseminated

3. Undertake trial in plots adjacent to reserve	*	*				SFG, WWT	
4. Report on trial and make recommendations for rollout of sustainable rice production			*			SFG, WWT	Report produced
5. Identify market for rice crop (with Wildlife Conservation Society)	*					SFG, Agri NGO, WWT, WCS	Agreement made with WCS
6. Rollout sustainable rice farming system to further demonstration plots as appropriate			*	*	*		
7. Scope potential for other low-input/sustainable agricultural products (e.g. fish, natural compost etc) and trial as appropriate	*					SFG, WWT, CLDMC, agri NGO	Report produced
8. Trial products as recommended		*	*	*	*	SFG, CLDMC	
9. Produce report on trials					*	Agri NGO	Report produced
10. Design and deliver training/awareness-raising programme (inc chemicals, protecting wetland resources, biodiversity)	*	*	*	*	*	WWT, SFG, MB,	Training events held, attendance records
11. Purchase equipment required to undertake work of SFG	*	*	*			WWT, MB	Invoices, equipment in use
12. Develop and agree on benefit-sharing structure that supports community conservation activities	*	*				SFG, WWT, CLDMC	Agreement documents
13. SFG to prepare quarterly reports and attend quarterly meetings of liaison panel	*	*	*	*	*	SFG	Quarterly reports

Table - Approximate budget for activities listed above that require separate funding (excluding salaries, per diems)

Activity	Cost/yr ($)	Total ($)
3. Undertake trial in plots adjacent to reserve	3,000	6,000
6. Rollout sustainable rice farming system to further demonstration plots as appropriate	3,000	12,000
8. Trial products as recommended	3,000	12,000
11. Purchase equipment required to undertake work of SFG	n/a	10,000
	Total ($)	40,000

6.4. RESERVE MANAGEMENT PROJECT

Project plan:

Purpose: To increase crane use of AP and enhance wider biodiversity through conservation management of habitats and hydrology.

Table 9. Activities to be undertaken under the reserve management project.

Activity	Y1	Y2	Y3	Y4	Y5	Implementing agency	Means of verification
1. Establish advisory and liaison panels	*					FA, WWT, CLDMC	Membership agreed, list published
2. Recruit site-based project coordinator	*					WWT	Officer in post
3. Recruit team of local people to undertake reserve management and extension training (biodiversity team, BT)	*					WWT, BT	Team recruited, management works undertaken
4. Conduct land elevation survey in wider floodplain	*					WWT & BL	Survey produced
5. Develop and agree water level management plan (WLMP) for reserve	*	*	*			WWT, BL, FA, CLDMC, community water management group, CAVAC	WLMP produced and agreed
6. Implement WLMP and monitor		*	*	*	*	WLMP group (as above)	Data collected and stored
7. Repeat ecosystem services appraisal undertaken by WWT/CCK in 2011					*	WWT & BL	Report produced

Activity	Y1	Y2	Y3	Y4	Y5	Implementing agency	Means of verification
8. Assess sustainability of natural resource use in reserve. Disseminate results, recommendations.		*	*			WWT, CLDMC, water-users group	Report produced
9. Develop and agree survey and monitoring protocol for hydrology, water quality, biodiversity, sustainable resource use	*					WWT, CLDMC	Protocol produced
10. Undertake survey and monitoring as per protocol	*	*	*	*	*	WWT, universities, CLDMC, local community	
11. Produce annual survey and monitoring report detailing activities and results	*	*	*	*	*	WWT, universities, CLDMC	Reports produced
12. Purchase survey and monitoring equipment as required	*	*	*	*	*	WWT	Invoices, equipment in use
13. Design and deliver training and awareness programme to include wetlands, biodiversity, management.	*	*	*	*	*	WWT & BL	Training events held, attendance lists
14. Continue studying crane use of AP	*	*	*			Charles Darwin University (CDU) & other linked universities	
15. Study plant ecology in AP (especially of *E. spiralis*)	*	*	*			CDU & other linked universities	
16. Design habitat management trials to improve food availability in reserve for cranes while maintaining biodiversity and ecosystem services	*	*	*			WWT, CDU & other linked universities	
17. Undertake trials	*	*	*			WWT, CDU & other linked universities	
18. Report on trials including recommendations for further action			*			WWT, CDU	Reports produced
19. Rollout additional habitat management as agreed			*	*	*	WWT,	

Table - Approximate budget for activities listed above that require separate funding (excluding salaries, per diems)

Activity	Cost/yr ($)	Total ($)
4. Conduct land elevation survey in wider floodplain	n/a	10,000
10. Undertake survey and monitoring as per protocol	5,000	25,000
12. Purchase survey and monitoring equipment as required	n/a	10,000
17. Undertake trials	3,000	9,000
19. Rollout additional habitat management as agreed	2,000	2,000
	Total ($)	56,000

6.5. FLOODPLAIN MANAGEMENT PROJECT

Project plan:

Purpose: To implement sustainable management of the floodplain that protects AP and its wildlife, ecosystem services and supports livelihoods of local people

Table 10. Activities to be undertaken under the floodplain management project.

1. Undertake scoping study of river basin (hydrology, water resources, geology, soils, land use, livelihoods, ecosystem services, threats etc)	*	*				WWT & BL, Universities	
2. Produce and disseminate report		*					Report produced
3. Develop and agree floodplain land-use plan (to include all land adjacent to reserve) to protect AP	*	*				WWT, BL, FA, CLDMC	Plan produced, agreed and disseminated
4. Implement floodplain land-use plan		*	*	*	*		
5. Identify priority land parcels outside of reserve for targeted management action (e.g. demonstration sites, management agreements etc)	*	*				WWT & BL	Report and map produced
6.Deliver targeted management action on priority land parcels		*	*	*	*		

Table - Approximate budget for activities listed above that require separate funding (excluding salaries, per diems)

Activity	Cost/yr ($)	Total ($)
1. Undertake scoping study of river basin (hydrology, water resources, geology, soils, land use, livelihoods, ecosystem services, threats etc)	n/a	15,000
6.Deliver targeted management action on priority land parcels	15,000	60,000
	Total ($)	55,000

6.6. LAWS AND REGULATIONS PROJECT

Table 11. Activities to be undertaken under the laws and regulations project.

1. Establish AP patrol team with members drawn from local community	*					Forestry Administration (FA)	Members recruited, membership publicised
2. Ensure adequate training, supplies and equipment for patrol team	*	*	*	*	*	WWT, FA	Training events held, invoices
3. Conduct daily systematic patrols covering all of the wider floodplain on a weekly basis	*	*	*	*	*	AP patrol team	Patrol data stored
4. Collaborate with local authorities to prevent illegal activities	*	*	*	*	*	AP patrol team, relevant authorities	
5. Produce quarterly reports and disseminate at liaison panel meetings	*	*	*	*	*	AP patrol team	Quarterly reports
6. Raise awareness of laws and regulations at AP and in wider floodplain	*	*	*	*	*		Training and awareness events held, attendance lists

Table - Approximate budget for activities listed above that require separate funding (excluding salaries)

Activity	Cost/yr ($)	Total ($)
2. Ensure adequate training, supplies and equipment for patrol team	5,000	25,000
3. Conduct daily systematic patrols covering all of the wider floodplain on a weekly basis	13,000	65,000
	Total ($)	90,000

6.7 Awareness and capacity building project

Project plan

Purpose: To ensure local communities, FA and other partners and groups are aware of the values and importance of AP in general and to build capacity to participate in the design and delivery of all planned activities. A specific activity within this project will be to undertake a general scoping assessment of wetland activities at AP related to risks to human and animal health. This will be important because it will detail for the first time whether current management practices represent a risk and if so, how these can be reduced or mitigated. Underlying the need for this activity is the idea that unwise management of natural resources be harmful to human and in this case, wetland health.

Bespoke training programmes will be delivered for each project but all will be based on the principle of sustainable and wise-use of the wetland.

Table 12- Activities to be implemented under the awareness and capacity building project

Activity	Y1	Y2	Y3	Y4	Y5	Co-deliverers	Means of verification
1. Undertake risk assessment to scope existence (real or potential) of pests/diseases related to human and animal/bird use of AP identifying examples of good and bad practice (based on Ramsar guidelines)		*				FA, WWT, MB, CLDMC	Report
2. Disseminate results, recommend actions to reduce/eradicate risks		*	*			FA, WWT, MB, CLMDC	Partners and stakeholders receive reports
3. Identify all training, capacity-building and awareness raising needs and develop consolidated plan for all such activities (see individual project plans above)	*					WWT, MB, CLMDC	Plan produced

Activity	Y1	Y2	Y3	Y4	Y5	Co-deliverers	Means of verification
4. Implement plan	*	*	*	*	*	FA, WWT, MB, CLMDC	Minutes of meetings and attendance lists
5. Project rep(s) to attend and provide reports at quarterly AP liaison panel meetings	*	*	*	*	*	FA, WWT, MB, CLMDC	Meeting minutes

Table 12.1- Approximate budget for activities listed above that require separate funding

Activity	Cost/yr ($)	Total ($)
1. Risk assessment	5,000	5,000
All costs for training and capacity programme are identified elsewhere		
Total		5,000

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APPENDICES

APPENDIX 1. LIST OF FLORA IDENTIFIED IN FEBRUARY 2013 BOTANICAL SURVEY

(Le Phat Quoi and Nguyen Huu Thien, 2013)

	Family	Species	English name
1	Acanthaceae	*Acanthus ilicifolius*	
2	Arecaceae	*Nipa fruticants*	Nipa palm
3	Ceratophyllaceae	*Ceratophyllum demersum*	
4	Commelibaceae	*Commelina bengalensis*	Dayflower
5	Convolvulaceae	*Ipomoea aquatica*	Water spinach
6	Cyperaceae	*Fimbristylis microcarya*	
7	Cyperaceae	*Fimbristylis miliacea*	
8	Cyperaceae	*Scirpus maritimus*	
9	Cyperaceae	*Fimbristylis sericea*	
10	Cyperaceae	*Eleocharis spiralis*	
11	Cyperaceae	*Eleocharis dulcis*	Water chestnut
12	Cyperaceae	*Eleocharis philippinensis*	
13	Cyperaceae	*Eleocharis parvula*	
14	Menyanthaceae	*Nymphoides indica*	
15	Myrtaceae	*Melaleuca leucadendra*	
16	Myrtaceae	*Melaleuca cajuputi*	
17	Nympheaceae	*Nymphaea nouchali*	Water lily
18	Poaceae	*Cynodon dactylon*	Couch grass
19	Poaceae	*Eragrostis atrovirens*	
20	Pteridaceae	*Acrostichum aureum*	Golden Leather Fern
21	Sonneratiaceae	*Sonneratia caseolaris*	
22	Xyridaceae	*Xyris indica*	

APPENDIX 2. LIST OF BIRDS RECORDED FROM ANLUNG PRING

(Nomenclature follows BirdLife International 2012)

	Family	Scientific name	English name
1	Acanthizidae	*Gerygone sulphurea*	Golden-bellied Gerygone
2	Accipitridae	*Circus spilonotus*	Eastern Marsh Harrier
3		*Elanus caeruleus*	Black-shouldered Kite
4		*Pandion haliaetus*	Osprey
5	Alaudidae	*Alauda gulgula*	Oriental Skylark
6		*Mirafra javanica*	Australian Bushlark
7	Alcedinidae	*Alcedo atthis*	Common Kingfisher
8		*Halcyon pileata*	Black-capped Kingfisher
9		*Halcyon smyrnensis*	White-throated Kingfisher
10	Anatidae	*Anas poecilorhyncha*	Indian Spot-billed Duck
11		*Anas querquedula*	Garganey
12		*Nettapus coromandelianus*	Cotton Pygmy-goose
13		*Dendrocygna javanica*	Lesser Whistling-duck
14	Anhingidae	*Anhinga melanogaster*	Oriental Darter
15	Apodidae	*Cypsiurus balasiensis*	Asian Palm Swift
16	Ardeidae	*Ardea cinerea*	Grey Heron
17		*Ardea purpurea*	Purple Heron
18		*Ardeola bacchus*	Chinese Pond Heron
19		*Ardeola speciosa*	Javan Pond Heron
20		*Bubulcus ibis*	Cattle Egret
21		*Butorides striatus*	Little Heron
22		*Casmerodius albus*	Great Egret

	Family	Scientific name	English name
23		*Egretta garzetta*	Little Egret
24		*Ixobrychus cinnamomeus*	Cinnamon Bittern
25		*Ixobrychus sinensis*	Yellow Bittern
26		*Mesophoyx intermedia*	Intermediate Egret
27		*Nycticorax nycticorax*	Black-crowned Night-Heron
28	Caprimulgidae	*Caprimulgus affinis*	Savanna Nightjar
29		*Caprimulgus macrurus*	Large-tailed Nightjar
30	Charadriidae	*Charadrius dubius*	Little Ringed Plover
31		*Pluvialis fulva*	Pacific Golden Plover
32		*Vanellus indicus*	Red-wattled Lapwing
33	Ciconiidae	*Anastomus oscitans*	Asian Openbill
34		*Ciconia episcopus*	Woolly-necked Stork
35		*Leptoptilos javanicus*	Lesser Adjutant
36		*Mycteria leucocephala*	Painted Stork
37	Cisticolidae	*Cisticola juncidis*	Zitting Cisticola
38		*Prinia inornata*	Plain Prinia
39	Columbidae	*Streptopelia chinensis*	Spotted Dove
40		*Streptopelia tranquebarica*	Red Collared Dove
41	Coracidae	*Coracias benghalensis*	Indian Roller
42	Cuculidae	*Cacomantis merulinus*	Plaintive Cuckoo
43		*Centropus bengalensis*	Lesser Coucal
44	Dicruridae	*Dicrurus macrocercus*	Black Drongo
45	Emberizidae	*Emberiza aureola*	Yellow-breasted Bunting
46	Estrildidae	*Lonchura malacca*	Black-headed Munia
47	Falconidae	*Falco peregrinus*	Peregrine Falcon

	Family	Scientific name	English name
48	Glareolidae	*Glareola maldivarum*	Oriental Pratincole
49	Gruidae	*Grus antigone*	Sarus Crane
50	Hirundinidae	*Hirundo daurica*	Red-rumped Swallow
51		*Hirundo rustica*	Barn Swallow
52		*Riparia riparia*	Sand Martin
53	Laniidae	*Lanius cristatus*	Brown Shrike
54	Meropidae	*Merops orientalis*	Green Bee-eater
55		*Merops philippinus*	Blue-tailed Bee-eater
56	Motacillidae	*Anthus rufulus*	Paddyfield Pipit
57	Muscicapidae	*Copsychus saularis*	Oriental Magpie Robin
58		*Saxicola caprata*	Pied Bushchat
59		*Saxicola torquata*	Common Stonechat
60	Nectariniidae	*Nectarinia jugularis*	Olive-backed Sunbird
61	Passeridae	*Passer flaveolus*	Plain-backed Sparrow
62		*Passer montanus*	Eurasian Tree Sparrow
63	Pelecanidae	*Pelecanus philippensis*	Spot-billed Pelican
64	Phalacrocoracidae	*Phalacrocorax carbo*	Great Cormorant
65		*Phalacrocorax niger*	Little Cormorant
66	Podicipedidae	*Tachybaptus ruficollis*	Little Grebe
67	Pycnonotidae	*Pycnonotus goiavier*	Yellow-vented Bulbul
68	Rallidae	*Amaurornis phoenicurus*	White-breasted Waterhen
69		*Gallicrex cinerea*	Watercock
70		*Gallinula chloropus*	Common Moorhen
71		*Porphyrio porphyrio*	Purple Swamphen
72		*Porzana fusca*	Ruddy-breasted Crake

	Family	Scientific name	English name
73	Recurvirostridae	*Himantopus himantopus*	Black-winged Stilt
74	Rhipiduridae	*Rhipidura javanica*	Pied Fantail
75	Scolopacidae	*Actitis hypoleucos*	Common Sandpiper
76		*Gallinago gallinago*	Common Snipe
77		*Limosa limosa*	Black-tailed Godwit
78		*Tringa erythropus*	Common Redshank
79		*Tringa glareola*	Wood Sandpiper
80		*Tringa nebularia*	Common Greenshank
81		*Tringa ochropus*	Green Sandpiper
82		*Tringa stagnatilis*	Marsh Sandpiper
83	Sturnidae	*Acridotheres tristis*	Common Myna
84		*Sturnus nigricollis*	Black-collared Starling
85	Sylviidae	*Acrocephalus orientalis*	Oriental Reed Warbler
86		*Megalurus palustris*	Striated Grassbird
87	Threskiornithidae	*Plegadis falcinellus*	Glossy Ibis
88		*Threskiornis melanocephalus*	Black-headed Ibis
89	Turnicidae	*Turnix suscitator*	Barred Buttonquail
90	Upupidae	*Upupa epops*	Common Hoopoe