CEPF FINAL PROJECT COMPLETION REPORT

Organization Legal Name:	Indian Institute of Science
Project Title:	Addressing the 'Wallacean Shortfall' for Small Vertebrates in the Western Ghats Across Space and Time
Date of Report:	November 25, 2014
Report Author and Contact Information	Dr. Kartik Shanker, Associate Professor, Centre for Ecological Sciences, Indian Institute of Science, Bangalore - 560012

CEPF Region:

Strategic Direction:

Grant Amount: $ 149,716

Project Dates: October 1, 2009 – November 31, 2014

Implementation Partners for this Project (please explain the level of involvement for each partner): Not applicable.

Conservation Impacts

Please explain/describe how your project has contributed to the implementation of the CEPF ecosystem profile.

Please summarize the overall results/impact of your project.

1. The project was able to deliver the primary goal, namely to fill in the gaps in distributional information for frogs, lizards and snakes. We started with the aim of mapping distributions for a relatively small number of species that were threatened according to a then recent IUCN Red List assessment. The discovery of a large number of new lineages forced us to expand the scope of this work. There is more than two fold increase in the number of species across a number of genera since the initiation of the project. Nevertheless, we managed to amass >5000 point records of >90% of the known species along with a large number of new lineages of frogs, lizards, and snakes.

2. The data generated has become the source for three major deliverables:
    a. An online digital atlas for herpetofauna of Western Ghats.
    b. Printed version of the visual and distributional ATLAS.
    c. A map of the important areas for frogs and lizards.

3. This is the largest attempt at mapping the distribution of fauna in the Indian subcontinent. The database developed here is much larger than a century of historical records put together for these taxa. With a unique interface, this data is available for visualization for the general public through an online portal. We plan to use this as a platform to create awareness, generate academic interest among the local student communities, and help in conservation prioritization.

4. A part of the spatial database generated has already become the backbone for answering much larger questions in ecology, evolution and biogeography. With time, we expect all these results to have lasting impacts on future research and set an example for an informed conservation of this region's biological diversity.

Planned Long-term Impacts - 3+ years (as stated in the approved proposal):

1. The project will provide information for conservation prioritization in the Western Ghats, and provide a basis for comparison with other biodiversity hotspots.

2. In the long term, these data will provide baselines for assessment of impacts and of conservation actions.

3. The dissemination of research and outreach is expected to create substantial local awareness of and involvement in conservation of a wide range of taxa by the state (Forest Department) and civil society, which again is likely to result in long term gains.

4. The project seeks to foster greater academic interest in smaller vertebrate taxa, which will eventually lead to greater knowledge of these groups, in particular their populations and distributions, which is critical for long term conservation.

5. A combination of biological information and widespread awareness in civil society lays the framework for conservation in reconciliatory landscapes where human use can coexist with biodiversity. This is a particularly important long term goal for the Western Ghats, where there is limited scope for the expansion of protected areas.

Actual Progress Toward Long-term Impacts at Completion:

1. Over the course of the project, the entire Western Ghats has been surveyed, generating data on 400 species of frogs, lizards and snakes, with **more than 5000 records**. This includes **more than 90% of the known species of lizards and frogs**. In addition, there are **more than 50 new lineages** that might have to be assigned a specific status. We have already published the discovery of more than 20 lineages of bush frogs from these mountains, making this group of frogs, with more than 58 species, the largest vertebrate radiation in the Western Ghats. To highlight, ***the number of species which we have documented as part of this project is almost double the total number of species*** provided in the CEPF Western Ghats profile document.

2. For over 75% of the species in this group, we have a minimum of five point records (populations), which includes all the priority species that we committed to mapping the distributions of. Taken together, we would be able to provide detailed insights into the spatial distribution of a majority of these 400 species and identify areas of evolutionary and biogeographic importance. We anticipate that these findings will have a long-term effect in conservation planning.

3. The online database and published Atlas is expected to provide a much needed tool to create awareness for both State as well as civil society (students, conservation groups). The online database will eventually develop a participatory component which will allow both domain experts as well as citizens to provide information and data. This will enhance engagement with the conservation of these groups and broaden the knowledge base.

4. The ongoing work on the systematics front has begun to throw light on the vast underestimation of the evolutionary and biogeographic potential of the Western Ghats and highlights the greater conservation significance of this hotspot. Our examination of a few endemic clades containing lineages with uncertain taxonomic and systematic status - along with extensive spatial data amassed as part of this project - has led to greater than 100% increase in the number of known lineages. These results are of great significance towards understanding uncertainty associated with range boundaries of a majority of the species. Further this dataset will enhance our understanding of the endemic areas of the Western Ghats. These results are expected to

have lasting impacts on future research and set an example for an informed conservation of this region's biological diversity.

5. We expect the above outcomes to lead towards greater civil society engagement with the conservation of small vertebrates in the Western Ghats. Large scale citizen science projects for birds and other charismatic groups have increased awareness of and participation in the conservation of these groups. We expect that the products of this project will promote small vertebrates in a similar manner towards the eventual achievement of these goals.

Planned Short-term Impacts - 1 to 3 years (as stated in the approved proposal):

1. This project aims to fill the gaps in our knowledge on the geographic distribution of various threatened taxa which is crucial for reassessing the conservation status of these taxa.

2. The results will of also be crucial in identifying hotspots for conservation.

3. Reassessing the importance of already identified areas.

4. Help to direct immediate conservation actions and funds towards these habitats and species.

Actual Progress Toward Short-term Impacts at Completion:

1. Over the course of the project, the entire Western Ghats has been surveyed, generating data on 400 species of frogs, lizards and snakes, with **more than 5000 records**. This includes **more than 90% of the known species of lizards and frogs**. In addition, there are **more than 50 new lineages** that might have to been assigned a specific status. To highlight, **we have generated data for almost double the total number of species** provided in the CEPF Western Ghats profile document.

2. For over 75% of the species in the group, we have a minimum of five point records (populations), which includes all the priority species that we committed to mapping the distributions of. These data are being used to create maps of important areas for frogs and lizards.

3. These maps can be used to examine the relative importance of different protected areas in the Western Ghats. This work is in progress, and requires further rigorous analysis as the results may have significant consequences for conservation planning in the region.

4. Going forward, the maps of important areas, the assessment of protected areas, and the assessment of species ranges will be used to identify and promote species and habitats.

Please provide the following information where relevant:

Hectares Protected: Not applicable.
Species Conserved: Not applicable.
Corridors Created: Not applicable.

Describe the success or challenges of the project toward achieving its short-term and long-term impact objectives.

There were numerous logistic challenges in carrying out the project, particularly access to remote areas, and permits from the Forest Department. This delayed the project in several states, and limited the work in some areas. In addition, the large number of new lineages created challenges for identification, which required considerable time and effort from the project staff, and funding from other sources. Despite this, the major goals of the project have been achieved.

Were there any unexpected impacts (positive or negative)? Not applicable.

Project Components

Project Components*: Please report on results by project component. Reporting should reference specific products/deliverables from the approved project design and other relevant information.*

Component 1 Planned (as stated in the approved proposal):
1. Occurrence data (geographic coordinates) for the 52 globally threatened taxa of frogs in the Western Ghats.

(Product/Deliverable: Atlas of geographic distribution of frogs, lizards and snakes of Western Ghats.)
2. Occurrence data (geographic coordinates) for priority species of lizards and snakes in the Western Ghats.
(Product/Deliverable: Species distribution (locality records) and other information on priority areas for WILD and CEMDE workshops.)

Component 1 Actual at Completion:
1. Occurrence data has been collected for more than 150 species of frogs (an underestimate), which is much greater than what was proposed. In addition, we have collected data for more than 100 species of reptiles and associated occurrence data.
2. Atlas of frogs and lizards of the Western Ghats has been prepared and digital versions of this atlas have been made available online.
3. Species distribution data (locality records) have been uploaded to an online database for the purpose of sharing with the general public.
4. Atlas for snakes will be prepared once the results from ongoing systematic work (by researchers and PhD students) is available. We expect this to be completed in mid 2016.
5. No WILD or CEMDE workshops have been held since the completion of data collection, but data on species ranges will be provided for any future conservation assessments.

Component 2 Planned (as stated in the approved proposal):
Distribution models for important frogs, snakes and lizards.
(Product/Deliverable: Maps of: Important frog areas (IFA), Important lizard areas (ILA), Important snake areas (ISA) for the Western Ghats.)

Component 2 Actual at Completion:
We will use recently completed analysis on distribution models for birds to evolve SDMs for frogs and lizards. We have generated preliminary maps of important areas for frogs and lizards. These require further analysis and refining before they can be shared with decision-makers. The final versions will be completed by September 2015. The important area map for snakes will be prepared in 2016 after completion of the Atlas.

Component 3 Planned (as stated in the approved proposal):
Outreach material for researchers, Forest Department staff, students and communities.
(Product/Deliverable: 1. Photographic field guides for important lizard areas. 2. Articles/Special Section in journals like Journal of Threatened Taxa, Current Conservation. 3. Website with online access of distribution data with options for inputs for long-term development of the database.)

Component 3 Actual at Completion:
1. Photographic field guide and atlas for Frogs and Lizards have been prepared and finalized. Hard copies of the limited edition will be printed for distribution. During 2015, we will contact and negotiate with a publisher for large scale printing of an edition for distribution to the general public.

2. A manuscript describing 9 new species of frogs published in the journal Zootaxa. Manuscripts describing 2 new species of frogs submitted to Zootaxa. Manuscripts describing 10 more species of frogs are under preparation. Additionally, a manuscript describing two new species of lizards is ready for submission.

The new species described so far include:

Raorchestes indigo
Raorchestes primarrumpfi
Raorchestes archeos
Raorchestes aureus
Raorchestes leucolatus
Raorchestes echinatus
Raorchestes flaviocularis
Raorchestes emeraldi
Raorchestes blandus

Another 9 species of *Raorchestes* have been reported in the earlier paper, but await formal description. In addition, the project has unearthed new lineages across all the families of frogs and in several genera of lizards. In total, we expect that the project will result in the eventual description of 35 – 40 species of frogs, and 20 – 25 species of lizards.

3. Work on front-end aspects of the online spatial database being finalized and the website is in testing phase. Final version of the database and website will be accessible to the public.

Were any components unrealized? If so, how has this affected the overall impact of the project?

There were no unrealized components that would greatly affect the overall impact of the project. We could not generate snake ATLAS due to taxonomic uncertainties (the work is underway) and equally due to the increase in number of new lineages handled by us in all the taxa (as mentioned earlier, a two to three fold increase).

Please describe and submit (electronically if possible) any tools, products, or methodologies that resulted from this project or contributed to the results.

Enclosed a recent paper dealing with lineage delimitation for frogs in the Western Ghats. The paper proposes a novel approach to addressing both “the Wallacean shortfall” and “the Linnean shortfall” to uncover and map hidden diversity in a hotspot.

Lessons Learned

Describe any lessons learned during the design and implementation of the project, as well as any related to organizational development and capacity building. Consider lessons that would inform projects designed or implemented by your organization or others, as well as lessons that might be considered by the global conservation community.

Project Design Process: (aspects of the project design that contributed to its success/shortcomings)

1. The strength of our approach was in using the fundamental biogeographic and evolutionary principles regarding species ranges, limits and speciation in spatial and taxon sampling of frogs, lizards and snakes.

2. This translated into incorporating the geological, geographical and ecological heterogeneity of the region and became a crucial part of our sampling design.

3. This has resulted in not only vastly higher resolution distribution information, thereby addressing the Wallacean Shortfall, but also a better ability to discriminate species, thereby addressing the Linnean shortfall.

Project Implementation: (aspects of the project execution that contributed to its success/shortcomings)

1. Delay and denial of research permits to work in the certain areas and states had a large bearing on our spatial coverage for the ATLAS.

2. Lack of availability of capable field personnel was also a limiting factor. The project was managed and completed with a relatively small team.

3. Nocturnal sampling for species in peak monsoon, especially the frogs, was limited by a number of logistic issues in field and became a limiting factor in covering certain remote areas.

Other lessons learned relevant to conservation community: Not applicable.

Additional Funding

Provide details of any additional funding that supported this project and any funding secured for the project, organization, or the region, as a result of the CEPF investment in this project.

Donor	Type of Funding*	Amount	Notes
CSIR (Council for Scientific and Industrial Research) India	Molecular lab work	~ USD 30,000	Grant for study of bush frogs in WG
MoEF (Ministry of Environment and Forests) India	Field and lab work	~ USD 20,000	Annual support for study of small vertebrates in hotspots
Department of Biotechnology	Molecular lab work	~ USD 10,000	Annual support for molecular work
Department of Science and Technology	Personnel, field and lab work	~ USD 30,000	Post-doctoral fellowship on Ranid biogeography in WG
Indian Institute of Science	Personnel	~ USD 30,000	Student fellowships for three students who worked on this project

****Additional funding should be reported using the following categories:***

A *Project co-financing (Other donors or your organization contribute to the direct costs of this project)*

B *Grantee and Partner leveraging (Other donors contribute to your organization or a partner organization as a direct result of successes with this CEPF funded project.)*

C *Regional/Portfolio leveraging (Other donors make large investments in a region because of CEPF investment or successes related to this project.)*

Sustainability/Replicability

Summarize the success or challenge in achieving planned sustainability or replicability of project components or results.

The online database is expected to develop into a participatory database with contributions from experts and civil society. This will ensure its sustainability without substantial subsequent financing. In addition, we are using a similar platform for other taxonomic groups such as birds and plants for which data bas been generated by other projects.

Summarize any unplanned sustainability or replicability achieved.

Not applicable.

Safeguard Policy Assessment

Provide a summary of the implementation of any required action toward the environmental and social safeguard policies within the project.

Not applicable.

Additional Comments/Recommendations

None.

Information Sharing and CEPF Policy

CEPF is committed to transparent operations and to helping civil society groups share experiences, lessons learned, and results. Final project completion reports are made available on our Web site, www.cepf.net, and publicized in our newsletter and other communications.

Please include your full contact details below:

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*****If your grant has an end date other than JUNE 30, please complete the tables on the following pages*****

Performance Tracking Report Addendum

CEPF Global Targets

(Enter Grant Term)

Provide a numerical amount and brief description of the results achieved by your grant.
Please respond to only those questions that are relevant to your project.

Project Results	Is this question relevant?	If yes, provide your numerical response for results achieved during the annual period.	Provide your numerical response for project from inception of CEPF support to date.	Describe the principal results achieved from July 1, 2013 to May 30, 2014. (Attach annexes if necessary)
1. Did your project strengthen management of a protected area guided by a sustainable management plan? Please indicate number of hectares improved.	No			Please also include name of the protected area(s). If more than one, please include the number of hectares strengthened for each one.
2. How many hectares of new and/or expanded protected areas did your project help establish through a legal declaration or community agreement?	No			Please also include name of the protected area. If more than one, please include the number of hectares strengthened for each one.
3. Did your project strengthen biodiversity conservation and/or natural resources management inside a key biodiversity area identified in the CEPF ecosystem profile? If so, please indicate how many hectares.	No			
4. Did your project effectively introduce or strengthen biodiversity conservation in management practices outside protected areas? If so, please indicate how many hectares.	No			
5. If your project promotes the sustainable use of natural resources, how many local communities accrued tangible socioeconomic benefits? Please complete Table 1below.	No			

If you answered yes to question 5, please complete the following table

Table 1. Socioeconomic Benefits to Target Communities

Please complete this table if your project provided concrete socioeconomic benefits to local communities. List the name of each community in column one. In the subsequent columns under Community Characteristics and Nature of Socioeconomic Benefit, place an X in all relevant boxes. In the bottom row, provide the totals of the Xs for each column.

Name of Community	Community Characteristics								Nature of Socioeconomic Benefit												
									Increased Income due to:												
	Small landowners	Subsistence economy	Indigenous/ ethnic peoples	Pastoralists/nomadic peoples	Recent migrants	Urban communities	Communities falling below the poverty rate	Other	Adoption of sustainable natural resources management practices	Ecotourism revenues	Park management activities	Payment for environmental services	Increased food security due to the adoption of sustainable fishing, hunting, or agricultural practices	More secure access to water resources	Improved tenure in land or other natural resource due to titling, reduction of colonization, etc.	Reduced risk of natural disasters (fires, landslides, flooding, etc)	More secure sources of energy	Increased access to public services, such as education, health, or credit	Improved use of traditional knowledge for environmental management	More participatory decision-making due to strengthened civil society and governance.	Other
Total																					

If you marked "Other", please provide detail on the nature of the Community Characteristic and Socioeconomic Benefit: