

CEPF SMALL GRANT FINAL PROJECT COMPLETION REPORT

Organization Legal Name:	-
Project Title:	Evaluation of aquatic insect diversity in natural water-filled tree holes and their artificial analogues, in a tropical forest of Western Ghats.
Date of Report:	30 th November 2010
Report Author and Contact Information	Dr. K.S. Anoop Das Wildlife Research and Conservation Trust Anupallavi, Chungathara Post, Malappuram Kerala, India

CEPF Region : **Western Ghats**

Strategic Direction : 2. Improve the conservation of globally threatened species through systematic conservation planning and action

Grant Amount : **\$9,627.55**

Project Dates : **1st September 2009 to 30th November 2010**

Implementation Partners for this Project (please explain the level of involvement for each partner):

Wildlife Research and Conservation Trust, Kerala & M.E.S Mampad College, Kerala

Wildlife Research and Conservation Trust managed the project by providing the base camp and other infrastructure. M.E.S Mampad College helped us to procure the permissions and extended the laboratory and library facilities to the project staff.

Conservation Impacts

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

1. The project contributed to ecosystem profile of CEPF by addressing strategic directions to improve the conservation of globally threatened species through systematic conservation planning and action. In which the systematic part of the directions was addressed by assessing and monitoring one of the important microhabitat in evergreen forests of The Western Ghats.
2. The project approaches the strategic direction through field observation and theoretical studies. The field observation provide evaluation of otherwise unknown microhabitat in the Western Ghats through assessing biodiversity in tree hole aquatic habitat along with insights on various habitat characteristics influencing the community composition in it. Theoretical studies provide an input on conservation by ecosystem approach through realization of importance as well as provision of tool for ecological experiments.
3. Field observation on tree hole aquatic habitat found in Silent Valley National Park and New Amarambalam Reserved Forest, both CEPF Priority areas, led to attain prime objective of the project, i.e. a. Enumerate the potential differences in the species assemblages in the water filled tree holes and its artificial analogues
b.) To test the hypothesis that tree holes with higher quantity of water and leaf litter support higher richness and densities of common resident insects than treeholes with lower amounts of these resources. c) To determine the vertical stratification of the species composition in the

trees. d) To evaluate the aquatic insect community differences at the spatial scales at six different altitudinal transects in a tropical rainforest to assess/ predict the general ecosystem health and properties of forest stand dynamics. The objective of evaluating aquatic insects found in tree hole aquatic habitat was achieved through surveying and monitoring around 161 tree hole habitat found across the study area. Appendix 1 gives a comprehensive report on aquatic insect and other communities largely shared by macro invertebrates and amphibians found in tree hole aquatic habitat. The study reports the first ever comprehensive occurrence of Trichoptera a separate order in the main habitat studied elsewhere.

4. The study also documented the breeding of near threatened and endemic frog species *Ramanella* of the Western Ghats, in the artificially created micro habitats (appendix 2). This documentation (manuscript) indicated the necessity or utilization of tree hole aquatic habitats which are essential for these organisms – helping in IUCN Redlisting assessment for the species. The project sites Silent Valley National Park and New Amarambalam Reserve Forest important priority areas of CEPF Ecosystem Profile were evaluated for insect diversity in tree hole aquatic habitats . The community clustering and variability in landscape level in this discrete microhabitat will be used for understanding the general ecosystem health of the Mysore-Nilgiri corridor. Further studies are warrant in understanding the epidemiological importance of this habitat and community level status assessment which can helpful in identifying reference condition for biodiversity and ecosystem assessment.
5. During project period, it is helpful in establishing key partnership among key players of conservation agencies in the study area, SACON, NCBS, IISc, Winrock International India, KFRI and CRGS – Centre for Research in Global Change and sustainability respectively. Collaboration with important zoological laboratories surrounding the study area and collaboration with forest officials was helpful in extending mutually beneficial long-term associations.

Please summarize the overall results/impact of your project against the expected results detailed in the approved proposal.

Please refer to appendix 2 for remaining results,

Please provide the following information where relevant:

Hectares Protected : NIL
Species Conserved : NIL
Corridors Created : NIL

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

Short term: Species

This one year study, despite its limitations of duration, rough terrain and difficult sampling regime, has however, come out with the following salient findings which are discussed in view of conservation measures for the SVNP and NARF. Aquatic insect assemblages differ in richness, diversity and abundance among habitat types within a tropical evergreen forest. The indexed parameters showed a descending trend at habitat types in the order evergreen forest with disturbed evergreen forests, then moist deciduous species forests. The study unequivocally showed that tree-holes are not neutral with respect

to the community structure of insects in the forests. This pilot- study standardized methods for studying these least known insect assemblages in tropical evergreen forests.

Long term:

Clearly more research is necessary to determine how the formation of a tree holes is contributing toward the insect colonization and the ecosystem service offered by the insect tree interaction. Informed forest management decisions can be made only with a more refined understanding of how the disturbance impacts the target communities at local and landscape level. The concern on the water retention capacity in the tree holes will also be affected with the predicted climate change scenario and can be considered as the effective monitoring tool in the context. The need for the canopy cover maintenance and prevention of the fragmentation by any means is another criterion which has to be satisfied while considering the management.

Were there any unexpected impacts (positive or negative)?

The tree hole aquatic habitats is considered as evolutionary significant breeding place for disease vectors and around 40% of mosquito species are container breeders typical of tree hole aquatic habitat. The community level control of vectors such as dengue-spreading *Aedes aegypti* happens in tree hole aquatic habitat, and this ecological service is largely underutilized in controlling these epidemics. In the scenario of large scale environmental change-related epidemics re-entry, the perceptive on community level control of disease vectors happens in tree hole aquatic habitats through invertebrate predators such as *Toxoyrinchites*, *Agabus* and Odonata nymph will be highly efficient.

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.

Lessons learned:

Incompatibility between human institutions and natural ecosystems are one of the reason for ineffective environmental management. Ecosystem approach is perhaps a better alternative to reduce this incompatibility. The present study examined water filled container habitats, from an ecosystem point of view, which are considered as the extensive breeding place for several mosquito transmitted diseases. These habitats supports an array of evolutionary pre adapted living organisms largely shared by disease spreading mosquito populations and aquatic insects. The study investigated insect community composition and ecosystem functioning in these habitats present in a landscape comprising a part of the Western Ghats of southern India. Considering the application point of view the study is can be redirected to give empirical and theoretical understanding on ecosystem functions in these habitats with practical application of better predication and devising management options on vectors.

Organizational Development:

The project brought new conscience to the WRCT staff with the forest department, by revealing the importance of the least attended phytotelmata. The project brought out the significance of the aquatic insects, its ecological and ecosystem function significance. Another significant output of the project was the formation of a network of civil society units with expertise in insect population studies along with

strong collaborations with SACON, NCBS, IISc, (National Research Organizations) ATREE, Winrock International India, KFRI (state R & D organization) and CRGS – Centre for Research in Global Change and sustainability (regional Non-Governmental Organization) respectively. During the project period many CEPF grantees were benefited by the logistics support in the field and stayed in the WRCT field station. They were from IISc- (Reptile Project / Mr. S.P. Vijayakumar), Centre for Research in Global Change (Fish project /Mr. Jobin Anto) and NIAS (Sky Island Project / Dr. Robin Vijayan). This association is expected to foster participatory conservation program.

Global Conservation community:

Several new taxa which are reported from the study will be a key enhancement of the biodiversity profile of the Western Ghats. If proper conservation planning is not done there are chances of have more local extinction that is affecting the global biodiversity negatively.

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

The Principal Investigator has an experience spanning more than six years in the study area SVNP and NARF, this made a significant impact on selection of the study sites which made the project execution without any lag. As the project also recorded the succession of the aquatic insects in the artificial tree holes, we had some problems with seasonality and establishment of the artificial tree holes in these spatially separated regions. The time taken for procuring the collection permits from the Department of Forests and Wildlife was too long considering the short duration of the project. This was not envisaged at the designing stage.

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

PhD registration: The research fellow in this project, Mr. Nishad, is registered for his PhD (Bharathiar University) with Dr. P.A. Azeez, Director, SACON, which has helped to address the project with more expertise and guidance.

Research Grant: The Principal Investigator is been granted with a major project on insects from UGC, New Delhi, which would help to pursue with the current study.

Species: Identification of the collected specimens is still underway due to the lack of expertise and the nature of the species. This has contributed largely to the delay in reporting the findings.

Elephant conflict: The infrastructural facilities at NARF were very inadequate. Apart from a small camp at the border of NARF built by the Department of Forests and Wildlife, no other facilities such as watch tower etc was available in the entire 248 sq. kms of NARF in comparing with the SVNP where all camps are well equipped with amenities such as wireless communication devices and solar panels. The elephants in this area have caused damage to the forest department camp at NARF and the field work was intermittently blocked by the elephants.

Weather

As expected, in all the rainforests the problems of the field surveys were mostly related to the unpredictable and harsh weather conditions and the sighting of the large mammals in the routes. The unexpected rain which made a temporary flood damaged some of the artificial traps established in NARF. Whereas in SVNP strong wind toppled down some of the traps established as branches on which the trap is attached, fell broken. One record of dislocation of an artificial analogue is attributed by the movement of large mammals.

Other lessons learned relevant to conservation community:

1. The investigation on the species with possible combinations of tree species and insect species specificity and habitat preferences are envisaged to have an increased resolution of the prevailing

information on the habitat quality, which in turn extracted from insect assemblages. The concept has to be tested and validated across different areas with the different degree of the habitat modifications.

2. The studies on the tree hole dynamics has to graduate from the sub-canopy level to the canopy level, which in-turn would help to unwrap the intrinsic changes and variations in the micro-ecosystem which can be considered as a vital part in the rainforest succession. It is considered that maintenance of several trophic levels and species diversity in the tree holes is a longstanding paradigm in ecological entomology.

3. This project have to be graduated to undertaking detailed evaluation of the rare, endemic, endangered and threatened species recorded in the current study, focusing on ecological requirements and population structure.

4. Extension programmes: Training for the Eco-development committee members and Forest officials has to evolve to advanced levels of ecological consciousness. The ongoing environmental education and awareness work with the Department of Forests and Wildlife should be continued and also expanded to people inhabiting the fringes of the forests.

5. Database generation: Along with the new check list generated, the study has also revealed the serious gap in systematic, time series assessment of the aquatic insect populations in the area. The protocol developed in this study for survey and monitoring has to be implemented in all the different habitat types of the area. Aided with GIS and ground truthing, habitat prediction models have to be run and conservation priorities fixed. Once the temporal and spatial contour of population distribution is established, it would facilitate subsequent evaluations meaningful in identifying new, hitherto unperceived threats.

Effort focusing on the preservation of the forest habitats with its serenity with out the removal of trees, is essentially initiated and the most important for the conservation of the forest insects. In addition effective measures of prohibiting illegal collection of firewood are also a very valid concern. The present study also warrants fresh legislation to upgrade the NARF to a sanctuary, so as to provide enhanced protection to the area. This would protect the realm from disturbance and permit uninterrupted gene flow so as to ensure long-term conservation of species- vertebrate or invertebrate.

ADDITIONAL FUNDING

Provide details of any additional donors who supported this project and any funding secured for the project as a result of the CEPF grant or success of the project.

Donor	Type of Funding*	Amount	Notes
Idea Wild, USA	B	1000 USD	Equipment Grant
University Grants Commission, New Delhi	B	23269 USD (9788 USD released)	Grant under Major Research Project in sciences Project- Developing a database on the select insect groups and evaluation of insects as bio-indicators of the ecosystem health in the Western Ghats.

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

- A** *Project co-financing (Other donors contribute to the direct costs of this CEPF project)*
NA

- B** *Grantee and Partner leveraging (Other donors contribute to your organization or a partner organization as a direct result of successes with this CEPF project.)*
NA
- C** *Regional/Portfolio leveraging (Other donors make large investments in a region because of CEPF investment or successes related to this project.)*
NA

Sustainability/ Replicability

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

The lack of historical data on the target fauna makes it difficult to comment on the status of particular species. Only limited insight into temporal changes in the diversity of the aquatic insects could be deduced as function of the present investigation. Additionally, it is also imperative that survey effort is increased in a spatial context (since only a limited number of habitat types have been assessed in this short term study) and that data (diversity, abundance, distribution) is related to habitat (or forest) type if effective conservation management strategies are to be proposed and implemented at the local level.

Summarize any unplanned sustainability or Replicability achieved.

- 1.
2. The survey and monitoring studies on this micro habitat helped in disentangling the various bottom-up processes influencing community composition in it. This helped in understanding the influence of resources and water medium availability in determining the trophic relationship and community composition. This initiates the understanding of the simple community residing in it, and the effects of frequent disturbances on it. The physiochemical analysis of the water in the tree hole aquatic habitats shows the extreme condition in terms of water quality and excess nutrient availability prevailing in the habitat. These characteristics of the tree hole aquatic habitat makes them suitable subjects for experimental studies on – disturbance/ fragmentation on biodiversity.
3. The artificial analogue experiments using plastic pots, rubber tubes and bamboo internodes reveals the important consideration of tractability of these habitats in colonizing almost all the natural community in tree hole habitats. The successional study in plastic pots reveals the colonization pattern in aquatic habitats along with breeding pattern of *Ramanella* frog species. This encourages the use of artificial analogue in further experimental studies as well as providing an opportunity to use its simplicity in landscape level studies of epidemiological and ecological importance.
4. Review on available literature of the project subject revealed the immense lacunae in community level studies on tree hole aquatic habitats found in entire South East Asia. It instigated us to know about various communities residing in it starting from microbes to vertebrates along with various process functionalizing this habitat and various ecological experiments carried out using it.
5. Pioneering studies led to the important recognition of the tree hole aquatic habitat as a potential laboratory for ecological experiments and it was termed as ‘Micro- Ecosystem’. This terminology, it helped, would invites fresh studies on this subject and able to reflect wider consensus on ecological experiments for better conservation of these natural habitats and their functionality through an ecosystem approach. The term also reflects other important properties of the tree hole aquatic habitat, as a model system, by its analogy to large scale fresh water aquatic habitats, and the metaphorical reflection on knowledge generation. Thus the project

hopes to initiate better sensitivity on one of the important and developing field of applied ecology, for better management and conservation in Indian scenario.

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

Performance Tracking Report Addendum

CEPF Global Targets

(Grant Term-1st September 2009 to 30th November 2010)

**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, 2007 to June 30, 2008. (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 1 below.	No			

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

Additional Comments/Recommendations

Conservation measures hitherto undertaken in the state were big mammal and/or top predator based. As believed earlier, conservation of top order animals may not necessarily conserve lower order organisms, which has been demonstrated in recent studies. Invertebrate conservation is a totally different ball game as shown in this study wherein subtle changes in forest structure or altitude by way of tree holes locations have had significant impact on insect diversity. This project has provided the start for infusing the concepts of invertebrate conservation into the management plan of the area. Translating and applying the results of these scientific investigations into practical conservation guidelines that are executable by conservation practitioners and/or by policy makers is essentially the next step which has already been initiated through some proposals. An effective conservation action plan has to be made, in accordance with the results of this study so as to implement mitigation measures in The Western Ghats.

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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List of appendices:

- 1) **Open access peer-reviewed publication from the project**
- 2) **Manuscript on Tree holes accepted in "Our Nature"**