CEPF Final Project Completion Report

Organization Legal Name:	California Academy of Sciences Madagascar
Project Title:	Insects and People of the Southwest Indian Ocean: A Network of Researchers for Insect-Focused Approach to Conservation
Grant Number:	65844
CEPF Region:	Madagascar and Indian Ocean Islands
Strategic Direction:	2 Enable civil society to mainstream biodiversity and conservation into political and economic decision-making.
Grant Amount:	
Project Dates:	May 01, 2016 - March 31, 2020
Date of Report:	May 28, 2020

IMPLEMENTATION PARTNERS

List each partner and explain how they were involved with the project.

A. Implementation
MNP: Research permit
PBZT: Research permit
MEDD: Research permit
University of Antananarivo: Student involvement Researchers for networking
B. Regularizations and administration
ONE: Classification of the project and environmental assessment of the project
Ministry of Industry: Visit of the farm to assess the feasibility of the project, the hygiene and safety in the farm and the processing of the crickets
ACSQDA Ministry of Health: "permit of consumption"
ELYTRA, ENTOTRUST: Sustainability assessment of the project: see attached Sustainability assessment
C. Final products (Cricket powder, frass)
Analyzes of the products
CNRE Analysis of the cricket powder in order to know the nutritional values, as well as microbial analyses.
FOFIFA Analysis of the frass Cricket frass content
D Impact
CRS
USAID
MBGFrass (assessment in processTesting on their fields; Students Testing of the frass and its effects on plant growth
D Exhibits, testing, tasting and talks
Events Partners Involvements

Exhibits ONN FIERMADA 2018
Exhibits and tasting of the cricket powder, see attachment: Rapport FIERMADA 2018; JNN Flyers related to the project; Bache MBC
ESSA (University of Antananarivo)
PROCINUT Talks to communicate about the overview and focuses of the project
Testing Café du Musée (Chef Johary)
Communication Safidy Andrianantenaina (Photograph)

CONSERVATION IMPACTS

Summarize the overall impact of your project, describing how your project has contributed to the implementation of the CEPF ecosystem profile.

The Insects and People project funded by CEPF developed into two separate focus areas. The first was to improve the visibility and impact of insects in conservation in the Malagasy Region. To achieve this we motivated our IPSIO network to develop content for display at National Parks which highlights local insect themes. We also spent a lot of effort positioning insects as an essential element for monitoring programs. Thanks to these efforts, insects are now bringing monitored at 50 sites in 37 National Parks with separate funding that could not have happened without the establishment of the IPSIO network. We have secured funding for 8 years of monitoring which will give sufficient time to demonstrate the impacts fo this project.
The second area was the establishment of Breakfast before Conservation. The approach melds traditional insect eating practices with farming technologies. It establishes social ventures that: (1) establish food security, (2) restore degraded soils, (3) promote green businesses, and (4) inspire the next generation. CEPF funded the established and research of pilot projects to farms native insect species consumed as traditional foods using novel, large-scale insect propagation techniques. Our methods maximize the growth of insects using minimal space, feed, and time. This initiative started by CEPF funding will expand as we seek funding to reach more villages and increase farming capacity.
The insect species we raise were selected based on our research into Malagasy cultural preferences for edible insects. We are also the first to use cricket manure to advance forest restoration. Cricket manure can jump-start degraded soils and improve the long-term growth of seedlings. Our program is the first to expand insect farming to reduce bushmeat consumption, improve the health of children, and provide a solution that can be scaled up to address malnutrition on a national scale.
Insect farming helps in two key ways: First, insect farming can be set up at the household level, supplying "hyper-local" food in widely distributed villages. Rearing insects is straightforward, low tech, based on traditional knowledge, requires no infrastructure or market access, and costs nothing for the household to produce. Insect farming can also be scaled up to provide food security in urban areas. Insect farming is also ecologically responsible: the carbon footprint of insect farming is orders of magnitude smaller than raising cattle, chickens, goats, and other vertebrates.
Each farm produces protein powder and manure in equal quantities. Luckily, insect manure is a robust, organic fertilizer that can be repurposed into a valuable tool for environmental conservation. Insect manure contains chitin, which appears to be uniquely beneficial compared to other natural and

chemical fertilizers. Our trials have shown cricket manure increases yield in family gardens and improves soil health. Insect fertilizer extends the useful life of current farmlands and reduces the need to clear additional forest. Our reforestation trials demonstrate the potential to use insect manure as part of the national drive launched in 2020 that aims to plant 60 million trees across Madagascar.
By focusing our village efforts around protected areas, Breakfast before Conservation will help save Madagascar's remaining forests. The slash-and-burn agriculture practiced in Madagascar is driven by necessity, not greed. High-quality insect protein will give children a chance to develop to their full physical potential, fuel their ability to learn and thrive in school and break the cycle of poverty.

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

Impact Description	**Impact Summary**
• 20 experts from at least 5 out of the 7 mains island groups participate actively to the network activity.	We fell short on this impact because of the extra cost it would require to keep all island groups involved. We instead focused on developing a richer program just in Madagascar.
• The 4 working group established (i-bio, i-socio, i-food, i-tour) continue to produce guidance and recommendations to the broader conservation community	We merged i-bio and i-tour to facilitate coordination and effort. The biodiversity effort also changed from focusing on specific taxonomic groups to including a more holistic approach - all flying insects. In the same way, i-socio and i-food merged into the edible insect group for the same reasons. This was done both for practical reason and for positioning these projects in terms of future funding opportunities.
• 5 protected areas have included insect conservation in their management plan	We are now monitoring insects at 37 National Parks with the Madagascar National Parks.
• 1 reforestation effort has included insects in their restoration monitoring	In Nov. 2019, Ambatovy agreed to include insect monitoring as part of their evaluation and monitoring of their restoration efforts on the mine footprint. Ambatovy has sent a tender for this insect monitoring and we expect the project to begin as soon as COVID permits travel.
• One mining company has included insects in their conservation management plan	One mining company, Ambatovy, is included in our insect Monitoring program.
• The trend in new invasive species in Aride and protected areas in Mauritius has changed.	As mentioned elsewhere, we were not able to work in Seychelles because of the extra costs needed. We instead focused efforts on Madagascar.

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

Impact Description	**Impact Summary**
• One National Park has agreed to have guides trained to provide insect focused tours.	We trained park guides at Marojejey National Park and developed information on the key insects that can be used during walks with tourists. We also developed insect posters for the park and other parks. In the final three months of the project, we developed three posters of insects for distribution to 30 National Parks. In addition, to further promote insects, each image from the poster was created as a single information block to be added to packaging in consumer goods.
• 10 conservation partners in the region consider insect issues during conservation planning.	We are working closely with Madagascar National Parks to monitor insects in 37 National Parks. In addition, we are working with Missouri Botanical Garden to incorporate insect frass as fertilizer in their forest reforestation program.
• Aride has agreed to develop a policy to reduce the introduction of invasive insects.	As mentioned elsewhere, we were not able to work in Seychelles because of the extra costs needed. We instead focused efforts on Madagascar.
• 10 entomologists have agreed to join IPSIO and focus their collective research to maximize	We exceeded this achievement and have a growing number of entomologists that have joined IPSIO.

conservation outcome.	
• IPSIO participants improve their capacity for collaboration and tools for maintaining connectivity.	Connectivity, collaboration, coordination, combined with leadership is a never-ending challenge. There are no shortcuts, no management software that helped us solve this issue. We had to find the right people and as our project grows, we think we will need to keep finding new people to fill these roles.
• IPSIO members improve their capacity to be a public voice and advocate for the importance of insects for human well-being.	IPSIO members have given a number of talks in Madagascar. The edible insect program has provided an important vehicle to engage the public on insects and to then discuss more broadly the concept that a forest makes no sense except in the light of insects.
• One mining company has agreed incorporate insect monitoring protocols.	Ambatovy is monitoring insects as of 2018.

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

The initial challenge was to establish a network of interested entomologists to participate in exploring how to improve insects as a tool for conservation. Though we established a group of about 20 experts, this was sufficient for brainstorming and development. The next challenge was to pilot projects and choose those that had the potential for continued funding. In the end, we feel our choice to focus on monitoring and edible insects was justified since we have succeeded in keeping these two project funded.
For edible insects, we successfully went through the government process to ensure the safety and human consumption of cricket powder. Since this was the first time the government approved an insect product for human consumption, it was a challenging process.

Were there any unexpected impacts (positive or negative)?

There were two unexpected impacts. First, we did not expect the impact with the cricket frass as a fertilizer and as tools for restoration. The research and benefits from frass are now as important as our efforts to reduce bushmeat consumption. Second, our projects attracted a number of diverse students from the University. Students from the diverse departments (toxicology, forest, nutrition, business) reached out to conduct Master level research as part of our projects.

PROJECT COMPONENTS AND PRODUCTS/DELIVERABLES

Describe the results from each product/deliverable:

Component		Deliverable		
#	Description	#	Description	Results for Deliverable
1	Establish IPSIO, a collaborative framework for strategic initiatives by interdisciplinary insect researchers that address conservation outcomes.	1.1	Preliminary institutional set up written by MBC and shared with potential IPSIO members along with invitation letters to first meeting.	Insects and People (IPSIO), since its first meeting, continues to be a recognized organization for insect conservation.
1	Establish IPSIO, a collaborative framework for strategic initiatives by interdisciplinary insect researchers that address conservation outcomes.	1.2	First workshop meeting held in Madagascar and report produced with list of participants by MBC.	There were two "first workshops." One focused on insect biodiversity and it was at the first meeting that the insect monitoring proposal and budgets were discussed. The second first meeting was on edible insects which also set us down the path of exploring edible insects.
1	Establish IPSIO, a collaborative framework for strategic initiatives by interdisciplinary insect researchers that address conservation outcomes.	1.3	Workplan and priorities for network members and working groups established and approved at first meeting.	As mentioned elsewhere, our focus evolved during the meetings to include two "departments" edible insects and insect biodiversity with two teams focused on projects and future funding.
1	Establish IPSIO, a collaborative framework for strategic initiatives by interdisciplinary insect	1.4	The status and governance documents for the network produced and	This was established during the first year meetings.

	researchers that address conservation outcomes.		approved by the network members.	
1	Establish IPSIO, a collaborative framework for strategic initiatives by interdisciplinary insect researchers that address conservation outcomes.	1.5	Fund raising activities provide 20% of the running costs of the network in Y2, 30% in Y3, and 50% in Y4 as demonstrated by financial report a of IPSIO.	We have raised just over $1 million to continue the projects started by CEPF.
1	Establish IPSIO, a collaborative framework for strategic initiatives by interdisciplinary insect researchers that address conservation outcomes.	1.6	Three reports based on results of the annual feedback survey, with recommendations to build a better IPSIO.	IPSIO, as a brand, will live on in Madagascar. However, one component, international experts, require constant funding to bring them to Madagascar. The availability of funding for such investment will change with time and will limit participation in the network outside of Madagascar.
1	Establish IPSIO, a collaborative framework for strategic initiatives by interdisciplinary insect researchers that address conservation outcomes.	1.7	Working group i-socio creates a one page flyer to brand IPSIO mission and is shared widely with external stakeholders.	The i-socio group was merged with the edible insect Valala Farm project and the one-page flyer (attached) described the problem and solution.
1	Establish IPSIO, a collaborative framework for strategic initiatives by interdisciplinary insect researchers	1.8	IPSIO has held at least two partner and 3 working group meetings by Y3 as demonstrate	We held two meetings per year since the start of the project. The final meeting was in March 2020, cut short by COVID.

	that address conservation outcomes.		d by minutes and participant list.	
2	Working Groups: Insect specialists and agencies collaborate and focus efforts on solving major knowledge gap	2.1	IPSIO members will be assigned to working groups at first meeting as indicated in shared minutes of the first meeting.	Completed; as mentioned we held two group meetings per year.
2	Working Groups: Insect specialists and agencies collaborate and focus efforts on solving major knowledge gap	2.2	Working group leadership clarified at first meeting as indicated in shared minutes of the first meeting.	Completed during the first year of the project.
2	Working Groups: Insect specialists and agencies collaborate and focus efforts on solving major knowledge gap	2.3	Working group next steps prioritized and budget allocations evaluated for activities and shared with members in Y1 as indicated in shared first year report to members.	Completed.
2	Working Groups: Insect specialists and agencies collaborate and focus efforts on solving major knowledge gap	2.4	Working groups meeting schedule established and timeline for deliverable shared with IPSIO members.	We discussed deliverables and funding opportunities twice a year during our meetings.

2	Working Groups: Insect specialists and agencies collaborate and focus efforts on solving major knowledge gap	2.5	Working group i-bio: has identified which insect groups have the greatest potential, available data and expertise for biomonitorin g and shares report with internal and external stakeholders.	This working group decided to focus on using one trap type, Malaise trap, for monitoring insects. We evaluated 6 specific insect groups but in the end, it was a simpler approach to use one trap combined with genomics and to offer "complete" flying insect monitoring as a solution.
2	Working Groups: Insect specialists and agencies collaborate and focus efforts on solving major knowledge gap	2.6	Working group i-bio has created guidance for at least one insect group for monitoring diversity, invasives, and ecosystem function and shared with conservation stakeholders in the region.	As mentioned, we moved away from focusing on one insect group and developed the filing insect Malaise trap approach. This is now being used at one Mining site (Ambatovy) and 37 National Parks.
2	Working Groups: Insect specialists and agencies collaborate and focus efforts on solving major knowledge gap	2.7	Working group i-socio has developed one outreach program to explain the importance of insects in Conservation and shared with NGOs.	As mentioned, i-socio is part of the edible insect program and we are using edible insects around key biodiversity areas (Masoala) to reduce bushmeat consumption.
2	Working Groups: Insect specialists and agencies collaborate and focus efforts	2.8	Working i-food group has created a list of edible insects in region and	We have published part one of the list and the second manuscript is underdevelopment. Here is part one: Van Itterbeeck, J.; Rakotomalala Andrianavalona, I. N.; Rajemison, F. I.; Rakotondrasoa, J. F.; Ralantoarinaivo, V. R.; Hugel, S.; & Fisher, B. L.

	on solving major knowledge gap		shared with programs to develop insect based protein source.	2019. Diversity and Use of Edible Grasshoppers, Locusts, Crickets, and Katydids (Orthoptera) in Madagascar. Foods. 8:666. DOI: 10.3390/foods8120666 Published: 10 December 2019
2	Working Groups: Insect specialists and agencies collaborate and focus efforts on solving major knowledge gap	2.9	Working groups i-food has provided recommendations on the importance of insects as food and the link to achieving conservation goals.	The edible insect group has done this mostly in grant writing at this point but we now have two manuscripts in review that address this point directly.
2	Working Groups: Insect specialists and agencies collaborate and focus efforts on solving major knowledge gap	2.10	Working Group i-tour has provided the scientific evidence to evaluate if insect tourism or entotourism has potential and is viable.	i-tour was incorporated into the outreach of the biodiversity group and developed posters for National Parks and the Ant Guide book (the icon book has yet to be published).
2	Working Groups: Insect specialists and agencies collaborate and focus efforts on solving major knowledge gap	2.11	Working Group i-tour has trained PA staff in insect tours and tour agencies contacted to promote insect tours as indicated in shared working group report to members.	We trained the staff at Marojejy National Park to promote insects in their work with tourists.

Describe and submit any tools, products or methodologies that resulted from this project or contributed to the results.

We have developed products for display at National Parks (these "posters" were included in the last reports but will be attached again in this report). In addition,

we have developed protocols to farm native insect species and process them. We are still developing these protocols and will include copies here but please do not share.
We attached a number of methodologies developed during CEPF.
1. The farming cycle is a document that can show the journey of the cricket from eggs to the powder
2. Rules and regulations in the farming area
3 Rules and regulations in the processing area
4. HACCP flow diagram for processing
In terms of products, previous reports and here we attached.
Diversity_and_Use_of_Edible_Grasshoppers_Locusts
Ant Guide to Genera of Madagascar
Marojejy Poster

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:

- Project design process (aspects of the project design that contributed to its success/shortcomings)
- Project implementation (aspects of the project execution that contributed to its success/shortcomings)
- Any other lessons learned relevant to the conservation community

Initially, our organization lacked the necessary "organizers" or "facilitators" to keep the diverse people, partners, and collaborators moving forward. The project had four areas of focus and it was too many for our capacity. As soon as we began to focus on just two areas, and hired two project leads, we were able to better manage going forward. We did not know at the beginning which of our four projects would receive the best reception so, in retrospect, I am glad we had 4 "ideas" to explore, but we did have to make a change at the end of year one when I became worried that we were over our heads in terms of organization and leadership in all four areas.
We debated internally whether we should devote time to participate in different exhibits and conferences. In the end, we are glad we accepted these invitations since they provided important visibility for the project.

SUSTAINABILITY/REPLICATION

Summarize the successes or challenges in ensuring the project will be sustained or replicated, including any unplanned activities that are likely to result in increased sustainability or replicability.

We admit that there were certain project targets that were not achieved (eg work in Seychelles on invasive species) but we felt we had to first ensure that the project lived on beyond the initial CEPF funding. Thus instead of focussing on all

four initial activities, we focused our efforts on the two which found the most traction. We were successful in obtaining funding and I think made the right choice.
Since this project was the first to go through the government process of getting an insect approved for human consumption, approval for additinoal insects will be much easier.

SAFEGUARDS

If not listed as a separate project component and described above, summarize the implementation of any required action related to social, environmental or pest management safeguards.

The development of a novel food source (cricket products) required working with the Minister of Health. Our project became the first and only edible insect product certified for human consumption in Madagascar.
Also, during March, because of COVID, our flurry of finishing activities were cut short because of the national shutdown.

ADDITONAL COMMENTS/RECOMMENDATIONS

Use this space to provide any further comments or recommendations in relation to your project or CEPF.

Funders take a risk if they include insects as part of their funding strategy and I want to thank you for taking this risk. The innovations that began with this project will have a long-lasting impact on Madagascar. I hope that as our tools develop, we could deploy them as solutions at specific sites of interest by CEPF - both in Madagascar and Africa.

ADDITONAL FUNDING

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

Total additional funding (US$)
$1,090,000.00

Type of funding
Provide a breakdown of additional funding (counterpart funding and in-kind) by source, categorizing each contribution into one of 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)

As a direct outcome of the IPSIO meetings and projects we have secured funding as follows:
(1) Insect Monitoring. We placed Madagascar insect monitoring as key components of these two proposals which will fund monitoring for a total of 8 years.
Knut and Alice Wallenberg Foundation, Insect Biome Atlas, Lead PI: Fredrik Ronquist, Swedish Museum of Natural History, $3,370,940, 2018-2022 [in Madagascar $280,000]
LIFEPLAN (€12.6M) – Enabled by a Synergy Award from the European Research Council, LIFEPLAN is advancing understanding of species dynamics through DNA-based studies on four systems (fungal spores, insect communities, soil samples, roots) coupled with sound recordings and photo traps. 2020-2026 [in Madagascar $280,000]
(2) Edible insect farming:
USAID: Wild and edible insects to sustain forests and fight malnutrition. $230,000
IUCN SOS, An evidence-based approach to reducing the illegal hunting of Threatened lemurs on the Masoala Peninsula of Madagascar, $80,000, 2019-2022
Private donors: $220,000

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 website, www.cepf.net, and may be publicized in our e-newsletter and other communications.

1. Please include your full contact details (name, organization, mailing address, telephone number, email address) below.

Brian Fisher, California Academy of Sciences, Madagascar Biodiversity Center, 55 Music Concourse Drive, San Francisco, CA 94118, 415-379-5314; bfisher@calacademy.org