

Centre ValBio's 2014 Annual Report

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VISION FOR CENTRE VALBIO

Patricia C. Wright, Founder and International Director

In a year in which lemurs were declared the most endangered mammals on Earth, and a crippling political crisis in Madagascar ended, the Center ValBio has never been better positioned to grow – nor its role more vital.

My vision is for CVB to become THE single most important conservation body for all animals and plants in Madagascar.

We plan, with bold new fund-raising and media initiatives, to put the unique and amazing biodiversity of Madagascar on the world stage, with lemurs as the ambassador creatures.

Madagascar is one of the highest biodiversity conservation priority countries in the world, because of the amazing diversity of its flora and fauna, the endemic nature of its incredible native species, and the high degree of threat. In fact on Madagascar exists the living origins of our primate ancestors and saving these origins, the lemurs, protects our understanding human behaviors as well as human diseases both infectious and genetic. Therefore Centre ValBio, the only modern research station adjacent to the rainforest in Madagascar has as a top priority to save and protect this extraordinary biodiversity, especially the communities of lemurs. As part of that priority, we also study, and protect the people of Madagascar, as their lives are closely entwined with the preservation of their natural resources.

In January 2014 the 6 year political crisis ended in Madagascar with the election of President Hery Rajaonarimipianina. Therefore Madagascar has now an incredible opportunity to rebuild and grow its economy. Our vision for Centre ValBio is to grow and expand with this opportunity. Centre ValBio has six main priorities in the next five years.

- 1) Lead in tropical science. Set global standards for long term monitoring of flora and fauna to understand climate change and forest resilience. Lead in the disease interface of wild animals, domestic animals, domestic pests and people and emerging diseases. Lead in studying genomic medicine in wild primates, increase our knowledge of systematics of forest flora and fauna and the effects of human impact on this biodiversity.

- 2) Expand the protected forests in the southeast of Madagascar. This includes protecting the 10,000 ha north of Ranomafana, and the forest to Vondrozo south of Ranomafana. Not only do we plan to protect the forests that now stand, but we hope to reforest areas with native trees to connect forest fragments and to reforest riverbanks from the mountains to the Indian Ocean. Much of the reforestation with endemic species will also include economic forest crops such as vanilla, chocolate and peppercorns, all cash crops with high value in the world economy. We hope to receive grants from both NORAD (Norwegian aid) and USAID to accomplish this.

- 3) Expand Centre ValBio infrastructure to enhance research capacity. This includes construction of the Biodiversity Laboratory, the LovaBe Administrative office, the kitchen, as well as an Amphibian Captive Breeding Laboratory and a Mouse Lemur breeding facility. We also hope to purchase a fleet of vehicles to enable continuing of our current operations and our new endeavors. And to feed our army of scientists, staff and guests...we need a new kitchen.

4) Develop more capacity building and training programs in Biodiversity science, genomics, infectious disease research and computer science. Set up fellowships for Malagasy students. Add three new study abroad programs in medicine, sustainability and cultural anthropology/sociology. Continue to expand our village outreach in education and health. Develop new income generating streams, increase the number of international and national workshops hosted at Centre ValBio, as well as augment our scientific tourism programs.

5) Partner with relevant organizations such as PIVOT, GHI, MICET, The Madagascar Ministry of the Environment, Marie Stopes, Madacasse, CRS, ADRA, the local Commune and Regional government, Emory University, Stanford University, University of Antananarivo, University of Tulear, and Harvard University for the expertise to assure this integrated approach is a success.

6) Develop an endowment of 10-20 million dollars and an Endowed Chair for Stony Brook University in Conservation Biology to ensure continuation of leadership of Centre ValBio.

Now at the beginning of 2015, with new revenue streams coming from international sources and a whole new approach to fundraising, I am hoping the CVB Board will join Centre ValBio in making this vision a future reality.

Overview of 2014

This was a glamorous year for Centre ValBio, filled with galas, film festivals, filming, and international meetings. A February fundraiser sponsored by Stony Brook University showcased a preview of the 3D IMAX film *Island of Lemurs: Madagascar*. The funds raised were matched by one of ICTE/CVB's invited guest, Mr. Andrew Sabin, doubling the total raised by the event.

The film's preview was followed by many speaking engagements where CVB founder, Dr. Patricia Wright, had the opportunity to explain the key role that CVB plays toward conservation in Madagascar. The spring months brought a lot of glitter to our research and conservation work with the Hollywood release of the IMAX film in late March complete with a walk on the red carpet for Dr. Wright accompanied by film narrator, Morgan Freeman, the Kratt Brothers, Director Dave Douglas, Producer Drew Fellman and Dr. Mireya Mayor. ICTE's Madagascar National Representative Dr. Benjamin Andriamihaja and CVB's Head of Logistics & Audiovisual, Desire Randrianarisata traveled to Hollywood to attend the premier. The film shows the beauty and grace of lemurs, and as well as the problems and solutions of conservation in Madagascar. The film's focus on CVB and our work has substantially increased tourist interest of the CVB research campus and Madagascar in general. The festive spirit continues with the honor of Dr. Patricia Wright being highlighted at the Stars of Stony Brook gala at Chelsea Piers in New York City. The event raised over \$4M for Stony Brook University's scholarship program. The New York Times reporter Claudia Dreyfus interviewed Dr. Wright for an article that appeared in the paper in August.

Other year highlights include:

- Dr. Patricia Wright and Centre ValBio was awarded the prestigious Indianapolis Prize for Animal Conservation, the first woman to receive this "Nobel Prize" in Conservation.
- Dr. Patricia Wright is awarded Wildlife Film Festival Lifetime Achievement Award in NYC.
- Dr. Patricia Wright is awarded an Honorary degree from the University of Fianarantsoa, in Madagascar.
- Pascal Rabeson was awarded a competitive ESRI Society for Conservation GIS fellowship to attend a month of intensive GIS trainings and conferences in California. This was an important networking opportunity to launch CVB's GIS laboratory off the ground and we led in the organization of the first national GIS day celebration in Madagascar at the end of November.
- At the International Primatology Society bi-annual meeting in Hanoi, Vietnam Onja Razafindratsima, CVB researcher from Rice University, Texas won first prize for her presentation "Seed Dispersal in *Varecia* in Ranomafana Rainforest" and Rachel Jacobs, CVB researcher from SBU, won third prize. Lydia Tongosoa, another Malagasy CVB researcher, did an excellent presentation at IPS as did Stacey Tecot, Sarah Zohdy, Andrea Baden, Tom Gillespie, and many other CVB researchers.
- At the Association of Tropical Biology and Conservation meetings in Cairns, Australia in July, Onja Razafindratsima and Andry Rakotonavalona, both CVB researchers, attended and gave excellent talks. Onja won a student prize for her talk.
- In June, the second Infectious Disease Workshop was held at the Institute Pasteur with our Malagasy partners, the Ministry of Health, Mireaux Institute and CVB. Dr. Tom Gillespie and his post-doctoral fellow Cassidy Rist presented on CVB's infectious disease research. The care and goals of our CVB Health team were presented by Dr. Herinjaka Andriambolamanana. On the ground at CVB, Tom Gillespie and Matt Bonds of our partnering health NGO PIVOT expanded the infectious disease research effort through a Gates Foundation-funded One Health Program. Jim Bliska, professor from the SBU Center of Infectious Disease, worked at CVB to perform preliminary laboratory analysis of exposure of

rats to plague. He found many individual *Rattus rattus* had antibodies to plague, suggesting that they had experienced and survived plague in the past.

- PIVOT, our partner health NGO, had a visit to see the work of Partners in Health in Rwanda in May. Seven Malagasies, including Ministry of Health and PIVOT team members, as well as CVB representatives Benjamin Andriamihaja and Patricia Wright participated. PIVOT hired a new country director, Dr. Djordje Gikic, and 45 other staff. PIVOT has made great progress in construction at the Ranomafana Basic Health Clinic II, engaging ambulances for the Ifanadiana region. We predict great “on the ground” progress in 2015.
- The “Mouse Lemur Genome Project” continued with an annual molecular biology training course in August 2014. The Stanford team, including Drs. Mark Krasnow and his post-doctoral fellow Caitlin Karanewsky, trapped mouse lemurs and produced mouse lemur fibroblasts in our CVB laboratory. Over 550 mouse lemurs have been trapped and provided with microchip transponders for identification and long-term monitoring. However, because of a delay in the breeding season, fewer individuals were captured this season than other years.
- Our biodiversity research projects included field studies on a diversity of taxa. Amphibian studies included exploring microbiota and susceptibility to chytrid by Molly Bletz and Ché Weldon, amphibian diversity by Carl Hutter, tadpole ecology by Noelikanto Ramamonjisoa, and Brett Scheffer’s exploring microclimate changes along elevational and canopy gradients in relation to amphibian diversity. Lemur studies included Onja Razafindratsima’s work documenting seed dispersal in frugivorous lemurs, Lydia Tongasoa documenting the behavior and ecology of gentle bamboo lemurs in remote sites within the park, Kevin Guilfoyle exploring bamboo lemur isotopes, Stacey Tecot documenting reproduction and allomaternal behavior in red-bellied lemurs, and Iris de Winter studying parasites and microbiomes among diurnal species of lemurs. In addition, Zack Farris launched a project to explore the relationship between invasive and native carnivore dynamics, Garshaw Amidi-Abraham studied crayfish diversity, Chris Collins examined bee pollination syndromes, Mar Cabeza led a team on disease transmission in bats, Sarah Zohdy explored mosquito-borne parasite ecology and vector transmission in humans and lemurs surrounding the park, Sarah Kariko supported spider diversity research, Michael Irwin continued to monitor fly diversity, and Patrice Ravonjariisoa studied macrofungi.
- Our conservation endeavors included Andrew Zamora, Lydia Tongasoa, and Garshaw Amidi-Abraham doing biodiversity surveys in our targeted forest north of Ranomafana National Park. The good news is that *Propithecus edwardsi* are abundant in this area and there are at least 3 species of endemic crayfish. This well preserved forest is part of the COFAV corridor, a community based protected area and we have been asked to assist in further research and conservation efforts in the area. In addition, we made substantial headway working towards the purchase of 20 hectares of unprotected forest in the peripheral zone of Ranomafana National Park (Ambatolahy dimy).
- Centre ValBio hosted 5 study abroad programs: two from Stony Brook University, one from California University of Pennsylvania, one from UK’s Reading University, and one from the University of Helsinki, Finland. We also supported many Malagasy students from the Universities of Fianarantsoa, Tulear, and Antananarivo through student research scholarships.
- CVB’s outreach programs continued in 54 villages around the park. Education programs continued in 34 schools and 20 conservation clubs throughout the periphery of the park, including the new high school in Kelilalana, promoting biodiversity, reforestation and health. Our mobile health team continued to provide critical mobile health delivery to remote villages - delivering diagnostics, treatment and preventative education to rural communities.
- Susan Cummings-Findel visited Ranomafana in August to follow-up on microloan women’s groups and promoting the continued development of an artisanal trail. This year was important for launching Centre ValBio’s eco-shop to promote the work being done by the local handicraft groups.
- Our Environmental Arts program expanded with Zara Aina theatrical company organizing workshops and performances at Centre ValBio that culminated in shows in the States including the singer Hanitra in the Brooklyn Academy of Music. Our local musicians

performed consistently throughout the tourist season and a workshop with a famous Indian dancer was a high point. In the last week of October, Centre ValBio collaborated with MNP to launch the first ever World Lemur Week celebration in Ranomafana National Park.

- In November, Centre ValBio hosted the IUCN International Amphibian meeting (ACSAM 2). The four-day conference was attended by 80 people from nine countries. This was the second largest international meeting held at Centre ValBio.
- Throughout the year, we also expanded our outreach through scientific tourism talks and diversified programs from a day to a week in duration, including groups such as the Sierra Club.
- November also marked the release of my new book “For the Love of Lemurs”, chronicling my 28 year commitment to Madagascar’s lemurs.
- In our continued efforts to diversify our revenue streams, several reconnaissance visits included Mr. Recipe (celebrity chef and spice trader) to explore vanilla and peppercorn export and Glen Bush for regional REDD+ opportunities.
- In addition, Centre ValBio is being featured in CNN’s “Parts Unknown” hosted by Anthony Bourdain. The TV film includes a traditional ceremony asking the ancestors if they approve of the transfer of land to conservation of the Ambatolahy dimy region, as well as close-ups of lemurs.
- I had the honor of being invited to be the Keynote Address Speaker at the 30th Anniversary of USAID in Madagascar. The Director of USAID, Susan Riley, and Madagascar’s first lady also gave speeches at this historic event.
- Special guests to CVB included Dorothy Lichtenstein and her family, Aaron Isaacson (Mr. Recipe), film Director, Darren Aronofsky (Director of Black Swan, the Wrestler and Noah), CNN presenter Anthony Bourdain, and wildlife film director and producer Alan Root and his family.

All of this would not have been possible without our outstanding staff, in Madagascar, at CVB, ICTE/CVB Antananarivo, and ICTE/CVB Stony Brook. 2014 has been a wonderful year and I look forward to a productive and successful 2015

I. CVB Station Use

In 2014 Centre ValBio experienced an almost three-fold increase in the number of individuals hosted by the center compared to 2013. The station hosted 410 individuals from 24 countries in 2014 compared to 140 individuals from 14 countries in 2013. However the total number of station-days within these categories actually decreased from 4,692 visitor-days in 2013 to 4,561 visitor-days in 2014.

Centre ValBio continues to attract researchers, training programs, project partners and tourists due to increasing interest in biodiversity and the people of Madagascar. Though we have noticed a significant interest in Centre ValBio more broadly, we note that more individuals are coming but they are staying for shorter periods compared to last year. Our calculation of station-day usage includes individuals hosted at Centre ValBio regardless of where they are lodging. Actual station occupancy, in which individuals lodged at Centre ValBio, amounted to only 25% (831 of 3,377) of all individuals hosted by Centre ValBio in 2014. The majority of people staying at Centre ValBio included researchers and course participants (86%), as well as volunteers and interns, scientific tourists and partners, film or artist teams, and conference participants. We have found that our more basic research type lodging is not necessarily attractive to scientific tourists; however, it is ideal for biodiversity related conference participants that are accustomed to field conditions and consider the dormitories luxurious compared to basic facilities at most research sites. While we remain almost at capacity during the 2014 high season and were at our capacity for station space availability in the month of November, we need to continue to be proactive in promoting station usage throughout the year, especially in the low season. Expanding training courses and the duration of participants' stay at the center as opposed to other locations, increased advertising for hosting workshops and conferences even at a national scale, and encouraging further research during the low season to increase station usage is in both ICTE and Centre ValBio's annual work plan for 2015. Additional study abroad programs are also in development for 2016.

Table 1: 2014 Centre ValBio Station Occupancy

	No. people	No. Days Station Occupancy
Researchers	136	2,091
Professor	31	252
Student	105	1,839
Courses	487	2,926
SBU (Summer)	90	432
SBU (Fall)	341	1,747
California University of Pennsylvania	19	367
UK Reading	23	184
University of Helsinki	14	196
Volunteers or Internships	13	246
Professional	5	115
Student	8	131
Scientific Tourists or Partner Visits	61	310
Scientific Tourist or Visitor	22	136
Professional Partner	22	106
Student	17	68
Film Crews, Photographers, Other Artists	12	49
Conference (ACSAM2)	122	211

Total	831	5,833
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In 2014, Centre ValBio hosted 3,377 individuals from 25 countries for a total of 7,744 station usage days. This consisted of individuals and station usage within the following categories (Table 2):

Table 2: Station usage by category in 2014

	Research Projects	Training Programs	Project Partners	Scientific Tourism	Field Trips	Conferences
No. Station Days	4,028	3,079	184	349	95	9
No. Individuals	136	90	54	220	2,792	85
No. Nationalities	15	9	6	14	11	10

As in previous years, both Research Projects and Training Programs dominated Centre ValBio’s station usage in 2014. However, the number of Scientific Tourists and Project Partners visits was also notable (Figure 1).

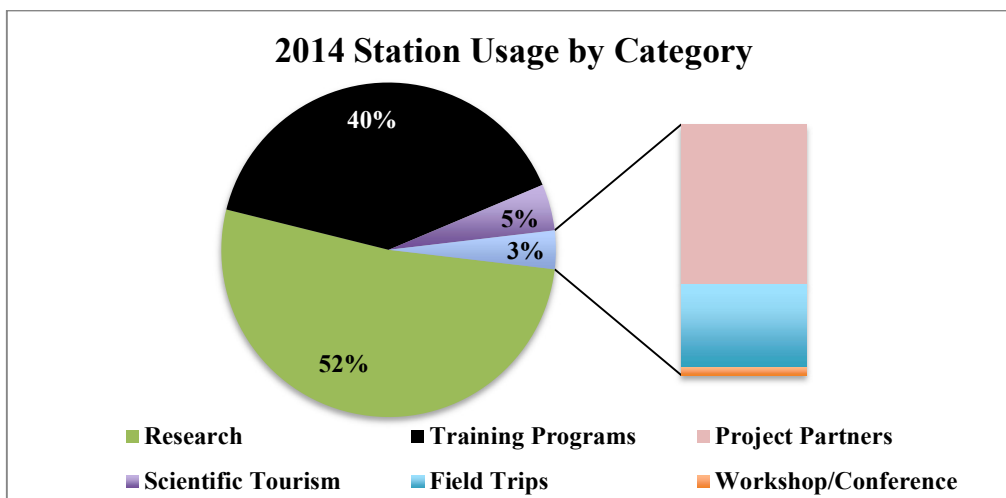


Figure 1: Centre ValBio station usage by category, 2014

While researchers and study abroad training programs had the most station usage, the number of visitors on daily field trips (n=2,792 individuals from 11 countries) and scientific tourist programs (n= 220 individuals from 14 countries) showed a significant increase from 2013. In addition, Centre ValBio hosted an international amphibian conference, *A Conservation Strategy for the Amphibians of Madagascar 2* (ACSAM2), as well as two other workshops in 2014. The three conferences drew in 85 people from 10 countries over the course of 9 days.

Aside from field trips and conferences, that are often a few days in duration, we found that the greatest number of individuals came from visiting scientific tourists (44%), followed by researchers, training programs and then project partners (Figure 2). While scientific tourist visits ranged from 1 day to one week, Centre ValBio is drawing a diversity of people through lectures, tours, meals, and participation in research and education programs.

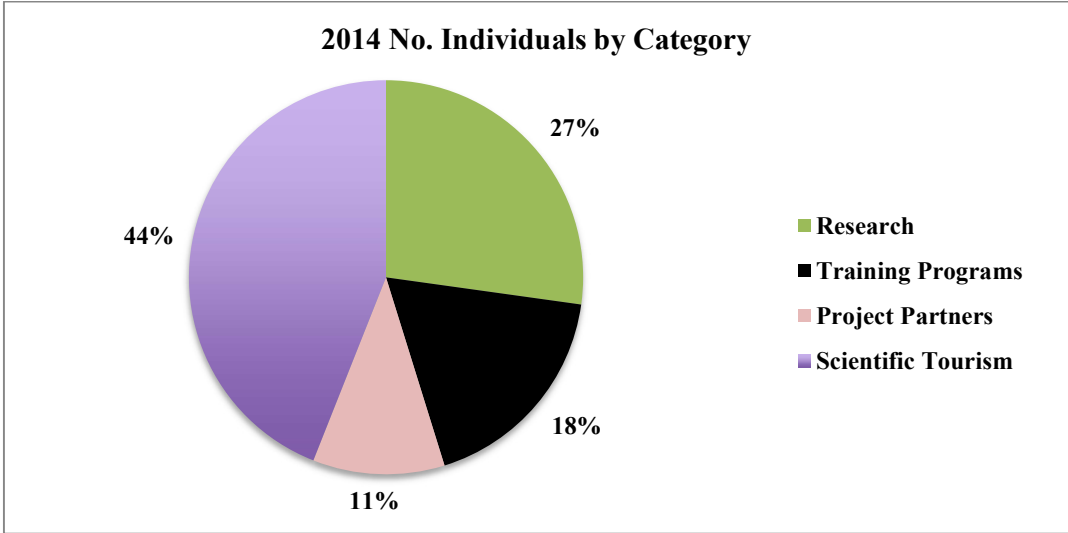


Figure 2: Individuals visiting Centre ValBio by category, 2014

Over 80% of the individuals hosted were from the U.S.A, Madagascar or Britain among the 23 countries represented (Figure 3). Most of our scientific tourism for 2014 was developed in partnership with Malagasy and international tour agencies working predominantly with British and American tourists. We do, however, have a more equitable representation of both American and Malagasy professionals and students participating in research and training programs alone (39% American and 29% Malagasy). Field trip visitors are predominantly composed of school group members (teachers and students) from Madagascar and consist of 96% Malagasy nationals. Additional school and university level training courses targeting Malagasy are in development for 2015.

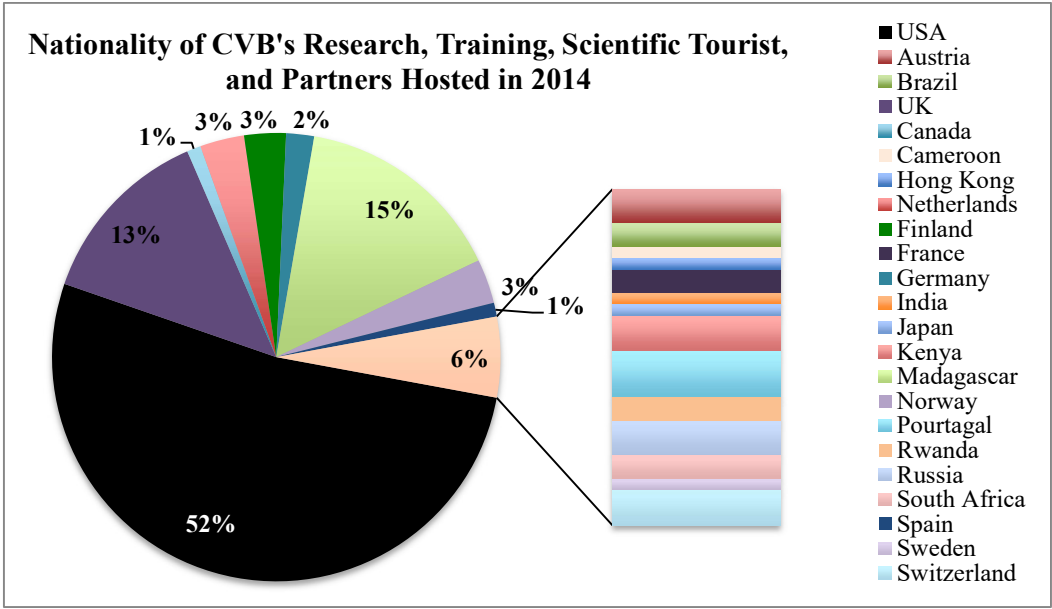


Figure 3: Nationality of Centre ValBio visitors, 2014

II. Research

A. Hosted Research Projects

Centre ValBio and its laboratories continue to provide exceptional resources for visiting researchers. In 2014, 136 researchers spent a total of 4,028 researcher-days at Centre ValBio. The United States and Madagascar accounted for most of the researchers (71%, Figure 1) and researcher-days (77%) but 13 other countries were represented in 2014. Malagasy researchers were almost equal in number and station usage compared to Americans in 2014, with 67% more Malagasy scholars than in 2013. While Malagasy students often assist foreign-run research projects as a national policy for capacity building, we were excited to facilitate several Malagasy researchers independently developing and implementing post-graduate, Ph.D., and Master's projects. In addition, ICTE and Centre ValBio supported several Malagasy student scholarships in 2014 through the Indianapolis Prize Fund continuing our mission of promoting opportunities for in country researchers (see training programs for more details).

Forty-five percent of the researchers were students working on D.E.A.*, Master's, or Ph.D. degrees. Although the number of researchers was approximately the same in 2013 and 2014, the number of researcher-days in 2014 show a 14% decrease from that in 2013. Researchers included 140 individuals from 14 countries in 2013 for a total of 4,692 researcher days compared to 136 individuals from 15 countries for a total of 4,028 researcher days in 2014 (Table 1).

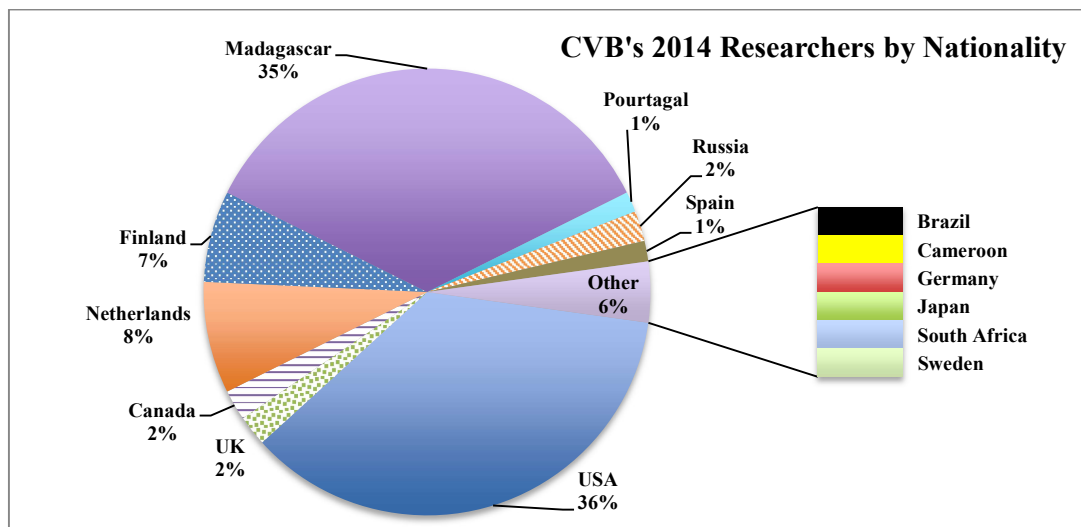


Figure 1: Nationality of Centre ValBio researchers, 2014

* Malagasy equivalent to a Master degree

Table 1: Number of researchers and researcher days by country of origin in 2013 and 2014

	2013		2014	
	No. Individuals	No. Researcher Days	No. Individuals	No. Researcher Days
U.S.A.	64	2,060	49	1,676
Belizean	2	8	-	-
Brazilian	-	-	1	7
British	6	166	3	19
Canadian	10	92	3	54
Cameroonian	-	-	1	9
Croatian	1	62	-	-
Danish	2	14	-	-
Dutch	7	786	11	446
Finnish	5	329	9	168
German	3	17	1	34
Japanese	3	26	1	11
Malagasy	32	1,040	48	1,424
Peruvian	1	56	-	-
Portuguese	-	-	2	65
Russian	-	-	3	12
South African	-	-	1	6
Spanish	2	18	2	88
Swedish	-	-	1	9
Swiss	2	18	-	-
Total	140	4,692	136	4,028

The primary topics of research projects in 2014 concerned lemur biology, seed dispersal and plant ecology, and disease ecology and parasites (Figure 2, Table 2). We were pleased to host several teams of returning researchers working on long-term projects at CVB. Dr. Mark

Krasnow and his team from Stanford University continued their study of mouse lemur genomics from August through October. For the third consecutive year, Dr. Krasnow also taught his mini-course in mouse lemur biology. This year the class included local high school students from the Ranomafana region where they learned basic genetic methods via lectures and lab exercises. Drs. Tom Gillespie and Sarah Zohdy (Emory University) returned with a team of researchers focusing on disease ecology in humans, domestic animals, and wildlife. Two of the student members on this team were completing Master's degrees in public health at Emory. Dr. Stacey Tecot (University of Arizona), Dr. Andrea Baden (Hunter College), and Rachel Jacobs (Stony Brook University) continued their studies of the behavioral ecology of *Eulemur rubriventer*, focusing this year on allocare-infant interactions.

Other researchers included several Ph.D. students from Europe and the U.S. returned to Ranomafana to continue field research for their degrees. Onja Razafindratsima continued her Ph.D. work on seed dispersal, extending experiments in seedling propagation both in the forest and CVB's on-site tree nursery. Iris de Winter encouraged numerous Dutch master's students to work on *Eulemur* demography and parasitology. This was also a notable year for continuing thesis related research on amphibians. Carl Hutter returned to continue searching for new species, Molly Bletz continued critical research on probiotic resistance to chytrid infection, and Noeli Ramamonjisoa started his Ph.D. research on tadpole morphology, ecology, and systematics. In fact, as announced at the 2014 ACSAM2 conference held at Centre ValBio, the Ranomafana area is currently the most diverse in terms of amphibians with a current total of 129 species.

Centre ValBio saw exciting new long-term projects launched this year. In addition to the annual RESPECT training course, Mar Cabeza led two additional research teams in (1) socio-ethnographic work around RNP's periphery to assist in gaining a better perspective of villager's perception of the park, and (2) a bat research team that selected public buildings (schools) in the periphery of the park to explore systematics, distributions, and potential disease transmission through guano. Zoavina Randriana and Zach Farris launched an extension of the MadDog Initiative, to target trapping, spaying/neutering, and vaccinating feral dog populations in villages nearby the park boundaries. Camera traps were set on forest edges to gain a better understanding how domestic carnivores may influence native carnivore distributions in the park. Brett Scheffers established gradient microclimate monitoring setting up climate sensors in the southern pristine region of the park, with a particular interest in amphibian and invertebrate diversity within bird ferns located in the forest canopy.

Note:

Please see Appendix 1 for a sample of CVB's Research Project Abstracts

Please see Appendix 2 for ICTE-CVB's 2014 publication list

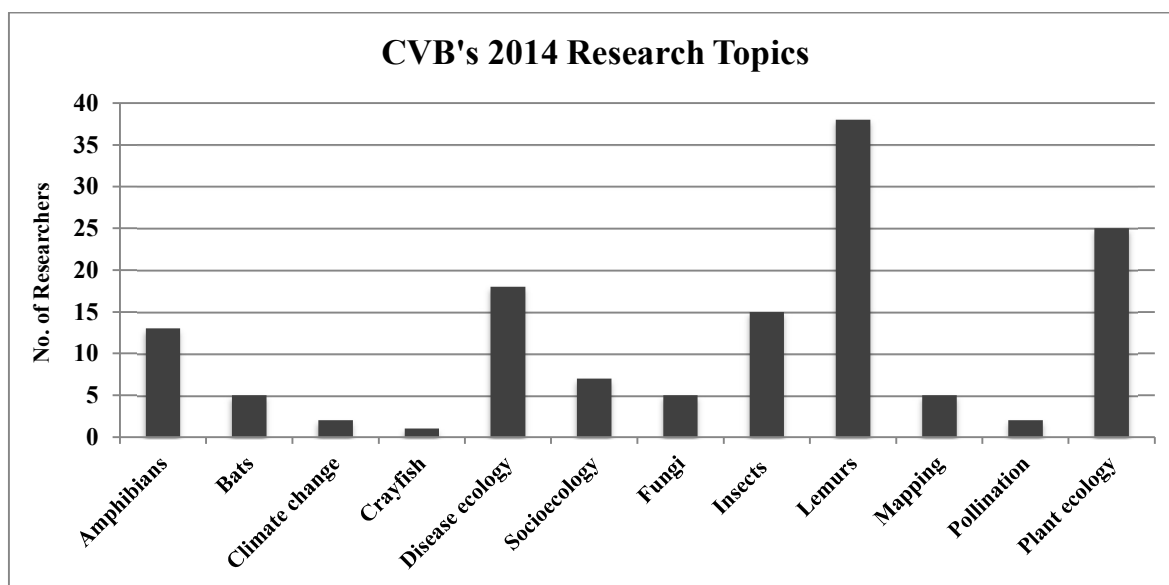


Figure 2: Main research topics at Centre ValBio, 2014

Table 2: Summary of major research topics at Centre ValBio during 2014

Subject of Study	Number of Researchers
Lemur ecology/behavior/genetics	38
Taxonomic inventory/frogs	3
Taxonomic inventory/insects	15
Taxonomic inventory/bats	5
Taxonomic inventory/fungi	5
Seed dispersal/plant ecology	25
Amphibian disease/probiotics	3
Amphibian ecology	7
Disease ecology/parasites (wildlife and human)	18
Education/Human socioecology	7
Crayfish ecology/biodiversity/sustainability	1
Pollination biology	2
Mapping (FANC)	5
Climate change/environmental monitoring	2
Other	9

B. CVB's Long-term Research

Centre ValBio's research teams continue to conduct research within and around Ranomafana National Park. CVB's research work contributes important information on biodiversity and pressures affecting the park and its surroundings, mainly through a focus on the long-term research sites distributed throughout the park (Figure 3). CVB has also been proactive in promoting visiting researchers to expand studies beyond the established sites of Talatakey, Vatoharonina and Valohoaka.

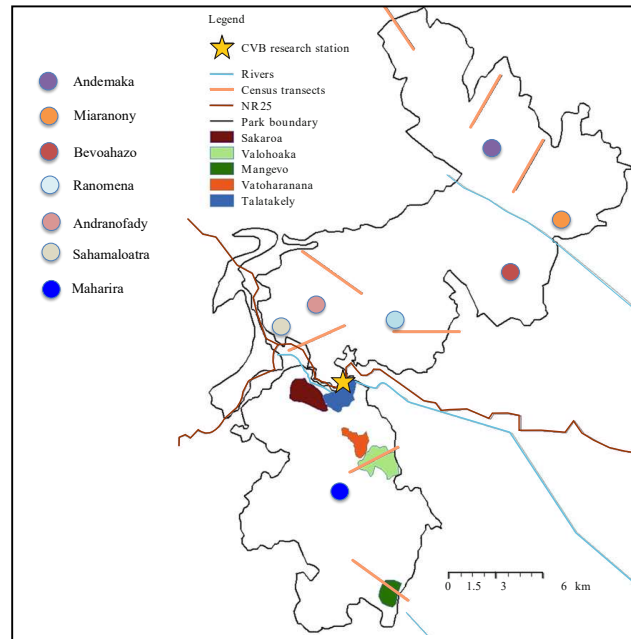


Figure 3: Long-term research sites at Ranomafana National Park (RNP)

The fact that Centre ValBio’s research teams are covering such a large area throughout the year is crucial to assist the authorities of Madagascar National Parks (MNP) in management of the park. Gold mining continues to be a problem, especially in the central portion of the park, just north of the road. We work closely with MNP to georeference, photograph, and take any additional details on observed disturbance. Mixed patrols are also supported by CVB in collaboration with MNP and the gendarme. Centre ValBio promotes educational campaigns and alternative and more sustainable economic opportunities for communities surrounding the park.

Examples of projects conducted by Centre ValBio in 2014

Aye-ayes

The aye-aye (*Daubentonia madagascarensis*) is an elusive lemur, with very few sightings in RNP since the park was created. In fact, at least 2 of the recorded sightings have been off the back veranda of Lovabe Hall! Thus, we were very excited to hear that technicians in Vatoharonina reported daily traces and heard them feeding at night near their research camp in April 2014. A tour guide also reported a sighting in late April. Centre ValBio tried to use this opportunity to set-up up camera traps in the canopy and conduct nocturnal monitoring of the *Canarium* (ramy) trees in fruit (n=15 trees). Unfortunately, we did not capture any photos of aye-ayes, and fresh traces were only found near 1 of the 15 fruiting trees. Evidence of activity continued to be found into the end of the year. Further monitoring via trace observations and our camera traps from the TEAM project will give us a better understanding of their distribution. TEAM project’s camera-trap monitoring, have captured photographs of aye-ayes in 2010 (one trap point in Array 2 – please see map for array locations under TEAM below), 2011 (one trap point in Array 2), and 2012 (three trap points in Array 1). While we’ve only captured aye-ayes at a total of 5 camera trap points thus far, we have documented individuals on multiple days, at different times of the day, at a particular location. The sampling between 2010 and 2011 was only one trap point away from each other indicating

likely aye-aye habitat over successive years. In addition, we've been able to document pairs of individuals travelling on the ground, as well as one individual travelling in the morning hours, providing important behavioral information on this species!



Black and White Ruffed Lemurs

The black & white ruffed lemur (*Varecia variagata variagata*) is still one of the most charismatic of all lemur species. This species is also a good indicator of forest health as they are frugivores that are typically restricted to more pristine forests. Over the past several years, we have been excited to observe *Varecia* moving more frequently into the Talatakely trail system – indicating successful forest regeneration since protection of the park was established. While we haven't been monitoring systematically, especially in the southern study group in Mangevo, we have been able to record occurrences and we encouraged two study abroad students work on semi-habituated groups in Valohoaka, where two of the females had infants! Sightings in Talatakely, Sakaroa, Vatoharonina and Valohoaka are much more frequent than in previous years. We are receiving several reports of vocalizations and visual sightings of *Varecia* in other areas. Several sightings confirm *Varecia* north of the road (north of Ambodiaviavy) and vocalizations were also heard while researchers were in Miaranony. This is great news that the road may not be as significant of a dispersal barrier as previously thought. There have also been several reports of frequent vocalizations outside the park in the periphery, especially just southeast of the road past Ranomafana. Further exploration on their distribution and dispersal throughout the park as well as more consistent monitoring on their ecology and demography (especially reproductive success) will need to continue into the future.

Milne-Edward's sifaka

The study of the Milne-Edwards sifaka (*Propithecus edwardsi*) is one of the longest primate research projects in the world. It was initiated and continues to be supervised by Patricia Wright. Centre ValBio technicians collect behavioral and ecological data on groups in Valohoaka and Talatakely. In 2014, one of our groups had a new immigrant male join in late October and it remains to be seen how the resident male will react. We also continued important health surveys on the sifakas, which gave us the opportunity to collar several more animals for facilitating further long-term monitoring and data collection on identified individual. Centre ValBio sifaka research team members also contributed their expertise on

survey and demographic studies in the unprotected forest of Ampatsona-Ambohidaza (see details below).

Bamboo lemurs

Centre ValBio continues to conduct long-term monitoring and data collection on the two lemur species that were the impetus for the creation of Ranomafana National Park, the golden and greater bamboo lemurs.

Golden bamboo lemurs: Centre ValBio technicians continue to follow 5 groups of golden bamboo lemurs (*Haplemur aureus*) around the Talatakely research site. In November 2014, two of our long-term study groups had infants. Group 1A had 3 infants (1 adult female with twins) and another female with a singleton. A second group (1B) had one infant. Despite an observed attempted predation event on one of the twins by Madagascar harrier-hawk (*Polyboroides radiates*) over the Christmas break, all infants are doing well. Unlike other lemur species such as red-bellied lemurs, males do not assist in caring for the infants. During the strike, the mother was only able to grab one infant and the other jumped, falling 20 meters to the ground. After the coast was clear, the mother left the one twin in the canopy and descended to the ground to retrieve the fallen infant. Fortunately, it appears the infant did not suffer any injuries and was observed behaving normally the next day by CVB’s research team. Ranomafana still remains one of the two protected areas where *H. aureus* is found and the only site where behavioral, ecological and demographic data is being collected.

Greater bamboo lemurs: Centre ValBio teams also monitor and collect data on the critically endangered greater bamboo lemur (*Prolemur simus*). Unfortunately, only 2 individuals (father and daughter) remain within RNP’s Talatakely trail system; however a healthy population of over 120 individuals in 4 groups exists just east of the park in Vohitarivo (Figure 4). Our teams regularly search for individuals in bamboo patches throughout the park’s boundaries. Centre ValBio teams work with local community members on monitoring for conservation of a population of *Prolemur simus* in an unprotected forest fragment in the Ivato Commune, Vondrozo District. Field reports towards the end of 2014 submitted by local guides who followed the groups daily had 56 individuals from 3 groups. A follow-up expedition led by Eileen Larney and Centre ValBio’s technicians is planned for early 2015.

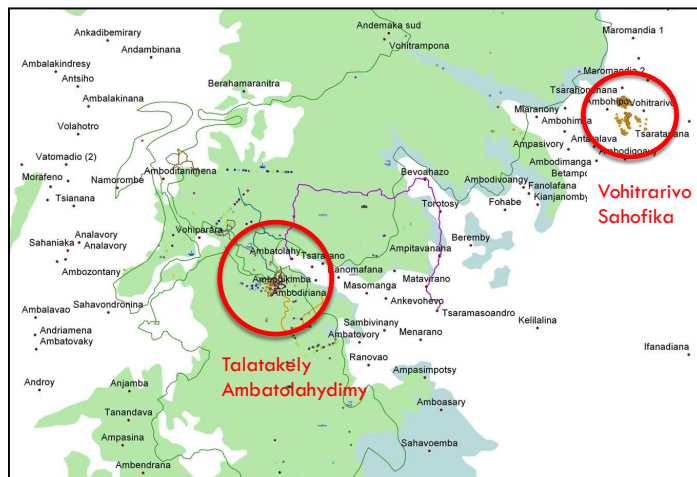


Figure 4: Distribution of habituated bamboo lemurs included in long-term monitoring efforts in and around Ranomafana National Park

All three bamboo lemur species (*Hapalemur aureus*, *H. griseus*, and *Prolemur simus*) are found in Talatakely. Ambatolahydimy, just peripheral to the park boundary, currently contains both *Hapalemur* species, and *Prolemur simus* individuals were historically observed to cross the park bridge and road to that portion of the park several years ago. It is possible that this route is an important dispersal avenue for many species, and especially *Prolemur simus*, to the large population outside the northeastern periphery of the park (Vohitarivo and Sahofika). Centre ValBio has been proactive in 2014 in moving forward with the purchase of an unprotected parcel in Ambatolahydimy, as it is critical habitat for bamboo lemurs.

Within the long-term research site of Talatakely, five groups of *Hapalemur aureus* and one group of *Prolemur simus* are found within the constraints of bamboo distribution in this area (Figure 7). While additional bamboo areas are being mapped by our research technicians, much of our long-term demographic, behavioral, and ecological data are from Talatakely. This does, however, give us an opportunity for important insight into the effects of tourism and habitat regeneration on these bamboo specialists. *P.simus* is found to range throughout the entire area of bamboo and *H. aureus* groups, consisting of family groups, have more fixed home ranges with some overlap. As part of a presentation for the 2014 International Primatological Society congress held in Hanaoi, Vietnam, we started to compile our long-term demographic data on these two lemur species.

Additional monitoring of the gentle bamboo lemurs (*Hapalemur griseus ranomafanensis*) is being conducted by Centre ValBio technicians in collaboration with Lydia Tongasoa, a Ph.D. candidate from the University of Antananarivo. The gentle bamboo lemurs appear to have a much greater distribution both inside and outside the park, although Talatakely is the only locality where all three *Hapalemur* species are sympatric.

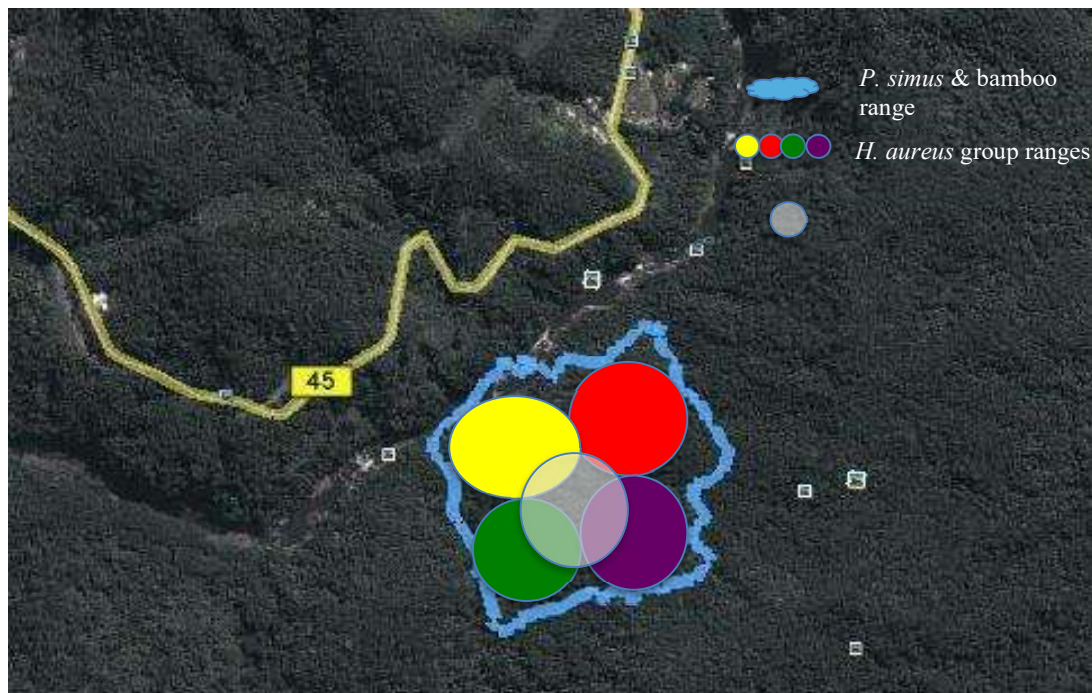


Figure 5: Range of the golden & greater bamboo lemurs in Talatakely trail system

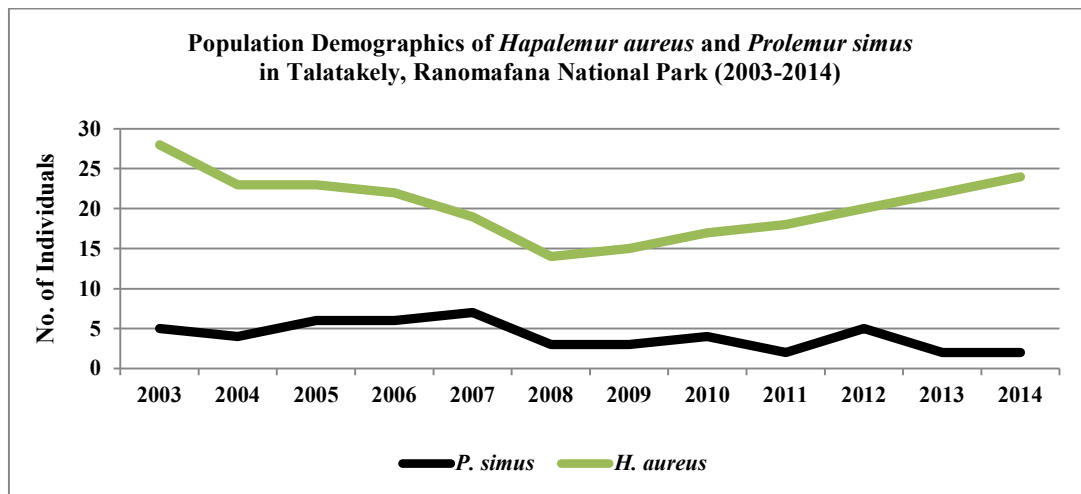


Figure 6: General population trend of habituated individuals of *H. aureus* and *P. simus* within the main research locality (Talatakely, Ranomafana National Park) from 2003-2014

While *Haplemur aureus* has a more restricted range (due to family groups defending fixed home ranges and elevational preferences), the number of individuals in this metapopulation has remained more or less consistent over the last decade. This is great news for conservation management, especially since additional individuals that are found within the park boundaries remains protected for the future. *Prolemur simus*, on the other hand, has always had one main group (that gradually fissioned or had individuals dispersing to unknown locations) from Talatakely. In general, the numbers of individuals in the main trail system have been steadily decreasing and translocation efforts in 2013 were unsuccessful, as the introduced individuals immediately dispersed from the Talatakely area. However, the population outside in the periphery of the park is steadily increasing. Further research needs to be conducted to understand why Talatakely may no longer be ideal habitat for *P. simus*. It is possible that the forest succession may produce less favorable bamboo characteristics, such as potentially tougher culm or different chemical components of the Madagascar rubbervine (*Cryptostegia madagascarensis*), which is a fallback food for Talatakely's *P. simus* during the dry season. The *P. simus* outside the park and in other disturbed locations feed on a several different species of bamboo, in addition to other food resources (e.g., rice, sugar cane, jackfruit, traveller's palm, etc.), and the disturbance in these areas actually favors a high turnover of bamboo regeneration (e.g., shoots). Continued long-term behavioral and ecological data collection will give us important insight on these endangered lemurs, additionally data collections will assist in monitoring the effects of tourism and potentially serve toward mitigating disease transmission (Rasambainarivo 2013).

Climate

Starting at the time Dr. Wright first established a research presence in RNP for the long-term database, Centre ValBio collects both temperature and precipitation daily via manual rain gauges and thermometers. These data will eventually be compared to those of the new climate monitoring technology from our automated Tropical Ecology Assessment & Monitoring (TEAM) climate station established in 2011. Below shows a graph of 2014's average monthly temperature (minimum and maximum) and precipitation recorded every morning at 6 am by CVB staff. The lowest temperature (8 °C) was recorded in August, while the highest (27 °C) in December. Total annual rainfall was 3.04 meters, with most rainfall from December-February.

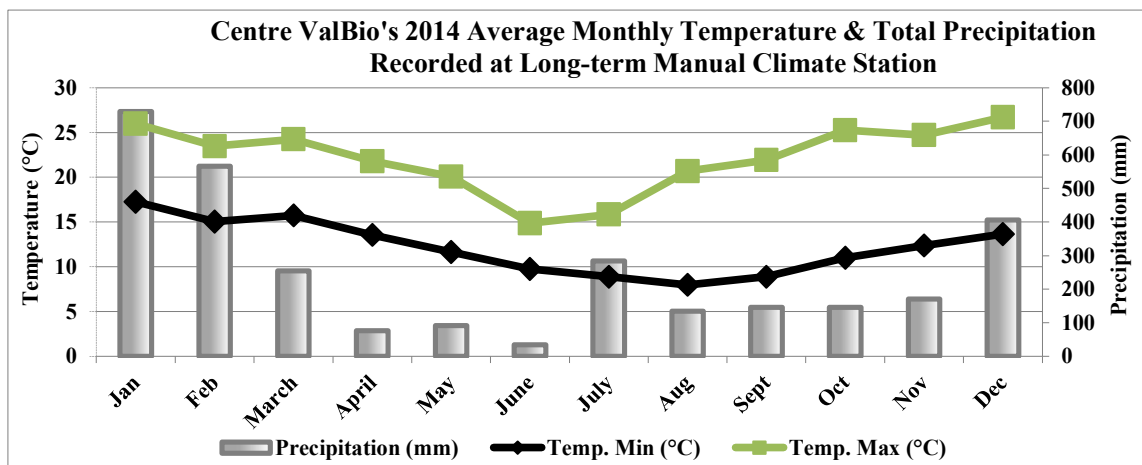


Figure 7: Centre ValBio's 2014 average monthly temperature & rainfall from the campus long-term manual climate station

Phenology

Phenology is the long-term project at Center ValBio, started in 1987, that monitors the fruiting and flowering of trees monthly and records DBH measurements twice a year. The monitoring was established with the goal of following the evolution of trees species that were important food resources for sifakas (*Propithecus edwardsi*). For 5 days every month, Centre ValBio's botanists monitor 342 endemic trees, including 24 families, 46 genera, and 71 species.

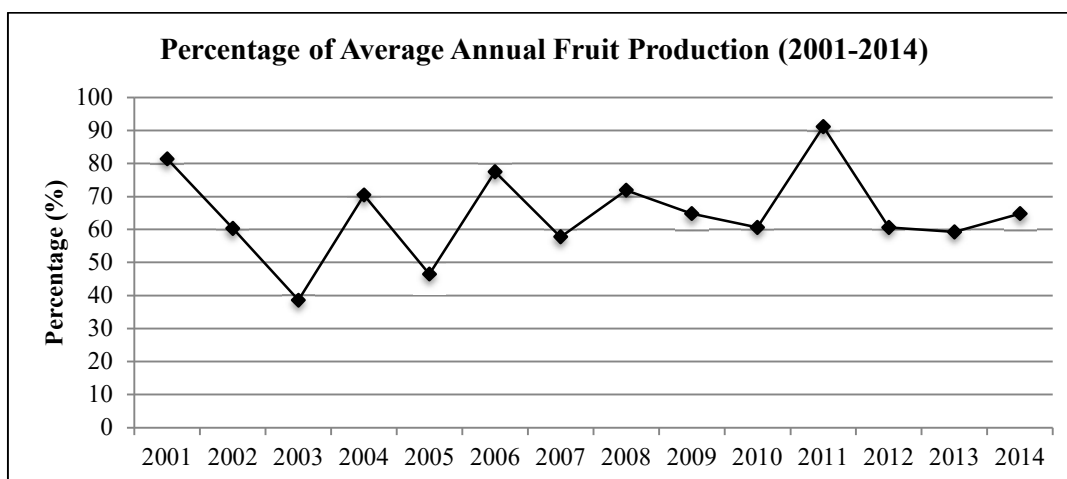


Figure 8: Percentage of average annual fruit production (2001-2014)

The percentage of average annual fruit production across CVB's 75 tree species from 2001 through 2014 is presented above. This ratio is calculated based on the percentage of fertile trees species ($100 \times \text{fertile species}$) by the total number of species. In both 2001 and 2011 (ten years apart), the trees had very high fruit production. 2003 was the lowest (worst) production. For 2002, 2003 and 2012, 2013, we observe that after high production, fruiting decreases for two successive years. During 2002 through 2008, the fruit production alternates, which is the typical pattern. We occasionally have to replace trees within our monitored transect due to natural mortality, wind, cyclones and less commonly human disturbance.

From 2007-2014, this included 60 trees from 26 species (2007-2008 = 17; 2009 =12; 2010 =7; 2011= 5; 2012=8; 2013=7; and 2014=4). 16 trees fell down due to the cyclones in 2008 and 2012. Two trees were killed by human disturbance, when MNP did trail maintenance in Talatakely in 2009, they unfortunately cut down the two phenology trees. One tree (Amontana # 339) was struck by lightning, and the rest died of uncertain causes. Of these 60 trees, we observed some species having a much higher rate of mortality (e.g., Seva (*Solanum maritimum*), n=9; Voarafy (*Maesa lanceolata*), n=6; and Harongana (*Harungana madagascariensis*, n=4). Notably, these three trees species are trees that grow in open areas. Seva and Harongana are often found to grow and spread relatively fast following slash and burn practices. Thus, over time (e.g., the course of ten years), mortality may be more likely for these species due to a denser canopy.

Tropical Ecology Assessment and Monitoring (TEAM) Network

The TEAM Project (a collaboration with Conservation International) continued through its fourth year and has been renewed for a fifth year of monitoring vegetation, terrestrial vertebrates and climate within the [TEAM network](#). The same standardized methodologies were conducted as in previous years and as implemented across all TEAM sites globally. Six vegetation 1ha plots (green squares), sixty camera trap points (black triangles or red circles), and climatic parameters were recorded through the automated climatic station (on CVB's upper campus) at established monitoring points (Figure 9). This year marked some significant changes in data verification protocols and taxonomic revisions for vegetation data. Due to site funding cuts at sites within the TEAM network this year, we found it a good time to transition one of the students, working towards his masters from the University of Tulear, as the new TEAM site Manager, and the old site manager into a more permanent position for developing university relations.

Vegetation Plots include six 1-hectare plots, in which all stems (trees, lianas, palms, tree ferns) with a DBH (Diameter at Breast Height) of ≥ 10 centimeters are monitored and measured at the POM (established point of measurement), located at 1.3 meters above the ground. Taxonomic identification of every plot stem was done when the plots were established, although annual changes (new recruits and mortality are logged annually) were made due to a concerted effort in 2014 to confirm identification, standardize previous years of field data sheet entry and identify those that were uncertain. Thus, we continued voucher specimen collection and but made more of an effort to collect from every identified species and particularly those that were yet to be taxonomically assigned. In addition to photos and the vouchers themselves, we then utilized readily available data and key traits available online via the website Tropicos. For those specimens that were still difficult to assign, we sent samples to our partner, MBG and PBZT herbarium at Tsimbazaza Antananarivo. A total of 6,568 individual plants were monitored in the six vegetation plots of the Ranomafana TEAM site (Plot 1: 746 stems, Plot 2: 1,051 stems, Plot 3: 1,426, Plot 4: 959 stems, Plot 5: 1,292 stems, and Plot 6: 1,094 stems).

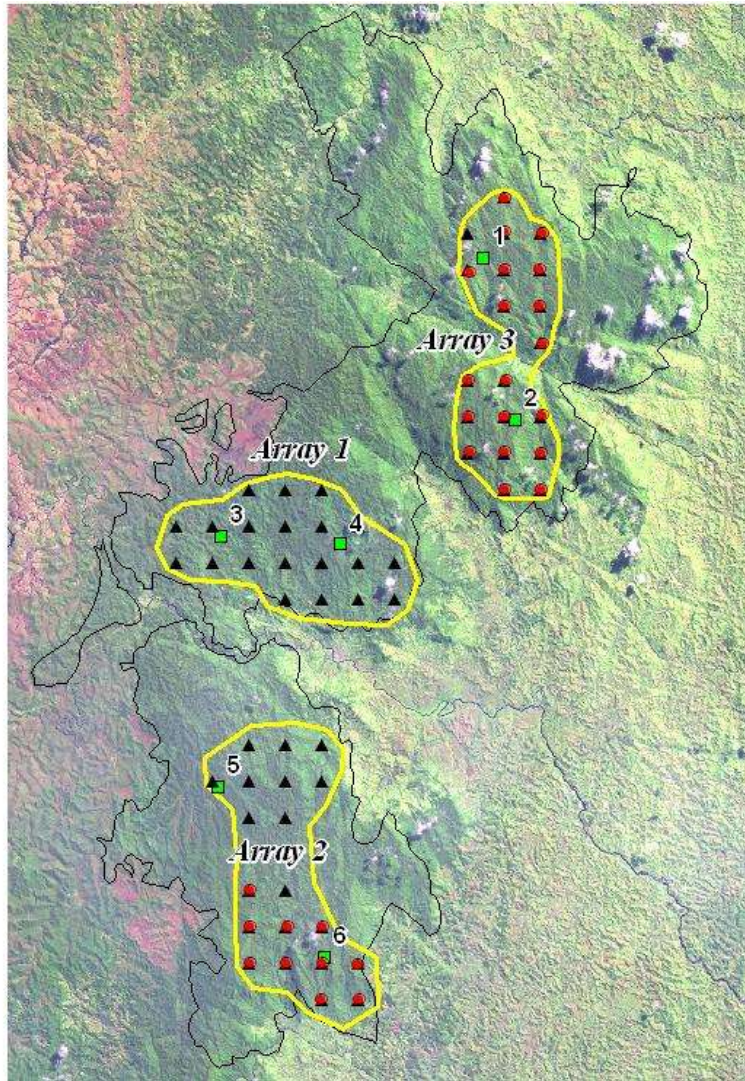


Figure 9: TEAM sampling points for vegetation and terrestrial vertebrate monitoring

Comparing the past two years of monitoring, an average of 30.36 % of plot stems had no annual variation in their DBH, 67.18 % had an increase in DBH, and 2.47 % a slight decrease in DBH. Stems with no recorded variation in DBH (e.g., same value as previous year of monitoring) were mostly found in the central areas of the park (Bevoahazo: 32.25%, Andranofady: 30.65%, Ranomena: 36.39%, and Maharira: 32.25%). As we look across the four years of monitoring (2010-2014), 63.04% of plot stems increased in DBH, 12.54% unchanged DBH, and 24.40% had their DBH decreased (Table 2). No change in DBH may indicate slow growth rates for certain species, that the stems reach its maturity, or that no major environment variation affects the growth of the stems. Some plot stems, from which their measured DBH decreased, and often included trunks covered with moss. It is possible that these stems might have lost some parts of their barks/moss volume during the dry season, and that also might have led to the differences in their DBH measurement. However, the decrease in DBH may be caused by multiple factors whether anthropogenic or non-anthropogenic. Some plants also renew the trunk-bark or loose bark when dying. Further exploration into why certain trees from certain areas display less or more variation and, more importantly, why some individual trees and/or species actually show decreasing values in DBH is currently being explored.

Across plots, the dominant families include Myrtaceae (14.69%), Lauraceae (9.21%), Malvaceae (6.36%), Rubiaceae (5.31%) Clusiaceae (5.2%), Cunoniaceae (5.2%), and Euphorbiaceae (5.07%). Despite the presence of dominant plant families, these are not necessarily evenly distributed across the six plots. For example, Plot 3 (Andranofady) contains more individual stems of the families Myrtaceae and Cunoniaceae, while Plot 5 (Maharira) is composed of more Clusiaceae, Lauraceae, and Malvaceae individuals than to any of the other plots. Seven plant families are found to be specific to only one particular plot location, and most of these families were very rare and represented by only few individuals (Table 3).

Table 3: Rare and restricted families within the TEAM Vegetation Plots

Plot #	Family	Density / hectare
1	---	---
2	---	---
3	---	---
4	Chlorantaceae	1
	Connaraceae	1
	Podocarpaceae	1
5	Celastraceae	12
	Ericaceae	5
	Rhizophoraceae	2
6	Rhamnaceae	1

Across plots, approximately 4% of all stems were found dead during this year’s monitoring. Most of the dead trees recorded within the six plots had smaller DBH values between 10 to 20 centimeters and are thus more likely susceptible to climate events (e.g., wind, etc.) or other types of disturbance (e.g., from humans or grazing cattle).

We started 2014 with a proactive plan to work towards data quality control and taxonomic revisions and designations of ‘unknown’ stems for the Ranomafana vegetation plots. After intensive sampling and referencing online, and in collaboration with MBG & PBZT for consultation on difficult specimens, 229 species were newly assigned (e.g., previously unknown) and/ or revised across plots (Table 4). However, there still remains 410 ‘unknown’ tree stems at the species level from a total of 28 genera. These stems will continue to be targeted during the next monitoring and voucher specimen collection period to provide further key characteristics and voucher reference material (e.g., fruits, flowers, etc.) for classification and potentially new species designations in collaboration with our Tsimbazaza and MBG partners.

Table 4: Taxonomic summary across TEAM vegetation plots

	Plots						Total
	1	2	3	4	5	6	
Total No. Stems	746	1,051	1,426	959	1,292	1,094	6,568
Total No. Families	38	45	44	38	42	44	57
Total No. Genera	62	77	75	64	61	74	120
Total No. Species	82	116	94	82	102	100	229
No. genera including unidentified stems	6	7	7	9	7	10	28
No. stems unidentified at species level	19	28	97	174	74	60	410

Following new taxonomic revisions including the collection of 580 voucher specimens and photographic documentation (to facilitate comparison with resources on Tropicos), 93.76% of all plot stems have been successfully identified and are being monitored, including 57 families, 120 genera, and 229 species. Twenty-eight individual stems, about 0.42% remain identified at the genus level and about 6.24% (410 individuals within 13 families and 21 genera) remained unidentified at the species level. We made great strides in our data quality control, monitoring field forms more closely as well as data entry issues. We also made a concerted effort to learn and utilize the online references available via Tropicos, in particular, before also consulting with our partner organizations in Tana for further assistance. We will continue to work towards further identification during the fifth year of monitoring.

Ranomafana National Park has been known for its high diversity and unique biodiversity, and the level of endemism is very high. Approximately 56% of all identified plot plant species within TEAM plots are endemic. In comparison with the 17 TEAM sites conducting the same monitoring protocol, the families of Asparagaceae, Canellaceae, Pandanaceae, Sarcolaenaceae, and Torrecilliacae are only found within the Ranomafana site. However, further taxonomic examination is needed due to several unknown genera or species and the rarity of certain plants within Ranomafana. Monitoring and collection of fertile reproductive parts as important components of any herbarium reference collection continues to pose a challenge for some rare genera (e.g., *Malleastrum* and *Ludia*). Others (e.g., *Syzygium*, *Cryptocarya*, *Norhonia*, *Memecylon*, *Ravenea*, and *Grewia*) also do not have adequate reference samples available for comparison at the national herbarium at Tsimbazaza. Thus, continuation of reference collection and improving our knowledge of the taxonomy of Ranomafana's vegetation will be an important contribution to the national database as well.

Terrestrial Vertebrates: Camera traps were deployed (for 30 consecutive days) utilizing our established sixty camera trap sampling points, with sampling points at a density of 1 camera every 2 km². For the past year's terrestrial vertebrate monitoring, 26,048 images were captured (with an average of 8,682.66 images per array and 434.13 images per camera trap point) and documented a total of 24 vertebrate species (Table 5).

During this year's monitoring, we found the most diversity in term of total number of species in Array 1 (18 species documented), followed by Array 2 (17 species) and Array 3 (15 species). Camera traps recorded a total of seven species of birds and seventeen mammal species. Some species were only documented in one array, including birds (e.g., *Atelornis crossleyi*, *Geobiastes (Brachypteracias) squamiger*, *Mentocrex (Canirallus) kioloides*, *Sarothrura insularis*) as well as certain endemic (e.g., *Hemicentetes semispinosus*, *Eupleres goudotii*, *Hapalemur aureus*, and *H. griseus*) and invasive (*Canis lupis*) mammals. Further exploration across the years will help us determine distributions to determine if we are just not capturing the individuals in our sampling or whether these species might be just absent in certain habitats due to specific habitat requirements or preferences. Comparing our terrestrial vertebrate data with the vegetation descriptions will help determine critical areas for rare species for conservation management. Other endemic bird (e.g., *Nesoenas picturatus*, *Lophotibis cristata*) and mammal (e.g., *Tenrec ecaudatus*, *Cryptoprocta ferox* (classified as vulnerable by IUCN red listing), *Fossa fossana*, *Galidia elegans*, *Eliurus tanala*, and *Nesomys rufus*) were documented across arrays. Introduced and invasive species – including *Potamochoerus larvatus*, *Rattus rattus* and, unfortunately, *Homo sapiens* were present in our sampling across the park. As expected, the presence of *Canis lupus* and *Bos taurus* are often in association with human presence.

Table 5: Terrestrial vertebrates documented from TEAM monitoring (camera trapping) during the Year 4 (2013-1014) monitoring phase (“X” = presence)

Class	Order	Family	Genus	Species	Red List	Array 1	Array 2	Array 3
Aves	Columbiformes	Columbidae	<i>Nesoenas</i>	<i>picturatus</i>	LC	X	X	X
	Coraciiformes	Brachypteraciidae	<i>Atelornis</i>	<i>crossleyi</i>	NT	X		
			<i>Geobiastes (Brachypteracias)</i>	<i>squamiger</i>	VU	X		X
	Cuculiformes	Cuculidae	<i>Coua</i>	<i>reynaudii</i>	LC	X	X	
	Gruiformes	Rallidae	<i>Mentocrex (Canirallus)</i>	<i>kioloides</i>	LC	X		
			<i>Sarothrura</i>	<i>insularis</i>	LC			X
Pelecaniformes	Threskiornithidae	<i>Lophotibis</i>	<i>cristata</i>	NT	X	X	X	
Mammalia	Afrosoricida	Tenrecidae	<i>Tenrec</i>	<i>ecaudatus</i>	LC	X	X	X
			<i>Hemicentetes</i>	<i>semispinosus</i>	LC		X	
	Artiodactyla	Bovidae	<i>Bos</i>	<i>taurus</i>	NE		X	X
	Carnivora	Canidae	<i>Canis</i>	<i>lupus</i>	LC		X	
		Eupleridae	<i>Cryptoprocta</i>	<i>ferox</i>	VU	X	X	X
			<i>Eupleres</i>	<i>goudotii</i>	NT			X
			<i>Fossa</i>	<i>fossana</i>	NT	X	X	X
			<i>Galidia</i>	<i>elegans</i>	NT	X	X	X
	<i>Galidictis</i>	<i>fasciata</i>	NT		X	X		
	Cetartiodactyla	Suidae	<i>Potamochoerus</i>	<i>larvatus</i>	LC	X	X	X
	Primates	Lemuridae	<i>Eulemur</i>	<i>rufifrons</i>	NT	X	X	
			<i>Hapalemur</i>	<i>aureus</i>	CR	X		
		<i>griseus</i>		VU	X			
	Rodentia	Muridae	<i>Rattus</i>	<i>rattus</i>	LC	X	X	
Nesomyidae		<i>Eliurus</i>	<i>tanala</i>	LC	X	X	X	
		<i>Nesomys</i>	<i>rufus</i>	LC	X	X	X	
Totals								
	2	11	14	23	24	18	17	15

Some species, like aye-ayes (*Daubentonia madagascariensis*) were not recorded in this years monitoring but have been in the past 3 years of monitoring. Thus, long-term monitoring is crucial to gain a complete understanding of species distributions. Also, the presence of species within a class (e.g., birds) could give us valuable insight. The presence of forest bird species of *Atelornis crossleyi*, *Brachypteracias squamiger*, *Coua reynaudii*, and *Lophotibis cristata* may be a good indicator of forest health, as they are typically found in more primary forest habitats. Wetland bird species, such as *Sarothrura insularis*, can also be used to infer a nearby wet habitat. Other species, such as *Nesoenas picturata*, may be more flexible and adapted to the changes in the environment since it is described from both primary and secondary habitat and has been recorded as occurring in all three arrays. In addition, long-term monitoring of carnivores or rodents could give important insight on disturbance, human encroachment and ecosystem health as we monitor if and how invasive species may influence endemic species distributions (e.g., *Cryptoprocta ferox* and *Canis lupus* or *Eliurus tanala* and *Rattus rattus*).

Through the 4 years of monitoring with the TEAM project, we have documented a total of 40 terrestrial vertebrate species 2010. (Table 6). However, as mentioned with the aye-aye, the number of species recorded via our terrestrial vertebrate monitoring is not all-inclusive – annually or across years thus far sampled. Firstly, while cryptic in design and methodology – the presence of humans during deployment and pickup may deter some animals from the areas. Although designed to sample across as a heterogeneous sample of the park’s available habitat, the randomized distribution of sampling points may also miss habitats more specific to certain species. Sampling methods are also designed at targeting terrestrial, not necessarily arboreal, species that typically travel along trails. Several images that are captured annually are also often unidentifiable due to image quality. However, it does seem that we are gradually adding species to our database (via ‘presences’) that will be extremely valuable in gaining insight into species distributions, particularly more elusive and rare species within the park.

Table 6: Cumulative number of terrestrial vertebrate species documented with camera traps from 2010 to 2013 within all arrays

	Array 1	Array 2	Array 3	Cumulative No. of Species	No. of New Species Documented
2010	12	18	7	19	
2010-2011	25	25	23	33	+ 14
2010-2012	26	27	24	35	+ 2
2010-2013	30	27	27	40	+ 5

Climate: The automated climate station located at Centre ValBio’s upper campus continued maintenance twice a month and data was uploaded monthly to the TEAM portal. Dual sensors for temperature, relative humidity, solar radiation, and wind continued to run (sampling continuously every 5 minutes) in addition to one automated and one manual logger for precipitation. Climate station maintenance is conducted twice a month, by checking all equipment and materials for damage, rust, nests, etc. Data is stored in the central logger on a compact flash that is removed from the logger the 15th of every month to be uploaded to the TEAM portal. An important part of our efforts this year was to continue and improve data quality assurance. As an additional means of data quality control, we also visually spot-check the climate data monthly to detect any potential sensor or logger malfunctioning. A faulty probe was detected towards the end of 2013. We were able to purchase the new Temperature/RH Probe from the Campbell Scientific office in South Africa in February and it was installed at the beginning of March. Fortunately, due to the protocol utilizing dual sensor readings to account for such equipment malfunctions, data was able to be continuously collected except during a brief period while rebooting the central logger and testing the newly installed probe in March 2014.

As in our manual station, the average temperature fluctuates throughout the year, with the coolest months starting from April until September and the hottest from October through March. For 2014, the coldest temperature record was recorded in September (3.36 °C) and the highest recorded in November (31.25 °C). Monthly fluctuations in temperature are also apparent, with an average variation of 17.32 °C in average monthly temperature within a 5 minute sampling interval, including some months (e.g., September with a range in temperature of 22.12 °C) more than others (e.g., March with a range in temperature of 11.65

°C). Average annual relative humidity (RH) was 88.56%, with the highest records from July (99.97%) and lowest in August (12.63%). Differences are likely due to variation in minimal RH values compared to maximum records, which are all over 99%. The automated climate station also recorded a total cumulation of rainfall annually of just over 3 meters.

Centre ValBio is world-renowned for its long-term data, especially for researchers interested in complementary data on climate. Running two simultaneous stations (since 2011) with different infrastructure and methods, both include some potential pros and cons. The manual weather station includes a basic thermometer placed outside Lovabe Hall and a rain gauge located on the lower lawn (recorded and emptied manually every morning at 6:00). The automated station is located on CVB's upper campus and includes sensors connected to a central data logger that is powered by solar panels and a battery to take weather variable readings continuously every 5 minutes. While further analysis is necessary in order to potentially combine and calibrate over 20 years of manual data with our newly installed automated station in 2011, we can gain some perspective from comparing the minimum and maximum temperature values from both climate sampling stations during 2014 (Figure 10). As would be expected, the automated monitoring system for climate detects much greater fluctuations in temperature (with the highest maximum and lowest minimum values) since it is recorded continuously throughout the day compared to one data point daily at the manual station. The manual temperature gauge displays less variation in minimum and maximum values, but both follow the same trend.

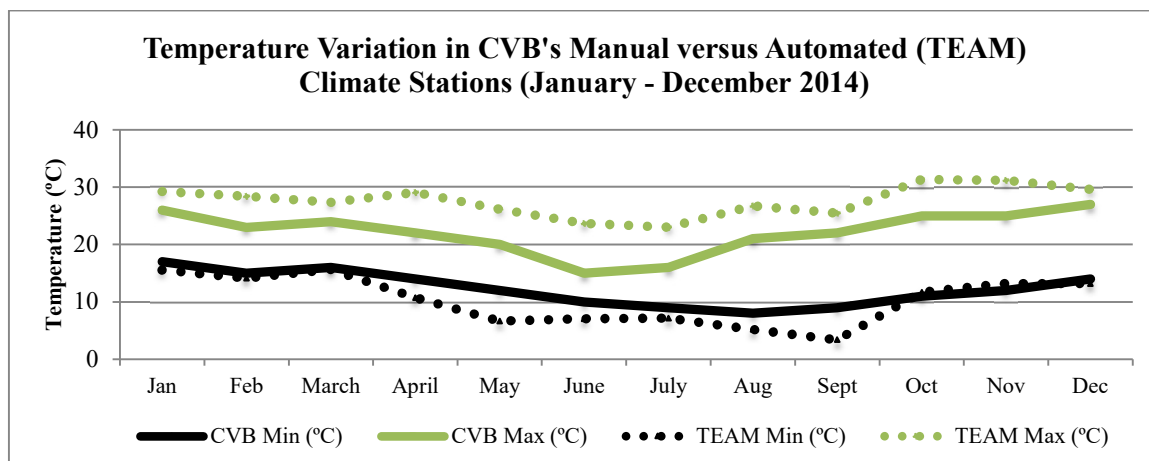


Figure 10: Temperature variation in CVB's manual vs. automated climate stations (January – December 2014)

Comparing total monthly precipitation between sites displayed comparable, yet slightly variable results (Figure 11). Both stations recorded an annual total of just over 3 meters of rainfall (3035 mm at the manual station and 3003 mm at the automated station). Some variation may result due to the different localities of the rain gauges/stations. However, it's more likely that due to the continuous collection method of the automated station, it might be more sensitive to more precise recording throughout the day and thus, monthly. Centre ValBio's guardians are attentive to emptying the manual gauge during large rainfalls, and it seems that overall both stations are yielding comparable results. This is a positive result, especially as manual stations are simple and inexpensive to establish in remote camps and sites surrounding the park. Nonetheless, it will be important to continue simultaneous collection at both stations, paying close attention to any potential issues (e.g., faulty gauges or sensors, human or equipment errors or malfunctions, etc.) to gain a better understanding of what may cause the potential discrepancies. Since both stations require minimal manpower,

yet reap a wealth of information for research, both will be important to continue for years to come.

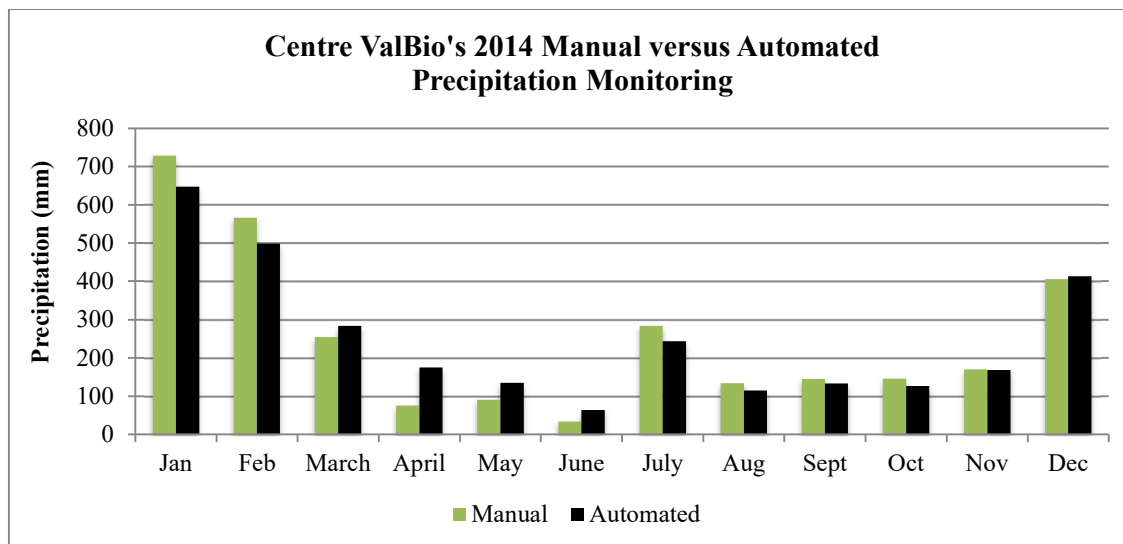


Figure 11: Centre ValBio's 2014 manual versus automated precipitation monitoring

The continuous evidence of human presence across all terrestrial vertebrate sampling arrays is cause for alarm. Due to the large area of the park covered systematically and annually, our technicians are also extremely valuable informants for park management. Unfortunately, our teams are still frequently encountering either ongoing signs of disturbance from small-scale gold mining as well as encountering large numbers of people in the park for this purpose. Gold miners are continuing to cut trees and digging up substantial portions of the park in an effort to find gold. New trails and indication of more extensive and frequent use of existing trails was evident when teams went out this year, especially around the middle portion of the park (Andranofady and Ranomena). If and how this disturbance affects our variables being monitored is under investigation. The goal of TEAM monitoring is to be able to detect changes to the biodiversity, so it can be used for guiding conservation action and setting up an early alarm system on its status for better management actions. Centre ValBio continues to inform Madagascar National Park's Ranomafana office upon any indication of anthropogenic disturbance and work closely with both MNP and the gendarme in patrolling, monitoring and educational components. However, the simultaneous and continuous annual monitoring of vegetation and terrestrial vertebrates to detect any influence new, increasing or prolonged anthropogenic disturbance may have will be invaluable.

Participatory Ecological Monitoring

For 2014, Centre ValBio planned to target 10 villages located near sizable forest fragments in the periphery of Ranomafana National Park to be part of a Participatory Ecological Monitoring (PEM) program. In PEM, villagers are trained in doing observations of plants and animals in their forests and patrolling for pressures in the forest. The targeted villages were chosen based on the presence of forest fragments belonging to the communities traditionally and they are interested in assistance with protecting these areas to be managed as a community based association (COBA). The goal is to invest and empower local communities to manage their forests and be active in monitoring the biodiversity and pressures in these fragments. For 2014, however, only two villages (Sahavondronina and Amboasary) were

visited for two days as a reconnaissance for the PEM project. Centre ValBio technicians and villagers conducted both diurnal and nocturnal biodiversity censuses along established transects to teach villagers how to conduct observations, using visual recording via datasheets, but also collecting waypoint data (using GPS units) that will help long-term mapping of biodiversity and pressures in the future.

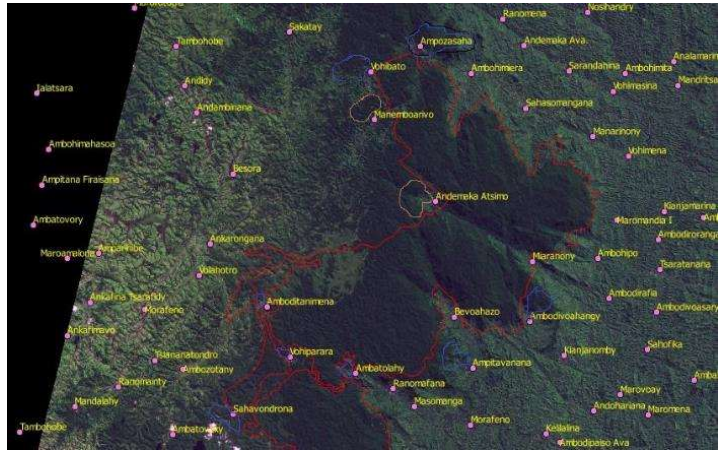


Figure 12: Location of 10 forest fragments selected for PEM monitoring

During this reconnaissance, we selected basic categories to inventory including: birds, lemurs, plants, amphibian and reptiles and disturbance. For Amboasary, we recorded 28 bird species, 3 lemur species, and 64 species of plants along established transects. In Sahavondronina, we observed 9 bird species, 2 lemur species, and 24 species of plants. Again, these observations were part of a rapid baseline reconnaissance conducted over the course of 2 days and more extensive and repeated surveys are likely to reveal additional biodiversity present. Below is the example of the map of 3 transects established and used for observations in Sahavondronina.

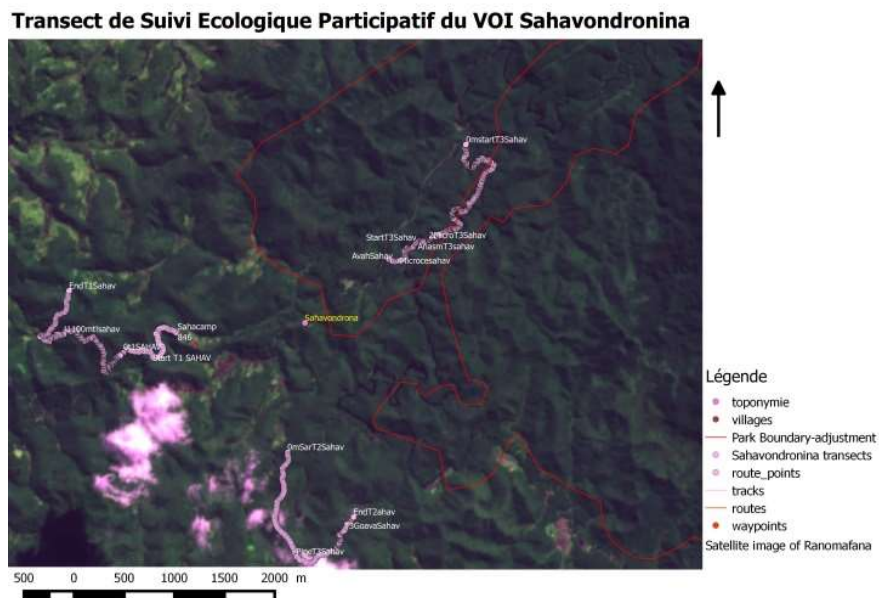


Figure 13: Transects established for observations in Sahavondronina

As mentioned, this was a preliminary rapid survey for launching the PEM monitoring around RNP (as we have lead in other areas throughout Madagascar in previous years). A reconnaissance for the remaining villages is planned for 2015. Centre ValBio supported the reconnaissance expeditions to have baseline data as part of the GIS training component and project development. Additional funding is necessary to continue these important baseline assessments and long-term monitoring within fragments and with village communities surrounding the park.

Finnish Association for Nature Conservation (FANC)

The Manondroala project has been collaborating with Centre ValBio, Madagascar National Parks and local guides from the community to work on vegetation classification of Ranomafana National Park and its surrounding area. Basically, local partners are responsible for visiting pre-determined locations to map and classify habitat types. Data collected are sent to GIS specialist working with FANC to produce more accurate maps throughout Madagascar. Since most of the field mapping and classifications was done in previous year, in 2014 FANC brought some preliminary maps produced (see below) for comments from our teams before producing a final version. Some suggestions for Ranomafana’s vegetation maps were: (1) to include bamboo forest as part of the vegetation classification since bamboo is important habitat for several critically endangered lemurs found within and around the park and (2) Ranomafana needs more detailed maps for researchers because they work in different habitats depending on the subject of their studies. Centre ValBio expects to have the final version of vegetation classification map for Ranomafana accomplished some time during the year 2015. In addition, FANC held a workshop entitled “Forest mapping and monitoring as local conservation tools in Madagascar “ in Antananarivo on December 1st, 2014 with many of FANC partners throughout Madagascar to continue to discuss the new maps as well as further steps for the project of mapping vegetation classification and monitoring in Madagascar. The mapping project collaborating with FANC is expected to continue for the next few years.

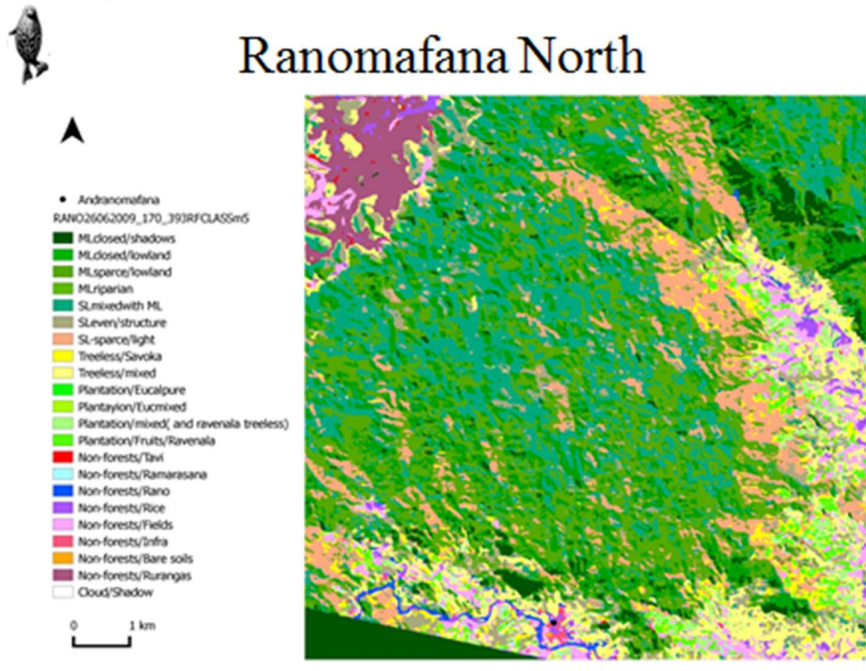
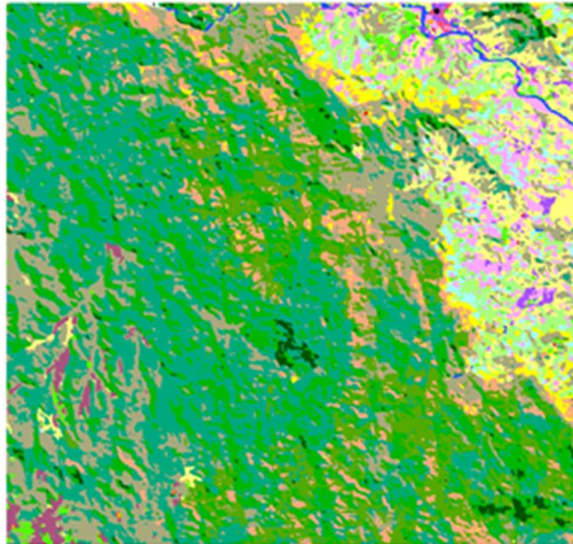


Figure 14: Vegetation classification in the north of RNP



Ranomafana South



13

Figure 15: Vegetation classification in the South of RNP

Ambatolahy dimy Land Acquisition

For 2014, we made great headway towards formalizing the purchase a portion of unprotected forest in Ambatolahydimy, located between Centre ValBio’s upper campus, the periphery of RNP’s northern parcel of the park, and the village of Ambatolahy. In a continued collaboration with the local communities owning the land, we mapped the independent parcels of individual land (18 parcels, from 15 individual land owners) that includes a total area of 17.2832 hectares.



Figure 16: Map of Amatolahydimy land acquisition

After meetings with the responsible of domaine and topography in Mananjary, we formalized the size and initial paperwork submission towards moving through with the purchase. Unfortunately, further steps in the paperwork process (6 addition steps) was put on hold until January 2015 due to some possible changes in land laws that was being discussed by deputy representatives. Thus, further follow-up will begin in 2015. In the meantime, the local landowners have been involved in the process and provided the individual parcel measurements. They are currently working on an initial price for their land, which may include variation among parcels dependent on the amount of disturbance (e.g., pristine forest, mixed crops/banana, agriculturally transformed).

Ampatsona-Ambohidaza forest monitoring and assessment

Centre ValBio continued to promote research in the unprotected 10,000 hectare Ampatsona-Ambohidaza forest parcel north of Ranomafana National Park. Patricia Wright's master's student, Andrew Zamora accompanied by CVB's sifaka technicians and Lydia Tongasoa, a Ph.D. student from the University of Antananarivo, studying gentle bamboo lemurs, conducted censuses and fecal sampling on Milne-Edward's sifakas. During this expedition, the team found 79 individuals from 22 groups of *P. edwardsi*. Compared to Ranomafana National Park, groups are slightly smaller on average (3.9 individuals/group vs. 5.3 individuals/group) and predominantly have a 1:1 sex ratio of male to female (with non-adult members), while those in Ranomafana are more variable in their composition of adult sex ratios. Additional diurnal lemurs sighted were rare, but included *Eulemur rubriventer* (four times), *Hapalemur griseus* (three times), and *Eulemur ruffifrons* (once). Later in 2014, as part of a preliminary study on crayfish ecology, conservation and sustainable development (crayfish aquaculture) components, Garshaw Amidi-Abraham conducted a two week expedition in the the north with Centre ValBio technicians and Lydia to determine three endemic species *Astacoides granulimanus*, *A. betsileoensis*, *A. crosnieri* in this part of the corridor. In addition to working with the local community, Centre ValBio is working with the local forestry office and Conservation International for a long-term conservation and management strategy for this important and biodiverse parcel of forest just north of Ranomafana National Park (see below under Project Development).

C. Laboratories

Computer and GIS Laboratory

Biodiversity database structure

Centre ValBio is in the process of constructing a long-term set of databases to enhance facility and personnel management, administrative needs, visitor resources, and provide comprehensive access to more than two decades of biodiversity, climate, and human socioecological/economic data. This is a major undertaking that will require considerable investment in the next couple of years. John Cadle and Jesse McKinney are spearheading this effort (see the separate I.T. report) and this year we developed a draft of the biodiversity database components and explored how these components should interact to permit the broadest array of scientific questions to be addressed (the administrative and researcher/visitor components of the databases are considered elsewhere in the report). We have also examined other large-scale biodiversity informatics databases and become more conversant with the literature on structuring large-scale databases with biodiversity, ecological, environmental, and taxonomic/ phylogenetic components. Early in 2015, we will start putting the nuts and bolts of some of this system in place.

GIS software and training

In preparation for launching a GIS laboratory component at Centre ValBio, Pascal Rabeson was awarded a scholarship to attend the annual SIGGIS training at the University of Davis in California, USA; which included attendance at the SCGIS conference in Monterey before the International User Conference organized by Esri in San Diego, California.



During this time, Centre ValBio applied for and was awarded an ArcGIS license to be used for mapping and was provided a laptop suitable for GIS analysis for launch CVB's laboratory. In addition, we are in the process with trying to negotiate a license through

Stony Brook University to enable multiple users (or at least two simultaneous users) to utilize ArcGIS mapping software simultaneously. Having multiple floating licenses will greatly enhance our abilities for more extensive mapping as well as training components to our GIS section. This training played an important role in the improvement of CVB's GIS component. With the laptop, license and the books sent from Esri to CVB, this implies not only the capability for producing maps for researchers and students for their work, but also to be able to give training for our staff and other people in the region of Vatovavy Fitovinany.

Clean Laboratory

Centre ValBio's laboratories saw extensive use in 2014 by four Study Abroad classes (California University of Pennsylvania, two from Stony Brook University, and the University of Helsinki); an infectious disease team led by Thomas Gillespie and Sarah Zohdy of Emory University; and a mouse lemur genomics group led by Mark Krasnow of Stanford University. In addition, many individual researchers used the laboratories for biodiversity research on parasites, insects, crustaceans, snakes, and plants. Some of the major lab-related activities included the following:

Hiring a laboratory manager. In October 2014, CVB hired a laboratory manager to assist with operations of the Namanabe and Lovabe laboratories and the computer lab. Rence received D.E.A. (2008) and is working towards completion of her Ph.D. degree in plant ecology from the University of Antananarivo. In addition to plant field ecology, she spent six months working in the molecular systematics laboratory of Edward Louis at the Henry Doorly Zoo (Omaha) and received additional training in molecular methods and bioinformatics during a workshop convened in Antananarivo by researchers from the University of Montpellier (France).

Revision and amplification of the laboratory policies and guidelines. The laboratory guidelines and policies continue to be revised, with major revisions in May and November 2014. The main improvements concerned several issues of laboratory safety and security, the institution of equipment use logs, procedures for reporting equipment malfunctions, requirements for specimen donations to CVB, and the addition of an alert to the presence in

Madagascar of 'chytrid fungus' (*Batrachochytrium*), an amphibian pathogen, and procedures to minimize its contamination and spread.

New laboratory equipment. Using the remaining funds from our current NSF FSML grant, the lab purchased a Nikon Eclipse 200 compound microscope, which can be fitted with any Nikon-mount camera for microphotography. We also purchased a Nikon D-5300 camera (usable with the Eclipse 200 microscope) and associated lenses (Micro Nikkor 40 mm 1:2.8G; Nikkor 18-35 mm f/3.5-4.5G; and Micro Nikkor 105 mm f/2.86).

Completion of electronic library of equipment manuals; identification of in-country sources of laboratory materials. We largely completed our electronic library of user manuals for the lab equipment. These are available to all researchers using the labs. Once our intranet is fully functional, these manuals will be available on our server so that researchers have access to them at all times. We also researched and identified sources of laboratory equipment and reagents in Madagascar as an aid to researchers. We have compiled an index of websites for lab suppliers and have received price lists and/or catalogs from many of them. We continue to investigate means of disposal of lab and biohazard waste, which is a challenge but one that we must address for long term sustainability of lab operations.

Advance planning for the new Biodiversity Lab structure. A new Biodiversity Lab structure is being planned for the space now occupied by the outdoor classroom between Namanabe Hall and the CVB entryway on Route National 25; the new structure will incorporate the current outdoor classroom. John Cadle, Patricia Wright, Robin Herrnstein, and Steig Johnson met on site to discuss the design and layout of the new building, which will include secure, climate-controlled space for biodiversity collections and space for research involving biological specimens; it will also include some badly needed office space and space for visiting researchers. Based on these discussions a preliminary design for the structure was drawn by Ali Yapicioglu and further recommendations are imminent.

Proposal related activities. We submitted the final annual report for the NSF-FSML facility grant (2012-2015) in September. The report cited several significant successes carried out by research teams using the Centre ValBio molecular labs. These included the successful culturing of mouse lemur fibroblast cells, successful DNA amplification, the detection of chytrid fungi in frogs from Ranomafana, and expanded use of the GIS facilities, for which one of our senior staff, Mr. Pascal Rabeson, attended month-long training sessions in the U.S. to further increase our capacity in this area. We submitted two further proposals to NSF, one to enhance cyber infrastructure at Centre ValBio and another (NSF-Opus program) to summarize and extend the more than two decades of research on lemurs at Ranomafana. Both proposals received favorable reviews but, unfortunately, did not receive recommendations for funding; we intend to resubmit in 2015.

Chytrid-alert activities. With the confirmation that chytrid fungi (an amphibian pathogen) are present in Madagascar, and in part stemming from discussions during the ACSAM2 meeting (summarized elsewhere in this report), we began formulating protocols for mitigating the spread of this pathogen by researchers visiting Centre ValBio and for tourists visiting Ranomafana National Park. While a preventative boot wash station was launched during the meetings, continued usage and public awareness campaigns need to be implemented for both researchers and tourists. We also had preliminary discussions with Madagascar National Park personnel about training for park guides and CVB research technicians and staff, and posting information about chytrids on the MNP and CVB websites in efforts to reach all visitors to Madagascar. Many other efforts with international scientific and conservation collaborations, and with both short and long-term timetables, will stem from

the ACSAM2 meeting; these efforts are presently being formulated into a working document. In January 2015, CVB staff will conduct an exploratory visit to Mitsinjo, an amphibian conservation center near Perinet National Park, with the goal of learning about their amphibian rearing facility and learning from their programs.

Ambient Laboratory & Collections

In an effort to start working with our biodiversity collections, ICTE supported a former SBU Study Abroad alumni, William Montag, who completed his review of the Centre ValBio collection of arthropods during 2014, part of a 7-month stay during which he also completed a field project on the ecology of theridiid spiders with Sarah Kariko. Students from four study abroad classes (California University of Pennsylvania, University of Helsinki, and two from Stony Brook University) used the laboratories heavily during their independent study projects, which included studies of insects, frogs and tadpoles, rodent and frog parasites, plant ecology, bats, and tenrecs. In addition, we continued our plant herbarium reference collection as part of the TEAM project. During a major effort for systematic re-assessment at the beginning of 2014, we've tried to catalog most species for long-term reference.

III. Training Programs

A. Study Abroad Programs

Stony Brook University, Summer 2014

Summary

A 6 week study abroad program took place between July 3 and August 17, 2014. The Stony Brook study abroad group was comprised of 17 students (13 from the USA and 4 from Madagascar), plus personnel: Prof. Patricia Wright (Program Director), Dr. Tharcisse Ukizintambara (Resident Coordinator), Ms. Gena Sbeglia and Mr. Franck Rabenahy (Teaching Assistants). During this session, students were exposed to a large range of knowledge and experiences including Malagasy language, health, environmental education, ecosystem diversity, and research. The program included lectures, field exercises, a cross country trip, and independent projects. The focus was on endemism and invasive species of plants and animals and the unique Malagasy culture and ecosystem diversity. Students designed unique and independent research projects that covered a large spectrum of issues in Madagascar. The results of these projects were presented at the Centre ValBio in Ranomafana and American Embassy in Antananarivo on the 12 and 14 August 2014, respectively. Students also wrote blogs about their weekly experiences which can be found at <http://madagascarstudyabroad.wordpress.com/>

Program Activities

Lectures on Biological diversity: Students were introduced to hands on methods used in research in the fields of tropical ecology and conservation. Students learned how to conduct animal censuses, record lemur behavior, mist net for birds, set up and measure botanical transects, and survey reptiles and amphibians. Statistical analysis of data and conservation applications of the biodiversity methods were also covered. In addition, students were exposed to conservation education projects implemented in the local community involving habitat restoration, medicinal plants, and improving health and hygiene. These lectures were concluded by a general exam to test the understanding of students on the topics discussed.

Ecosystem and Cultural Diversity: Students learned about the diversity of the island of Madagascar, both its ecosystems and culture. In addition to exploring different habitats within the recently created Maromizaha Protected Area near Andasibe National Park and Ranomafana National Park, students also embarked on an eight-day cross country trip to the southwestern parts of Madagascar. In Maromizaha, students witnessed the degradation of a rain forest but also conservation efforts to maintain remaining populations of some of the largest and most attractive species of lemurs (*Indri indri* and *Propithecus diadema*), as well as many species of chameleons and birds. Students also worked with local kids to raise environmental awareness in the Anevoka village regarding these natural treasures. From Maromizaha the group drove to Ranomafana National Park, where we conducted a series of lectures, field and lab exercises in primatology, ornithology, parasitology, medicine, and more. Between July 28 and August 4 we embarked on a cross country trip through southwestern Madagascar. En route and at each stop, lecturers and local guides explained the biodiversity and cultural aspects of each ethnic group found there.

Independent Research Projects: The study abroad program encourages students to design individual or small group research projects through developing methods to collect and

analyze data, as well as present results in a public forum. Fifteen projects (Table 1) on health and hygiene, environmental law, environmental education, post-traumatic stress disorder due to cyclone, role of dogs in Malagasy villages, zebu body characteristics, zebu manure and farmers' health, speech sound perception in Malagasy and English languages, traditional and modern medicine around the park, benefits from the park, parasitology in lemurs, and climate change were implemented and results presented at CVB and at the US Embassy in Antananarivo. A written report of these independent research projects was submitted by each student to Professor Patricia Wright of Stony Brook University on the 15th September 2014.

Table 1: Independent Projects, Summer 2014

Student	Independent Project Title	Affiliation
Alexander de Reeder	Healers of Madagascar: Connected or divided?	Stony Brook University
Ange Nomenjanahary Raharivololoniaina	Impact of climate variables on plant growth in Ranomafana National Park between 2005 and 2013	University of Antananarivo
Baholy Ramangason	Evaluation of attitudes, knowledge, and practice of hygiene in villages in Ranomafana	
Elizanjara Mahatohotrarivo	Observance of conservation law around Ranomafana National Park	University of Fianarantsoa
Freda Guo	Gender study in Madagascar: Are there significant differences between men and women living standards and decision making?	Stony Brook University
Hasinala Ramangason	The relationship between conservation and quality of life for local communities: A cinematic exploration	
Jonathan Wei	Speech sound perception between English and Malagasy Languages	Stony Brook University
Katie Seminario	Centre ValBio conservation education in villages around Ranomafana	Stony Brook University
Julia Wais	The role of dogs around Ranomafana National Park	SUNY Canton
Mai Fahmy	Centre ValBio conservation education in villages around Ranomafana	Stony Brook University
Meghana Reddy	Protein peanut Podi: A long-term sustainable dietary solution for protein deficiency near Ranomafana National Park	Stony Brook University
Nikki Dodd	The relationship between conservation and quality of life for local communities: A cinematic exploration	Wesleyan University
Rachel Lordahl	Linear body measurement characteristics of Zebu in Eastern Madagascar	Stony Brook University

Rima Madan	Does village distance from a modern healthcare facility influence the medical choices of local people in Madagascar?	Stony Brook University
Sarika Kumar	Cyclones and the psychosocial wellbeing: An assessment of Post-Traumatic Stress Disorder symptoms among children living in Manokakora village	Barnard College
Zuri Dawkins	Ecology of zoonotic transmissions: The impact of Zebu fertilizer on the health of Malagasy farmers	Stony Brook University

Contribution of the Program

The study abroad summer 2014 hired three local guides and a full time cook for the duration of the program. The program also organized a dinner with all the personnel of CVB and part of PIVOT staff (a health NGO in Ranomafana) in appreciation of their continuing support and service that both organizations provided to the program. The dinner was part of the fundraising events that the CVB association of personnel hosts regularly and was held at the new Karib Hotel in Ranomafana. Presentation at the American Embassy was attended by some staff of USAID in Madagascar, regular users of the American cultural center and trainees of the English training program at the Embassy. Some parents of Malagasy students were part of the audience and study abroad students had a privilege to interact with one of the Study Abroad Alumni (summer 2012) who was then an intern at the US Embassy. Before the end of the program, the resident coordinator of the study abroad program was interviewed by the editor of Tana planet (Mrs. Francoise Eid) and the program will be showcased in the upcoming issue of Tana Planet.

Suggestions for Improvement

The 2014 summer program run very smoothly thanks to the dedication, hard work, and excellent team working spirit of the program core personnel and support staff. Students were very organized, independent and thoughtful. They provided the following ideas for the improvement of the upcoming programs:

- Study statistics over longer period of time - Download R stat package and learn how to use it from the USA
- Increase the number and length of lectures of Malagasy history and culture
- Give more time to independent research projects
- Encourage students to bring laptops, headlamps with red light, movies and games

Stony Brook University, Fall 2014

Summary

A 10 week study abroad program took place between September 12 and November 22, 2014. The Stony Brook study abroad student group comprised of 16 students (14 from the USA and 2 from Madagascar). The staff included Dr. Patricia Wright (Program Director), Dr. Tharcisse Ukizintambara (Resident Coordinator), Dr. Anja Deppe (Teaching Instructor) and Mr. Franck Rabenahy (Teaching Assistant). Several visiting lecturers also shared their

expertise ranging from geology, ornithology, entomology, herpetology, botany, environmental education, health and hygiene and primatology. The program focused mostly on biodiversity in general, endemism, endangered and invasive species of plants and animals and the Malagasy unique culture, language and ecosystem diversity. Individual and pair projects were conducted on issues related to lemur behavior, lemur food plants, tadpole diet, terrestrial birds, tenrecs, mouse lemurs and mosquitoes, crabs diversity, hydra on crayfish, fungi, environmental education and participatory reforestation project with school children, and how to make an effective antibacterial soap from local materials. Most of these projects were new or part of ongoing work by Centre ValBio staff and visiting researchers. The results of these projects were presented at CVB and at the University of Antananarivo on the 17th and 21st November 2014, respectively. Students authored a blog of their weekly activities which can be found at <http://madagascarstudyabroad.wordpress.com/>

Program Activities

Over 10 weeks, the program included a series of lectures, field exercises, lab work, a cross country trip and independent project design, data collection, analysis and presentations.

Week 1&2

Lectures: Dr. Benjamin Andriamihaja on the geology of Madagascar at MICET Office; Mr. Rivo Ranarisoa of NGO Asity on Important Bird Areas of Madagascar, Mrs. Jeanne Raharimampionona of Missouri Botanical Garden on botany and important plant areas of Madagascar; Ms. Daniella Rabino on Environmental Education and lemurs and children, Dr. Tharcisse Ukizintambara on the conservation challenges of lemurs in Madagascar (a lecture prepared by Prof. Jonah Ratsimbazafy), Field botany (Ms. Nivo Raharison), feeding behavior of Indris (Ms. Lovasoa Razafindravony) and Malagasy language (Nivo and Lovasoa).

Visits: Tsimbazaza Zoo to see the Malagasy biodiversity including the fossa and the aye-aye, which are normally difficult to find in the rain forest; Ambohimanga world heritage site for the history of kings and queens of Madagascar; Maromizaha new protected area for a 4 night camp trip and introduction to lemurs and behavior studies on indri indri and diademed sifaka; Peyrieras reptile and Coquerel's sifaka sanctuary; Manondona village for a one night homestay to half the 12 hour bus drive to Ranomafana; visit to Ranomafana town and courtesy visits to the Mayo or Ranomafana, the Director of Ranomafana National Park and the PIVOT health organization in Ranomafana.

Week 3- 5

Lectures: Dr. Anja Deppe: What is a primate? Predator recognition by a mouse lemur, Primate Adaptation and evolution and ecosystems of Madagascar, Mr. Pascal Rabeson: What is biodiversity? Aquatic invertebrates, community based research and conservation, Dr. Jean Claude Razafimahaimodison: Values of biodiversity, Tropical ecosystems assessment and monitoring, Pitta-like ground roller breeding success in Ranomafana National Park, Mr. Emile: Amphibians of Ranomafana National Park, Mr. Nemese and his team; Environmental Education and Outreach, Mr. Franck Rabenahy: Malagasy language, research by asking (how to conduct interviews), species extinction and sub fossils of Madagascar, Mr. Desire Randrianarisata: Media and conservation, Dr. Tharcisse Ukizintambara: Mandrill social structure in Gabon, mammal survey techniques, introduction to statistics (with Ndimby), independent projects and research design, how to write and read a scientific paper, measuring behavior, and threats to biodiversity, Dr. Njaka: Health and hygiene around Ranomafana

National Park, Ms. Gena Sbeglia: Statistic lecture and natural selection: misconceptions and truths in evolution.

Activities: Hikes in Ranomafana National Park, visit to the medicinal plant garden (with Mr. Rakoto Pierre), Night walk with Emile, Camping trip to Valohoaka, assessing biodiversity index using aquatic invertebrates (with Pascal Rabeson). Camping at Valohoaka

Week 5-6

Guided tours: Anja village reserve (Eric), Isalo national park (Persen), and Honko mangrove project, Marine museum in Tulear, Reniala botanical garden, Mosa ornithological site, and coral reefs of Ifaty and Tortoise sanctuary in Ifaty. During the 10 day cross country visiting different ecosystems and landscapes including the rainforest, open grassland, dry forest, the canyons, spiny desert, mangroves and coral reefs. We observed ring-tailed lemurs, verreauxi's sifaka, brown lemurs, mouse lemurs, big baobabs and other succulent plants. We found the most restricted and endemic species of birds and tortoise and learned about threats affected the ecosystems and taxa. These threats include fire, overgrazing, over harvesting (fishing), coral bleaching, pollution and waste management, etc.

Activities (Led by Mr. Desire (Dede) Randrianarisata): Hikes in Anja, Isalo, Ifaty; snorkeling at the Ifaty coral reefs, sailing with local fishermen in Ifaty; swimming in the natural pools of Ifaty, visiting the Ihosy cave.

Week 7-10

Lectures: Prof. Pat Wright: The future of lemurs and conservation in Madagascar, Dr. John Cadle: Herpetology of Madagascar, Dr. Anja Deppe: Mammals of Madagascar, Mr. Wyatt Amini Abraham: Crayfish in Madagascar, Dr. Tharcisse Ukizintambara: Results presentation
Activities: Project proposals with Drs. Pat Wright, Eileen Larney and John Cadle, independent project and data collection, music with local bands (Priska), lemur festival, Halloween and final parties, Sambatra festival in Mananjary, basketball vs. Pivot, visit to the Antsirabe town including the thermal springs and THB factory, and final result presentations at CVB and at the University of Antananarivo and final party at MICET office (see Table 2).

Table 2: Independent Projects, fall 2014

Student	Independent Project Title	Affiliation
Kelly Amador	Foraging behavior of nursing <i>Varecia variegata</i> in Valohoaka, Ranomafana National Park	Stony Brook University
Katherine Barie	Tadpole diet in reference to oral morphology and habitat	Lawrence University
Tyler Barriere	Behavior of Milne-Edwards' sifaka in Valohoaka, Ranomafana National Park	SUNY Cobleskill
Danielle Calhoun	Comparison between the morning and afternoon behaviors of <i>Haplemur aureus</i> in Talatakely, Ranomafana National Park	Lawrence University

Christopher Coulter	Creation of a soap from local materials with a survey of usage in three villages surrounding RNP	Stony Brook University
Devin Eklund	Foraging behavior of nursing <i>Varecia variegata</i> in Valohoaka, Ranomafana National Park	Stony Brook University
Michela Giampetroni	Tenrec diversity between highly disturbed habitats and secondary forest in Ranomafana	Lawrence University
Katelynn Kiuber	Crayfish: Juvenile and hydra prevalence in and around Ranomafana National Park	Stony Brook University
Rachel Lambert	Crayfish: Juvenile and hydra prevalence in and around Ranomafana National Park	Stony Brook University
Catherine McLean	Mosquito attraction to <i>Microcebus rufus</i> in Ranomafana National Park, Madagascar	Stony Brook University
Eric Murphy	Crabs of Ranomafana National Park	Stony Brook University
Alicia Protus	The diversity and abundance of macrofungi morphological groups in Ranomafana National Park	SUNY College of Environmental Science and Forestry
Ndimbintsoa Ranaivorazo	Relative abundance of Pitta-like ground roller in Ranomafana National Park	University of Antananarivo
Angelico Randriambololonirina	Primary vs. secondary forests: Distribution of food plants in Milne-Edwards' sifaka's home range	University of Fianarantsoa
Make Tyneway	Age related performance of the brown mouse lemur (<i>Microcebus rufus</i>) in a T-maze task	SUNY Binghamton

Contribution of the Program

The study abroad fall 2014 hired four local guides and four extra kitchen staff for the duration of the program, as well as 10 extra research technicians for the independent research projects. Alicia Protus' independent research project is currently being reviewed to be a presentation at the 1st annual SUNY Undergraduate Research Conference.

Suggestions for Improvement

- The recruitment of teaching assistants should focus on their working, socializing and teaching skills and ethics. TAs should also have contracts that specify their responsibilities and who they should report to.
- The program should also employ knowledgeable research technicians and more visiting lecturers with a variety of expertise in Malagasy biodiversity and tropical environmental sciences.
- CVB teaching staff should update their lectures and prepare longer lectures (over 1 hour) with field exercises when applicable.
- The program schedule should be prepared ahead of time and in conjunction with the management of CVB to secure student accommodation.
- Negotiations should take place to have HTH reimburse medical treatments directly to ICTE.

Other Study Abroad Programs

California University of Pennsylvania held a study abroad program from May 28 to June 26, 2014. Led by Summer Arrigo-Nelson, this program included 20 participants and focused on the ecology, biodiversity, and culture of Madagascar. The University of Reading (United Kingdom) held a short field course in September 2014 that included twenty-one students and two professors. The University of Helsinki RESPECT Program ran from November to early December. This program included 14 students (six Finnish and six Malagasy), plus two professors and 3 teaching assistants and focused training and group research projects on comparing amphibians, birds, and vegetation in pristine forests within the park compared to forest fragments in the periphery of Ranomafana National Park.

B. Plans to Increase Study Abroad Enrollment and Funding

Recruitment

On Campus

During the start of each semester, posters advertising both the summer and fall study abroad programs are displayed around campus. These posters are primarily hung in departments that we generally recruit the most students from (anthropology, biology, sustainability), as well as in common spaces such as the library, the Student Activities Center, and the Union.

ICTE staff participates in IAP-run study abroad fairs throughout the semester. During these events, at least one staff member and one former study abroad student are present to attract students to the program and answer questions. In addition, we run our own information sessions during the semester (3-4 sessions per semester). All Stony Brook students are invited to these events via email. During these info sessions, an ICTE staff member gives a presentation on the program, followed by a question and answer session. Former study abroad students also attend these sessions to share their experiences with prospective students.

During the first week of classes, an ICTE staff member visits some classes to give a short presentation on the study abroad program and hand out fliers. Targeted classes include

anthropology (ANP 120, ANP 200, ANP 201, ANP 325, and ANT 102), biology (BIO 201, BIO 202, BIO 203), and other environmentally focused classes (e.g. ECO 373, ENS 301). These sessions expose a large number of students in relevant majors to the program and allow them to ask questions and gain more information.

Leading up to the application deadline, email blasts are sent to students in anthropology, biology, and sustainability to alert students to the approaching deadline and encourage them to complete their applications. These emails include a description of the program, the courses, and the campus (Centre ValBio), as well as pictures on an attached flier.

ICTE offices are open 9-5 Monday through Friday, and a staff member is on hand during these times to meet with interested students. We are also available via email and answer many inquiries at all hours of the day.

Off Campus

ICTE maintains a list of emails for study abroad offices at schools from which we have had students in the past. At the start of each semester, we contact these offices with a description of the program and attached fliers. We ask for assistance in promoting the Madagascar study abroad program at these schools. If the school is willing to display our materials at a study abroad fair, we request former study abroad participants that may still be students to attend the fair and promote the program.

Dr. Wright participates in many events each year, and at each of these, one of her main goals is study abroad recruitment. She always mentions the program at talks and suggests it to any students that she meets with.

Study abroad is advertised at all ICTE events, both on campus and off campus. We hand out postcards and flyers and answer questions for interested students or parents.

Future Goals

In upcoming semesters, we plan to increase our efforts in each of the above categories. We will increase the number of flyers and hang them multiple times per semester. We will hold more study abroad information sessions to attract students. In the past, these have been held in conjunction with the TBI field school, and we hope to continue that partnership to reach more students that may have not known about the Madagascar program. We will also visit a more diverse array of classes during the start of each semester. In the past semesters, we have had increased interest from students in majors outside of the life sciences and anthropology, so we propose to visit more intro level courses in different departments (e.g. business, psychology, engineering).

To increase out-of-state student enrollment, we hope to increase the number of talks given by Dr. Wright each year. Dr. Wright's stories of Madagascar and her experiences there are the most important tool for inspiring students to apply to the program. We also plan to make stronger partnerships with other universities and their study abroad offices. The Madagascar study abroad program is a unique opportunity and most schools do not have similar offerings. We propose to reach out to a greater number of schools, especially ones that we have not had students from in the past, in order to increase awareness of the program.

New Programs

In addition to the current fall and summer semesters, we plan to increase the number of available study abroad programs to include at winter session and a spring semester. The winter session program will be for three weeks during the Stony Brook winter session, and will focus on reptiles and amphibians of Madagascar. Students will earn 6 credits during this time and will participate in hands on activities and receive lectures from with experts in the field. This program is already in the works; we have planned courses and recruited faculty. Courses will be submitted for approval and we hope to begin in winter 2016. This program will attract students who cannot dedicate the time to a full semester program, as well as students with interests outside of anthropology.

The new spring semester program will focus on sustainability studies in Madagascar. This program will offer courses relevant for students with majors the growing Sustainability department as Stony Brook, as well as other departments across the country. We will be working with Dr. Heidi Hutner of Stony Brook to develop this program for Spring 2016.

Funding

The most important way to increase the funds coming in from the study abroad program is to increase enrollment. In particular, increasing out of state student enrollment is crucial, as these students pay much higher tuition. Figure 1a shows In State vs. Out of State student enrollment for Fall 2014. Figure 1b shows the percent of fees paid by In State vs. Out of State students. Despite Out of State enrollment being significantly lower than In State enrollment, the Out of State Students pay nearly 50% of the total budget. If we are able to increase enrollment to 20 students per semester (10 in state and 10 out of state) for four programs, we could save over \$27,000 (see attached test budgets). More realistically, if enrollment were to be mostly in state, a total enrollment of 22 students (17 in state, 5 out of state) could save over \$36,000. In order to accomplish these savings, we would need to raise the program fee for summer to \$4,000. The fall program fee would not change. Program fees for the fall semester are \$6,500, the same as the TBI program, which is a similar, faculty-led field school. We believe that increasing program fees for fall will make the cost of the program prohibitive to students and will decrease enrollment. Money earned from the program can be increased without raising the fall program fee if enrollment is increased.

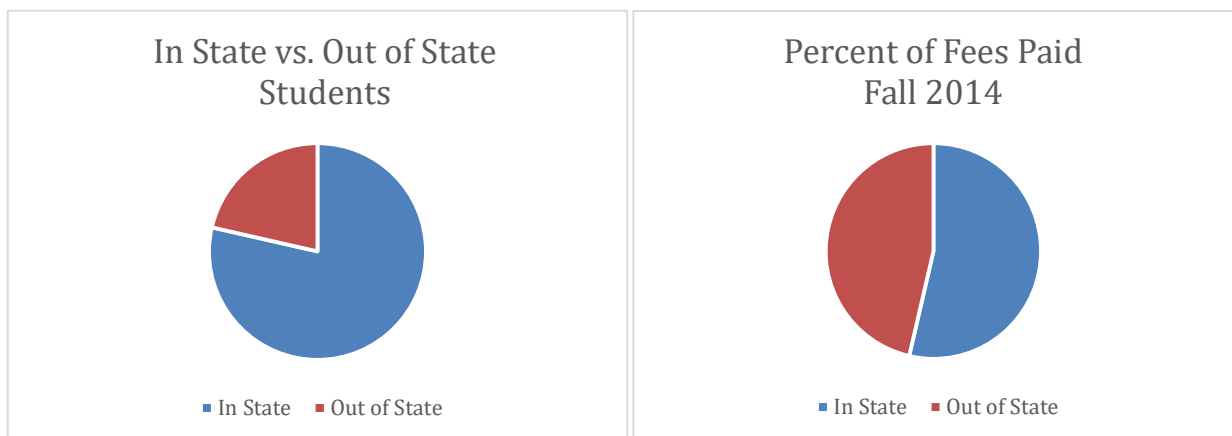


Figure 1: a: In State vs. Out of State student enrollment for fall 2014; b: Percent of total fees paid by In State vs. Out of State students for fall 201

IV. Sustainable Development Projects

The Conservation Education & Outreach (CE&O) Department works within the context of poverty, population growth, low education, unsustainable agricultural practices (tavy or slash & burn agriculture) and natural resource exploitation (subsistence hunting & harvesting) within villages surrounding Ranomafana National Park (RNP). Through the years, conservation priorities for the surrounding community have been identified as sustainable activities for poverty alleviation, medical diagnostics, treatment and prevention of common diseases, forest protection and reforestation and promoting the value of the forest and biodiversity. Our program includes both an education component (biodiversity & conservation, reforestation, health and hygiene) as well as a practical component (conservation clubs, reforestation techniques, improved agricultural techniques, sanitation and nutritional techniques and medical diagnostics, prevention and basic treatment).

A. Conservation Education

Departmental efforts are based at Centre ValBio campus, Kianja Maitso Demonstration Site or 'Green Center' in Ranomafana Village, and 46 villages in periphery of RNP, including 34 schools and 20 Conservation Clubs. The majority of our outreach efforts are conducted in the field. The three departmental sectors target communities at various levels including school children and educators, youth (post-school teenagers) and adults. This is accomplished through school programs, conservation clubs and households. For 2014, we reached over 9,400 local members of the community surrounding Ranomafana National Park in our conservation education and outreach efforts through our various programs (Please see map and list in Appendices).

For year 2014, The CVB Conservation Education Program includes 3 main components:

1. In-school Environmental Education
2. Youth-based Environmental Education
3. Community-based development support program

In-School Environmental Education

Goal: The main goal is to help schoolchildren reach the understanding of the value of the rainforest and its biodiversity and the need to protect it.

Approach

1. The "Things kids need to know and things kids need to do" approach include in working with children to become familiar with good practices such as cleaning school yards, gardening, brushing their teeth, washing their hands, taking care of their clothes and personal objects and attitudes such as greetings, and politeness, etc. Songs and poems on the environment, games and drawings are part of the children education, especially in the schools. Improving school environment such as keeping the school clean, and beautiful, enjoyable and healthy encourage kids to learn and study.
2. The "From the schools to the communities" approach helps parents understand the same messages that CVB transmit to their children. Schoolchildren bring back home the gained habits and share to families. They grow up with the good attitudes and practices and will become good citizens later.

Methodology

Every year, theme-based classes focused on the Ranomafana National Park rainforest and biodiversity are provided to target schools and villages and to the visitors of Centre ValBio. Additional health and hygiene education aims to promote good attitudes pertaining to the respect of hygiene rules and prevention of common diseases among the schoolchildren. This program includes:

1. Regular rainforest and reforestation class in the 22 schools that are accessible by road, at least once a month, depending on the availability of each local school.
2. Expeditions to remote off-road schools according to the availability of the CVB education team and alternating site visits with the mobile health team to have a more frequent presence in the remote areas.

Centre ValBio's Target Schools and School Population

During the school year 2013/2014, Centre ValBio worked with **34** schools (see lists and maps below) with **6,116** schoolchildren, **225** teachers, and **3,523** parents. In a more concerted effort to reach unprivileged schools in 2014, we continued with our 22 'road' schools in addition to conducting expeditions to 12 more remote schools around the periphery of the par.

School Rainforest and Reforestation Classes

Rainforest and reforestation classes for the 22 road schools was scheduled at least once a month during the 2013-2014 academic year. While the program is scheduled at the beginning of the year, it depends on the availability of each local school. In 2014, we taught a total of 63 sessions in primary, secondary and high schools located along the road.

4 main themes related to the environment were developed during the sessions, including:

1. The 5 roles of the rainforest
2. The RNP rainforest and its biodiversity
3. Biodiversity and interdependence in the rainforest including water cycle, oxygen cycle, link between forest and animals
4. The current situation of Madagascar's forests including the forest corridor, human pressure on the rainforest, alternative activities to forest degradation

Note: specific subthemes such as environmental problems and issues, sustainable alternative activities and the links between each element within the environment were also discussed. All messages transmitted towards ***value of the rainforest and its biodiversity*** and the ***need to protect it***.

Communication Tools to Strengthen Rainforest Classes

- Photos and films were taken in the schools during the in-class and practical rainforest class sessions to be used for theme-based moving exhibits (mini posters, albums and short videos that will move from school to school).
- New mini posters and new PowerPoint presentations were created to help educators master the history of the CVB EE program, the current situation, and perspectives.

- Educational concepts and theories and fiche techniques were improved while at CVB.
- Visits of the botanical gardens and school arboreta as learning sites were conducted. Schoolchildren participated on maintaining school arboreta and botanical gardens. In addition, Centre ValBio has started creating identification plaques on tree species to enhance the learning experience in these living laboratories.

Rainforest Classes for Road Schools

Table 1: Centre ValBio's 2014 Environmental Education School Program

Level	No.	School	No. Teachers	No. Students
Primary (n=14)	1	EPP Ambalakindresy	6	257
	2	EPP Ambatolahy	5	163
	3	EPP Ambatovaky	6	269
	4	EPP Ambodiaviavy	5	128
	5	EPP Amboditanimena	3	151
	6	EPP Androy Centre	8	409
	7	EPP Ankialo	3	185
	8	EPP Kelilalina	13	597
	9	EPP Morafeno	5	228
	10	EPP Nanda be	2	92
	11	EPP Ranomafana	16	425
	12	FMJ Ranomafana	19	331
	13	EPP Sahavondronana	2	122
	14	EPP Vohiparara	3	105
			96	3,462
Secondary (n=5)	15	CEG Ambalakindresy	21	429
	16	CEG Androy	16	302
	17	CEG Kelilalina	16	279
	18	CEG Ranomafana	13	324
	19	FMJ Ranomafana	11	145
			66	1,032
High School (n=3)	20	Lycée Ambalakindresy	11	121
	21	Lycée Ifanadiana	24	389
	22	Lycée Kelilalana	10	183
			35	510
Total School Participants:			197	5,004
			5,201	

Overall attendance in the rainforest and reforestation classes in the 22 schools was 89%. Primary school attendance is greatest; however, Centre ValBio has to work within the school program to fit in classes in stricter curriculum of the secondary and high schools and some classes (e.g., 5th year Catholic school) are not open to additional programs, while others (e.g., CEG Ranomafana) allow a voluntary participation during the sessions. In addition, teacher motivation is greatly correlated with program success and attendance.

Table 2: Rainforest class demographics and attendance for road schools

	No. Schools	No. Schoolchildren	No. Participants	% Attendance
Primary	14	3,462	3,446	99.54
Secondary	5	1,032	675	65.41
High School	3	510	322	63.14
Total	22	5,004	4,443	89

Rainforest class sessions for the Parent's Associations

Only **3/21** parents associations could get direct intervention from our staff in 2014. Centre ValBio staff take advantage of the parents meeting organized by the local schools. It was not possible to organize separate meetings for the CVB staff due to logistic difficulties although it is important to meet with parents. The staff needs to see how to reach more parents' associations in the future and to renew the EE committees.

Rainforest Classes for Remote Schools

During the 2013-2014 academic school year, four expeditions to remote schools in 4 zones were organized reaching targeting a total of 1,112 schoolchildren and 28 teachers. Only one session of rainforest class per school was possible due to various logistics in 2014. Session attendance varied, with an overall attendance of 74%. In general, children were interested in the sessions, although many students in more remote areas don't necessarily attend school as regularly as those along the road and happened to miss the time when Centre ValBio's education team visited. In addition, many children were sick during the visits as well and unable to attend.

Table 3: Rainforest class demographics and attendance for remote schools

	School Name	No. Children	No. Teachers	No. Participants	% Attendance
Kelilalana Zone					
EPP	Ampitambe	92	3	74	80
	Ankazotsara	54	2	44	81
	Kianjanomby	249	4	179	72
	Mandrivany	209	3	188	90
		604	12	485	80
CEG	Kianjanomby	82	7	77	94
			82	7	77
		686	19	562	82
Mangevo Zone					
EPP	Ambinanindranofotaka	72	1	36	50
	Amboasary	51	1	45	88
	Sahavoemba	71	1	56	79
	Vohimarina	140	4	93	66
		334	7	230	69

Ranomafana Zone					
EPP	Menarano	103	3	85	83
	Ranovao	64	3	36	56
		167	6	121	72
Miaranony Zone					
EPP	Miaranony	71	1	24	34
		71	1	24	34
Total		1,258	33	937	74

For schools in each of the 4 remote zones, Centre ValBio adapted its school program approach to include themes that are related to the basic elements of the environment (definition, elements of the environments, human pressures on the environments and the need to protect the environment, and natural events such as cyclones).

ZONE 1: Kelilalana

During the visit to the 4 primary schools and 1 secondary school in the Kelilalana zone during May, Centre ValBio's education team included the following:

Communication Tools: consisting of audiovisual stimulus including albums, posters, films, and kit Mad'Ere to teach about the environment. Including:

- 5 sessions of showing a video for all visited schools (Madagasikara Nosy Maitso)
- 9 sessions of Kit Mad'Ere's shows and demonstration (animal and plant species, pressure on the environment, protection of the environment)
- 8 Sessions on the explanation of 1 Masoala poster (Let's all help save Madagascar's beautiful forests), 1 poster on the Ranomafana National Park, 1 poster with the 12 species of lemurs.

Distributed Materials, including:

- 2 Masoala posters per school (8 posters in total)
- 40 booklets from UNICEF Loina sy Mbolo (10 per school)
- 40 Tsimihira ilay babakoto (10 per school)
- 8 saplings including 2 papaya, 2 orange, 2 rahiaka and 2 ramiavontoloho have been provided for the Mandrivany primary school

Notes:

- Mandrivany, Ankazotsara, and Ampitambe primary schools have clean toilets and have improved school hygiene
- Kianjanomby has a school orchard with orange and avocado, the school was partially destroyed by the cyclone in 2012 and still needs to be fixed, including the latrine.

ZONE 2: Mangevo

In June 2014, education staff visited 4 primary schools in the Mangevo Zone with similar themes as that of Kelilalana.

Communication Tools: The team used mainly audiovisual items including albums, posters and kit Mad'Ere to teach about the environment, excluding films.

- **5** sessions of Kit Mad'Ere's shows and demonstration
- **8** Sessions on the explanation of the biodiversity posters.

Distribution of Materials, included:

- **2** Masoala posters per school (8 posters in total)
- **40** booklets from UNICEF Loina sy Mbolo (10 per school)

Notes:

- Ambinanindranofotaka primary school does not have toilet, all primary schools in this zone need to built durable building and toilet, except the Vohimarina primary school (supported by FID)
- The Amboasary primary school uses, for now, an old building that serves also as church on Sunday, no desk for schoolchildren. There is no latrine.

ZONE 3: Ranomafana

In March 2014, our staff visited two of the more remote primary schools (Menarano and Ranovao) in the Ranomafana region using the abovementioned themes and included more interactive activities related to biodiversity and the environment through drawings, games and cleaning sessions.

In addition, the following materials were distributed:

- **30** booklets Tsimihira ilay babakoto (10 Menarano and 20 Raanovao)
- **30** Loina sy Mbolo (10 Menarano and **20** Ranovao)
- **80** Bitsik'Ivoloina volume **10** and volume **11** (40 Menarano, 40 Ranovao)
- **10** Masoala posters (5 menarano and 5 Ranovao)

Notes

- Not enough classrooms for the 2 primary schools
- Salary of teachers not paid at the right moment (supported by parents)
- Low rate of attendance caused by flood problem during rainy season
- Poverty of parents causes bad impacts on schoolchildren
- Bad status of children's health: high frequency of fever and headache
- Expressed needs: Schoolchildren healthcare is a high priority according to the teachers.

ZONE 4: Miaranony

In March 2014, our staff planned an expedition to visit Miaranony EPP. In addition to schoolchildren, other kids and local villagers also received instruction during the visit in order to understand how important environment protection is.

Themes of the rainforest classes included:

1. Definition of the environment, why and how to protect the environment, role and importance of the environment for the life of biodiversity, interdependence between human's life and the environment, the 12 species of lemurs in RNP and their nutrition habits, importance of biodiversity

2. Drawings, games and cleaning sessions (tree nursery and classroom cleaning) have been done by schoolchildren.
3. Tree nursery management: What is a tree nursery, How to use it, How to prepare seeds, How to prepare saplings before transplantation, How to plant trees

Distribution of Materials, included:

- Booklets from UNICEF have been distributed to the schools
- **20** copies of Tsimihira ilay Babakoto
- **20** Loina sy Mbolo
- **10** Fikojakojana ny nify
- **5** Masoala posters have been distributed to the school

Notes:

- The Miaranony EPP has a tree nursery with **373** forest tree saplings and **21** fruit tree saplings and are interested in increasing their nursery and transplanting saplings.
- In general, the people in this area are poor but aware about the value of the forest

School Health & Hygiene Education

Members of Centre ValBio's health team paired up with our classroom education program to promote nutritional and sanitation education targeting school aged children. Our education team had found students with poor nutritional conditions less interactive in the school programs. Our H&H team followed-up on promoting the vegetable garden program that had been established in several schools as an opportunity for enhanced nutrition for the students. Themes incorporated into the classroom sessions were techniques and understanding sanitary practices, construction of hygienic infrastructure (latrine, shower and garbage pits), the use of sanitation infrastructure and practices in daily routines both at school and at home, improving the cleanliness of the environment surrounding the schools and villages, livestock management, food and water sanitation, suggestions for nutritional improvements and malaria awareness and prevention.

A total of **68** sessions were conducted in schools in tandem with our rainforest classes during the 2013-2014 academic year to transmit messages on hygiene practices and the prevention of common diseases. **12** developed themes have been discussed during these sessions. Practical learning accompanied by songs and poems made the rainforest classes and the health and hygiene education more interesting for the schoolchildren.

Izay Mahakolokolo No Manana Ny Soa

Madame Mariette provided lessons for children to help them have good behaviors towards the environment and the society. **3** main topics in these lessons include: 1) Good behavior (savoir vivre) with **42** sub-themes; 2) Respect and protection of the environment with **10** subthemes; and 3) Hygiene/Cleaning and Beautification with **22** subthemes. These subthemes will help the CVB educators, the schoolteachers and the relay groups for their EE activities.

Youth-Based Conservation Clubs

Due to the overall low educational level of members of Ranomafana's rural communities, many youth are not targeted in Centre ValBio's school programs. CVB's CE&O also targets previously neglected groups (illiterate and poorly-educated adolescents and young adults) in our effort to reduce negative impacts on the national park and its peripheral zone by converting these young members of society from being environmental destroyers to environmental advocates. CVB currently has **20** Conservation Clubs (CCs) with **481** members in the villages surrounding Ranomafana National Park. CC members are encouraged to become friends of nature and advocates for the environment and sustainable development. Club Leaders continue to be trained in leadership and communication skills via workshops and on-site technical support. In collaboration with CVB, CC leaders provide theme-based rainforest classes and training on sustainable alternative techniques to other club members. Our CCs act as relay groups and examples in their community by encompassing good attitudes and practices into their daily lives. Our conservation clubs provide support to the schools and the other members of the CCs and community, which has proved successful by having farmers helping farmers. Most of the clubs are continuing to see positive results (in crop yield and overall health) in improving their agricultural techniques and will be pioneers within their own communities with continued support and encouragement. In 2014, our out of school youth network continues to be an important relay group for conservation education and learning and promoting more sustainable agricultural techniques. During 2014, the 4 club leaders (2 per club) played the role of field actors and assume the link between CVB and their own communities. Conservation club activities include:

- *Sustainable agricultural techniques (SA)*– including improved rice cultivation, vegetable gardening, crop rotations and seed bank management.
- *Compost (C)*– Waste management and a recycling program was launched through training programs and most of the clubs have started to use organic fertilizer made with compost that can be used for crops, flowers, tree nurseries and even be sold to external markets.
- *Pisciculture or Api-culture (P/A)* – small-scale fish farming or beekeeping to produce honey. While many clubs have been trained on associated techniques and some have demonstration ponds and or hive management, we hope to further promote these practices, especially for clubs in more peripheral villages.
- *Agro-forestry (AF)* – fruit trees and decorative plant production. In addition to these, almost all clubs have been active in planting endemic saplings as well. Our conservation club in Ambatolahy is also launching a pilot endemic tree nursery in collaboration with school children.
- *Animal husbandry (AH)* – Currently, two of our conservation clubs works with chicken or and/or rabbit husbandry for sale. This is an avenue that we are continuing to explore and potentially expand as an economic opportunity for club members and an important source of protein for villagers.
- *Art & Culture (A&C)* - Creating new bands for cultural performances is also part of the Conservation Club program to help them maintain their own cultural development leading them to be initiated on cultural tourism combined with agricultural tourism, since CVB started to bring students in the villages through its Study Abroad program. For example, the Ankialo and Nambolempary clubs gained experienced in welcoming foreign guests. Near Ranomafana, the Andafiatsimo and Masomanga clubs are gaining attention due to their good practices. The CVB education team continues to bring visitors to highlight their conservation efforts. Varijatsy is our most successful club that is also actively involved in Centre ValBio's Art & Environment Program. In

addition, members of Association Soa Fianarana are part of our local handicraft program with weaving and embroidery.

In addition to our education teams, Centre ValBio's Agricultural Development Agent (ADD) is busy throughout the year providing training and follow-up on sustainable agricultural techniques, seed bank management, vegetable gardens and compost-based fertilizers. For 2015, additional clubs are being established in remote areas overlapping with our mobile health outreach but lacking our remote school programs. All clubs will be emphasize growing trees (mixed endemic and fruit trees) in an effort to expand reforestation efforts surrounding the periphery of the park.

Table 4: Centre ValBio's 2014 Conservation Clubs (out of school youth)

Commune	Village	Club's name	No. CC members	SA	C	P/A	AF	AH	A&C
Androy	Ambatovaky	Rian'Ala	22	x	x	x			
	Androy Centre	TATAMO (Tanora Tantsaha Mivoatsa)	25	x	x	x			
	Nanda Ambalandrotsa	Miraisa hina	32	x	x	x			x
	Sahavondronana	Imaitsoanala	30	x	x	x			
Ambalakinresy	Amboditanimena	Tanora Hivoatsa	33	x	x				x
	Ankialo	Fitahiana	36	x	x	x		x	x
	Nambolempary	FITARATRA	36	x	x	x			x
Kelilalana	Kelilalina	SAHI (Solofo Antoka Hanatanteraka Iraka)	23	x	x		x		x
Ranomafana	Ambatolahy	MAINTSOANALA	25	x	x				x
	Ambatolahy	IMAITSOANALA	7	x	x		x		
	Ambodiaviavy	Youth club	20	x	x				
	Ambodiriana	Manirisoa	18	x	x	x			
	Andafiatsimo	TSIMOKAVAO	45	x	x		x	x	
	Bevoahazo	DERA LAZA	70	x	x				x
	Morafeno	MIRANA	15	x	x	x			
	Masomanga	ALAMAITSO	14	x	x				
	Masomanga	TREAMATREMAKA AN'ALA	6	x	x				
	Ranomafana	SOA FIANARANA	11	x	x	x	x		x
	Ranomafana	Youth of Ranomafana	4						x
	Sambiviny	VARIJATSY	9	x	x				x
TOTAL			481						

Support for Community Development Programs

In 2014, Centre ValBio coordinator Madame Mariette spent a total of **180** sessions on the CVB gardening program (potted garden, botanical gardens and green roof garden) including Kianja Maitso and the youth garden, **7** sessions on Vohiparara, and **6** sessions in Ambalakindresy. CVB, Kianja Maitso and le Jardin des Jeunes are the main learning sites for beautification program.

Beautification

CVB Gardening Program: For Centre ValBio visitors, we have promoted the campus green roof as a new learning location (with new signs on plant identification) in addition to displaying potted flowers and ferns around the campus as part of a botanical garden.

Kianja Maitso: Centre ValBio's green center in Ranomafana village continues to be a location to bring school groups to hold sessions on the environment, health and agriculture.

Youth Garden: As part of an effort to involve youth in gardening and beautification of Ranomafana village, Centre ValBio works with youth to maintain a garden located by the health center in town.

Papaya Project in Vohiparara: As part of the school beautification program and as a means of income for the school parent association, papaya was planted around the school yard. In the first attempt, there was high mortality (3/36 saplings) mainly due to 1) poor soil quality, clay 2) climate (too humid and too cold), and 3) not enough maintenance (weeding, fertilization, etc.). In mid-2014, 20 new papaya saplings were provided to 12 members of the parent association, which have been instead planted on parent's land with much greater success (19/20 saplings surviving at the end of 2014).

CVB Board member Susan Cummings-Findel visited in August of 2014 at which time she agreed to provide an alternative to the papaya project: *pig farming*. However, the members of the project said they will continue to take care of the papaya saplings CVB recently provided. The CVB EE staff went to Vohiparara to check on the preparation to house pigs. The pen is ready for the 3 females pigs, though some small improvement are still needed. Project members will also build a pen for the 1 male.

Vegetable Gardening Project Ambalakindresy

The members of the vegetable garden project in Ambalakindresy are dynamic women. From vegetable sales since the start of the association, they collect annual dues from each member that help with small expenses and in addition to those that were preserved from the previous crop the women were able to plant and purchase additional seeds in 2014, and then asked further support from Centre ValBio through Sunshine Comes First, Ltd. for additional seeds and supplies. In 2014, green vegetable seeds (23 packets of petsay and cabbage) and red beans (30 kapoakas) were provided by CVB. Following a site visit in August 2014, Susan Findel agreed to provide dried seeds and green vegetable seeds for the association. For the September planting season, the women's association was provided the seeds (including Beans: 230 cups, Round beans: 230 cups, Potatoes: 115 kilos, Eggplant: 23 packets, Sesame: 6 cups and Pepper 23 packets) in addition to agricultural supplies (including 23 watering cans, shovels and pitch forks).

Waste Management & Compost

Centre ValBio has promoted cleaning sanitation throughout its target villages and schools. Villagers are encouraged to clean up their own household and surrounding environment in an effort to reduce the likelihood of attracting rodents and fleas that increase the prevalence of disease. Thus, we promote the use of garbage pits and train in their construction as well as sustainable waste management through producing compost from garbage. The compost is then promoted as an eco-friendly fertilizer for vegetable gardens, agricultural fields, and both native and fruit tree saplings. In addition to our target villages, Centre ValBio has been active in waste management for Ranomafana Center. Centre ValBio's agricultural development agent at Kianja Maitso, currently collects and sorts all of the garbage for Ranomafana at our demonstration site in Ranomafana village. Due to the increasing demand for waste management, we expanded our area at Kianja Maitso to handle garbage and produce compost. The biodegradable items are turned into compost and available to the local community and also used for Centre ValBio's endemic saplings, vegetable and flower garden demonstration sites as well as school, conservation club and village plots. Kianja Maitso's waste management center had receives over 1,500 wheelbarrows full of material that need to be sorted. This consumes a large proportion of the Development Agents time and we hope to recruit members of the commune to assist in this undertaking. The commune has identified a large-scale garbage management site and produced a preliminary budget has been made, including necessary transport since the location is in Morafeno village.

Living Laboratories & Forest Field Trips

While students are provided a great deal of information through classroom sessions and audio-visual tools, they are also given interactive lessons to encourage and expand their learning environment. Some of the additional programs we have in the schools include the following:

1. *Living Laboratories*: These are small arboreta on school land established over the years to teach children about endemic trees. Centre ValBio is working with the schools to provide informative tree identifications (Malagasy and scientific names and the year in which the tree was planted). We began to work with teachers in Ambatolahy to create interactive lessons within the school grounds using the endemic trees.
2. *Arboretum*: For schools that have larger areas of land available, arboretum have been established in which students assist in planning and caring for native saplings throughout the year along with their parents.
3. *Tree Nurseries*: School nurseries were not a huge success, due to little oversight when the schools were out of session. In 2014, we launched a collaborative project involving children in our school program to create an endemic tree nursery in their respective village. We plan to expand this pilot project in 2015 since it appears to ensure much better oversight of saplings in the nursery by involving community members and parents in their care and also provides children fun environmentally focused activities when out of school.
4. *Vegetable Gardens* – Seeds had been provided for planting on school land in an effort to improve the nutritional condition of the students so that they have energy to learn. The gardens are also used as practice seed bank management, although only a few schools continue to provide for school children meals.
5. *Youth Garden* – the Jardin de jeunes was established in Ranomafana to promote youth involvement in learning gardening techniques and contributing to improving the surrounding village environment.

6. *Sanitation Infrastructure & Supplies* – We continue to promote the construction and use of latrines in the schools and implementation of sanitation practices (tip-tap stations to wash hands, brushing teeth, etc.).
7. *Garbage Management* – To clean up the surrounding area of the schools, we promote garbage pits and bins in the schools and promote the planting of trees and flowers in the surrounding environment.

For 2014, in collaboration with Madagascar National Parks, we were able to support the Ambatolahy primary schoolchildren and teachers to visit Ranomafana National Park. In addition to the forest visit, in which they learn about the interrelationship of biodiversity and the environment, members of each of the groups were given an educational tour of Centre ValBio's campus and provided lunch. These students have also been part of a Saturday Program working in the tree nursery and transplantation of endemic saplings in and around Ambatolahy village and come to Centre ValBio about once a month as part of our environmental audio-visual program. We hope to continue to enable more of the schools, clubs and villagers to visit Ranomafana National Park, especially targeting those programs that both excel academically or in promoting our outreach efforts as well as those who have yet to visit the park to fully understand its beauty and value.

B. Reforestation & Restoration

Our endemic reforestation program was previously based at our demonstration site (Kianja Maitso) in Ranomafana village. In 2014, we expanded our main tree nursery to Centre ValBio's upper campus, so that it is closer to the forest for seed collection and also an additional location as a component for tours and trainings held at Centre ValBio's campus. Our goal is to promote the value and use of endemic saplings in restoring degraded landscapes in both the periphery of Ranomafana National Park and throughout Madagascar. Due to a large proportion of the tree nurseries team designated to nursery construction and maintenance in addition to the passing of one of our long-term members of the team this year, our propagation rates for 2014 were less than normal. In total, we collected and sowed over 5,400 seeds, and successfully produced over 3,200 endemic saplings and transplanted 1,000 saplings (from our stock 2013 stock) have been systematically monitoring the growth of saplings transplanted locally in previous years. 3,396 additional saplings are ready for transplanting during the wet season in early 2015.

Seed Collection, Planting and Germination

Through our knowledge of local fruiting cycles of endemic tree species, we target seed collection from multiple parent trees for multiple species throughout the year. For 2014, we collected over 5,000 individual seeds from 10 families, 12 genera and 14 different species shown below. Collected seeds are then prepared and sown at Centre ValBio's upper campus tree nursery. All seeds collected were sown. The saplings then germinate and depending on differential growth rates, this may take some time to produce a viable sapling. Thus far, 59% of the seedlings sown have germinated successfully, however this is an underestimate of the total expected due to a lag time in germination, especially for those seedlings collected and prepared later in the year. However, for the few species that we targeted multiple source trees, we noticed differential growth success, reiterating the importance to collect from numerous trees to ensure a more diverse and potentially successful batch of saplings.

Table 5: Centre ValBio's 2014 Endemic Seed Collection, Potting & Germination at Campus Nursery

No.	Family	Genus	Species	Malagasy Name	No. mother trees	No. Seeds Collected & Sown	No. Seeds Germinated	% Germination as of Dec 2014 ^
1	Anacardiaceae	<i>Protorhus</i>	<i>sp.</i>	Sandramy mena	3	979	704	74% (57-87%)
2	Apocynaceae	<i>Craspidospermum</i>	<i>verticillatum</i>	Vandrika	1	48	7	15%
3	Clusiaceae	<i>Mammea</i>	<i>bongo</i>	Natojabo	1	883	642	73%
4	Erythroxylaceae	<i>Erythroxylum</i>	<i>sphaeratum</i>	Malambovony	1	162	115	71%
5	Euphorbiaceae	<i>Bridelia</i>	<i>tulasneana</i>	Harina	2	1,592	1,225	75% (63-87%)
6	Lauraceae	<i>Cryptocaria</i>	<i>acuminata</i>	Tavolomalady	1	100	6	6%
7		<i>Cryptocaria</i>	<i>sp.</i>	Tavorano	1	204	66	32%
8		<i>Cryptocaria</i>	<i>ovalifolia</i>	Tavolomanitra	1	65	46	71%
9		<i>Ocotea</i>	<i>recemosa</i>	Varongy fotsy	2	626	289	52% (33-70%)
10	Menispermaceae	<i>Burasia</i>	<i>madagascariensis</i>	Masoposaina	1	293	13	4%
11	Myrtaceae	<i>Syzigum</i>	<i>danguyanum</i>	Rotramena	1	184	15	8%
12	Salicaceae	<i>Scolopia</i>	<i>sp</i>	Faritraty	1	50	28	56%
13	Sapindaceae	<i>Plagioscyphus</i>	<i>louvelii</i>	Lanary mainty	1	196	23	12%
14		<i>Buguea</i>	<i>apelata</i>	Lanary madinika	1	70	43	61%
Total						5,452	3,222	59%

^ The percentage of seedlings that germinated as of the end of December 2014 is an underestimate of the total number of seeds that are expected to produce viable saplings. Due to variation in the time of year seeds were collected and differential growth rates, additional saplings from this seed stock are expected to sprout over the next several months

Measuring Sapling Growth Rates

Our reforestation agents are responsible for maintaining Centre ValBio's upper campus nursery, the saplings (fruit and endemic) at Kianja Maitso's endemic tree nursery and measuring the endemic sapling growth in the nursery and in situ after transplantation. For 2014 we continued to make a concerted effort to improve our monitoring data management system to systematically track growth rates of our endemic saplings both in the tree nursery and after transplantation for native trees planted since 2005. For transplanted saplings, we follow annual (and bi-annual when possible) mortality and growth rates across 27 sites in the periphery of the park. As a representation of sapling success following transplanted, three communal sites in Ambodriana were provided a total of 878 endemic saplings (see below) with a success rate after one to two years of 80% of sapling survival. In our plantation site on private land donated in Ambatolahy in late 2014, sapling survival is currently at 93%.



Figure 1: Tree nursery plantations

Communal Reforestation

Since school land is limited, we expanded our reforestation to include planting of endemic saplings on communal land around the periphery of Ranomafana National Park starting in 2010. Through this program, we planted 1,023 endemic saplings in the periphery of RNP in 2014. In particular, 3 community members from Ambodriana and one CVB staff supporting the youth program in Ambatolahy offered land for transplanting endemic saplings in exchange for 10 fruit trees per plot. Since availability and willingness of owners to provide land for endemic saplings to be planted, our strategy of including some fruit trees as cash crops to be mixed in the translocation sites is working well. In addition, Centre ValBio will continue to work with these landowners to develop further projects in the plots as the young saplings grow (e.g., potential beehive projects, vanilla or spices, etc.). Overall for 2014, we have been promoting reforestation and restoration through endemic saplings (for biodiversity), fast-growing endemics (for communities to use as an alternative to invasive species for construction purposes and beehives) and fruit trees (as a nutritional and economic resource) in an effort to continue to green the periphery of Ranomafana National Park. For 2015, we hope to expand the program further with more seed collection and propagation of endemic saplings not only in Centre ValBio's nurseries, but also youth managed nurseries through our conservation clubs.

In fact, our youth group in Ambatolahy has already collected and sown seeds from 6 families, 6 genera and 6 species to ensure diversification of the saplings from the start and also transplanted 355 endemic saplings on a donated parcel of land in the latter part of 2014. Our conservation club in Andafitsimo is doing well with the propagation and sales of fruit trees. Further expansion and encouragement to additional conservation clubs is a main component of our 2015 reforestation plans.

C. Mobile Health Clinic

In general, the remote populations surrounding Ranomafana National Park still have a lack of access to healthcare, money, hygiene, education, and diversification of livelihoods. Most depend on cultivation for mere subsistence, which is hard physical work done with little to no tools or equipment.

Goals:

The goals of the mobile health team are to:

1. Improve the health of rural villages within the periphery of Ranomafana National Park
2. Promote a way of life that is compatible with improving health within the social context of rural villagers with little education
3. Gather important demographic and diagnostic data that can lead to improvements and advances in infectious disease research.

Activities

CVB's core activities involve visits to the villages in the periphery of the park to:

1. Conduct free consultations and provide primary and urgent care

2. Gather demographic, diagnostic, and hygiene related data
3. Educate the villagers within their social context to promote better hygiene and more favorable habits to reinforce disease prevention and improved health
4. Family planning

Location of Mobile Health Outreach

Criteria for choosing villages:

- Villages within the periphery of Ranomafana National Park (RNP)
- Villages (remote locations) with difficult access to community health centers (at least 3 hours by foot to the nearest CSB (community health center))
- Villages that are critical in sustaining the preservation of RNP's biodiversity

For 2014, we targeted a total of 4 zones, conducting expeditions 17 days per month, to provide consultations and education programs to 5 villages in each zone (for a total of 20 villages) for 3 consecutive days in each village twice a year. The closest villages are 3 hours by foot and the furthest 12 hours by foot. For the majority of 2014, our health team consisted of 1 doctor, 1 nurse and 1 midwife.

The **20** target villages in 2014 included **8,251** individuals from 3 communes, including:

- Miaranony Zone (Tsaratanana Commune) :1,727 individuals consulted
- Mangevo Zone (Ranomafana Commune): 1,576 individuals consulted
- Bevoahazo Zone (Ranomafana Commune): 2,320 individuals consulted
- Mandrivany Zone (Kelilalana Commune): 2,628 individuals consulted

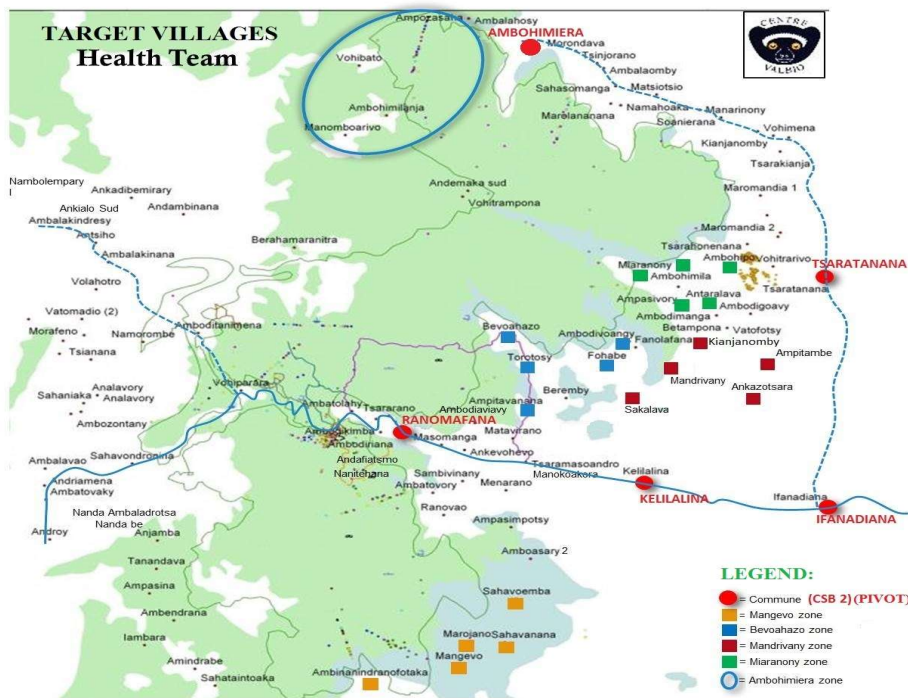


Figure 2: Target villages for the CVB mobile health team

Table 6: 2014 Mobile Health Team’s Target Zones, Communes and Villages

ZONES	COMMUNES	VILLAGES
Mangevo	Ranomafana	Ambinanindranofotaka
		Mangevo
		Marozano
		Sahavanana
		Sahavoemba
Bevoahazo	Ranomafana	Bevoahazo
		Torotosy
		Fohabe
		Ampitavanana
	Kelilalana	Ambodivoangy
Mandrivany	Kelilalalana	Sakalava
		Mandrivany
		Kianjanomby
		Ampitambe
		Ankazotsara
Miaranony	Tstaratananana	Ambohipo
		Ambohimila
		Miaranony
		Ampasivory
		Antaralava

Preliminary Results from 2014 Health Consultation

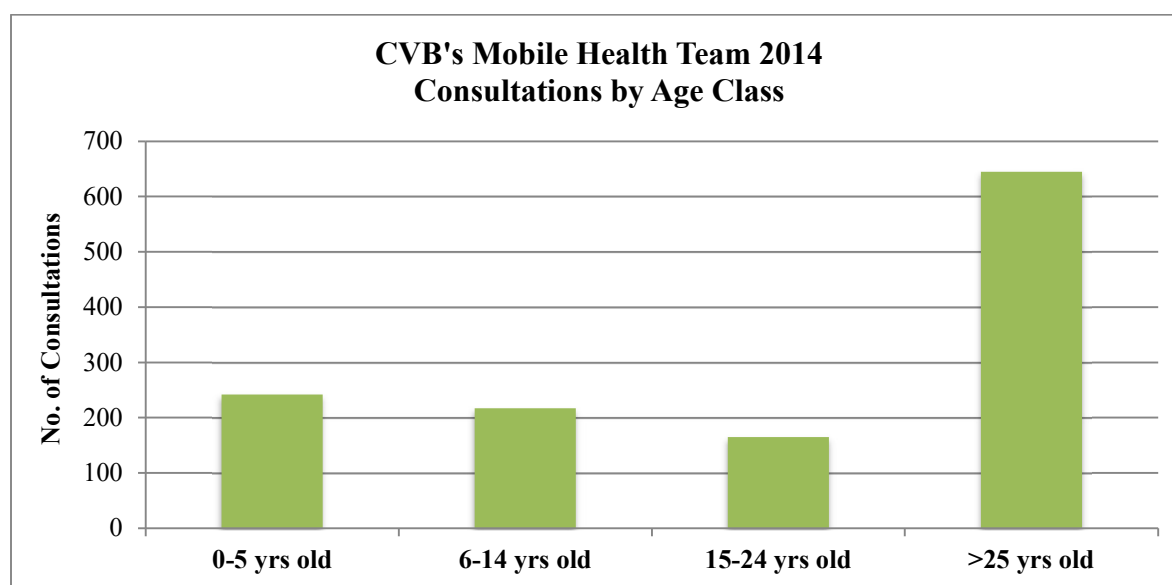


Figure 3: Number of consultations according to age

Across zones, our largest demographic group that sought consultations were individuals over 25 years of age, followed by infants 0-5 years old and then youth and young adults. By zone, the under 25 demographic age categories varied slightly by zone.

Over the course of 2013-2014, Centre ValBio’s health team conducted 3,397 consultations for rural villagers surrounding Ranomafana National Park. During these consultations, 13 illnesses were the most commonly diagnosed and comprised of over 70% of the illnesses (2,399 consultations). Osteo-articular related illness was the most common comprising of 15.31% of all consultations, followed by respiratory illness (11.45%), malaria (10.30%) and flu/cold (10.16%). Consultations are conducted twice a year, in an effort to sample different seasons that could influence our representation of illnesses. In sampling bi-annually, we noticed that malaria, for example, is most frequent during the rainy season (December – April). Respiratory infections are common during changes in season (April and May). Surprisingly, there were much fewer cases of diarrhea than would be expected given the poor personal and environmental hygienic practices. While other infectious diseases (e.g., filariasis) may be more common than the handful (n=23) of advanced cases seen during consultations, villagers are often shy to come for consultation for such problems. Continued presence and offering healthcare bi-annually and forming long-term relationships with these community members has improved villagers trust in us and we know that we will continue to gain a greater understanding of disease prevalence in these rural areas.

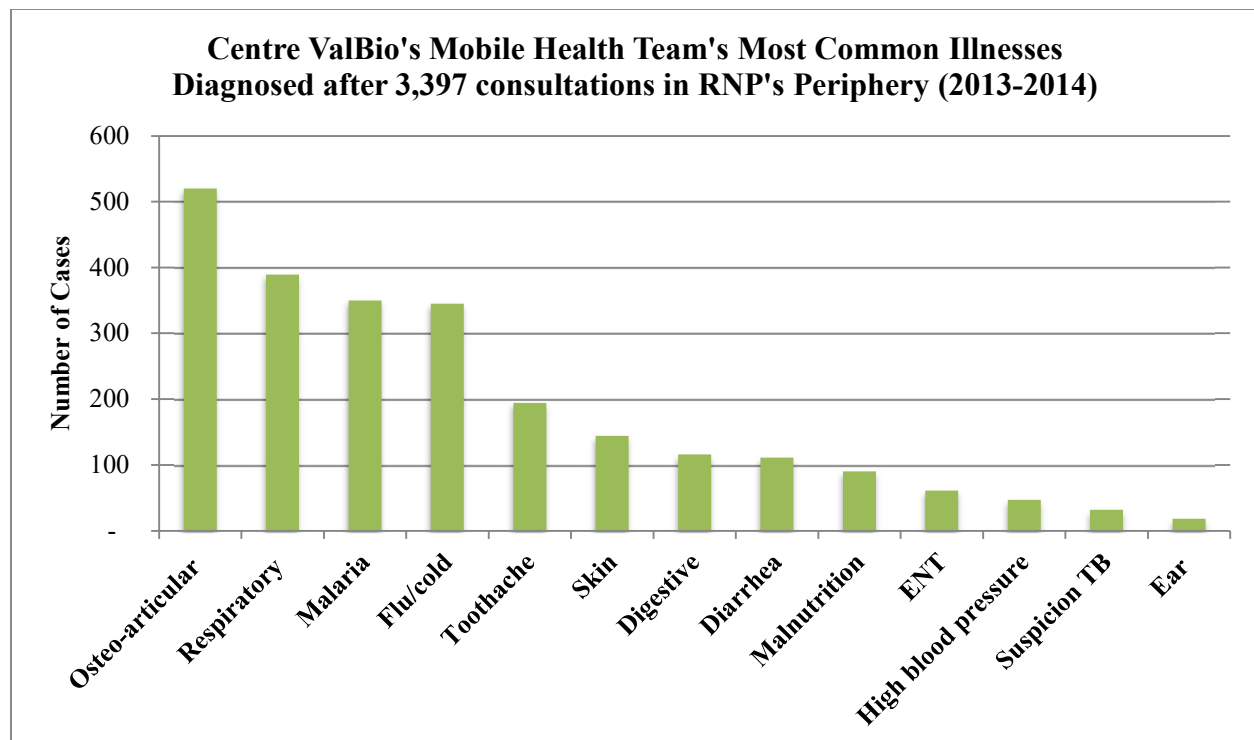


Figure 4: Most common illnesses seen by the mobile health team

Our midwife, in particular, was also proactive in helping during remote childrearing. In fact, she delivered several infants in these remote villages, especially when their mothers were experiencing difficult deliveries. During these visits, advice is provided for troubleshooting

during birth complications with traditional birth assistants. In addition, these traditional relay groups are encouraged to advise pregnant mothers to seek pre-natal care and post-natal vaccinations available through the community health centers.



Voluntary Health Agents (AVS)

Our health team has several villages to visit throughout the year and therefore rely heavily on local voluntary health agents (AVS or AC – agent communautaire) located permanently within each of our target villages that are trained in basic healthcare and dispensing of common medicines. The AVS are an important relay group for our health team between and during site visits. The 20 AVS (1 per village) follow-up on health education and outreach activities within their respective villages.

Health & Hygiene Education & Outreach

One of our main objectives is to educate people on practices that will improve the well being of the population so they can participate in the conservation of the environment, for which their livelihoods depend. We hope they will incorporate good practices of health and hygiene in their daily lives. Our efforts focus on the prevention of diseases while simultaneously adapting these themes to social contexts via our consultations and data collection. We aim to reduce unnecessary and easily preventable deaths by reducing exposure to pathogens. The themes we use depend on the social context according to the data collected, the consultations made and common diseases diagnosed; however the general topics addressed are:

- *Hygiene*: Poor hygiene is the cause of most infectious diseases found; thus, improvement in hygienic behavior (personal hygiene, clean clothing, clean and nutritiously balanced

foods, hygiene of the village environment) and promotion of hygienic infrastructure and practices (latrines, showers, garbage pits) are proven steps towards disease prevention. While collecting demographic data during village visits, we found that very few households had hygiene infrastructure (latrines, etc.) thus this will continue to be an important component in our health outreach.

- *Prevention of common diseases:* The most common diseases are related to lifestyle and bad habits; thus, education towards behavioral change and promoting items such as mosquito nets, etc. can greatly reduce the incidence of disease.
- *Annual themes, especially Family Planning:* On average, a woman of 25 years typically gives birth to 5 children and many rural villagers have misconceptions about the benefits of waiting to conceive, spacing births (for both maternal and infant nutritional improvement) and readily and freely available options to space births to improve maternal and children's health.



As part of CVB's mission, we have sought to improve the health of remote villagers surrounding Ranomafana National Park. CVB's mobile health team is an important component in achieving this goal and ultimately maintaining healthy people and a healthy environment. Our mobile health team brings critical care and outreach to remote populations of villagers that would otherwise have no access to healthcare, while also collecting data that contributes to a greater understanding of tropical diseases and avenues of prevention. Our mobile health team is critical for gaining important health related data, delivering basic and emergency healthcare that would otherwise be unavailable, and promoting rural communities to utilize community health centers when possible. For 2015, we will continue to work closely with our new health NGO partner, PIVOT, Marie Stopes Inc., and the Ministry of Health in a communal goal to improve the livelihoods of villagers in the periphery of the park.

V. Partnerships

A. Commune of Ranomafana

Centre ValBio continued to work closely with the Commune of Ranomafana in collaboration on a diversity of projects, events, and community support. In particular, the mayor's support for moving forward with negotiations for acquiring electricity for Ambatolahy was crucial and the commune has agreed to offer partial funding towards this endeavor. The launch of World Lemur week and festivities held in Ranomafana village was also an important opportunity to highlight the importance of Ranomafana's special biodiversity to the local community and livelihoods. Centre ValBio assisted in supporting the new construction of the Commune office as well as supplied 20 folding chairs for the main meeting room. With the facilitation of the mayor, Centre ValBio also collaborated with PIVOT to provide emergency assistance to the village of Sahavoemba; which had been destroyed during a fire.

B. Madagascar National Parks

Meetings

As scientific and technical partner of Madagascar National Parks, Centre ValBio (CVB) and MNP have regular monthly meeting the first Tuesday of every month. Many different subjects are discussed during the meeting such as writing information in the brochure for tourists by MNP, the use of the old research cabin in Talatakely, the news from the monitoring of biodiversity in the Park (*Prolemur simus* for example), program of researchers, security issues especially related to disturbances in the park such as intruders to the Park for gold mining. Beside the regular meetings, MNP and Centre ValBio call for a meeting when there are urgent issues to be solved immediately.

Collaborations:

MNP and CVB have collaborations in many different domains. CVB participated in the discussion with KINOME consulting agency on the strategy for financial sustainability of MNP for the management of protected areas in Madagascar. For the realization of researchers works, the two institutions help each other in paperwork and also in logistics for example, this year many of the researchers were conducting research in the satellite camps of MNP within the Park in particular in Vatoharanana and Sahamalaotra where MNP does the maintenance of the camps and CVB provides all the necessary logistics at the camp for the researchers. Disturbances noticed by researchers in the field that were reported to CVB were transmitted immediately to MNP for appropriate measure to be taken. One case was some intruders trying to settle in Valohoaka for gold mining. The Director of the Park was giving a lecture on conservation and management of the Park at the lecture room of CVB for the four Study Abroad program this year 2014. MNP have been attending actively conferences or workshops held at CVB such as the congress on frogs ACSAM2, the workshop lead by Finnish Association for Nature Conservancy (FANC) presenting the map of vegetation classification of Ranomafana area at CVB and in Antananarivo in December this year. Representative of CVB participated in the workshop

organized by Finnish researchers in December in Antananarivo about the assessment of effectiveness of protected areas management by MNP in Madagascar.

Joint activities

Joint activities were conducted by MNP and CVB when needed whether working in the field or participating in other events organized by partners outside Ranomafana. For the reforestation opening celebration, both entities participated together in site for the Region of Vatovavy Fitovinany. MNP and CVB attended together the workshop for reinforcing the strategies to combat fires around Ranomafana with the responsible of forest in the District of Ifanadiana in September this year. For data collecting in the field with the Tropical Ecosystem Assessment and Monitoring (TEAM), MNP agents join CVB team for the fieldwork on vegetation and camera trap with vertebrates.

Future Collaboration

Consultants asked CVB to take a leading role in our partnership and continue promoting research, conservation education and health outreach surrounding the park. In addition, discussions with MNP local and national office were undertaken to have Centre ValBio acquire the historic cabin and laboratory for further education and outreach geared towards both national and international tourists. MNP is also opening a new interpretation center in early-mid 2015 and CVB will assist in planning and creation of several of the biodiversity, cultural and conservation materials and displays. The acquisition (rental) and rehabilitation of the new education centers are planned for 2015.

C. FIMARA and Ampanjaka

Traditional leaders and healers have been partners of Centre ValBio since 2004 during the project of drug discovery and economic development working with the National Institute of Health: International Cooperative Biodiversity Group (NIH-ICBG, U.S.) in Ranomafana. After the project was completed, Centre ValBio, the traditional leader and healers continued collaborating on other projects such cultivating medicinal plants, plants for essential oil (Ravintsara and Geranium), maintaining the plantation of medicinal plants at Mahatsarabe, and selling medicinal plant product including Homeopharma products at the store “Pharmacie Verte” or green pharmacy.

Essential oils

The cultivated Ravintsara in 5 villages in 1 to 2 ha were grown and ready to be harvested to be extracted as essential oil. Now is the fifth year for the cultivation. The problem is the lack of funds to pay for the extractor to make essential oil out of the Ravintsara and the market for it was decreased. Similar case for the cultivation of more than 350 saplings of Geranium that are supposed to be harvested in 4 months after their purchase in July 2014, but because of lack of extractor and the money to extract the plants, therefore, they stay in the plantation so far. The purchase of extractor which cost is 14,000,000 Ar (\$7,000) was in the plan of the associations with the help of Malagasy program called PROSPERER for the half of the price and the help from other sources for the remaining money. Until now this extractor was not purchased which

creates difficulty for the associations to develop their activities for their source of income. Centre ValBio is still looking for donors to help purchasing this extractor for essential oil. If this problem is resolved, the members of Ampanjaka and traditional healers would increase the amount of money as yearly benefit sharing to each member.

Mahatsarabe

The 3 ha medicinal plant site in Mahatsarabe belonging to the associations of Ampanjaka (traditional kings) and traditional healers include the plantation of medicinal plants, essential oil plants (Ravintsara and Geranium), in a form of botanical garden where visitors come to know more about medicinal plants and traditional healing in Ranomafana. Visitors are composed by groups of national or international students, local and international tourists. There is no fix fee to visit this plantation, but visitors give donations after the visit. As a consequence, this year 2014, the associations received in total during the year Ar. 150,000 (\$75.00) to be used for the maintenance of the gardens and benefits to be shared among the members at the beginning of the year 2015.

Pharmacie Verte

The Green Pharmacy (Pharmacie Verte) sales point (stand) located in Ranomafana village belongs to the association of traditional Leaders and Healers. This is part of the source of income for the associations where they sell medicinal plant product from the member of traditional healers with the Homeopharma (green pharmacy in Madagascar) products. The benefits from it are shared to the members of the two associations at the beginning of the year as a share. This year 2014, less products from the members are made compared to Homeopharma products which needs to be addressed because many people ask especially medicinal plants from traditional healers. This store was opened in 2010 and still running until now. The last balance for the sale this year on December 15th, 2014 was 75,859 Ariary (\$37.00)

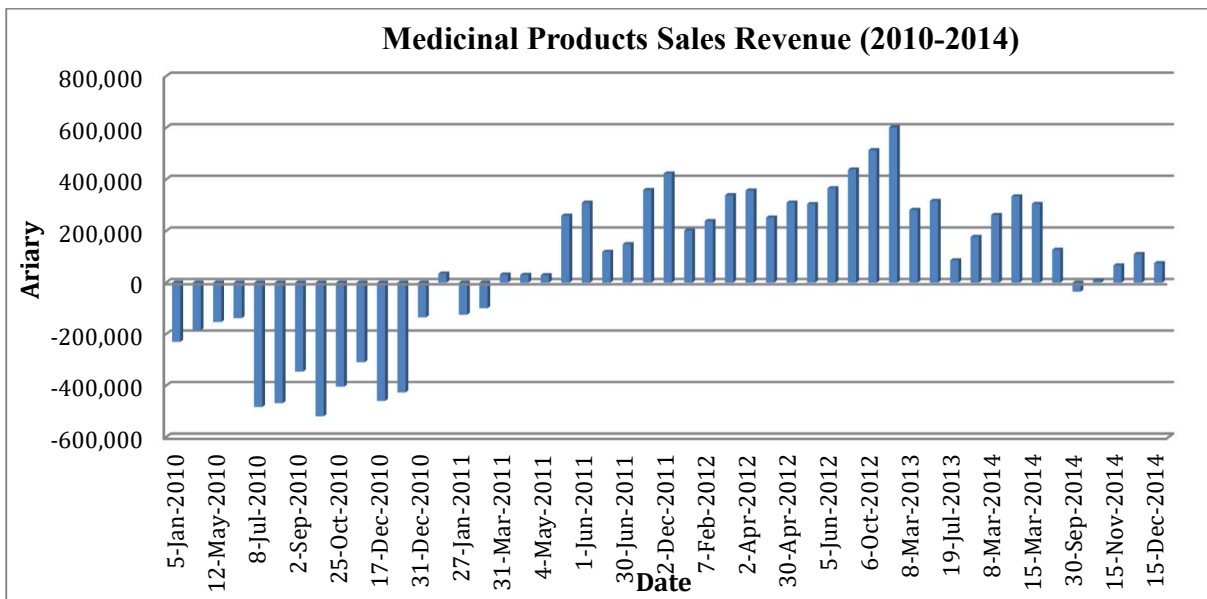


Figure 1: Sales revenue from the sale of medicinal products (2010 – 2014)

Overall, sales were not good due to the decrease of the products from traditional healers and the decrease of purchase frequency of supplies, which means less products were sold this year (Figure 1). A better strategy should be implemented for next year to increase product sales as a source to generate revenue for the traditional healers association. This strategy will be discussed during the yearly benefit-sharing meeting during in January 2015.

D. PIVOT

2014 marked an exciting year for much needed healthcare expansion in the region. Through several years of project development with Centre ValBio, PIVOT was officially launched by two of Centre ValBio's board members, Drs. Jim and Robin Herrnstein, and additional partners that had been working with Partners of Health. While Centre ValBio's mobile health team continues to bring mobile health diagnostics, treatment and prevention to the remote rural communities surrounding Ranomafana National Park, PIVOT's goal is to simultaneously reinforce and restructure the public Ministry run health centers. Following guidance from Centre ValBio, PIVOT launched their program in the Ifanadiana District, concentrating on rural health centers in Ranomafana, Kelilalana, Tsaratananana and the District capital of Ifanadiana. Centre ValBio's teams worked closely with new PIVOT staff in initial recruitment of staff, providing administrative forms and procedures, and advising on components of the project and community relationships. Centre ValBio's mobile health team also benefited from training supported by PIVOT on national health issues as well as was a recipient of a donation of the 40 basic medicines program that was being distributed to the community health centers.

E. Friends of Madagascar

Centre ValBio continues to support the work of our partner organization, Friends of Madagascar, which primarily concentrates on building and expanding school infrastructure and programs in Kelilalana. In addition to our rainforest and reforestation classes in the schools, Centre ValBio staff give guest lectures to the students to inspire them to consider diversified careers and continue their education – particularly to students in the new high school inaugurated in 2014. In addition, Centre ValBio provided saplings to Friends of Madagascar in late 2014 as part of a new agroforestry plot mixing endemic saplings with coffee trees.

F. U.S. Embassy

Centre ValBio continues to receive support and encouragement from the U.S. Embassy. We continued to finalize our recording studio in Namanabe Hall and hope to have the studio up and running for recording in the beginning of 2014. We also continue to work together to promote Ranomafana as a national tourist destination through our 'Vive un Experience Naturelle' Program and have made plans to transfer the Facebook site management and much of the Public Relations material from the U.S. Embassy to Centre ValBio and its local partners for long-term sustainability and upkeep. The U.S. Embassy also supported several billboards promoting Centre ValBio and Madagascar National Parks that have been placed along the national road. In addition, as part of our continued 'Artist & Environment' project, the embassy supported visits of international artists to visit Ranomafana in addition to promoting the local artist performances during the tourist high season. In addition, Centre ValBio contributed to the U.S. Embassy

promotional programs in Antananarivo, especially geared towards environmental journalists, by offering a prize to one of the winning categories that included a few days lodging and meals at Centre ValBio in addition to a park visit supplemented by Madagascar National Parks.

VI. Art & Environment Program

Centre ValBio continues to promote environmental conservation and sustainable development through the arts. For 2014, we continued to work with our local handicraft and musician groups as well as hosted national and international artists.

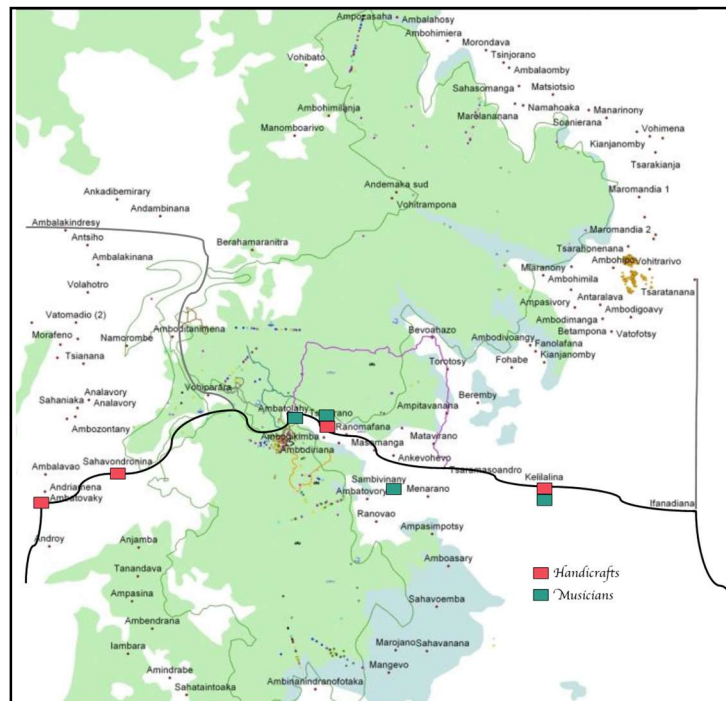


Figure 1: Location of musician and handicraft groups working with CVB

A. Handicrafts

FAMIOVA



FAMIOVA, our local women's textile weaving cooperative, continued to remain relatively independent, proactive as a successful small business, and productive for 2014. Monthly meetings were held as of April and some rules and regulations were re-emphasized, especially that the person responsible for respecting an overall quality of products (e.g., size, color, pattern)

as well as standardized pricing. At the end of April, elections were held for the new officers for a three-year term (President (Beby), Vice President (Lydie), Treasurer (Lucienne), and Secretary (Soa)).



One request for 2014 was to offset material costs and logistical challenges by receiving assistance in training on raising silkworms to produce their own natural silk for weaving instead of purchasing from Amboitra and or Antananarivo. The group acquired some silk worms to practice husbandry techniques and future training is planned for 2015.

In July, we worked with FAMIOVA to further explore their economic equity, savings and potential to offset costs that have been subsidized by Centre ValBio and funders in the past. That meeting was focused on the financial position of the cooperative. Previously, we have asked if the cooperative can have the means to pay the rent of their workshop or participate in this payment. With the treasurer, we calculated how much the cooperative can disburse per month given that 60% of the price of each product sold belongs to the person who made it, 25% for the raw materials, and 15% for the activity of the cooperative. Using 2013's financial position and exploring the 15% savings for the cooperative to explore how FAMIOVA can be more systematic in repayment of their outstanding loan and independent in terms of covering their actual workshop and sales point venues. FAMIOVA still owes 2.3 million Ariary (\$1,150) towards their microloan of 6 million ariary (\$3000.), and according to the repayment agreement, they still have more than three years to pay it.

Examining 2013's financial situation, on average, FAMIOVA has approximately saving of 141,900 Ariary per month (range 37,000Ar – 240,000 Ar). Thus, the cooperative agreed to put aside 120,000 Ar (ca. \$60) per month for the following:

- 50,000 Ariary (\$25): participation on the rent of the workshop
- 10,000 Ariary (\$5): rent for the point of sale
- 60,000 Ariary (\$30): paid to the bank for reimbursement of 6 million

By paying 60,000 Ariary (\$30) per month, the remaining 2.3 million will be reimbursed till the agreed time limit. However, there are still over 400 000 Ariary (\$200) in activity funds to fill the

void during the low season. After the debt is settled, the cooperative will finally pay more than 50 000 Ariary (\$25) for rent of the workshop.

On August 18, Susan Findel (CVB Board Member and Founder of Sunshine Comes First, Ltd.) visited FAMIOVA, one of the first SCF, Ltd. micro-loan recipients. Susan came with her colleague, Eric, a specialist in the field of clothing design and met with 15 of FAMIOVA's members.



- In general, client's number has decreased because of the political crises and the insecurity, but the cooperative always continued their work.
- One of the large looms was broken and did not work since the beginning, although the cooperative failed to discuss this with anyone.
- FAMIOVA discussed their interest in raising cocoons to get silk, so that there is no need to buy silk from Tana. The said that they have already tried to raise cocoons but it did not work well, so they need some training about raising cocoons in Ambositra or Antsirabe.

Mrs Findel was happy to hear that even if the crises in Madagascar, they did not stop the work, and she promised that she would try to contact the manufacturer of the machine to resolute that problem. Then, Mrs Findel asked them to make a budget regarding the silk training and promised to find solution. Mrs. Findel and Erik also provided some advice, including: (1) creating scarves, not only for the cold season but also for the hot season, so they should manufacture something thin and lightweight with silk or cotton and (2) using only natural colors expect the customer order and to always continue the good work.



MAEVA

Centre ValBio continued to provide MAEVA with assistance and technical support, also marketing their products. Our marketing system is devised in the following ways: (1) We take the clients (students, researchers and tourists) to visit their workshop or their point of sale to see their way to work and to buy their products; (2) They are invited to come to the CVB to exhibit and sell their products, and (3) we continued to promote private weaving sessions (coasters) to promote their artisanal craft and products as well as interaction with foreigners.



Centre ValBio's board member, Mrs. Susan Findel (Sunshine Comes First, Ltd.) visited with MAEVA along with Centre ValBio's team for a meeting in Sahavondronina for meeting with the MAEVA association. In general, MAEVA felt that everything has been going well for the association, although they need a more accessible and obvious sales location to market their products. Susan advised putting a new and interchangeable panel along the roadside to help market their location and products and is developing a design for it. She also continued to suggest that they (1) always use natural colors/dyes and (2) make different sizes and models of all baskets that the association produces.

Association Soa Fianarana (ASF)



We also continued supporting ASF during 2014, although illness, loss of members, and personal issues hindered much of their productivity this year. The group leader, Florine, continues to be an inspiration and they have been most successful in their production of unique embroidered

biodiversity products and still continue to work with the local recycling art initiative turning plastic bags into purses, belts and jewelry. For 2015, we hope to work with this association to find a more ideal location as a work location and sales point. In addition, as we continue to promote their presence for selling products in our ecoshop and hosting tables when we have large groups, they are gaining a better understanding of what products are marketable to the tourists. We also continue to bring scientific tourists to their work location in Ranomafana village to promote their work and offer ideas of new product lines.



On August 18, Susan Findel visited ASF, a recipient of one of SCF, Ltd.’s micro-loans Surprised by their products, she said *“Soafianarana’s products are unique because I have visited some artisanal groups, more point of sale, but I see that you are very creative and always have new ideas. I encourage you to continue the good work.”* She has found one of the products, a bag that was very special, so, she encouraged them to continue making others like it and suggested to always put natural colors, then to create big and small of this and put some drawing of special things of Ranomafana like lemurs, fish, wood, crayfish, butterfly and so on. At the end, the leader of the association has thanked her for her visit and her advice.



Fidy & Association PRIDE in Kelilalana

We continued to work with Fidy and his association PRIDE, promoting sustainable handicrafts hand-carved from wood and other natural products. In addition, for 2014, the group started to

work with a recycling program to use recycled bottles and plastics that are mixed with cement to create tiles for houses and pavers for gardens. While the procedure and design are under development, we are excited to promote recycled products in the community. Centre ValBio collects all of its plastics on campus and from our garbage management at Kianja Maitso in town that are provided to the group in Kelilalana. While some pilot products have been produced in 2014, Centre ValBio will continue to advise on design, quality and marketing of the products.

Ambatovaky Ironworkers

As part of an artistical trail under development, Centre ValBio started to promote visits and some support to an association of ironworkers in Ambatovaky (along the national road between Fianarantsoa and Ranomafana). The association primarily produces high-quality agricultural tools (e.g., shovels) and the process for which they do this is worth a visit. The association constructed a new demonstration site and sales point along the road to promote Ambatovaky and its handicrafts as a tourist destination. Centre ValBio is working with them to try to produce additional products that might be geared more towards foreign tourists.

Centre ValBio's Eco-shop

In addition to products from our local handicraft groups, Centre ValBio's eco-shop also promotes and sells products (both purchased and on consignment) from artist groups from Antananarivo, including Alexandrine (woven vetiver products), Nannie (metal sculptures), and Onja (embroidery and stuffed animals). Showcasing the local artists products, in particular, has been an important training for them to understand interest, design as well as functionality of products, for foreign markets. Centre ValBio adds a marginal mark-up to products to offset the cost of our staff designated to the artist groups, the PR material for the groups (ink and paper) and transport and purchase of materials.

B. Musicians

Local Musician Monthly Workshops & Performances (2014)

As part of the Art & Environments program, Centre ValBio launched a more formal partnership to work with and provide opportunities for the local musical and dance groups surrounding Ranomafana National Park as a means of diversification of jobs in the periphery of the park that could be geared not only to national but international markets. In addition to economic development opportunities, we encourage the artists to promote environmental and cultural preservation in Ranomafana. In particular, CVB works closely with four groups (*Ahay An'ala*, Ranomafana; *Bako-manitra*, Kelilalana; *Tsangan'ala* group from the village of Ambatolahy; and *Varijatsy* of Sambiviny).

Ahay An'ala = We are from the forest

- From Ranomafana village
- 3 members
- Acoustic and electric music including guitar and drums with both instrumental segments as well as a combination of vocals and instruments.

- Inspired by the forest of Ranomafana and more folk type nature in their work, transmitting messages of the forest, its biodiversity, and the Ranomafana region



Bako-manitra = Conservation of tradition

- From Kelilalana village
- Has about 20 members
- A youth group, consisting of both males and females, from the Kelilalina secondary school that works to promote youth to partake in secondary activities and leadership roles in the community through the performing arts.
- Their acts embody the preservation of traditional dance using costumes and props (for acoustics) reflecting the local culture. The males perform dance and acrobatic acoustic routines using dombolo (bamboo pieces) while the females harmonize on the side.



Tsangan'ala = local name for ring-tailed mongoose

- From Ambatolahy village
- Has 6 singers and 12 dancers for a total of 18 members
- A traditional group that consists of song, instrumentals and dance reflecting the Betsileo culture.
- The pace/rhythm of their music is known as the Horija



Varijatsy = local name of black & white ruffed lemur

- From Sambiviny village
- Has 1 singer, 2 musicians, and at least 2-4 dancers
- Youth group from the periphery in a village that had traditionally been known for poetry, song and strong collaboration in conservation.
- Dancers from the group Varijatsy accompany the band by dancing "trematremaky", the origin of the rhythm "kilalaky".



In 2013, Centre ValBio launched local artist performances geared towards the tourist community. This was way to give tourists additional entertainment while visiting Ranomafana as well as the opportunity to experience more of the local culture through music and dance. This is also an important venue to convey cultural preservation and environmental protection to the local and national community.

Every month coinciding with the high season in 2014, meetings and workshops were organized to work with the local artists to give them skills, confidence and management sessions about performing to the public and working together as an association of local artists. The goal is to empower these artists by offering a sustainable economic opportunity while preserving important cultural and traditional art from this region. Centre ValBio also helps to promote them through additional outlets by arranging public performances for tourists, researchers and students as well as the general public. Another mission is to have them work together to exchange ideas but also with visiting artists, both national and international, to learn more about song, dance, theatre, etc. from around the world and discuss how this can be great opportunity for the association to work on and share their skills and talents.



Centre ValBio designated some of its staff to make a concerted effort to continue to help work with the local artist association and prepare and publicize for marketing to tourists, student groups, researchers and the general public. The group also is important in capacity building of the artist association and has to support performances through audio-visual and facilitation support. In addition to the exchange between the artists groups themselves, visiting artists from throughout Madagascar and abroad, the staff serve to help improve the local artists confidence, performance skills, and sustainability.



In preparation for the high season in 2014, monthly workshops commenced in April 2014. The goal was to start early to see how the previous years of this program have went, and plan for the future as a collaboration between Centre ValBio and the local musician groups from the Ranomafana area. Also, sustainability and promotion of venues for the local association was discussed. Due to the funding from the U.S. Embassy, the local artists were able to launch their program in Ranomafana; however, this was an important year to now strategize about how to promote long-term sustainability and new avenues of income, dissemination of their song and dance, and exchange.

Similar to at the time of the local artist program was launched in Ranomafana. Each group was again interviewed to determine the group's situation (financial situation, material field, problem solving, reviews and solution proposal, wishes and opinions of the band to improve the collaboration with Centre ValBio). This also helps Centre ValBio assess if and how the program is progressing and what improvements can or need to be made. Moreover, Centre ValBio provided advice to help each of the groups remain unique yet develop to achieve their best. Our goal is to continue to provide them inspiration and begin to further improve their livelihoods through their creativity. Along with Centre ValBio's mission - this helps provide a sustainable development opportunity, but more importantly, a venue to preserve and transmit important cultural and environmental themes through song and dance.



To further motivate these artists, Centre ValBio decided to launch a competition between the four local artist groups. They were given approximately two months to prepare for the competition and were informed that in addition to further publicity, the winning group would also will receive a prize.

In addition, Centre ValBio continued to promote the local artists with organized performances open to the public as well as special events requested by our researchers or student groups. Transportation, small snacks and a stipend were provided to each of the groups with the intention that the association will also put some funding aside to help the long-term program sustainability. Centre ValBio also was able to provide additional support to the group through improving some of their costumes during performances as well as was able to utilize some of the audio equipment from previous support of the U.S. Embassy for the recording studio in Centre ValBio's Namanabe Hall. In addition, each 2 of the three groups participated in the traditional ceremony filmed in Ambatolahy village for CNN's Anthony Bourdain: Part's Unknown.

Local Musician Competition (June 1, 2014)

One of our goals was to give the local artists incentive and also more exposure, by arranging a competition given to the public, but also with a twist as it was in front of a 'jury'. This was a way to motivate the groups to think about the way they deliver their performances and to motivate them to practice their acts even outside of Centre ValBio's monthly workshops and scheduled performances to improve their stage presence. The objective to motivate artists and help them grow and develop their capacity and creativity while at the same time keeping with preservation of the local traditional aspects of their performance (song, choreography, uniforms, instruments, and music, etc.). After almost a year of monthly workshops and practice performances geared towards tourists and Centre ValBio's researchers, students and staff, the competition was held on June 1, 2014. Dr. Wright made the opening speech, and then the artists have taken over, and showed their talents. During the competition, each group picked one piece (song and/or song and dance) to perform in front of the jury, which included guest judges Ann Norton, Thomas Gillespie (CVB Board Member), and Michael HerrNSTein. Each group has its own specialty, according to its rhythm and its history. The performances commenced with the group "Ahay An'Ala", then the "Tsangan'ala" group from the village of Ambatolahy, the "Varijatsy" of Sambiviny, and finally, the "bako-manitra" group from Kelilalina. The winner, *Bako-manitra*, received Ariary 150,000, and the other three participating groups received 50,000 Ariary.



Singers and dancers from the traditional Ambatolahy Tsangan'ala group



Dancers from the group Varijatsy accompany the band by dancing "trematremaky", the origin of the "kilalaky" rhythm



Solo (guitar) and Benja (percussion) from the « Ahay An'ala » local artist group from Ranomafana



“Bako-manitra” the youth band from Kelilalina that won 1st Place in the competition!

Photos: Some of the Centre ValBio staff that work closely with the local artists as well as a youth audience member and guest judge who got in the spirit by joining the Kelilalana group as an honorary member!



With some continued support from the U.S. Embassy as part of our Artists and Environment collaboration, Centre ValBio continues to support monthly workshops, exchanges, and performances with collaborating local artists from the periphery of Ranomafana National Park. The four groups have seen great personal and professional group through the support over the last few years. Centre ValBio looks forward to working together to promote their skills and sustainability as a local artist association into the future.

C. Visiting Artists

Sangeeta Isvaran



In June 2014, an internationally renowned guest artist from India, Sangeeta Isvarana, also visited Centre ValBio. As part of our artist exchange program launched with the Art & Environment Program in collaboration with the U.S. Embassy, the goal of her visit was to have an exchange with the local artist groups in Ranomafana to share experiences of performing art as a sustainable and important career and venue to communicate. Following this exchange and several days of traditional Indian dance lesson sessions and workshops, Centre ValBio organized a public performance

in which Sangeeta performed not only for the local artists but also for local school children, Study abroad and researchers at the Centre ValBio, and Centre ValBio staff.



Photos: One of Centre ValBio's local musician groups from Kelilalana preformed as part of the opening guests for a public performance. This group includes traditional components of Antanala dance in their routines.



Photos: Varijatsy, local Artists from Sambiviny, perform original songs of traditional and environmentally inspired music and dance of the region



Zara Aina Artist Program (2014) at Centre ValBio

In 2013, the Zara Aina (meaning Share Life) came to Ranomafana in collaboration with the U.S. Embassy and Centre ValBio as part of the Artists and Environment program. Zara Aina was created by theatrical actors and professors from New York, USA. The founders were inspired to bring creativity, empowerment, skills and cultural preservation to underprivileged children in Madagascar. The core group of students that started with this non-profit as it launched in 2013 included inner-city children from Antananarivo, teaching them the art of theater. After one year of training under the supervision of a Malagasy leader, Dina, these children came to Centre ValBio to present the fruit of their work and inspire the expansion of the project to children in rural Ranomafana.

In August 2014, about 150 schoolchildren from the village of Ambodikimba-Ranomafana came to work with two representatives from "ZARA AINA", an organization of American actors from New York City, headed by Mr. Lucas Caleb Rooney. The organizations mission is to offer children in Madagascar the tools to succeed as students and storytellers by delivering school supplies to their villages and producing their original works of theatre. They have been working in collaboration with Centre ValBio since 2013. According to Lucas, they are actors and theater performers, the team leaders work to educate and empower children through cultural arts such as dance, songs, stories, tales, and folklore. *"We like the stories and tales from Madagascar, which has really impressed us, is the story of Ikotofetsy sy Imahaka"*. In a continuation of an exchange initiated between Centre ValBio and American students started several years ago, Zara Aina also is helping to create and facilitate communication between the children from the USA and those of Madagascar. Zara Aina worked with children in Rhinebeck, NY to produce a video that shows children saying "Hello" to Malagasy schoolchildren that was shared with the Ranomafana children during their visit to Centre ValBio. *"We traveled to the village of Rhinebeck, New York. We asked two hundred 11-13 year old children to say HELLO to the children of the village of Ranomafana. The children of Rhinebeck hope you will send them a message in return"* said Mr Rooney.

Photo: Children from Rhinebeck, New York send a greeting to Ranomafana schoolchildren to make the exchange even more personal



Photos: Ranomafana children are excited to see their greetings from their friends in New York, USA. After the U.S. Greeting, the students in Ranomafana produced a similar greeting video of “Salama” to show to their friends in New York.



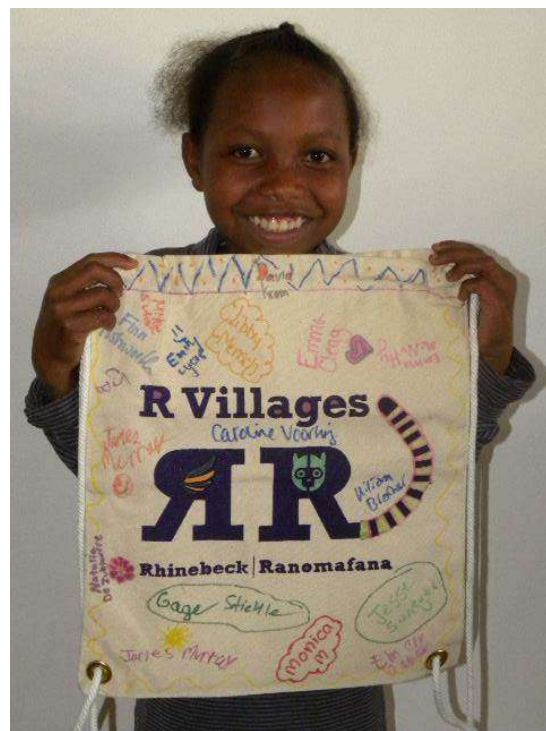
Thirty children from Ranomafana were selected to launch the local branch of Centre ValBio’s Zara Aina collaboration. The theatre teachers worked with the children to learn about storytelling, acting, etc. They also created a story that would reflect the environment and biodiversity that makes Ranomafana so special. After training, the children then debuted their act at Centre ValBio to a public audience, including their parents and peers. Centre ValBio’s education team also continues to work with this group to create more skill training, and artistic and theatrical avenues to promote environmental and cultural preservation in and around Ranomafana National Park.

Photos: Ranomafana schoolchildren learning theatrical exercises and teamwork skills from the Zara Aina teachers in preparation for their public performance.



Following a performance by the local children participating in the Zara Aina program, Susan Findel delivered some cynch sacks donated and decorated by the children from Rhinebeck with little notes for their friends in Madagascar during her visit in August 2014.

As you can see below, the reaction by the children was priceless and these gifts will continue to be treasured by the local children in Ranomafana.



VII. Project and Collaboration Development

Ambatolahy dimy Land Acquisition

During the past year Pascal Rabeson and Patricia Wright have been working with 17 landholders from Ambatolahy who own land at Ambatolahy dimy (see above under research). These 17 plots of land are adjacent to our Centre ValBio property on the north side of the road. Pascal has been working with the Office of Land Deeds to assure that everything is legal about the purchase. The first step was the surveying, which is complete. The next paperwork was delayed by the December and January holidays. We are optimistic that the ownership of the 17 hectares will be officially transferred to Centre ValBio/MICET in 2015.

Ambatolahy Village (Ranomafana Commune) Electricity Project

Ambatolahy fokontony has been one of the first villages to work with the Dr. Wright, however, are still among the nearby villages without electricity, despite power lines running over their heads. After several years of discussions, Centre ValBio finally was able to make progress and convince JIRAMA to work with us towards getting the village of Ambatolahy on the electrical grid. Unfortunately, due to the exorbitant costs of hooking up Ambatolahy alone (\$26,807 at a \$1=2,500 Ariary exchange), the rest of the fokontony will have to wait for electricity at this time. Dr. Patricia Wright has committed to providing \$10,000 and Dr. Stacey Tecot, University of Arizona Assistant Professor, secured funds for an additional \$8,000. The remaining funds needed to initiate the instillation was in the amount of \$8,807. Throughout the year, we also worked with the community to determine how JIRAMA, local hotels or entities, or the commune might contribute to offset costs as their contribution. CVB has worked closely with the mayor and the Chief of Sector from JIRAMA to initiate the process, finalize and reduce price quotes, secure suppliers and also secure local funding. JIRAMA gave an estimate of the needed materials and equipment for the electricity installation in Ambatolahy as well as supplier contacts, for which we found the most reliable and affordable option. By the end of 2014, JIRAMA agreed that the current commune electricity tax paid to JIRAMA will go towards the rest of the costs – with a contribution towards the instillation of electricity in Ambatolahy amounting to \$6,772 (16,930,440 Ar)! Dr. Tecot is trying to secure the remaining \$2,035. The final negotiations and fund transfers will take place in the beginning of 2015 and we anticipate that Ambatolahy will be on the electrical grid by mid-year.

Northern Forest Monitoring and Assessment

One of CVB's new priority areas is a 10,000 hectare unprotected forest just north of RNP. This area is still under intense pressure from mineral mining (rubies), gold mining, and slash-and-burn agriculture. In late 2014, two fragments within this forest parcel were officially transferred as COFAV's (community run areas) with the assistance of the District water and forest office and Conservation International. The District water and forest office has asked Centre ValBio to continue our work in this area and especially to begin working with the two new community run programs in 2015 hopefully assisted by USAID funding. In addition to continuing research in this area, Centre ValBio plans to extend its participatory ecological monitoring project, in addition to health and hygiene programs to this area for 2015. In late 2014, Dr. Wright met with the CI-Antananarivo office, which was responsible in initiating the transfer of management to the

local communities along the entire corridor (and for who Centre ValBio had consulted for in previous years establishing Community run monitoring systems). Centre ValBio will continue to work closely with the regional CI office in Fianarantsoa, in particular, to collaborate on management strategies for this area.

Prospect for an Amphibian Breeding Center and Chytrid Screening in Ranomafana

Following a visit from Jeffery Dawson (Durrell) in late 2013, discussions continued regarding the potential to create a regional amphibian captive breeding center on Centre ValBio's campus. Valerie Clark was awarded a seed grant by AmphibianARK to begin exploration of the feasibility of new captive breeding center in Ranomafana. Logistical and financial concerns regarding facilities and husbandry were discussed with captive breeding experts and Centre ValBio staff (Patricia Wright, Eileen Larney, and John Cadle) during the ACSAM2 meeting. Despite the daunting task of creating and maintaining a breeding facility, Centre ValBio is well suited to host such a regional hub due to the high amphibian biodiversity in the park, the existence of chytrid from initial analysis, and the distance from other breeding facilities (e.g., Mitsinjo) in the event of an emergency. Thus, we will be exploring this potential and begin planning development and seeking funds in 2015.

Sahavoemba Relief Efforts

One of Centre ValBio's health outreach villages, Sahavoemba that is located in the southeast periphery of the park was attacked by bandits in mid-November. During the lean times of the year, the villagers are sometimes panning for gold as a source of income. One family in particular was known to purchase some gold and was then a target for an attack by the bandits. When the local villagers retaliated, the bandits set fire to one of the houses to distract and get one of their injured people out. The thatched roofs caught fire and resulted in burning 39 thatched roof houses to the ground, affecting 41 households including 219 people (98 adults – 47 males/51 female and 121 children (61 male/60 female). Only two houses remained – one that was upwind a distant from the rest and another with a tin roof.



We assessed the major needs for relief efforts with the local leader, commune of Ranomafana and PIVOT. PIVOT distributed the first relief drop of food and supplies and Centre ValBio organized a second food drop just before the holidays. Additional plans for construction and food relief are planned for early 2015 and Centre ValBio hopes to coordinate closely with PIVOT to ensure the most efficient assistance program. In addition, Centre ValBio will continue to work with the villagers with our mobile health clinic and conservation education outreach and brainstorm about alternatives sources of revenue to small scale gold mining to ensure future security and livelihoods. One potential incentive to participate in conservation and sustainable alternatives is to offer an agreement with the villagers in exchange for tin roofs.

VIII. Scientific Tourism

Centre ValBio's Scientific Tourism Program expanded substantially in 2014. Similar to other years, Centre ValBio receives casual tourists that happen to be visiting Ranomafana and stop by to inquire about our activities. This is often through suggestions from local Ranomafana tour guides or after reading about Centre ValBio in Bradt's Madagascar guidebook. In 2014, we also received several tourists that wanted to see specific parts of Namanabe (especially the lab) after seeing the IMAX movie. We made a more concerted effort in 2014 to promote more formal tours and advanced reservations. We also promoted 'Scientific Tourism' by offering more diverse activities in collaboration with both national and international tour agencies as well as by word of mouth. Centre ValBio formed collaborations with both National Tour Agencies (Dodo Travel, Madagascar Chameleon, Madagascar Grace Tours, Remote River Expeditions, Tamana Tours, Trans Continent, Wilderness Travel, and Za Tours) as well as International Tour Agencies (Sierra Club and Wildlife Worldwide). Through these efforts, we attracted over 349 individuals from 14 countries for a total of 220 station usage days. Through our various activities, Centre ValBio generated almost \$12,000 in revenue through visit fees, lectures, meals, and program and lodging fees.

Scientific Tourism programs varied from one activity for one hour (e.g., tour or lecture) to several activities over the course of a week. In addition to biodiversity and conservation lectures and tours of Namanabe Hall, Centre ValBio also offered diversified options for half, full and multi-day programs. Additional programs included reforestation sessions, which included learning about native tree reforestation efforts, sowing seeds in our campus tree nursery, and planting saplings to promote tourist involvement in contributing to greening Madagascar. Centre ValBio staff also guided tours to visit our local handicraft groups, the medicinal plant plantation in town (Mahatsarabe), and the arboretum. Longer programs also included participation in biodiversity research on lemurs, in particular, as well as visits to our conservation projects in villages around the park.

Opening our doors to tourism was a new avenue for income generation and publicity for Centre ValBio. These efforts have taken a considerable amount of senior staff time and usually coincide with our busy season. In addition, we are only beginning to understand the tourist perspective in terms of interest and continue to work on expanding our programs and quality of service in this domain. That being said, 2014 proved that continuing to expand this type of service holds great potential for interest and income generation. From our experience, these visits can also stem into continued interest and support for our programs.

In addition to our tourism agency related programs, Patricia Wright encouraged several special guests to visit Centre ValBio and Ranomafana during 2014, including the following:

- Nancy Reposa
- Alan & Fran Root
- Dorothy Litchenstein
- Jeff Rudolph (California Academy of Sciences)
- Mr. Recipe – to explore vanilla & peppercorn agroforestry
- Glenn Bush (Wood's Hole Research Institute) – to explore REDD+ possibilities
- Susan Findel and Eric Lichtness

IX. Film

In addition to national journalists visiting the centre throughout the year, Centre ValBio also hosted several international film crews again in 2014, including the following:

Indianapolis Prize (May's Entertainment)

2014 was launched with a crew from May's entertainment to film components of Patricia Wright's story and achievements in Madagascar that was debuted at the gala in which she was awarded the 2014 Indianapolis Prize.

CNN Part's Unknown

In December, Anthony Bourdain and the CNN crew of the series Part's Unknown joined Dr. Wright and village elders to film a traditional ceremony asking the ancestors for their permission to move forward with the purchase of the Ambatolahydimy land purchase. The segment is expected to debut in spring 2015.

IMAX Premier

In addition, the premier of IMAX Madagascar: Island of Lemurs was debuted on March 31 in California and then in New York. Desire Randrianarisata, Centre ValBio's head of Logistics and Audio-visual, and Benjamin Andriamihaja, ICTE National Representative, were both supported by IMAX and ICTE to attend the red carpet depute in Los Angeles and New York to reward their logistical support during the filming.



X. Events

World Lemur Week

A major event of this year was participating in the launching of the first celebration of World Lemur Week in Ranomafana from October 25-31, 2014. Different activities were organized jointly between CVB and other partners in Ranomafana including the Commune of Ranomafana and Madagascar National Parks to celebrate this day with festivals, debates, sports, performances by local artists, biodiversity films, and closing with a dance the last evening in the town hall.



ACSAM 2: A Conservation Strategy for the Amphibians of Madagascar – 2

Centre ValBio hosted its second international conference, A Conservation Strategy for the Amphibians of Madagascar (ACSAM-2), from 17-22 November (ACSAM-1 was held in 2006 in Antananarivo). Seventy-two amphibian biologists and conservationists from ten countries assembled at Centre ValBio to assess the current conservation status of Madagascar's amphibian fauna. Representatives of all major NGOs concerned with amphibian conservation in Madagascar attended, as did the Director General of the Madagascar Ministry of Water and Forests, the Director of Ranomafana National Park, and representatives of the IUCN, AmphibianArk, Durrell Wildlife Conservation Trust, Madagascar Faunal Group, Vahatra, Mitsinjo, and other conservation organizations. Eileen Larney and John Cadle of CVB served on the local organizing committee. The meeting was timely because in 2014 two discoveries that could have a major impact on amphibian populations in Madagascar were made: the presence of the amphibian pathogen *Batrachochytrium* (chytrid fungus) was confirmed in Madagascar, and populations of an introduced highly invasive Asian toad (*Duttaphryne melanostictus*) were discovered near Toamasina on Madagascar's east coast. These are potentially grave threats to Madagascar's frog fauna and the toad is a potential threat to many other components of the native fauna.

Participants at ACSAM-2 had lively discussions on topics of direct import to developing a conservation strategy for Madagascar's frog fauna: species status in the wild, mitigation efforts, disease ecology, captive breeding potential, and the impact of invasive species. By late

December 2014 a draft action plan had been circulated for comment and revision. The action plan targeted specific goals and timetables centered on seven major areas relevant to conservation efforts: (1) coordination of research and conservation activities; (2) development of standardized population monitoring programs across Madagascar; (3) basic research on emerging amphibian diseases in Madagascar and mitigation possibilities; (4) basic research on climate change effects; (5) management of focal amphibian sites for conservation; (6) assessment of harvesting and trade of amphibians; (7) captive breeding and zoo actions. Ranomafana National Park, with the highest known species diversity of amphibians in Madagascar (about 129 species), was a focus of much attention as the protected area with greatest species diversity and greatest capacity to quickly implement monitoring and research efforts. Centre ValBio is poised to lead in these efforts for amphibian conservation.

International GIS Day Celebration

Following the GIS training in the U.S., Centre ValBio applied for membership as an institutional partner in the national Society for Conservation in GIS (SCGIS). As part of the SCGIS national Malagasy chapter and the fellowship responsibilities, Centre ValBio lead in organizing the first national GIS day celebration held on November 28, 2014 in Antananarivo. The workshop brought together several organizations utilizing GIS techniques and presented the utility of this work via oral presentations and posters.

XI. Conferences, Trainings & Workshops

External Workshops And Meetings Held At Centre Valbio During 2014

- WWF Workshop*, Centre ValBio, Ranomafana, Madagascar, April 16-17, 2014: WWF.
- Local Comity of Planification, Tandavanala Fianarantsoa*, Centre ValBio, Madagascar, July 22, 2014: Tandavanala Team.
- USAID visit*, Centre ValBio, Madagascar, July 16, 2014: USAID, PIVOT, CVB, MNP, CSA, CDC, NGOs.
- Meeting about collaboration with FJKM Ranomafana*, Centre ValBio, Madagascar, July 29, 2014: FJKM.
- Reinforcement of security in Ranomafana*, Centre ValBio, Madagascar, October 14, 2014: PIVOT, MNP, Commune, Rianala Gite, Forêt Australe, Ambodiamontana, Ambatolahy, Gendarme.
- International Amphibian's Conference (ACSAM 2)*, Centre ValBio, Madagascar, November 18-22, 2014: Ministry of Environment, NGOs, and researchers.
- Collaboration with the University of Fianarantsoa*, Centre ValBio, Madagascar, December 12, 2014: University of Fianarantsoa Professors from the Department of Sciences, Drs. Patricia Wright, Eileen Larney, John Cadle, and Jean Claude Razafimahamaodison.

Sample of External Workshops and Meetings Centre ValBio Staff Participated in During 2014

- Meeting with Madagascar National Parks*, Antananarivo, Madagascar, January, 2014: Dr. John Cadle.
- Planning about CVB and Pivot Collaboration*, PIVOT Ranomafana, Madagascar, January 15, 2014: Dr. Patricia Wright, Dr. John Cadle, Pascal Rabeson, Dr Herinjaka Andriambolamanana, Prisca Andriambinintsoa, Dr Michael Rich, Amber, Tara Loyd.
- Memorandum Of Understanding (MOU) between CVB and Pivot*, Pivot Ranomafana, Madagascar, February 10, 2014: Pascal Rabeson.
- Reflexing meeting of ONG Santé Mobile*, Ranomafana, Madagascar, February 17, 2014: Dr Herinjaka Andriambolamanana.
- Regional Reforestation*, Analavory Manakara, Madagascar, February 22, 2014: Jean Némèse Randriarimanana, Talata Jean Lucien.
- Preparation of World Womens Day (8th March)*, Ranomafana, Madagascar, February 23, 2014: Heritiana Anne Louissette.
- Quick books training*, MICET Antananarivo, Madagascar, February 23-26, 2014: Andriambinintsoa Prisca, Rakotovelo Lovaso, Jaoferalijaona Safidiniaina.
- Collaboration between CVB and UNICEF*, Antananarivo, Madagascar, March 13, 2014: Dr. Eileen Larney and Pascal Rabeson.
- Ampanjaka meeting*, Ranomafana, Madagascar, March 14, 2014: Florent Ravoavy.
- Gendarme exhibit*, Ranomafana, Madagascar, March 14, 2014: Dr. Jean Claude Razafimahamaodison.
- Studio equipment at CVB*, US Embassy, Antananarivo, Madagascar, March 14, 2014: Eileen Larney, Pascal Rabeson, Desire Randrianarisata.
- Comité du Développement Communal (CDC)*, Tranompokonolona Ranomafana, Madagascar, March 19th, 2014: Ravoavy Florent.
- IMAX Film Premier*, New York, USA, April 1-18, 2014: Randrianarisata Désiré.

Inauguration of KARIBOTEL, Ranomafana, Madagascar, April 2, 2014: Dr. John Cadle, Rabeson Pascal.

TEAM report supervision, Centre ValBio, Ranomafana, Madagascar, April 14, 2014: Mme Alida from CI Fianarantsoa, Rakotovelov Lovasoa.

Using Kit Mad'ere in Environmental Education, Antananarivo, Madagascar, April 23-26, 2014: Laza Rehodo Soloniaina.

Regional Reforestation, Analavory Mananjary, Madagascar, May 9, 2014: Ravoavy Florent, Rakotonirina Paul, Talata Jean Lucien.

Lycée Kelilalina Inauguration, Kelilalina Madagascar, May 10, 2014: Randrianarisata Désiré, Rabeson Pascal, Andriambinintsoa Prisca, Dr. John Cadle.

Catholic Church Inauguration, Ranomafana, Madagascar, May 11, 2014: Dr. Razafimahamaodison Jean Claude, Andriambinintsoa Prisca.

Inspection de travail meeting, the law for OSIER, JIRAMA Ranomafana, Madagascar, May 23, 2014: Andriambinintsoa Prisca.

World Environment Day (JME) preparation of celebration, Kianja Maintso Ranomafana, Madagascar, June 4, 2014: Andriambinintsoa Prisca, Dr. John Cadle.

Infectious Disease and Health Team activities, Institut Pasteur, Antananarivo, Madagascar, June 6, 2014: Dr. Patricia Wright, Dr Andriambolamanana Herinjaka.

World Environment Day (JME) Celebration, Ranomafana, Madagascar, June 24, 2014: Randrianarisata Désiré.

Geographic Information System (GIS) training, Society for Conservation in GIS (SCGIS) for conservationist in the world in using GIS through communication, networking, scholarship and training, University of Davis California, June 6-July 7, 2014: Rabeson Pascal.

Conference in Asilamor Monterey California, for conservationist in the world in using GIS through communication, networking, scholarship and training, California, USA, July 7-20, 2014: Rabeson Pascal.

Esri User Conference in San Diego, for conservationist in the world in using GIS through communication, networking, scholarship and training, San Diego, California, USA, July 7-18, 2014: Rabeson Pascal.

Independence Day Celebration, Ranomafana, Madagascar, June 26, 2014: Ravoavy Florent.

Rehabilitation of Thermal Station Ranomafana, Kianja Maintso Ranomafana, Madagascar July 18, 2014: Maminirina Miora Henintsoa.

Pollution, waste in Ranomafana, Tranompokonolona, Madagascar, August 11, 2014: Ravoavy Florent, Heritiana Anne Louisette.

Rural development CMP, talking about CORRIDOR, Ranomafana, Madagascar, August 8, 2014: Claude Jacquot Ralazampirenena.

Ivo Fanoitra meeting, talking about trade, Ifanadiana, Madagascar, August 19, 2014: Dr. Razafimahamaodison Jean Claude.

Consultant KINOME, finance evaluation of MNP, Ranomafana, Madagascar, September 13, 2014: Dr. Patricia Wright, Dr. Eileen Larney, Randrianarisata Désiré, Rabeson Pascal.

USAID collaboration, Antananarivo, Madagascar, September 17, 2014: Dr. Patricia Wright.

WCS collaboration, Antananarivo, Madagascar, September 19, 2014: Dr. Patricia Wright.

Trade and development, Ministry of Trade, Coin d'Or Ranomafana, Madagascar, September 19, 2014: Razanakolona Santatriniaina.

PIVOT information and activities, Centre ValBio, Ranomafana, Madagascar, September 26, 2014: All CVB Staff.

Eighth of March Association, Tranompokonolona, Ranomafana, Madagascar, October 4, 2014: Razanajaona Mariette.

EPP Sahavondronina Inauguration, VOI, Sahavondronina, Madagascar, October 10, 2014: Ravoavy Florent.

“Fête des Simus” MNP, Tsaratanana, Ifanadiana, Madagascar, October 11, 2014: Randrianarisata Désiré.

Preparation of the celebration of “Santé de la mère et enfant”, PIVOT, Tranompokonolona, Ranomafana, Madagascar, October 17, 2014: Rakotoarisoa Miarintsoa Fara Nantenaina.

WWF, WCS, and CI’s Madagascar Environmental Address, Hotel Colbert, Antananarivo, October 24, 2014: Dr. Eileen Larney and Pascal Rabeson.

Celebration of “Santé da la mère et enfant” Health ministry and PIVOT, Ranomafana, Madagascar, October 27, 2014: Rakotoarisoa Miarintsoa Fara Nantenaina.

CNAPS training: Goals, advantage of CNAPS, Ranomafana, Madagascar, October 28, 2014: Andriambinintsoa Prisca.

Forest Inventory Results and Analysis of deforestation for Vatovaby Fitovinany, SIDI Hotel, Manakara, Madagascar, November 5, 2014: Pascal Rabeson.

Oral examination for thesis, ISTE Fianarantsoa, Madagascar, November 22, 2014: Dr. Razafimahamaodison Jean Claude.

HONORIS CAUSA of Dr. Patricia Wright, Andrainjato, Fianarantsoa, Madagascar, November 24, 2014: CVB Direction, CVB Staff.

GIS Day Celebration, Madagascar SCGIS Chapter. CAS, Antananarivo, November 28, 2014: Pascal Rabeson (co-organizer).

Forest Mapping and Monitoring as local conservation tools in Madagascar, FANC, Café de la Gare, December 1, 2014: Pascal Rabeson.

Protected area management effectiveness, MNP and University of Helsinki, Antananarivo, Madagascar, December 4, 2014: Pascal Rabeson.

Activities restitution, PIVOT, Karibotel Ranomafana, Madagascar, December 4-5, 2014: Drs. Patricia Wright, Eileen Larney, John Cadle, and Ravoavy Florent.

Nagoya Protocol, Ministry of Environment, Ecology and Forests, DLL, Antananarivo, Madagascar, December 11, 2014: Dr. Eileen Larney.

USAID 30th Anniversary, Panorama Antananarivo, Madagascar, December 12, 2014: Drs. Patricia Wright and Eileen Larney.

XII. Construction & Information Technology

Construction

Centre ValBio was relatively quiet in terms of construction during 2014.

While Centre ValBio's Namanabe Hall has been more or less functional since 2013, there still remains some issues with the building that the need to be addressed. A final walkthrough of Namanabe Hall was conducted in November to address outstanding issues (please see Appendix 5 for walkthrough notes), although the work has yet to be finalized. We are hoping that the majority of the building will be completed in early 2015. However, it still remains unclear how and when the clean laboratory space on the bottom floor of Namanabe will be reconfigured. There were several exchanges among CVB Board Members regarding design options provided by Kornberg Associates, although a final resolution was never reached.

In addition, we began the initial planning for the new biodiversity laboratory construction. An initial meeting to brainstorm about what components should be included in the biodiversity laboratory involved Steig Johnson, Eileen Larney, John Cadle and Pascal Rabeson. A summary of main points during the meeting and potential construction options were compiled (Appendix 6) that provided guidance for Ali from InSite Architecture to sketch a first draft of plans for the new biodiversity laboratory (Appendix 7). Later in the year, another meeting was held with Robin Herrnstein, Patricia Wright and John Cadle to further discuss the pros and cons of the design and optimal utilization of the space.

Information Technology

Overview

Centre ValBio has undergone major modernizations in 2014 to its I.T. infrastructure. Over the last year we have completed the high-speed internet connection and deployed the internal network. CVB has hired its first dedicated I.T. person Jesse McKinney for one year to function as head of technology and I.T. systems. Toward the end of 2013 and the beginning of 2014 we finished installing audio visual (A/V) systems in two areas of CVB, with a third area in the cafeteria currently being installed. The library now features four computer lab computers, as well as a dedicated ArcGIS computer. Almost every staff computer in LovaBe now has a wired network connection bringing much needed network reliability to our staff. CVB has also completed and submitted two technology- focused grants over the last year.

2014 Project Summaries

IT 1.1: High Speed Internet

Linking CVB to the rest of the world is important to its growth as a research campus. At the end of 2013 and beginning of 2014, we saw a major steps forward in accomplishing this with the completion of CVB's microwave based network connection funded mainly through an NSF grant awarded to Dr. Mark Krasnow (Stanford) on CVB's behalf. This system has proven invaluable in the last year for research and administrative purposes. It has also been a major attractant for

secondary programs that help fund CVB such as conferences, events, media crews, and visitors / scientific tourists.

The internet connection currently functions at a maximum speed of 2Mbps (synchronous) and in 2014 has had an 87% uptime. Downtime events typically were caused by repeated failure of a switch in Ambatolahy network tower that our ISP TELMA has been reluctant to replace. On average we have 29 devices on the network with the yearly record reaching 111 devices on the network at once during the ACSAM herpetology conference.

Although our internet connection and internal network are functioning, there is much room for improvement in this area. The current 2Mb/s connection can sustain around 20-30 users at a time without noticeable lag in web browsing / email. Given that CVB had on average 29 concurrent devices on the network at any given time we have already begun to outgrow our existing connection. This "slow" by modern standards connection was recently discussed by a number of panelist as the major reason in denied funding for a National Science Foundation (NSF) grant CVB wrote to overhaul our internal network and establishing a secondary "research only" network at CVB. In addition, as the world becomes more and more connected, bandwidth requirements per device increase linearly at a rate of around 50% per year. In order to keep CVB competitive in research we must be planning now to increase the connection speed to keep pace with demand.

Although the majority of installation funding was provided through the Krasnow / NSF grant. Our monthly fees, which must be paid for the remainder of the contract term of four more years, are about \$6000 a month. Of that, \$4000 a month is covered through the Krasnow grant or an endowment from the TELMA foundation. This leaves \$2000 in currently unbudgeted expenses for CVB to pay each month. As will be discussed in the PTA section of this report (IT 2.1) CVB currently does not have a funding mechanism to cover this \$2000 monthly shortfall.

IT 1.2 --Internal Network

CVB started construction on its internal network in late 2013 and major sections have been completed in 2014. It currently consists of five HP 2920/24 network switches connected to a Untangled UTM box which manages internet connectivity coming from a microwave dish. All switching fabric is running at 1Gbs. This is pictured in Figure 1. Two D-link unmanaged switches serve as access level switches providing wired connectivity to the wall outlets in NamanaBe. A Ubiquity Networks "Unify" WIFI system provides wireless coverage throughout CVB. CVB currently has one converted desktop acting as it's file and application server. This hosts all shared network resources, database, WIFI management console, RADIUS server, security camera system, and a file backup system. A new server purchased in 2014 will soon take over as the application server as well as act as a database and internal web server. As of now CVB has wired network connections in 93% of all offices and WIFI covers about 85% of the campus.

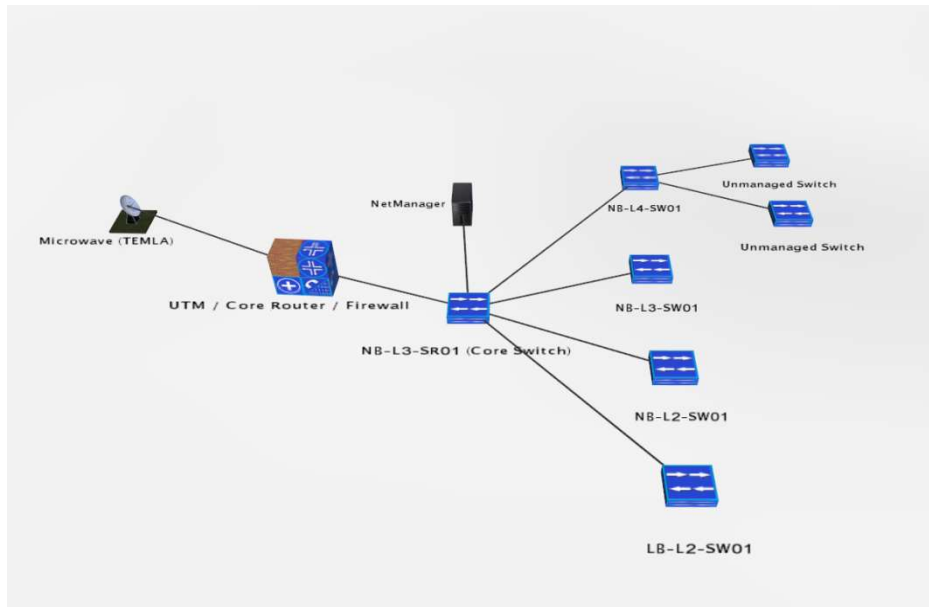


Figure 1.2.a | Current 2014 Core Network

Because funding this project extremely tight in 2013-2014, it was decided that priority would be given to buying the most vital equipment such as the network switches immediately and finding funding to implement "best practices" at a later time. This means that although the CVB network is functional, things you would find in any other modern network do not yet exist in CVB's network such as network racks (enclosures to protect the equipment), re-using old obsolete hardware such as the unmanaged switches running the wired network in NamanaBe, and backup / redundant systems. Even things like network patch cables which cost between \$1-\$3/piece to buy prefabricated were all made by hand at great hourly expense because funding was not available to buy them premade. It is important that funding be identified to maintain this network that is now heavily relied on for administration and research purposes.

In 2014, CVB I.T. submitted an NSF CC*IIE grant to fund completing the core network bringing it up to core I.T. standards as well as fund an experimental ultra high speed, 100Gbs+, research only network at CVB. In September of 2014 we received word that the grant funding was denied because the panelist felt that our internet connection was too slow to justify funding internal network changes at CVB. The main recommendation was to get a faster connection and then resubmit the grant for the internal network upgrades.

IT 1.3 --I.T. Personnel

In September 2014 ICTE (CVB) through SBU hired its first dedicated I.T. staff member Jesse McKinney to function as head of Technology and I.T. at half-time for one year. Jesse has 15 years of professional I.T. experience in a wide range of technology fields such as software and database programming, hardware design and fabrication, industrial design, computer and server administration, user experience design, and industrial robotics. Prior to his appointment Jesse served as a Peace Corps I.T. volunteer and helped CVB on a volunteer basis from 2012-2014.

Appendix 1: Summary of 2014 Research Projects Conducted at CVB

Organized by PI's Last Name

** Note: all projects are not abstracted*

Biology and conservation of *Astacoides* (native freshwater crayfish) in Ranomafana National Park

Garshaw AMIDI-ABRAHAM (Stony Brook University, postgraduate)

Among Madagascar's understudied freshwater fauna, the crayfish genus *Astacoides* is perhaps both the most threatened and economically important. The main threats are anthropogenic, including the introduction of exotic species, habitat loss and overharvesting. The need to protect these species is urgent; anthropogenic pressures are increasing and the loss of these species may severely impact rural economies. IUCN data for *Astacoides* is limited. Most of the species are threatened or understudied; *A. petiti*, *A. madagascarensis* and *A. hobbsi* are IUCN data deficient, *A. betsileoensis* and *A. caldwelli* are endangered and only *A. granulamanis* is least concern. I will conduct crayfish surveys around RNP and surrounding villages. For each encounter, the names of the streams, GPS, substrate, water quality (dissolved oxygen, calcium, pH), morphological measurements, canopy cover, elevation, stream depth and width at capture point will be recorded. Streams in deforested, agricultural, catchment and mined areas will be sampled in addition to streams in primary and secondary forest. Relative abundance will be measured by calculating a unit of effort with timed searches. The main focus for the first three months of this study will be on biodiversity surveys and assessing various anthropogenic forces affecting the park. This will take place between September and December. Water quality measurements will not only provide information on how mining and other damaging activities are affecting crayfish habitats, but it may also provide useful information for the later aquaculture component of the study in determining optimal water conditions and potential aquaculture species. The need to research these crayfish is time sensitive; anthropogenic pressure is unrelenting, people continue to go hungry around the park and endemic crayfish populations continue to dwindle.

Socioeconomic inequities in early pregnancy, age at marriage and contraception use in Madagascar

Meghana ANUGU (Stony Brook University School of Medicine, M.D. Candidate, *CVB Student Internship)

According to data from the 2008-2009 Demographic and Health Surveys from Madagascar, nearly half of women surveyed were married by age 18.9 years, 32% of women between ages 15-19 have begun childbearing, and only 29% of currently married women ages 15-49 are using a modern method of contraception. Given the limited literature of recent data surrounding early pregnancy age, early marriage and contraceptive use for the general population in Madagascar, particularly in a health equity lens, I aim to study the determinants of these parameters. Data for the study will come from Standard Demographic and Health Surveys (DHS), which is funded by the U.S. Agency for International Development (USAID) and implemented by ICF International. The DHS are large, nationally representative cross-sectional surveys that collect a wide-range of data in the areas of health, population and nutrition in over 90 countries. I will analyze data from

the women's questionnaire, which is administered to women ages 15 to 49, and includes information on background characteristics, reproductive behavior and intentions, and contraception. The main outcomes of interest are contraceptive use, early marriage, and early pregnancy. If time permits, I plan to conduct key informant interviews to contextualize the findings of my quantitative analysis. There have been many changes since the last DHS was conducted in 2008, particularly given the coup and the resulting withdrawal of much international aid. Key informants will help identify areas of need for future programming and provide information regarding whether my estimates will be upper bounds due to decreased funding and services since the coup. It will be imperative to replicate these analyses when a new DHS is conducted. Key informants will include health workers (formal and lay), community leaders (including leaders of women's groups), and NGO staff.

Mitigating the potential extinction crisis of Malagasy frog communities from chytridiomycosis: Selection of probiotics that inhibit *Batrachochytrium dendrobatidis*

Molly BLETZ (Ph.D. candidate, James Madison University/ Technische Universität Braunschweig), Falitiana Rabemananjara (Chytridiomycosis Working Group), Che Weldon (North-West University, South Africa), Serge Ndriantsoa (University of Antananarivo)

Recent work has shown that some species of amphibians' skin bacteria inhibit the lethal amphibian pathogen *Batrachochytrium dendrobatidis* (Bd) (Harris et al. 2006; 2009a,b; Muletz et al. 2012). Bd causes the disease chytridiomycosis, which has caused widespread amphibian declines and extinctions around the world. Anti-Bd skin bacteria isolated from amphibians can be used as a probiotic to inhibit Bd. Indeed, defensive skin microbes are the only line of amphibian defense that is not directly host produced and has been successfully manipulated to mitigate disease. Sampling of amphibians will take place in various locations in Madagascar in order to obtain a sample of protective skin microbes from our target endangered and threatened species and from members of the three major families (Mantellidae, Microhylidae, Hyperoliidae). We will sample, collect and identify effective antifungal probiotics from Malagasy amphibians to target critically endangered species and at-risk amphibian communities. A proactive plan is necessary to protect currently endangered species and to prevent widespread species declines and extinctions. We have developed two treatment strategies that involve augmenting amphibian-derived, locally-occurring anti-Bd skin bacteria onto susceptible amphibian hosts. The first strategy is a species-specific strategy that focuses on treating individuals of endangered species with probiotic baths. The second strategy is a community-based strategy that targets amphibian assemblages by treating ponds or local areas with a locally-occurring community-based probiotic that is effective for multiple amphibian hosts. Anti-Bd bacteria can be transmitted from soil and water to amphibians. Our species-specific and community-based strategies to develop effective amphibian probiotics are divided into five and six phases, respectively. At the end of phase two, we will have the following product: a collection of Bd-inhibitory isolates that are probiotic candidates for protecting critically-endangered species with species-specific probiotics and for protecting phylogenetically diverse amphibian assemblages with community-based probiotics. We plan to complete the remaining phases with additional funding. With our established collaborations in Madagascar, environmental persistence (phase 3) and host colonization and persistence trials (phase 4) can be accomplished using in-country ex-situ conservation facilities, such as those at Association

Mitsinjo. This collaboration will involve local university students in the development of effective probiotics. Clinical trials (phase 5) will be completed outside of Madagascar, using biosecure international zoo breeding colonies. The final product will be effective probiotics that can stem Bd spread when it arrives in Madagascar and therefore potentially prevent the massive Bd-associated amphibian extinctions that were seen in Central America.

Bat's in Madagascar: Health Hazards or food security assets

Mar CABEZA, Kati Suominen (University of Helsinki), Christoph Meyer (University of Lisbon), Daniel Rakotondravony, and Maria Hariniaina (University of Antananarivo)

Bats are among the most economically important non-domesticated mammals in the world. They are well-known pollinators and seed dispersers, they make an important protein contribution to the diets of many, their waste - “guano” has been shown to be a highly effective fertilizer, and they appear to play an important role in crop pest suppression. Despite these numerous benefits that bats provide to both humans and ecosystems, bats have in recent years drawn increasing attention due to their association with a number of emerging infectious diseases. Bats thus potentially also pose a high health risk to humans. Disease exposure through bats is, however, often a result of anthropogenic activities, increasing with environmental degradation. Extensive forest loss in Madagascar has led many species – including bats – to become increasingly “human-tolerant”, with bats now inhabiting a growing proportion of public buildings, with a preference for schools, thus sharing closed spaces with children. In addition, ongoing food insecurity in rural Madagascar has resulted in an increased consumption of bats. This combination of environmental erosion with high population densities increases human exposure to disease, with similar cases documented elsewhere. For instance, the 2007 outbreak of Ebola in the DRC was linked to bat use as food, and bats are believed to have recently carried the virus to West Africa. Our goals twofold: a) research to understand the complexity of dynamics between humans and bats, particularly from the perspective of human health risks and food security, and an overall understanding of how these dynamics are influenced by local perceptions and the broader environment, and b) a broad dissemination of research findings with the aim of increasing awareness of both the costs (risks) and benefits (services) that bats provide. We will conduct a pilot study primarily sampling rural villages surrounding RNP, but also conduct primarily passive sampling (echolocators) within the park, to compare bat communities. For sampling in villages, we will preferably sample bats at school buildings, other public buildings and some households. Bats in public buildings will be trapped with mistnets at night. We will also use endoscope cameras when possible, to count densities of bats roosting between ceiling and roof of public buildings. Trapped bats will be identified, and measured. A small biopsy sample will be taken from the wings (this has been proven to not affect flight, and heal within days), for genetic and bacteriological studies. We will also take samples of ectoparasites, and small blood samples, that will be placed on filter paper and dried, for viral analyses. Blood samples and biopsy samples will be sent to Finland for initial screening and to develop detailed future plans in collaboration with Institute Pasteur of Madagascar.

Educational outreach (biodiversity of reptiles and amphibians): Live from Ranomafana National Park

Erik CALLENDER (Erik's Reptile Edventures)

This research/ educational outreach program will allow me the opportunity to share knowledge with children about the biodiversity of reptiles, and amphibians that live within Ranomafana National Park, Madagascar. Erik's Reptile Edventures recently launched a distance-learning program that utilizes internet technology (SKYPE, U stream, U tube) to produce live animal shows from different countries and share them with children. We have been up and running since Feb 2006. This Research/ Educational outreach program will help children develop an appreciation and understanding of the biodiversity of Reptiles and Amphibians of Madagascar. Malagasy and US students will share in the learning process together through live interaction, and internet communication. The students will develop an understanding of animals in the environment, wildlife conservation, animal adaptations, geography, and respect and stewardship of our natural world. New York State and the US require that students meet specific learning standards for Life Science, Math, Social Studies and Language Arts. Erik's Reptile Edventures educational outreach program is aligned with these standards. This coupled with interaction with animals during the program will result increased enthusiasm for nature and benefit academic growth of the student participating in the program. In addition Erik's reptile Edventures is committed to the development of fundraising projects within school systems that will donate money to help provide supplies for Malagasy schools. The ultimate goal of the program is to use technology as a tool to educate children of all ages about Malagasy species of reptiles and amphibians, and encourage them to enjoy life science and respect Nature. During the process, students will learn to identify species of Malagasy reptiles and amphibians; learn adaptations of the animals observed during the SKYPE sessions; gain familiarity with maps using Google earth, physical maps and globes; learn how to create and use dichotomous keys to identify animal species; and develop communication and writing skills.

The Influence of global climate change on plant-pollinator interactions

Christopher COLLINS (Stony Brook University, undergraduate), Sahondra Rahanitriaina (University of Antananarivo)

Pollinators are important because their interactions benefit biodiversity, and in turn benefit people. Pollination interactions provide important ecological services. A growing amount of evidence that shows that many ecosystems are being affected by regional and global climate changes, particularly the temperature increases associated with global warming. Because of this, and because of the ecological benefits of pollinators, there has been a dramatic increase in the scientific interest associated with the ecological effects of climate warming. These changes are most apparent, for pollinators, in their changes in flowering phenology and the changes in the appearance of migrating butterflies. Through field observations of bees in particular, this study will aim to better understand the influence of ambient temperature on plant-pollinator interactions using the following guiding research questions, including: (1) Is there a relationship between time of day and number of plant-pollinator interactions? (2) What is the relationship between size of active pollinators and ambient temperature? (3) What is the relationship between size of active pollinators and number of flowers visited per patch? (4) What is the relationship between visitor category and ambient temperature? (5) What is the relationship between visitor category and number of flowers visited per patch? It is expected that the rate of pollination will vary with temperature differences. The data acquired will hopefully help in the future of conservation, as well as set the precedent for conservation.

Patterns of antimicrobial resistance in enteric bacteria of humans in rural Madagascar

Robert C. GIORDANO (Emory University Global Health Institute, M.S. candidate)

In recent years, Madagascar's human population has increased exponentially, leading to serious sanitation infrastructure issues. Thus, control of orally-transmitted fecal pathogens is often inadequate, which has led to diarrheal disease becoming the leading cause of mortality in children under five, and the second leading factor for increased morbidity across all age groups, second to malaria. Only 34% of the rural population has access to clean water and 27% has access to adequate sanitation effectively leading to high rates of enteric disease. Although morbidity/mortality rates are projected to show great improvements in developing regions by 2020, most models neglect to address the growing concern of increasing antimicrobial resistance. We propose to screen fecal samples for positive isolates of *Vibrio cholerae*, *Salmonella spp.* Enterotoxigenic *Escherichia coli*, and *Shigella spp.* while systematically testing for susceptibility to antibiotics through Antimicrobial Resistance Tests (AMR). In addition, we plan to screen all fecal samples for the presence of resistance genes that may exist within the full enteric bacterium population. The information from this survey will provide a key resource for practitioners and policy makers alike, which can then be used to further guide clinical management on appropriate treatments of diarrheal disease in the region. These results may also aid updating treatment guidelines, educating prescribers and guiding infection control policies. There are few proven mechanisms that effectively address resistance control and, importantly, almost none of those that are effective have been validated for developing regions. Widespread misuse and mishandling of antimicrobial agents in the tropics has led to serious issues of antimicrobial resistance. Our data will be useful in establishing a baseline for AMR in the Ranomafana Region by providing useful information on the social contexts that are key in bacterial resistance development. The main study tools will consist of Antibiotic Susceptibility Tests conducted on cultured pathogenic isolates from human fecal samples and surveys administered by trained enumerators from INSTAT. The survey will be translated into Malagasy, piloted and back-translated to confirm accuracy in assessing the varying human behaviors that could lead to potentially favorable conditions for AMR development. Our survey will be included in a larger survey containing questions on basic demographics, size of household, distance to nearest water source, etc., as part of a larger Gates Grand Challenges study aimed at defining an economic burden of disease. It is my hope to better understand the epidemiology factors that influence the development of AMR in infectious enteric disease in the region surrounding RNP. I am particularly interested in understanding the correlation between disease ecology, land-use change, and socioeconomic standing. Not only will the information from this study play an integral role in the development of my master's thesis, but also, it will ultimately help to develop a comprehensive Malagasy health care system.

Enteric pathogen transmission among humans and mouse lemurs in Ranomafana National Park, Madagascar

Robert GIORDANO (Emory University Global Health Institute, M.S. candidate)

** Lemur work is conducted as a part of the Mark Krasnow/Stanford 2014 project*

The nature and frequency of human interactions with wild lemurs is changing rapidly as a result of land use modification. These activities bring humans and lemurs into close proximity or direct contact, allowing for the potential alteration of disease dynamics in ways that may allow for disease emergence and transmission from people to threatened lemur populations. With only 10% of its original forest cover remaining and rampant deforestation pressuring residual forest refuges, the island nation of Madagascar is at elevated risk for human-wildlife overlap and associated disease transmission. Further, it has been projected that lemurs could face extinction within the next 20 years, short of drastic action to tackle the poverty driven habitat disturbance. As it stands 93 of the 105 known lemur species are on the endangered list. Our goal is to investigate the ecological impact that habitat overlap has on infection rates and patterns of transmission of environmentally persistent gastrointestinal bacteria between humans and wild lemurs. We will focus on *Microcebus rufus*, the eastern brown mouse lemur, as our model system, as this species has relatively high population densities, allowing for a maximum sample size. We hypothesize that the data will demonstrate higher levels of human-wildlife habitat overlap leads to increased risk of zoonotic transfer of disease. It is our hope that the results of this study will help to pinpoint regions of Madagascar with elevated risk of zoonotic transfer, offering the opportunity for interventions benefiting both human and wildlife populations.

The Use of Stable Isotope Analysis to Infer the Trophic Levels of *Prolemur simus*, *Hapalemur griseus*, and *Hapalemur aureus*

Kevin GUILFOYLE (Long Island University), Tojohery Tiana RASAMIMANANA (University of Antananarivo)

Stable isotope analysis has been used to analyze the nutritional ecology of numerous species. As forest cover is reduced, as in the case of degraded forest, the ratio of carbon isotopes present in the animal's diet and as a result, in their feces, will be different. It is thus hoped that we could use the stable isotope composition of feces from three bamboo lemur species as a proxy for the level of habitat degradation and to assess the impact of reforestation efforts over time. The primary goal of this study is to better understand how each of the following species, *Prolemur simus*, *Hapalemur griseus*, and *H. aureus*, utilize nutritional resources across time and in response to numerous variables. Fecal samples from *Prolemur simus*, *Hapalemur griseus*, and *H. aureus* will be collected in RNP (pristine) and in degraded habitat on the park's boundary. A fecal sample will be collected from each individual and then exported to the US, cleaned, and then analyzed in a stable isotope mass spectrometer. Ratios of carbon isotopes present in samples from animals in "pristine" forest will be compared to those living in degraded forest. Because these three lemur species feed almost exclusively on bamboo, and live within the same ecological niche, we expect to see carbon isotope ratios in these three species to be nearly identical to one another in "pristine" habitat. As an animal is forced to feed in degraded, more open forest, carbon isotope ratios in the feces will be different. Thus, we expect to see significant differences in carbon isotope ratios present in the populations of Ranomafana than in those in surrounding degraded forest.

Integrative Taxonomy of the Herpetofauna of Madagascar

Carl HUTTER (Ph.D. candidate, University of Kansas), April Hillman, Zo Faniry Andriampenomanana, Shea Lambert (assistant), Asa Conover (assistant), Richard Glor (University of Kansas)

Our primary goal is to understand and adequately report the extent of undescribed reptile and amphibian biodiversity occurring in Madagascar, with a current focus on the undescribed species of Ranomafana National Park. The presence of up to 40 divergent lineages of frog in Ranomafana National Park (based on morphological, acoustic and molecular evidence) is suggested in recent studies, as well as fieldwork conducted by this research team in the past two years. Visiting nearby sites is necessary to collect related species for comparison. In the field, we will use morphological (body size, shape, color) and acoustic (call length, frequency, call repetition rate) evidence to hypothesize whether the specimen represents a divergent lineage. If our careful observations in the field lead us to believe that the specimens represent an undescribed taxa, we will then test this hypothesis through careful examination and laboratory work, where we will study the sequence divergence (through DNA barcoding) of these specimens and compare their morphology and vocalization to closely related species in order to validate if they represent evolutionary distinct species. Therefore we will also need to collect species closely related to the undescribed taxa in order to more accurately describe and compare the relationships of any new taxa. We also aim to collect additional data on species richness, abundances and habitat preferences of all taxa we encounter. Finally, several technical manuscripts will be prepared describing each of the new taxa through their morphological, acoustic, and molecular differences. This study will aid in further understanding the extent of herpetofauna biodiversity in RNP, and Madagascar. As many of these species are increasingly threatened by habitat loss, it is important to catalogue and understand the biodiversity in Madagascar in order to help guide conservation efforts by targeting and protecting areas with large numbers of threatened and endemic species.

Measuring the Economic Burden of Disease in Rural Madagascar

INSTAT, Milijaona Randrianariveojosia (Institut Pasteur), Matthew Bonds (Harvard University), Thomas Gillespie (Emory University), Ann Miller (Harvard University), Patricia Wright (Stony Brook University), Cassidy Rist (Emory University), Cara Brooks (Princeton University)

Infectious diseases are the primary source of human mortality in the developing world and are responsible for significant losses in annual agricultural productivity. We suggest a straightforward quantification of the economic burden of disease, based on the unifying principle that both humans and animals serve as simple, complementary, components of economic production in developing countries. We combine traditional epidemiological models with economic growth models to elucidate connections between disease burden and capital accumulation in human and livestock systems. Pilot studies conducted in three villages in 2011-2012 suggest that the threat of inter-human-livestock-wildlife pathogen transmission in the RNP region is high, exemplifying how perturbations to the animal system can feed back into human public health. Our research builds on 26 years of pre-existing ecological studies and public outreach in the Ranomafana region and will be conducted in conjunction with collaborative investigations of the role of wildlife zoonotic interchange in this human-animal disease system. We aim to collect the necessary field data to refine and test the overall integrative model. If

successful, we will quantify the economic burden of disease for the Ranomafana region and use the model to predict the effects of intervention and policy strategies aimed at breaking the feedback cycles of poverty and disease. Data for model parameterization will be collected in villages located in the Ranomafana region; the villages are part of a larger human healthcare implementation project currently underway. Twenty households will be randomly selected from each of 4 selected villages, for a total of 80 households enrolled in the study. Fieldwork to parameterize our model will be performed over a six-week period and will include (1) Household and individual surveys: to assess livestock holdings, household health and household economic status; (2) Human data collection: Fecal samples to determine the prevalence of infectious diarrheal disease; Rapid detection tests for anemia and malaria; (3) Livestock data collection: Fecal samples from all poultry, pigs or zebu owned by the household to assess for zoonotic pathogens (e.g. *Cryptosporidium*, *Giardia*, *E. coli*, *Campylobacter*) and other gastrointestinal pathogens of animal health significance (e.g. intestinal parasites, liver flukes).

Biodiversity of Malagasy Invertebrates Focusing on Arachnid Microfauna

Sarah KARIKO (Museum of Comparative Zoology, Harvard University), Patricia Wright (ICTE, Centre ValBio, Stony Brook University), William Montag (ICTE), Sahondra Lalao Rahanitriniaina (University of Antananarivo)

We spent two months searching for spiders in Ranomafana National Park, focusing the team's efforts on transects near Vatoharanana and Talatakely. After initial biodiversity sampling where each collector performed three hour-long collecting samples using standard arachnological field techniques including beating, litter sifting, nocturnal hand collecting and pitfall traps, the study focused on the arachnid microfauna particularly spiders from the genus *Phoroncidia* (Araneae: Theridiidae). The team was able to successfully observe some behaviors and document webs, and these ethological observations helped in gaining a better understanding of the natural history of the spiders. Areas for further research were identified and include field observations on mating and predator-prey interactions. We are hopeful that we found male and female specimens of each species. Due to the tiny size of our study animals, 1.5–3 mm, further study in the laboratory is required. After preliminary analysis of our samples, we found that our field efforts yielded mature males and females of described *Phoroncidia* species. We were unable to find mature specimens of some of the *Phoroncidia* of particular interest. In the interim, *Phoroncidia* specimens have arrived for study from the California Academy of Science and a comparison of our field samples supports that our field team was in localities where these animals have been previously found even though we did not find any. Many of the specimens from our field samples are immature so we are unable to identify them to species. However, we are now better able to combine this information with data from previously known samples to better understand what time of year may be best to find mature specimens to inform future research. The fieldwork strengthens our interest in finding ways the arachnofauna of Madagascar can play an important role in invertebrate conservation.

Investigating the evolution of coloration and toxicity in Mantella species in Madagascar

Karina KLONISKI, Richard Kloniski (University of California-Berkely)

Madagascar possesses many unique, toxic and brightly colored amphibians and reptiles, but the

purpose and diversity of this coloration is often poorly understood. This investigation will strive to determine the function of this conspicuous coloration and its underlying genetic mechanisms. During the rainy season of 2013-2014, we plan to collect a number of tissue samples and skin secretions from selected sites in the central to southeastern region of Madagascar to be able to determine the relationship between coloration, toxic skin secretions, genetics and geographic location. In addition, we will conduct pilot clay model experiments to better understand predation pressures, and assortative mating experiments to determine the role of mating preference in driving color variation. For all specimens of *Mantella* we will collect a color photograph, toe clip sample, a skin swab sample and a sample of the toxic skin secretions.

Investigating adaptive radiation in *Heteropsis* butterflies (Lepidoptera: Satyrinae)

David LEES, Oskar Battsrom (Cambridge University), Ahmadi Allaoni (University of Antananarivo)

In surveys of biodiversity in Madagascar, butterflies are one of the most accessible groups, and yet there is a paucity of knowledge on their distribution. There are 300 described butterfly species and the latest count of all Lepidoptera tallies 4589 valid described species of butterfly and moth. We are focusing on the large target taxon satyrine butterfly genus *Heteropsis* for this study (around 70 species in Madagascar). We want to investigate what has driven speciation in *Heteropsis*, a system (adaptive radiation) used prominently in other studies. Our current project involves unravelling the nature of adaptive radiation using molecular work (making a robust phylogeny), isotope sampling (examining C3 and C4 isotope signatures of the grass hostplants), chemical work (looking at the chemistry of the male sex pheromones and the diversification of androconial scent brushes), eyespots (how they respond to the environment and its seasonality) and predicted distribution (via GIS/bioclimatic modelling using GPS-level data). Our overall goal is to (1) record the butterfly fauna of the areas we will visit and compare the results with previous inventories to judge the effects of global warming; (2) to examine ecological speciation in allopatric and sympatric mycalesine satyrine butterflies of the genus *Heteropsis*.

Mechanism of coexistence and functional roles of anuran larvae in Ranomafana stream systems

Yoshihiro NATSUHARA (Nagoya University), Noelikanto RAMAMONJISOA (Ph.D. candidate, Nagoya University), Sakai Masaru (Tokyo University of Agriculture and Technology), Serge Ndriantsoa (Ph.D. candidate, University of Antananarivo)

Anuran larvae are considered ecosystem engineers and a change in tadpole communities is expected to bear dramatic changes on freshwater ecosystems. Information about feeding ecology is crucial to understand the functional role of consumers. At least 44 tadpoles coexist in RNP streams but the mechanism through which this coexistence is mediated and how species loss affects ecosystem processes remain poorly understood. A preliminary classification of tadpole community in Ranomafana identified 8 guilds based on tadpoles' mouthparts, suggesting a specialization in feeding habits that could be the prime mechanism of species coexistence. The objectives of this study are to (1) clarify the mechanism of coexistence of tadpoles in Ranomafana streams from the viewpoint of feeding niche, (2) investigate the effects of anthropogenic disturbance on tadpole communities, and (3) determine the physical and chemical

impact of each guild on ecosystem processes. We test the following hypotheses: (1) habitat degradation and deforestation affect the diversity and the abundance of adult amphibians and tadpoles (2) extinction of some species affect the feeding niche of tadpoles by reducing competition (ecological release theory) (3) overlapping feeding niches cause the extinction of specialist and the prevalence of generalist species, and (4) species guild differentially impacts the ecosystem (physically and chemically) and are not functionally redundant as previously understood. We collected tadpoles and their potential diets at sites with various vegetations: pristine forest (Vatoharanana), degraded forest (Talatakely) and agricultural land (Ambatolahidimy), and habitat characteristics, species composition, stable isotope and fatty acid composition of animal tissues are analyzed. We investigate the relationship between morphology of mouthparts and diets. To clarify tadpoles' diets and interspecific interactions, enclosure experiments are conducted. To evaluate the role of tadpoles in lotic ecosystems, abundance of aquatic insects and periphyton is compared between enclosure and control sites. Tadpoles' excretion rate is measured to estimate their nutrient recycling rate. In each study site, water depth, stream width, stream velocity, bottom sediment, water temperature, pH, EC, NO_2^- , NO_3^- , NH_4^+ , PO_4^- , DO, solar radiation, and vegetation are recorded. We collect tadpoles in a 10m transect and record swimming position (surface, intermediate and bottom layers) and substrate. Mouthparts and external morphology are recorded, and muscle tissues and gut contents are preserved in ethanol or dried. As potential diets of tadpoles, aquatic insects, zooplankton, floating particles, periphyton, sediment, and fallen leaves (litter) are sampled. We use fatty acid and stable isotope analyses to examine feeding niche of tadpoles. Gut contents are identified under a microscope, if possible. Stable isotopes and fatty acid of gut contents, muscle tissues and potential diets are analyzed. These samples will be brought to Japan and analyzed at the faculty of Agriculture of Nagoya University.

The Effect of Social Support on Childhood Malnutrition in Rural Madagascar

Samuel POTTER (Stony Brook University School of Medicine, M.D. candidate, **CVB Student Internship*)

The World Health Organization has stated that malnutrition, especially among children, is one of the biggest threats to the world's public health. In Madagascar, the rate of malnutrition among children is the 9th highest in the world. 53% of children under the age of 5 are stunted, 42% are underweight and 13% are wasted. The population of Madagascar has become increasingly at risk to suffer from malnutrition given the increasing frequency of droughts, cyclones and recent political turmoil. Understanding the effects of different social, political and environmental factors on this topic is critical to informing policy and programming on the issue. This is especially important in light of new evidence that child malnutrition may not be entirely due to food scarcity or a lack of family economic resources. I will assess the role that various forms of social support have on the occurrence of childhood malnutrition. I suspect that my study will confirm that lack of social support will have a greater impact on children who are at greater risk for malnutrition due to a shortage of food stores in the previous year. From 2004 to 2005, two ethnographic surveys were conducted in 12 Tanala villages in eastern and southeastern clusters of Ranomafana National Park through a grant from the Packard Foundation. A total of 2,511 individuals in all 12 villages participated in the first survey, followed by 1,785 individuals in the second. Demographic data and information on farming practices were collected from heads of household. This population has previously been shown to suffer from high rates of childhood

malnutrition. Given limited measures available in the secondary data source, this project will measure only indicators of support availability and received support. Support availability will be measured by the presence of a partner living with the mother as well as the presence of relatives living in the same village. Received support will be measured by the type of support received (housekeeping, childcare, cooking, firewood collection, financial or labor). Degree of social support will be assessed on a graded scale of 0-9 depending on the type and quantity of support received. Child malnutrition will be measured comparing height, growth and weight to the international growth standards. This will be done for all children aged 0-9.

Seed dispersal of plant species consumed by *Eulemur rubriventer*, *E. rufifrons*, and *Varecia variegata variegata* in the Ranomafana National Park

Andrilalao M. RAKOTONAVALONA (Ph.D. candidate, University of Antananarivo)

Species have evolved complex interdependencies. Arguments on the co-evolution in plant-frugivore interactions are highly controversial. One estimate suggests that approximately 90% of tropical tree species require some sort of interaction with animals to reproduce. In tropical forests, endozoochory is the most important mode of seed dispersal and potential primary dispersers are birds and bats. As bats have a low density and are mainly insectivores in Madagascar, primates play a particularly important role in seed dispersal instead. Ranomafana National Park preserves one of the richest primate fauna in the world. Six of the 13 species of lemurs are sympatric and they are mainly frugivorous. Some tree species depend on lemurs for both seed dispersal and germination. The main seed dispersers are *Eulemur rubriventer*, *E. rufifrons* and *Varecia variegata variegata*. Lemurs swallow fruit pulp with seeds, which they are unable to separate. Seeds pass through their digestive system and they are dispersed through the defecation far from the parent plant. Once on the ground, they germinate and take root. The removal of the pulp and intestinal treatment are even considered fostering or a prerequisite for successful seed germination for some species of plants. In general, animals travelling a lot in one day deposit seeds on a larger area than those that move over shorter distances. Indeed, the seeds that spend more time in the digestive tract are generally deposited at greater distances from the parent tree and animals with a short retention period gut often deposited seeds closer to the parent tree. Then exclusive or semi-exclusive lemur feeding on certain species of fruit, in theory, can be quite significant to the ecological change of plant communities and it is reasonable to expect that the loss or the immigration of lemurs seed dispersers change the spatial distribution of seedlings of certain plant species over time. The overall objective of this study is to continue research on seed dispersal in RNP, especially the post-dispersal phase. *Objective 1*: estimate the distance of seed dispersal; identify the genotypes of the target plant species; distribution mapping. *Objective 2*: determine the ecological requirements of the target plant species; compare species richness and ecological parameters between study sites; modeling of the dynamics of forest stands. The study will help to determine the influence of sympatric lemurs on the dynamics of forest stands, it will be a step in the study conducted post-dispersal and the ecological requirements of the species of plants are known for future reforestation.

Improving Forest Conservation in the Tropical Forest of Ranomafana, Madagascar.

Stephane Olivier RANDRIAMANANTSOA (Kyoto University, M.S. candidate, **CVB Student Internship*)

Malagasy endemic tree species have been threatened by various indigenous people's activities such as slash and burn agriculture, monoculture, logging, charcoal production and many others. These activities are major factors of forest fragmentation and the downfall of endemic tree species, and the increase of invasive species such as the Eucalyptus, Psidium, Pine, non-native bamboo, etc. in unprotected areas in the periphery of RNP. Because of the extension of forest degradation, preserving endemic trees has become tremendously important. Besides, the loss of endemic trees is a major factor of reduction of various endemic animals that feed on those trees' leaves, fruits, seeds, etc. Consequently, CVB launched projects to conserve and propagate endemic trees, and restore degraded landscapes around Ranomafana. The objectives of this internship study were to forge knowledge on the importance of preserving the tropical forest by various methods. Anthropogenic impact on the forest in Ranomafana is an important factor of deforestation in this region because most indigenous people depend considerably on the community forest to meet their livelihoods. Understanding the different challenges of safeguarding tropical forests is an important objective in order to develop more efficient conservation methods. Additionally, the conservation of endemic plants depends heavily on the management of nursery plants and reforestation of degraded areas. Nevertheless, the success of reforestation depends greatly on multiple variables. Many plants requires specific conditions to grow, however, reforestation often take place in impoverished soil such as fallow land. Therefore, it is crucial to evaluate the reforestation activities especially by monitoring the growth of young plants in the nursery and the transplanted saplings. Data collection on the area and plants such as height, diameter, leaves, elevation etc. in order to work out on the best area to grow specific plants was also an important component of the internship. Sapling mortality in the nursery was caused mainly by rat predation, and less frequently birds; although the success rate in the plant nursery yard is very high because it can reach up to 90 and 95 percent. Higher mortality rates of transplanted plants need further attention and oversight. Conservation is strongest when grassroots community efforts are seeded at country and local levels. Currently, many projects are conducted in the Ranomafana region to empower villagers, but teaching them that they can make a better life through ecotourism and by protecting the forest and wildlife existing there is a challenging task.

Madagascar Dog Initiative: Controlling feral dogs to conserve Madagascar's wildlife

Zoavina RANDRIANA (D.V.M. SOS Madagascar), Kim Valenta (PhD Candidate, University of Toronto), Zach J. Farris (PhD. Candidate; Virginia Tech), Mamiarilala Jean Célestin Tojonirina (Veterinary student, University of Antananarivo)

We propose a targeted research project that will include capturing, spaying, neutering and vaccinating feral dogs, transporting feral dogs to a local shelter for training and placement in permanent homes, and monitoring dog and wildlife populations. We will collaborate with Malagasy (University of Antananarivo, SOS Madagascar, Centre ValBio), US (Virginia Tech), and Canadian (University of Toronto) institutions to control feral and domestic dog populations and monitor wildlife populations at RNP. In addition, we will provide a critical service to villages surrounding RNP while also working to understand the ultimate causes of why domestic animals are allowed to go feral within Madagascar's forests. As these exotic predators and endemic wildlife species are increasingly forced into isolated fragments of forest, predation by exotic predators are impacting endemic wildlife populations that are simultaneously being

limited by declining habitat quality and human encroachment. Our project represents the first attempt at combining a targeted feral and domestic dog spay/neuter, vaccination, and relocation program with simultaneous surveys of how wildlife respond to these efforts. This project will serve to improve the livelihoods of the people living in villages near RNP while also improving the efforts of CVB and MNP to protect Madagascar's threatened wildlife.

Environmental Education/Information Halls in MNP Ranomafana Park and Kianja Maitso

Onitiana RANDRIAVAHY (University of Florida, undergraduate, **CVB Student Internship*)

To further promote environmental education and conservation, the idea of creating information halls at the MNP park entrance and CVB's Kianja Maitso was proposed. These two locations were chosen because they are the most frequented places for locals and tourists, who are the intended targets. The information encompasses two main themes, biodiversity and the social aspects and problems of Ranomafana. The intended goals of these information halls are to educate and inform the locals on environmental protection. One of the main causes of environmental destruction and degradation is a result of the local's lack of knowledge and to alleviate this problem, expanding their knowledge on the value of the rainforest will hopefully change their perspectives and ways. Another goal of these halls is to teach the locals, especially children, on the value of Ranomafana's biodiversity. The information and the pictures strive to expand the local's knowledge on the species that are endemic in Ranomafana, as many are only aware of the *Lemur Catta*, as Rico's research indicated. The information halls will contain interactive visuals, rather than solely information and pictures. For example: We can have a forest and Velcro pictures of species to stick on the different rainforest strata; For rainforest threats section, people can write in their proposed solutions; Matching game can be used for the 5 benefits of rainforest and rules of hygiene.

Seed dispersal interactions and plant community structure

Onja H. RAZAFINDRATSIMA (Ph.D. candidate, Rice University), Parfait Rafalinirina, Daniella Takiya, Fensoa Francine Rajoarivelo (ENS, University of Antananarivo), Amy Dunham, Jake Kraws, Jordan Sinclair (Rice University), Zo Faniry Andriampenomanana (University of Antananarivo)

The purpose of this project is to understand how seed dispersal and recruitment of plant species in a community are dependent on other species with similar vectors and producing fruit in the same season. We conduct an experiment to assess how the dissemination of seeds per lemurs affects seed germination and seedling recruitment trees producing fruit in the same season, examining the effects of soil pathogens associated with different species trees on the germination and recruitment of seeds. In Phase 1 (wet season), we use 4 species of seeds that are dispersed by frugivorous lemur species: Tivolomanitra, Ramandriana, Natovoraka and Solaitra fotsy. *Seedling recruitment monitoring.* We selected 6 species (2 lemur dispersed, 2 bird dispersed, and 2 abiotically dispersed) from the 128 species represented in our botanical transects and recorded all seedlings within 1 meter of either side of the transect. Seedlings were designated as either first year or >1 year and their location on the transect was recorded as well as all adult species

within a 15m radius. *Seed traps and germination rates.* We sampled seed rain using seed traps placed under the same 6 species. Seed traps were placed under 5 individuals from 5 of the target species and under 2 individuals from one species due to rarity of that species, hung on trees to a height of 1-1.5 m to reduce seed removal by granivores. We recorded the identity and number of seeds in each trap every two weeks and will continue this monitoring throughout the year. A subset of seeds from the trap was then placed in a defined area under the same adult tree and germination are being monitored and recorded on a bi-weekly basis. *Phylogenetic trends in germination rate.* Using the same 27 individuals from 6 species described above, we set-up an area under each tree, place seeds from all 6 species in a defined area, and monitor germination rates. Seeds for this experiment were obtained from the seed traps. Accurate phylogenies are an important tool for studying community assembly and functional trait evolution. Using leaf samples, DNA barcode sequences can be produced and used to create a phylogeny with > 98% accuracy. We collected a leaf sample from individuals from as many of the 128 species found along the series of transects mentioned above. Fresh leaves were cut from the tree to ensure accurate species identification. Samples were placed in a paper bag, stored in a sealed container with silica gel to dry, and exported to Rice University for genetic analysis to create the phylogeny. *Summary of field results.* We mapped all trees within our 20 phenological transects in Valohoaka and Vatoharanana, and surveyed all mature trees within 10 new quadrats in Vohiparara. We continued monitoring the phenology of the plant species within our transects, and checked whether all tagged individuals were still present. It appears that besides natural disaster, which knocked down a large number of trees, some individuals were intentionally cut by humans. Few seeds of *Solaitra fotsy*, *Ramandriona* and *Natovoraka* germinated in the nursery experiment, which is still running until January 2015. Including last field season, we collected fruit samples from 26 species for nutritional analyses. Besides *Eulemur spp.*, *Alectroenas madagascariensis* (Madagascar blue pigeon) was observed to consume the fruits of *Cryptocarya*; however, they seem to be unable to disperse *Cryptocarya* seeds away from parent tree because of their behavior – defecating seeds few minutes after ingestion, or dropping seeds after consuming only part of the fruit pulp. None of the seeds in the germination trails had germinated yet. As for the secondary dispersal, we haven't analyzed data yet; only the native rodent species *Nesomys rufus* was seen removing seeds from their initial location in both Valo and Vohiparara field sites (pictures from camera traps). We collected leaves from 115 tree species. These samples have been exported to Rice University where they will be processed for genetic analysis. Data from the seedling transects have not been analyzed yet. Seeds planted under the six target species have not germinated yet but continue to be monitored.

Epiphytes, mini-ecosystems with big biodiversity: Assessing the threat of human disturbance on the rainforest canopies of Madagascar

Brett SCHEFFERS (James Cook University in Townsville, Australia), Andriamahohatra Rakotoniaina (ENS, University of Antananarivo)

Epiphytes (i.e., free living plants in forest canopies such as basket ferns) represent a common above-ground structure in rainforests and provide shelter for biodiversity in rainforest canopies. We will identify the importance of *Asplenium* bird's nest ferns (an epiphyte) to canopy dwelling frogs and determine whether these ferns might serve as refuges that counter the negative effects of warmer and drier climates caused by human disturbances such as selective logging and climate change. These surveys will also document an unknown community of frog

as few canopy surveys have been conducted in Madagascar. This will be a highly comprehensive assessment of plant usage by frogs in Madagascar and of habitat disturbance on canopy frogs in Madagascar. Furthermore, our study on habitats within rainforest canopies will help us understand their roles in climate change adaptation and mitigation. This study will reveal important considerations for conserving species in Madagascar both from direct habitat loss and long-term impacts from novel climates. Our proposed research will identify plausible mitigation and adaptation options for canopy animals under changing climates, with the following goals: (1) Determine if ferns amplify non-invertebrate biodiversity such as frogs; (2) Identify fern and surrounding habitat characteristics that best determine fern density and frog usage of ferns across elevation and within undisturbed and selectively logged habitats; (3) Measure the microclimate within ferns to determine if they function as a climate refuge; and (4) Create a comprehensive library of frog calls in Ranomafana National Park.

Cross-Species analysis of helminth prevalence and health effects in Ranomafana National Park, Madagascar

Katie SMITH (Emory University)

Soil transmitted helminths (STH) are intestinal parasites that infect roughly 2 billion people worldwide. Those infected usually live in extreme poverty with poor access to sanitation and poor hygiene. STHs live in the intestinal tract where they lay thousands of eggs every day, which are excreted into the feces. The eggs enter the soil through contaminated feces, causing infection when the eggs contaminate vegetables and water sources, when people walk barefoot through contaminated soil, or place fingers with contaminated soil into their mouths. STHs cause severe health effects in their hosts, with higher intensity of parasite burden leading to increased morbidity. Health effects are general malaise, diarrhea, abdominal pain, as well as physical and developmental retardation in children. STHs also cause anemia, a reduction in the number of red blood cells. Hookworms are the main cause of anemia, as they feed on blood in the intestines and cause intestinal hemorrhaging. Anemia causes the patient to feel fatigued, short of breath, causes headaches and dizziness, and complications can even lead to death. This leads to educational and economic losses as children feel too weak to attend school and adults are unable to work. Little research has been done on helminth prevalence in Madagascar. In 1995, Kightlinger showed high prevalence of roundworms (*Ascaris lumbricoides*), whipworms *Trichuris trichiura*, and hookworms in children living around Ranomafana. And while STHs can be seen in macroscopic evaluation of livestock feces, no data on STH prevalence in livestock could be found for Madagascar. Seven villages around RNP have been chosen for inclusion in the study (Ambatolahy, Ambodiaviavy, Ankialo, Vohiparara, Menarano, Bevohazo, and Manokoakora). The villagers have a high level of contact with their own livestock and the wildlife in the forest, combined with a lack of sanitation and safe water, increasing their chances of STH infection. Fecal samples will be collected from the people randomly selected to participate in the questionnaire, covering subjects such as number and type of livestock owned, interaction with livestock and wildlife, hygiene habits, and health status.. Allowing for a 90% compliance rate, an expected 440 fecal samples will be collected. Fecal samples will also be taken from livestock and rodents in each village. Traps will be set in the households overnight. Fecal samples will be obtained from all livestock owned by the 10 selected households, which will include pigs and zebu. 80% of fecal samples will be stored in formalin and prepared using a formalin-ethyl acetate sedimentation concentration procedure. The other 20% of fecal samples will be evaluated fresh

in the field, since storage in formalin may effect what is seen in the sediments later. Prevalence will be determined by using light microscopy to identify ova morphologically down to genus level. Eggs per gram of feces will be calculated as an indirect measure of worm intensity. I will use a portion of this blood (collected by the nurse & veterinarian) to perform a packed cell volume (PCV), which will give a basic measure of anemia in the patients. Two sample t-tests will be done to determine if there is an association between anemia (low PCV) and STH infection.

Infant care behavior in the red-bellied lemur (*Eulemur rubriventer*)

Stacey R. TECOT (University of Arizona), Andrea Baden (Hunter College), Rachel Jacobs (Stony Brook University), Avery Lane, Laura Diakiw (University of Arizona), Soafaniry Razanajatovo (University of Antananarivo), Alicia Sanchez (Spain)

The research is a continuation of the pilot study initiated in August 2013 to document variability in infant care behavior by fathers and siblings. *Eulemur rubriventer* are one of the few lemur species in which individuals other than the mother commonly care for infants (allomaternal care). While it is known that siblings and fathers help transport infants, little is known about 1) how often and when during the infant's development mothers receive help, 2) who provides help, or 3) the proximate mechanisms (e.g., hormones) promoting infant care. Answering these questions is critical to understanding the evolution of primate allomaternal care. While few studies have investigated the energetic burden and benefits of caring for lemur infants, no studies of allomaternal care have been conducted with wild *E. rubriventer*. Furthermore, no studies have investigated the relationship between allomaternal care and the hormonal mechanisms mediating this behavior in any free-ranging lemur species. This study is designed to determine who cares, how much, and whether kinship (i.e., genetic relatedness) or steroid hormone (e.g., cortisol and testosterone) changes during gestation and infant development vary with the amount of infant care provided. This 2014 study will allow us to refine behavioral data collection methods, and add infant care behavior to our pilot dataset to increase our sample size to an acceptable level. The goal of this pilot project is to collect infant care behavior data to establish the extent to which such behavior varies across individuals, and to collect fecal samples to 1) estimate genetic relatedness and 2) measure steroid levels, and document changes in these steroid levels across gestation and infant development. The results of this study will aid in the development of methods for a long-term study on allomaternal care, infant development, and the hormonal mechanisms involved in infant care. Specifically, this pilot study will ask the following questions: What are the best behavioral data collection methods to document infant care behavior? Who provides infant care? What proportion of an individual's time budget is devoted to infant care? Do individuals providing infant care vary in the type or frequency of care that they provide? Is the amount of infant care related to kinship (i.e., genetic relatedness)? Are cortisol level changes during gestation associated with the type or amount of care individuals provide? Are testosterone level changes from pre- to post-partum associated with the type or amount of care individuals provide?

Parasite prevalence in lemurs: The effect of human-induced habitat changes and climate factors from a multi-scale perspective

Iris de WINTER (Ph.D. candidate, Wageningen University, The Netherlands), Niels Kil, Hilde de Laat, Freek Ijdema, Elke van Gils, Jeroen Baron Bentick, Anna Luijten, Wessel Nieuwland, Nathalie Houtman, Jeroen Schutt (M.S. candidates, Wageningen University, The Netherlands)

The mission of this PhD project is gaining a better understanding of the current and future distribution and transmissibility of gastrointestinal parasite infections in wild prosimian primates. We aim to assess the most important mechanisms determining ectoparasite (e.g., ticks, lice and mites) and gastrointestinal (GI) parasite (e.g., bacteria and nematodes) prevalence in non-human, prosimian primates throughout the seasonal cycle, while focusing on the effects of anthropogenic habitat disturbance and human proximity. By improving our understanding of disease ecology in non-human primates, we will gain more insight into the relations between anthropogenic and natural stress factors and the occurrence of parasites in a wild primate species. The association between parasite prevalence and the potential spread of infectious diseases within and between wildlife and human populations underlines the importance of this project from an anthropological, conservation and medical perspective. The questions and hypotheses of this study focus on habitat disturbance and seasonal variation at the population level (1), on group behavior, home range and dominance at the group level (2), and on characteristics including age, sex, body condition, immune system and social rank at the individual level (3). Six field sites, three sites with a relatively high level of disturbance and three with a relatively low level of disturbance), within RNP form an ideal location to test these hypotheses. To what extent do anthropogenic and natural stress factors influence lemur parasite prevalence and diversity, from a population, group and individual perspective? The main hypothesis is that parasite prevalence in lemurs is determined by a range of anthropogenic and natural factors which operate on different demographic/organizational levels (i.e., population, group and individual).

In addition, several masters students are assisting with components of the data collection including Anna Luijten, Parasite infections in sympatric *Eulemurs*; Jurian van Duursen, Microbial composition in sympatric *Eulemurs*, Wessel Nieuwland, Fluctuations in parasite infections in *E. rubriventer/Eulemurs* - seasonal and yearly variation + behavioural study; Nathalie Houtman, Fluctuations in parasite infections/microbial composition in *E. rubriventer* over time + behavioural study, and Jeroen Schutt, Lemur densities in Ranomafana (Vatohoronina, Valoahoaka, Talatakely, Sakaroa, Vohiparara, and Miaranony).

Impacts of the environment and ecosystem health on biodiversity

Patricia WRIGHT (ICTE, CVB, Stony Brook University), James Herrera (Ph. D. candidate, Stony Brook University), John Cadle (CVB), Lydia Tongaso (Ph.D. candidate, University of Antananarivo), Centre ValBio technicians

The loss of seed-dispersing lemurs due to anthropogenic disturbance can have cascading effects in the ecosystem. Understanding the feedback between the biodiversity and ecosystem health and function is critical to predicting changes to forest communities in the future. Genetic diversity is a strong indicator of the health and viability for a population, and diversity is usually highest where resources are most abundant. Thus, understanding the links between the environment, biodiversity and ecosystem health are crucial for conservation. Our goal is to understand the intimate relationships between the natural environment, biodiversity and humans in a rainforest

community. We can then use the relationship to estimate the total population size of the species at our study sites, which is one of the only protected sites for several endangered species.

Preliminary analysis has resulted in biodiversity data for six main groups of organisms that are commonly surveyed and for which standardized methods are available to accurately estimate presence and abundance. These data will allow us to compare the effects of habitat disturbance on many different kinds of organisms and so far we have shown that disturbance has an effect on some lemur species (e.g., *Eulemur rufifrons*, *Varecia variegata*, *Cheirogaleus* sp.), some species have not been heavily affected by disturbance (e.g., *Propithecus edwardsi* seem to be relatively abundant in both sites), while other species are just very rare in general and difficult to find (*Lepilemur microdon*, *Hapalemur griseus*, *H. aureus*, *P. simus*, *Daubentonia madagascariensis*). We suggest these species may be at high risk of extinction due to their low abundance, limited geographic range and the amount of disturbance we detected in their habitat. Some species are already considered Endangered or Critically Endangered (*Hapalemur aureus*, *P. simus*), but others (*Hapalemur griseus*, *Lepilemur microdon*) are considered of low conservation threat. We suggest the conservation status of these last two species be updated to reflect their extremely low abundance and limited geographic range size. Preliminary analysis of the data on birds in RNP suggests that, similarly to lemurs, some species exist at higher abundance in disturbed habitats, others are higher in undisturbed habitats, and many species are widespread. We must further investigate the traits of species that allow some to be so widespread, and this will help us to understand how so many birds seem to be of low conservation concern. Early comparisons of frog data from Miaranony and Valohoaka suggest that habitat disturbance decreases frog diversity and abundance due to factors such as increased light, heat and wind and much lower moisture levels. The distribution and abundance of micromammals suggest that elevation and habitat disturbance are affecting species. Some, such as *Nesomys audebertii*, are only found at low elevations and are replaced by close relatives at higher elevation (*N. rufus*). Some, however, are only found at higher elevation (e.g., *Gymnoromys*, *Brachytarsomys*, *Eliurus tanala*). Further, during trapping we took data on the ectoparasite prevalence on captured animals and it appears that parasite load varies among species. The combination of disturbance and parasites has been shown to affect lemurs in RNP, and we should follow up to collect similar data on rodents. Analysis of botanical data suggests differences in species composition between the two sites, between disturbed and undisturbed transects and in the size of trees in relation to disturbance. The Miaranony site is pristine with abundant large trees and little to no evidence of logging in the park. In contrast, at Valohoaka there are many areas that show evidence of past selective logging for *Dalbergia*, as well as recent cutting for honey or other wild resource extraction as well as for building materials.

Health survey of *Propithecus edwardsi* in Ranomafana National Park

Patricia WRIGHT (ICTE, CVB, Stony Brook University), Elizabeth Abram (Oakland Zoo), Margaret Rousser (Oakland Zoo), Hajanirina Rakotondrainibe (D.V.M, Ambatovy), Lydia Tongaso (University of Antananarivo), Centre ValBio technicians.

The survey and analysis of wildlife health of a population of lemurs within Ranomafana National Park is extremely important for their conservation. The only way to determine long-term status of a population is to observe an animal known in time. Unfortunately, we know too little about the lemurs. Our study is very important to monitor the population of lemurs in Ranomafana. Collars should be checked annually to enable our research teams to continue important long-term

studies. We have established a database to begin a long-term program to monitor the health of the population of lemurs in the Ranomafana National Park, primarily from *Varecia* from Mangevo. We want to expand this project to include *Propithecus* (and *Avahi*). For this, the capture and collection of biological samples are needed. The data will help us to track changes over time, allow us to revise strategies for captive breeding and the long-term health monitoring of these species. Health Examinations will provide us with important baseline information for which we can use to compare the results of future studies to determine whether the population is declining, improves or remains the same. This information has significant value for conservation.

Demography of *Propithecus edwardsi* in Ampatsona-Ambohidaza, an unprotected Malagasy forest corridor, during the 2014 birth season

Andrew J. ZAMORA (Stony Brook University, M.A. candidate), Charles Rasolondravoavy (University of Antananarivo)

Milne Edward's sifaka (*P. edwardsi*) is an endangered lemur native to the southeastern rainforests of Madagascar that exhibits a high degree of variation in social groups. While *P. edwardsi* has been extensively studied inside of Ranomafana National Park (RNP), little research on *P. edwardsi* populations outside of RNP has been published. Moreover, much of the data used to assess the status of *P. edwardsi* has relied on research conducted within the few protected areas, such as RNP, within its known range. Additionally, research in RNP has demonstrated that disturbance has adverse effects on the demography and home ranges of *P. edwardsi* populations. As the amount of protected habitat encompasses just over 10% of *P. edwardsi*'s it is imperative that populations at other sites be studied. Ampatsona-Ambohidaza is a montane forest located at S21.009, E47.398 which encompasses 100 km² of unprotected forest north of RNP and ranges in elevation from 1200-1400m. Much of the site consists of secondary and disturbed forest that has been recovering from agricultural, non-commercial, and logging use during the mid-20th century. My goals are: (1) Gather demographic data on *P. edwardsi* found in Ampatsona-Ambohidaza; (2) Collect preliminary data on the home ranges of groups; (3) Collect fecal samples for use in future pedigree analyses; (4) Survey how many *P. edwardsi* infants are born during the 2014 birth season; (5) Actively participate in ongoing conservation efforts with local Malagasy in Ampatsona-Ambohidaza.

Mosquito-borne parasite ecology (malaria and filariasis) and vector transmission dynamics in humans and lemurs* around Ranomafana National Park

Sarah ZOHDY (CDC, Emory University, Postdoctoral fellow), Wesley Mason (USA), Centre ValBio technicians

* *Lemur work is conducted as a part of the Mark Krasnow/Stanford 2014 project*

Two mosquito-borne parasites of particular public health concern in Madagascar are malaria and lymphatic filariasis. An understanding of how the environment influences mosquito ecology is necessary in order to better understand the role of transmission dynamics of these diseases, and to better implement prevention and intervention strategies to intercept and control these parasites and their vectors before they can cause deadly and debilitating disease in human populations. The goal of our research is to better understand the role that habitat destruction plays in vector transmission dynamics in humans and lemurs that live in and around RNP. The main objectives

of this study are to collect mosquitoes to 1) survey mosquito populations in different land-use sites and screen them for human and lemur malarial and filarial parasites to identify potential ‘hotspots’ of disease, 2) to identify mosquito species that act as vectors of human and lemur malaria and filariasis in RNP, and 3) to evaluate insecticide resistance in the region. Then in collaboration with the Stanford Krasnow Mouse Lemur Genomics Research Group 4) characterize lemur malaria and filarial nematodes in wild brown mouse lemurs and identify their mosquito vectors, and 5) examine prevalence of these parasites in a wild population of brown mouse lemurs and identify host-specific characteristics that make certain lemur individuals susceptible to these parasites. We aim to combine these efforts to better elucidate the role that deforestation and land-use change play in human and lemur vector transmission dynamics in the hopes of creating and implementing effective research-based conservation and public health strategies to simultaneously improve human and lemur health. The ultimate goal of this research is to investigate how habitat destruction influences vector borne diseases in human and lemur populations simultaneously to better inform conservation and human health implementation strategies.

Additional 2014 Research Project Titles (only):

Evaluation of the impact of invasive species on the native biodiversity of Ranomafana National Park

Summer ARRIGO-NELSON, Heather Sahli, Shelby Zikeli (California University of Pennsylvania), Emily Yu (Princeton University), Rio Ridish Hernianina (University of Antananarivo), Jim Bliska, Lawton Chung (Stony Brook University); students (ENS, University of Antananarivo)

Long-term study on the biodiversity of *Diptera brachycera* with a focus on the *Therevidae* and *Acroceridae* families

Michael IRWIN, Franck Porter, Harin’Hala Rasolondalao, Tahiana Ramanantsoa, Lanja Razafindranaivo (California Academy of Science-Madagascar), Stephen Marshall (University of Guelph), Ashley Kirk-Spriggs (National Museum, South Africa)

Therevidae and Acroceridae of Madagascar

Martin HAUSER (California Academy of Sciences), Stephen David Gaimari (California Department of Food and Agriculture), Rin’Ha Rasolondalao (CAS-Antananarivo)

***Microcebus*: A novel organism as a genetic model for medicine**

Mark KRASNOW, Megan Albertelli, Caitlin Karanewsky (Stanford University), Sarah Zohdy (Emory University), Alex Sholtz, Camille Ezran, Jozeph Pendleton, Emily Willick (Stanford University), Robert Giordano (Emory University); ENS, University of Antananarivo

Predation on Birds in Ranomafana National Park

Eric Temba MARCEL (Ph.D. candidate, University of Antananarivo)

Species Recognition in red-fronted lemurs

Hanitra RAKOTONIRINA (Ph.D. candidate, German Primate Center)

Study on the diversity of mushrooms

Patrice RAVONJIARISOA, Santarininiaina Valimbavaka, Tsiory Andrianjafy, Voloniaina Natacha Hasinarivelo, Njivalalaina Rivomanantsoa (IFT, Antananarivo)

Herpetological Inventory of Madagascar

Christopher RAXWORTHY (AMNH), Felix Rakotondraparany, Achille Raselimanana, Christian Randrianatoandro, Sando Mahaviasy, Nihry Rabibisoa, Sara Ruane, Frank Burbrink

Appendix 2: Publications

2015

Bodager JR, Parsons MB, Wright PC, Rasambainarivo F, Roellig D, Xiao L, Gillespie TR. 2015. Complex epidemiology and zoonotic potential for *Cryptosporidium suis* in rural Madagascar. *Veterinary Parasitology* 207:140-143.

Bublitz DC, Wright PC, Rasambainarivo FT, Bodager JR, Gillespie TR. 2015 (in press). Pathogenic enterobacteria in lemurs associated with anthropogenic disturbance. *American Journal of Primatology*.

Karanewsky, C.J. and Wright, P.C. (submitted). An investigation of sleeping site selection and sharing by the brown mouse lemur *Microcebus rufus* during the dry season.

Karanewsky, C.J., Bauert, M., and Wright, P.C. (in revision). Effects of sex and age on dry season hibernation in eastern rain forest mouse lemurs – evidence from wild and captive animals.

Tecot S, Baden AL. 2015 (in press). Allomaterial care in primates. In: Scott RA, and Kosslyn SM, editors. *Emerging trends in behavioral and social sciences* Hoboken: Wiley Blackwell.

Zohdy S, Fried IR, Cross KC, Wright PC, Gillespie TR. 2015 (in press). Diversity and prevalence of diarrhea-associated viruses in the lemur community and associated human population of Ranomafana National Park, Madagascar. *International Journal of Primatology*.

Zohdy S, Derfus K, Andrianjafy MT, Wright PC, Gillespie TR. (in press) Field Evaluation of Synthetic Lure (3-methyl-1-butanol) When Compared to Non Odor-Baited Control in Capturing Anopheles Mosquitoes in Varying Land-Use Sites in Madagascar. *Parasites & Vectors*.

2014

Baden AL, Holmes SM, Johnson SE, Engberg SE, Louis EE, Bradley BJ. 2014. Species-level view of population structure and gene flow for a critically endangered primate (*Varecia variegata*). *Ecology and Evolution* 4:2675-2692.

Bublitz DC, Wright PC, Bodager JR, Rasambainarivo FT, Bliska JB, Gillespie TR. 2014. Epidemiology of pathogenic enterobacteria in humans, livestock, and peridomestic rodents in rural Madagascar. *PLoS ONE* 9:e101456.

Cadle JE. 2014. Natural history and taxonomic notes on *Liopholidophis grandidieri* Mocquard, an upland rain forest snake from Madagascar (Serpentes: Lamprophiidae: Pseudoxyrhophiinae). *Herpetological Conservation and Biology* 9:406-416.

- Cadle JE, Savage JM. 2014. Systematics of the Neotropical snake *Dendrophidion paucicarinatum* (Cope). with a description of its hemipenis (Serpentes: Colubridae). *Bulletin of the Museum of Comparative Zoology* 161:111-138.
- Cahill, A.E., M. E. Aiello-Lammens, M. C. Fisher-Reid, X. Hua, C. J. Karanewsky, H. Y. Ryu, G. C. Sbeglia, F. Spagnolo, J. B. Waldron, and J. J. Wiens. 2014. Causes of warm-edge range limits: systematic review, proximate factors and implications for climate change. *Journal of Biogeography* 41:3, 429-442.
- Kotschwar Logan M, Gerber BD, Karpanty SM, Justin S, Rabenahy FN. 2014. Assessing carnivore distribution from local knowledge across a human-dominated landscape in central-southeastern Madagascar. *Animal Conservation*: DOI: 10.1111/acv.12137.
- Razafindratsima OH, Dunham AE. 2014. Assessing the impacts of nonrandom seed dispersal by multiple frugivore partners on plant recruitment. *Ecology* <http://dx.doi.org/10.1890/14-0684.1>
- Schwitzer C, Mittermeier RA, Johnson SE, Donati G, Irwin M, Peacock H, Ratsimbazafy J, Razafindramanana J, Louis Jr. EE, Chikhi L, Colquhoun IC, Tinsman J, Dolch R, LaFleur M, Nash S, Patel E, Randrianambinina B, Rasolofoharivelo T, Wright PC. 2014. Averting lemur extinctions amidst Madagascar's political crisis. *Science* 343:842-843.
- Taylor CM, Malcomber S, Schatz GE. 2014. Updated taxonomy of *Gaertnera* (Rubiaceae, Gaertnereae) in Madagascar, with sixteen new species. *Annals of the Missouri Botanical Garden* 99:688-729.
- Wright PC. 2014. *For the love of lemurs: my life in the wilds of Madagascar*. New York: Lantern Books.
- Wright PC, Andriamihaja BR, King SJ, Guerriero J, Hubbard J. 2014. Lemurs and tourism in Ranomafana National Park, Madagascar: economic boom and other consequences. In: Russon A, and Wallis J, editors. *Primate tourism: a tool for conservation?* Cambridge, UK: Cambridge University Press.
- Zohdy S, Gerber BD, Tecot S, Blanco MB, Winchester JM, Wright PC, Jernvall J. 2014 Teeth, sex, and testosterone: aging in the world's smallest primate. *PLoS ONE* 9:e109528.

Master's Theses

- Richter SR. 2014. Screening mammal biodiversity using DNA from Malagasy leeches. Copenhagen, Denmark: University of Copenhagen. MS.

PhD Dissertations

- Banks M. 2014. Determinants of abundance and the distribution of primates in northern Madagascar Stony Brook, NY: Stony Brook University.

Appendix 5: ICTE/CVB U.S.A. based activities

- Jan 28 – Andrew Sabin Family Foundation Primate Conservation Award, inaugural award presented to Dr. Wright’s student, Fanny Cornejo
- Feb 1 – NYC – Special fundraising screening of IMAX Madagascar: Island of Lemurs
- Feb 22 – Visit to the Oakland Zoo, meet with donor Margaret Rousser
- Feb 24 – Seminar at UC Davis, CA
- Mar 1 – NYC -IMAX film interview at ABC World New Tonight
- Mar 5 – Meeting with Newsday reporter, Brittany Wait (SBU gala)
- Mar 6 – IMAX film at the Bronx Zoo, ABC interview
- Mar 6 – PIVOT Launch Party
- Mar 10 – Interview for SBU bookstore newsletter
- Mar 14 – IMAX film screening at AMC Loews Stony Brook for Newsday
- Mar 14 – Newsday Kids Day Interview
- Mar 17 – National Science Foundation Proposal Submission - CC*IEE Networking Infrastructure: Developing a Cyberinfrastructure Backbone at Stony Brook University’s Madagascar Research Campus, Centre ValBio, \$483,297.00. Declined
- Mar 28 – IMAX film premier in Los Angeles , Press Day
- Mar 29 – IMAX film premier, Red Carpet Opening
- Mar 31 – IMAX film, Press Day and Duke University, NC
- Apr 1 – IMAX film premier at Washington D.C.
- Apr 1 to 17 – Dr. Benjamin Andriamihaja, ICTE/MICET and Mr. Desire Randrianarisata CVB in New York
- Apr 7 – Warner Brothers arranged interview for MINI Page
- Apr 9 – IMAX presentation in Calgary
- Apr 16 – Stony Brook University Gala
- Apr 21 – New York Times Interview
- Apr 22 – Indianapolis Prize Finalists Tweet-up at SBU
- Apr 23 – SBU Africa Bus inauguration
- Apr 24 – ICTE/CVB table at SBU Earthstock
- Apr 24 to 26 – American Philosophical Society Members Meeting
- May 5 – Science on Tap with Patricia Wright
- May 9 – Meeting with Dorothy Lichtenstein
- May 12 to 16 – Indianapolis Prize Winner Announcement Tour, IN, DC & NY
- Jun 6 – Institute Pasteur Madagascar Meeting, Joint Workshop with Centre ValBio
- Jun 15 – Mr. Pascal Rabeson, CVB in U.S.A.
- Jul 3 - Study Abroad Orientation
- Aug 1 – National Science Foundation Proposal Submission – OPUS: Synthesis of long-term research on sympatric rainforest lemurs. \$187,736.00
- Aug 13 to 16 – International Primatological Society Congress
- Sep 2 – Meeting with Star Chef Mr. Recipe, Aaron Isaacson
- Sep 10 – Fall Study Abroad Orientation
- Sep 23 – Presentation in Cincinnati
- Sep 27 – Indianapolis Prize Gala
- Oct 2 – Harvard Museum Lecture
- Oct 6 – Mongabay Interview
- Oct 7 – Stony Brook University Award Dinner

- Oct 10 – Primary Perspectives Radio Interview
- Oct 11 – Presentation at Canio’s Bookstore in Sag Harbor
- Oct 14 – Martha Steward Radio Program Interview
- Oct 15 – Wildlife Conservation Film Festival IMAX film screening
- Oct 17 – Wildlife Conservation Film Festival Gala – Lifetime Achievement Award
- Oct 21 – National Science Foundation Pre-Proposal Submission - PIRE: Ecological speciation genomics in vanishing habitats: building evolutionary expertise and environmental wisdom from Madagascar to China. In partnership with Duke Lemur Center. Pending
- Oct 23 – MacArthur Fellows Forum – Chicago
- Oct 27 to 31 – Lemur Week activities on the Stony Brook University campus
- Nov 18 – National Science Foundation Proposal Submission – CNH-L: Ecology of Poverty in a Biodiversity Hotspot. In partnership with Harvard and Emory University, \$1,799,770.00, pending
- Nov 19 – National Science Foundation Proposal Submission – EEID: Poverty Traps and the Ecology of Infectious Diseases in Madagascar. In partnership with Emory and Harvard Universities, \$2,375,999.00. pending