Centre ValBio

Annual Report

2020

Oxylabes madagascariensis

Contents

History of CVB

In 1986, primatologist Patricia Chapple Wright was given a seemingly impossible task: to travel to the rainforests of Madagascar and find the greater bamboo lemur, a species that hadn't been seen in the wild for thirty years. Not only did Dr Wright discover that the primate still existed, she proved that it lived alongside a completely new species, the golden bamboo lemur. What followed was a love affair with an animal and a country that continues to this day. Dr Wright is best known for her study of lemurs in Ranomafana National Park ('RNP'), which she helped establish in 1991.

Centre ValBio ('CVB') was created by Dr Wright in 2003 under the Institute for the Conservation of Tropical Environments' agreement with the Government of Madagascar. The richness of the critically endangered plants and animals, contrasted with the poverty of the people, inspired her to help both survive in harmony.

CVB's mission is:

- To promote world-class research and biodiversity training opportunities in one of the world's most biologically diverse and unique ecosystems;
- To promote environmental stewardship by providing conservation education and ecologically sustainable economic opportunities within local communities; and
- To provide the local villagers with the knowledge and tools to improve their quality of life through projects focused on health and wellbeing.

Letter from the Executive Director

Dear CVB friends and supporters,

2020 was a challenging year globally due to COVID-19, and consequently it was a very difficult year for a developing country like Madagascar. It started well, with workshops and study abroad students filling CVB for the entire month of January. I even returned in March to work on a translocation of greater bamboo lemurs from Ivato in southeastern Madagascar to Ranomafana National Park. Then, because of the spread of the virus worldwide, Madagascar insisted that all foreigners leave. I left on March 20th, luckily catching the last plane out. The only international airport in Madagascar has remained closed since then, and I was unable to return to Madagascar for the rest of the year.

CVB faced incredible challenges in 2020. With the international airport closed, tourists and researchers could not come to Madagascar. Inevitably, this resulted in there being no income for CVB and no income for Ranomafana National Park and its tourist guides.

In addition to this financial difficulty, I was very concerned about the spread of the virus in a country with few respirators and without modern healthcare facilities. I gathered the CVB Board together in April and we launched into action to combat the spread of the virus and save CVB. Working to fundraise together, the NGO BeLocal and CVB's Board raised enough money to allow the purchase of sewing machines and mask fabric, and we organized the local women's weaving group along with some of our staff to produce over 10,000 masks. We also purchased alcohol from local stills and made hand sanitiser, as well as producing posters and materials warning about COVID-19. Jessie Jordan, a consultant who has worked with CVB many times, teamed up with Joan Miyazaki, Jacqueline Grennon, Susan Wheeler, and Mary Lee Gaylor to set up virtual wildlife tours featuring the official Ranomafana tour guides. These were filmed at and broadcast from the CVB media studio, reaching people from all over the world and showing them the incredible biodiversity of RNP. The income from these virtual tours has managed to keep the tourist guides safe and secure since the pandemic started.

With the options for generating income severely limited, Dini Diskin-Zimmerman and the Stony Brook communications team invited me into the studio to create a fundraising video. A committee led by Dr Joan Abrahamson wrote the text for this compelling broadcast, which, in conjunction with the CVB Board's personal efforts, led to us raising enough funds to support all salaries for our 133 staff for six months. I cannot thank the Board enough for this heroic effort. In autumn, when it was clear that COVID-19 would continue to disrupt things for some time to come, Dorothy Lichtenstein and her family foundation came to our rescue and provided funding for staff salaries until June 2021. Thank you, Dorothy, from everyone at CVB who has worked so hard for the past 30 years to save the lemurs, wildlife, and people around Ranomafana National Park. Additionally, the anonymous donors for the Health Team have agreed to continue supporting our remote village health interventions for the next four years—good news indeed!

It was a rocky year; CVB was forced to take the extreme precaution of closing its doors three times. In October, seven staff members lost their sense of smell and subsequently tested positive for the virus. They were quarantined immediately but only one required further intervention—a couple of nights in hospital. Thankfully, everyone made a full recovery, and since there have been no additional cases amongst the staff, we opened CVB again.

Making lemonade out of lemons, CVB staff teamed up with ICTE researchers at Stonybrook to concentrate on digitising the thirty years of data that have been generated by CVB. Spearheaded by Dr Beatriz Otero Jimenez, David Cyrille, and Dr Elinor Schoenfeld, the database project has begun to take shape. With the help of CVB Research Department staff Jean Claude Razamahaimodison, Laza Andrianandrianina, and Dina Andrianoely, our Research, Education, and Health Teams digitised their historical hardcopy data in a concerted effort to create a repository of information encompassing climate material and lemur behaviour information to educational statistics and health data.

Although many of our field research projects were curtailed, long-term projects such as my *Propithecus* project, Andrea Baden's Mangevo research, the TEAM programme (thanks to CVB Board member Steig Johnson's financial assistance), and the CVB bamboo lemur work were all able to resume in November.

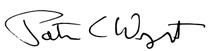
Mariah Donohue, a PhD student at the University of Kentucky and a Fulbright Scholar, was the only researcher to remain at CVB, bravely continuing her work examining whether gut microbiome functional plasticity is correlated with host reproductive output. It would be remiss not to mention the bright spots in this dark year: Noromalala Eliette, a Malagasy graduate student who has worked for many years with various CVB projects, is getting her master's in the USA; Dr Onja Razafindratsima began her first year as an Assistant Professor at Berkeley; and Dr Jonah Ratsimbazafy was elected President of the International Primatological Society and has a mouse lemur (*Microcebus jonahi*) named after him. Thanks to Michael Docherty, CVB Administrative Director, a social company named Ecosia that converts internet searches into trees planted has agreed to fund a pilot reforestation project to plant 300,000 endemic trees. Catholic Relief Services, our long-term collaborator, has received further funding for the SPICES project through the USAID grant 'HEARTH', and we will again be subcontractors. Jim Hazen of CRS was the prime mover on this collaboration, and we thank him for his continued efforts. Dr Meg Lowman, founder of Mission Green, is working with CVB and Madagascar National Parks to build the first ever canopy walkway in Madagascar in Ranomafana National Park. Lastly, we are expanding the scope of our biodiversity surveys and long-term monitoring to the island of Île Sainte-Marie on the east coast, through a partnership with The Essence of Madagascar, a high-end eco-tourism organisation.

On January 15th, 2021, we christened our new SOS IUCN building 'AinaBe Hall', which translates to 'great life' (and hence 'biodiversity'). To prepare for the opening of this incredible new facility, members of the Research Department participated in comprehensive herbarium training with Missouri Botanical Garden. After three hard years of work on this building, the laboratories, herbarium, and insect and fossil collections are all in place, the server room is nearly up and running, the research offices are beautiful, and the conference room is ready for meetings and workshops.

We are all pleased that 2020 is over and that CVB has survived. We are hugely grateful to the CVB Board and all of the donors who have made this possible. We remain optimistic that 2021 will be a successful and productive year, with researchers and visitors returning to Madagascar and to CVB.

My best wishes to our wonderful CVB staff, including the leadership of Michael, Pascal, Dede, Jean Claude, Lovasoa, Nicolas, Prisca, and Dr Ando.

Sincerely,



Dr Patricia C. Wright
Founder and Executive Director
Centre ValBio

2020 Highlights

Meetings and Events Hosted by CVB
Activities Attended by CVB Staff
COVID-19 Response

Jan. 6—13
Ecological and Epidemiological Modelling Madagascar ('E2M2') workshop, 40 pax

Jan. 2—25
Stony Brook University study abroad, 20 students

Jan. 13—17
Catholic Relief Services workshop on reforestation

Jan. 16—18
USAID Access Program workshop, 32 pax, USAID staff

Feb. 4
Investiture of the new Mayor and his staff, Commune Ranomafana

Jan. 14
Inauguration of High School Ranomafana, Attended by Dr Patricia Wright and CVB's senior management

Jan. 19
Official launch of reforestation in the District of Ifanadiana

Feb. 17—19
FANC (Finnish Association for Nature Conservation), training on forest monitoring, 15 pax

Feb. 22
Pre-presentation of independent projects of M2 students, E-atiala Centre, Centre ValBio, University of Fianarantsoa

Feb. 26
Celebration of schools' day, Lapan'ny Vahoaka, Ifanadiana

Feb. 29
BeLocal Business Development Workshop on recycling grass and other materials to make charcoal, 30 pax, BeLocal staff

Feb. 19
Population Health and Environment Workshop, Creation of the Health Population Environment network (SPE) of Ifanadiana District, Lapan'ny Vahoaka Ifanadiana

Feb. 22—Mar. 7
Trichuris project, training in epidemiological evaluation and parasitology, University of Manchester, Maminiaina Rakotonandrasana

Mar. 21—Dec. 2
COVID-19 Committee meeting (District of Ifanadina), SDSP Ifanadina. Attended by Pascal Nalimanana Rabeson, Dr Ando Lovasoa Rakotoniaina, and Laza Harifetra Andrianandrianina

Apr. 17
The Ministry of Public Health and Governor of the region reach out to officially request that CVB's lab be used for testing

Jun. 10
Coordination meeting on COVID-19 between CVB and PIVOT

Jun. 15—Jul. 13
Training on green charcoal in Ambinanindrano

Oct. 10
Preparation meeting of DIP FY 21 SPICES and training on organic certification, CRS office, Antananarivo

Oct. 22
Training on grafting orange trees, Ambositra

Nov. 9
Training of villagers on organic certification and business planning in Ifanadiana, led by Tojoniaina Andriamparany

Nov. 14
The bulk of the CVB laboratory conversion work is completed, including all partitions

Nov. 16—24
Training on creation of a herbarium, at Tsimbazaza, Missouri Botanical Garden, and University of Antananarivo. Attended by various CVB Research Department staff

Nov. 24
Training workshop on reforestation and tree nurseries, Farafangana. Led by Health In Harmony and the CVB Reforestation Team

Nov. 30—Dec. 4
CRS MMAC workshop, 24 pax, CRS staff

Dec. 3
CRS workshop, "Spices of Ranomafana", 36 pax, CRS staff and two CVB staff

Dec. 9
Lemur Portal. Exchange with Madagascar Lemur Portal about primatology. at Centre ValBio, Attended by two CVB staff members

Dec. 7—18
Second session of the training on the creation of a herbarium, at Centre ValBio

Continuing our productive 18-year partnership, CVB continued to work closely with MNP as they welcomed their new Ranomafana Director, Vola Raherisoa. Vola was previously Head of Conservation and Research at Andringitra National Park, and is familiar with Ranomafana after having done a chameleon population study here after specialising in herpetology at the University of Antananarivo. We look forward to many more years of collaboration!

As a mark of our continued support for the Park, plans are afoot to create a canopy walkway. Not only would this be an incredible addition to the Park's appeal for tourists, it would allow our canopy amphibian researchers easier access to this critical biome. Seeing the forest we know so well from this new perspective will be a fascinating experience!

Slightly further afield, we also started discussions this year with PIVOT about a project to protect the Namorona River which flows through the Park. Deforestation of the riverbanks exacerbates erosion, impacts wildlife specific to that habitat, and decreases water quality. We hope to partner with PIVOT to combat this destruction.

Tsihy be lambanana ny ambanilantra.

- Dr Benjamin Andriamihaja,
ICTE Country Director

2020 was marked by the COVID-19 pandemic, and Madagascar was one of the victims. As a research centre, Centre ValBio was severely impacted as researchers cancelled bookings and national restrictions limited movement. Much activity, such as field work, had to pause, leaving CVB staff to work on campus with intermittent interruptions when the number of COVID-19 cases increased.

Centre ValBio participated actively in the fight against COVID-19, helping with the distribution of masks and hand washing stations while supporting the regional sanitary checkpoints. We worked hand in hand with the Commune and with other NGOs to spread sensitisation messages.

Good things also occurred, including the completion of 'AinaBe', our new biodiversity laboratory which enhances our ability to work on botany and entomology. It is a point of pride that we were able to complete this building despite the global situation.

I would like to thank Patricia, Benjamin, Michael, all the members of the CVB Board, Stony Brook University, and all CVB staff; together we were able to get through 2020. I am looking forward to prosperity for each of us, and CVB, in life and work in 2021.

- Pascal Rabeson,
CVB National Director

It is difficult to summarise a year that witnessed so much change between January and December. CVB would not have survived without an ability to find silver linings, and I am immensely proud of the way that our staff, our researchers, and our community have managed to respond positively despite the COVID-19 crisis.

I would especially like to highlight the new era of Board involvement that has been ushered in by our response to COVID-19. In addition to providing the direct donations that have kept CVB running, the Board have started to meet more regularly and formed various task forces. I have high hopes for what this energy and talent will do for CVB!

Discussions are continuing regarding solar power, with a German company in the advanced stages of creating a plan for a system that includes battery backup. This will reduce electricity costs while protecting our laboratories, and we hope to start searching for funding soon.

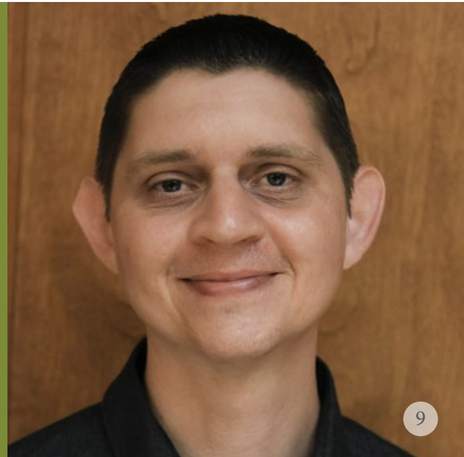
Lastly, we are lucky to have been able to meet with the UK and US ambassadors a number of times during the year. Both embassies are committed to the conservation of Madagascar's biodiversity, and we look forward to collaborating with them in the future.

- Michael Docherty,
ICTE/CVB Administrative Director

The era of COVID-19 brought about many trials for CVB. These included a complete stoppage of researchers visiting the campus, staff falling ill and having to quarantine, and the economic and social fallout from Madagascar going into lockdown. However, over the last year I also watched as our staff, campus, and community rose up to this challenge, ensuring not only CVB's future but giving hope for a brighter tomorrow for Madagascar. Our staff produced over 10,000 masks by hand, helping to keep the campus and community we serve safe. We converted our primary flex-lab into a dedicated PCR testing site, including facilities that will let us test for COVID-19 with our partner PIVOT. We also completed AinaBe, and with it enhanced our capability to detect and monitor future viruses. Watching CVB completely transform in response to a unique situation demonstrates why it commands a top position in tropical science research.

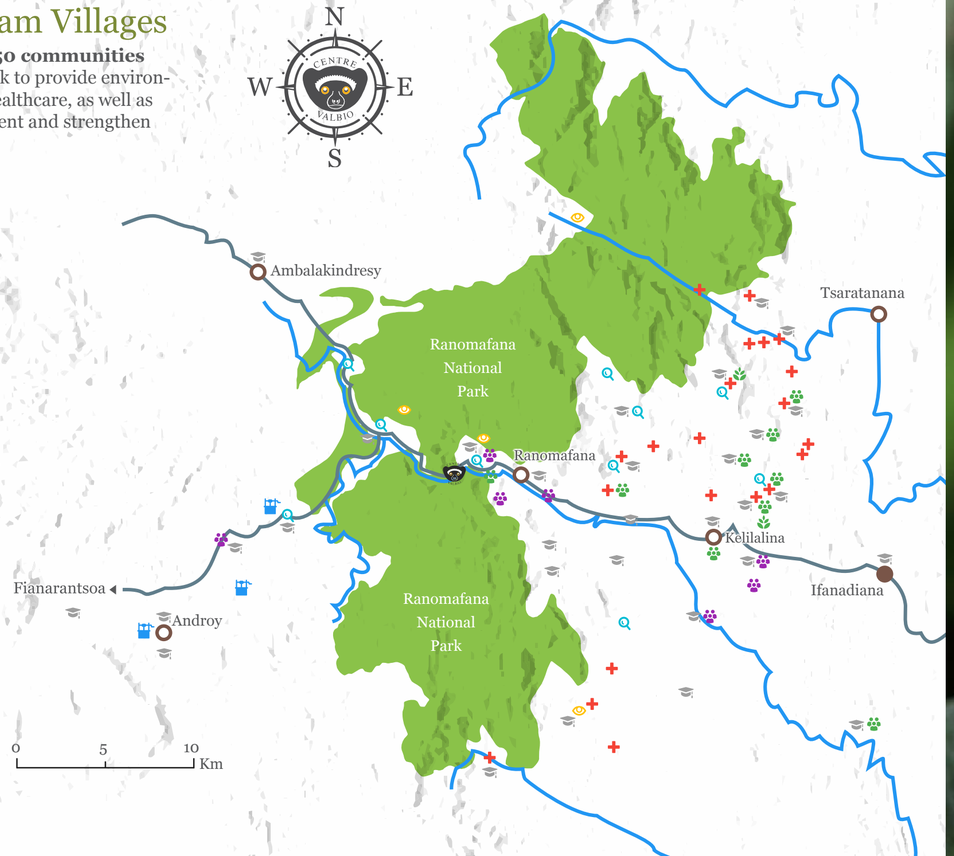
I am thankful for each and every one of our staff, partners, and scientific researchers, all of whom have helped to make this transformation possible. And I am especially thankful for our community members like you, for supporting CVB.

- Jesse McKinney,
ICTE/CVB Chief Technology Officer



Map of CVB Program Villages

Centre ValBio is working in over **50 communities** around Ranomafana National Park to provide environmental education and access to healthcare, as well as to facilitate community development and strengthen income-generating opportunities.



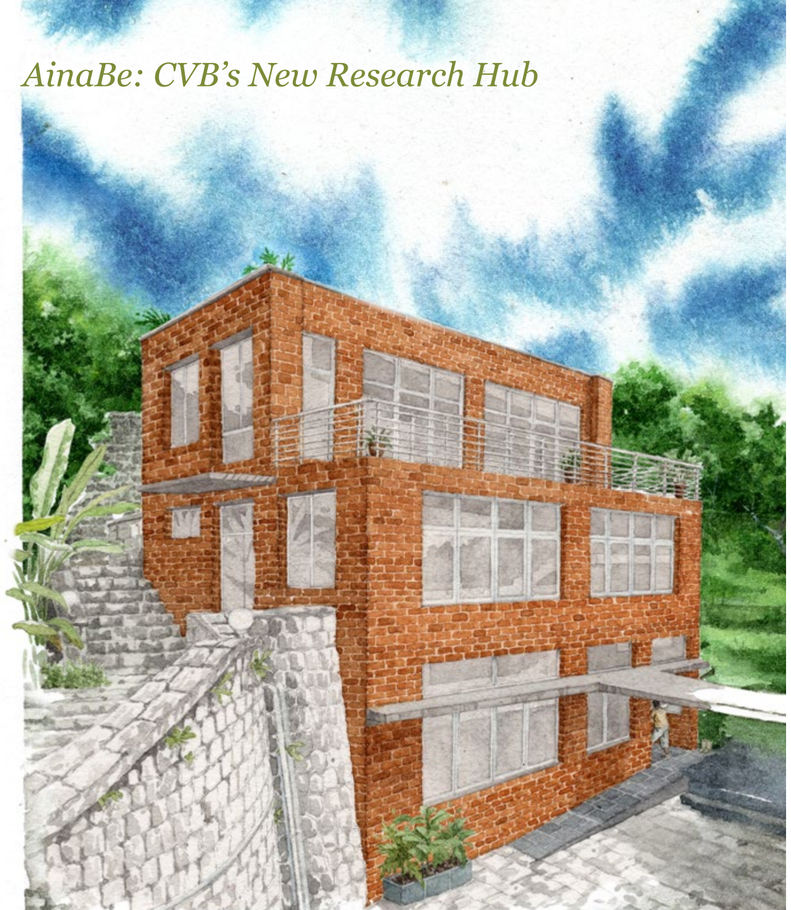
Key

- Conservation Club
- Conservation Club & Reforestation
- Reforestation
- Health
- Education
- Participatory Ecological Monitoring
- TEAM
- Wells

- Road
- River
- District
- Commune

Junonia goudotii

AinaBe: CVB's New Research Hub



In December, CVB reached an important milestone in its growth with the final completion of the 'AinaBe' research hall. The name AinaBe complements our other campus buildings ('LovaBe' and 'NamanaBe'), and translates to 'great life', a fitting name for a building dedicated to preserving biodiversity!

The facility includes additional laboratory space, allowing CVB to welcome more researchers as we expand to examine every aspect of life in a tropical biome. This additional space is especially important given that the NamanaBe laboratories have been dedicated to the COVID-19 testing project—please see page 28.

As well as laboratory space, there will also be a dedicated collections room where we will document and preserve the great diversity of life to be found in and around Ranomafana National Park, including plants, reptiles and amphibians, Lepidoptera, insects and other arthropods, and the fossils that Dr Wright has collected over the years. Our ability to document botanical samples to the highest standards is thanks to the MBG training that our staff undertook—please see page 36.

On the upper floors, there is much-needed office space for the senior members of the Research Department, as well as desk space for some of CVB's long-term researchers. Now they get to perform their work while enjoying a panoramic view of the very park they are studying! Additionally, a new high-tech server room has been included, bringing CVB's technological capabilities to the level needed for us to begin our expansion into the field of genomics.

Special thanks are due to the SOS ('Save Our Species') initiative of the IUCN, without whose generous funding all this would not have been possible. This facility will greatly help CVB's efforts to ensure the long-term survival of threatened species and habitats, and the people who depend upon them.

A small, outdoors, socially-distanced ceremony to officially inaugurate the building was held, presided over by Dr Wright, Dr Andriamihaja, and the mayor of Ranomafana, Victor Ramiandrisoa.

Ranomafana Virtual Tours

Jessie Jordan

Jessie Jordan first came to Madagascar in 2018 for an artist residency at CVB, but her role evolved to encompass communications, partnerships, and community engagement on conservation projects. Finding herself trapped in Madagascar because of COVID-19, she turned her talents to solving a pressing local problem.

Realising that local tour guides had seen their incomes completely evaporate due to the pandemic, I joined forces with Dr Wright and Dr T. Ukizintambara to apply for a grant that would support the guides in the absence of tourists. However, it became clear after applying that it would take time before we heard whether or not we had been successful. The guides could not wait this long.

Given this, I started to develop the concept of a 'virtual tour', as well as launching a GoFundMe campaign to provide the urgent support that the guides and their families needed: monthly relief packages containing food and other essential items. This foresight proved fortunate, as we did not receive the grant but were nonetheless in a position to build a team for the virtual tour initiative. We began putting together a programme alongside some of the guides from the *Association des Guides Ranomafana* ('AGR').

The team experimented with Zoom and the use of green screen to take people on immersive virtual educational hikes from the comfort of their own home during lockdown. I wrote up the programme guidelines and managed content development and marketing. Working with Diamondra, a guide and photographer, I filmed videos of wildlife to use on the tours. We practiced our tours with Dr Wright and a team of advisors who offered us helpful feedback to improve the overall experience. We called our project 'Ranomafana Tours', and were able to secure a website, cover our monthly Zoom fees, and support the project participants and guides most in need – all thanks to our generous donors.

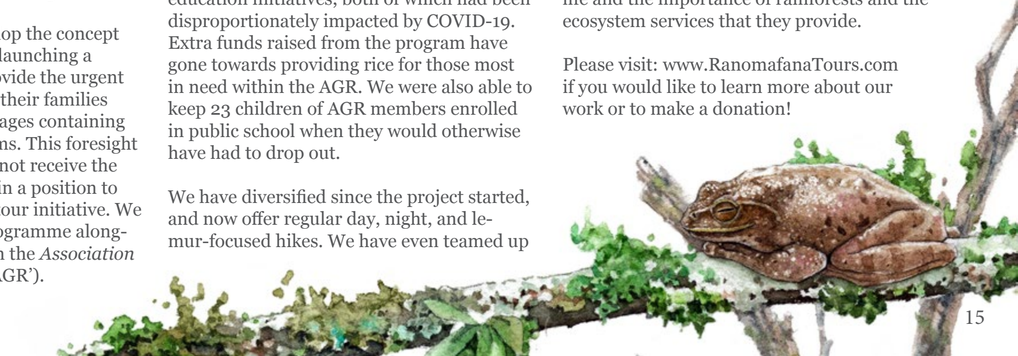
The goals of Ranomafana Tours are to raise awareness about, and celebrate the unique biodiversity of, Ranomafana and other parts of Madagascar, and also to generate funds for local wildlife ambassadors and conservation education initiatives, both of which had been disproportionately impacted by COVID-19. Extra funds raised from the program have gone towards providing rice for those most in need within the AGR. We were also able to keep 23 children of AGR members enrolled in public school when they would otherwise have had to drop out.

We have diversified since the project started, and now offer regular day, night, and lemur-focused hikes. We have even teamed up with some wildlife artists to co-host special nature art classes. We do public virtual tours on the weekends, but have also hosted virtual sessions with universities around the world.

CVB has supported us greatly by allowing us to use their studio space to host our virtual tours in the evenings and on weekends. Not only does the recording studio provide exceptional sound and light quality control, it also ensures that we have power when the electricity cuts off unexpectedly—sadly a frequent occurrence in Ranomafana! The town, along with the rest of the region, relies on hydroelectric power. However, water levels have been abnormally low, and it is difficult not to think that climate change plays a role in this.

We are always developing, and most recently have created a conservation education program where the guides lead local school groups on hikes to teach children about wildlife and the importance of rainforests and the ecosystem services that they provide.

Please visit: www.RanomafanaTours.com if you would like to learn more about our work or to make a donation!



Stony Brook Study Abroad Programme

When people look back at their time in college, they can often point to one or two life-altering experiences. If a student travels abroad, it is almost certain to be one of those experiences. From January 2nd to 25th, Stony Brook University took 20 students on just such a life-altering study abroad trip to Madagascar. The trip included students from China, Madagascar, and the USA.

For many of the students, this was their first time traveling internationally. But, in the span of 22 days, they experienced a new world. This encompassed trying novel foods, learning to greet fellow researchers in Malagasy, and seeing animals and vistas that they had previously only seen in books. A truly incredible experience.

Each student conducted an independent research project while based in Madagascar, based on their personal interest and experiences. These projects covered a wide range of fields, including ecology, economics, education, health, renewable energy, deforestation, pollution, and zoology. Students crisscrossed around Ranomafana taking samples, observing animals, meeting community members, and writing up the results. It was a whirlwind of activity.

For students interested in veterinary medicine, this was a chance to engage closely with unique wildlife. Much of their time was spent in the field observing animals in RNP and walking through the forest tracking lemurs as they leapt from tree to tree. In one case, they helped Dr Wright capture and tag lemurs. Transformative experiences such as this can dramatically impact a student.

Of course, there was also time for fun. Students visited the UNESCO World Heritage Site at the Royal Hill of Ambohimanga as well as Anja Community Reserve. There was also time for hiking, swimming at the waterfall, kayaking, singing, dancing, weaving baskets with the local cooperative 'Famiova', and laughing around the dinner table!

Prolemur simus

Naturally, when the students came back from the trip the world had changed. COVID-19 was spreading over the globe, forcing universities to move online and halting international travel. The 2020 winter study abroad trip might be one of the last trips where the students won't have to wear masks or show proof that they were vaccinated.

CVB study abroad changes students' lives. Studying in Madagascar is a once in a lifetime experience. The students grow academically, but, more importantly, they learn about themselves as they adapt to their new settings and persevere in the face of novel challenges. We can't wait to host more study abroad students in 2022.

Noromalala Elliette's Fulbright Foreign Student Scholarship in the USA

After working for a year and half on Andrea Baden's *Varecia variegata* project at the Mangevo research site in Ranomafana National Park, I was awarded a Fulbright Foreign Student Scholarship to further my education by studying in the USA. This academic experience will allow me to better protect the endangered lemurs of Madagascar.

I arrived in America at the beginning of January and had never experienced freezing cold weather like this in my life! My studies began by learning English intensively for six months in Champaign, Illinois, prior to the academic section of the scholarship. This pre-academic course aimed not only to help familiarize me with US culture, but also to increase my idiomatic English comprehension to help me prepare for the school year ahead.

In September I started the academic component of my studies at Central Washington University, in the Primate Behavior and Ecology programme. Of course, my project will be focused entirely on lemurs!

- Noromalala Elliette

Hapalemur griseus ranomafanensis

Phelsuma lineata

Varecia variegata editorum

Eulemur rufifrons

Dr Onja Razafindratsima

Dr Onja Razafindratsima has started a new position as a tenure-track Assistant Professor in the Department of Integrative Biology at the University of California, Berkeley, in January 2021. Her tropical ecology lab will continue conducting research in Ranomafana National Park, alongside Centre Valbio's dedicated team of field technicians. Her research aims to provide new insights to advance the field of seed dispersal ecology, including the impacts of animals on plants. This will cover effects from the individual level to population and community levels, the implications of this plant-animal interaction on the ecology of both partners, and the consequences of losing animal seed dispersers on ecosystem health. Her field team, including Malagasy students, CVB research technicians, and local guides, began fieldwork in November 2020 surveying biodiversity in fragments around Ranomafana National Park, as a baseline for future research projects.

- Dr Onja Razafindratsima

Microcebus johani

We are delighted to share the news that Jonah Ratsimbazafy, one of Madagascar's foremost primatologists and a researcher with a longstanding connection to Centre ValBio, was this year given the great honour of having a newly-discovered species named after him; the mouse lemur *Microcebus jonahi*.

Dr Ratsimbazafy has been associated with CVB since the 1990s, and received his PhD from Stony Brook University. Dr Wright, CVB founder, was his doctoral supervisor in Anthropological Sciences.

Furthermore, Dr Ratsimbazafy is co-founder and President of the Madagascar Primate Study and Research Group (GERP), and in 2020 he was elected President of the International Primatological Society.

The new species was discovered in north-eastern Madagascar, after a study of communities of mouse lemurs at five different sites, measuring a variety of morphological parameters and assessing reproductive states for 123 individuals belonging to five different lineages. It has short and dense reddish-brown fur, with ears that are small and are of the same rufous colour as the head. The tail is densely furred and of the same colouration as the back.

For more information, please see: https://doi.org/10.1002/ajp.23180

CVB & COVID-19: The Story

CVB entered 2020 like many of you will have; with a general idea of what the year would be like, and a list of goals that we hoped to accomplish. And, as it will have been for many of you, our reality was radically different from these expectations.

This is not to say that we have accomplished nothing! Rather, we have managed to achieve and excel in ways that we could not possibly have imagined back in January when COVID-19 was only being discussed far away from the headlines.

When the scale of the pandemic became apparent, CVB shifted gears and refocussed on combatting the virus, locally and nationally. For many staff, this involved learning new skills (soap and mask making), enhancing their training (PCR testing), or applying their time and effort in new ways (sensitisations and distribution of equipment). The willingness and energy displayed by all CVB staff when embracing these challenges has been incredible, and they have contributed to Ranomafana being one of the most well-prepared towns in all of Madagascar.

In total, over 10,000 masks, 6,000 bars of soap, and 28 handwashing stations were distributed to Ranomafana and 17 surrounding villages, in addition to the 648 hours that were spent by the Health Team assisting at the government's sanitary barriers. While not totally escaping the virus, Ranomafana has avoided the worst of the situation, and this is at least partly due to the swift actions of CVB and our partner PIVOT.

None of this response would have been possible without the generous intervention of CVB's donors. In normal years, CVB works hard to accommodate researchers, study abroads, and other science- and conservation-based activities to generate revenue. Of course, this was not possible this year. Nonetheless, we were able to retain all of our staff, and we were able to help combat COVID-19 as documented below. Our donors and supporters deserve a massive 'thank you' for this.

Masks

Facemasks became a global phenomenon in 2020, and Madagascar was no exception. Thanks to the hard work of a number of our staff (working alongside local seamstresses), and supported by our partnership with the NGO BeLocal, the particular masks worn by many people in the Ranomafana region were actually provided free of charge by CVB.

Travel restrictions were imposed in early April by the authorities, who have to be congratulated for their quick response. We requested and received permission to travel to the nearest city, Fianarantsoa, to pick up supplies. As well as purchasing rice for the staff, in case of shortages, we obtained the materials required to produce masks. Prisca Andriambinintsoa, Head of HR, organized a team of local seamstresses and we set up an assembly line with four sewing machines at CVB supplemented by six more in town. Within three weeks we had produced and distributed over 10,000 masks.

The distribution strategy followed a risk-based approach. We initially held small meetings to distribute masks (and soap—see below) to all CVB staff, accompanied by training on sanitary best practices in order to help prevent transmission. After we had assisted our own staff, we distributed masks to public officials and the market vendors selling essential supplies such as food.

Following this, the Health Team branched out. They continued to distribute masks, while also setting up handwashing stations in the market and certain other high traffic hotspots along the main road. This intervention was replicated in over 20 villages from Ambatolahy to Morafeno. We also worked closely with the Mayor of Ranomafana and his staff to teach people about the importance of wearing masks, social distancing, and hand washing. Lastly, in order to make sure these messages were quite literally heard, we donated a megaphone to the commune to help spread the word through public health announcements.

Soap

As has become apparent, no single intervention is sufficient to tackle COVID-19 on its own. In addition to promoting scrupulous mask-wearing, CVB also purchased 6,000 bars of soap and began the process of investigating how artisanal soap could be made using locally-available ingredients—all, again, with the support of BeLocal.

At the same time as we distributed home-made masks, we gave all staff enough soap for their whole families. Then, looking to the wider community, we set up 28 hand-washing stations in locations where they would have the most impact: churches, markets, and schools. We have monitored these for the last nine months, replenishing the soap when needed.

In parallel to this, we have gone through multiple iterations of a recipe that allows soap to be made from locally-available items. By burning banana leaves and soaking the ash in rainwater for five days, potassium hydroxide (lye) is formed. This can be combined with rendered zebu fat and boiled, with the resulting substance being soap.

Because this is all done without the benefit of a laboratory (the purpose is to generate a recipe and methodology that can be replicated in local villages), trial and error has been our guide. For instance, we initially used the iconic aluminium pots that are available locally. However, lye (NaOH) dissolves the layer of aluminum oxide that normally protects such pots from reacting with water. Therefore, using aluminium pots for the work corrodes the pots as well as weakening the lye solution. We swiftly transitioned to stainless steel.

CVB is a research station, however, and we are more than used to experiments! Along with Chris Coulter and Dr Caroline Rojosoa we are refining the recipe, and hopefully this project will soon mature to the point when it can join our other economic empowerment initiatives, the Fimara essential oil project and the Famiova weaving collective.

During the pandemic we integrated into the district rapid intervention team, conducting field investigations and performing contact tracing. When the sanitary barrier was set up, we assisted with passenger checks; assessing people's health status and raising an alert if required. The Team is proud to have been able to support the local efforts to combat COVID-19.

- Lovasoa F. Daniel, CVB nurse

Hand Sanitiser

There was an almost complete dearth of hand sanitiser in Madagascar in April and May, due to panic buying. Dede Randrianarisata, CVB's Head of Logistics, responded to this situation by developing a homemade hand sanitiser composed of ravensara (*Ravensara aromatica*) essential oil, pure aloe, liquid soap, and locally-produced ethanol. The process involved sourcing ethanol that could be demonstrated to be at least 75% pure using a hydrometer, then mixing in the other ingredients while ensuring that the alcohol content remained above 70%. The resulting non-potable substance was distributed to the Ranomafana authorities along with the recipe so that they could create their own.

10,020
masks were made by local sewers between April 9th & 25th. These were made according to government guidelines.

648
hours at the sanitary barrier, assisting the local health authorities with their checks to prevent the spread of the virus.

28
hand washing stations were installed in the market, and at churches, schools, government offices, and other priority areas.

17
villages were given masks and sanitary advice, including: Ranomafana, Ambatolahy, Ambodikimba, and Tsararano.

6,000
bars of soap were distributed to staff, government employees, the commune, and local villages, at regular intervals.

Collaboration

By far the most complex and challenging aspect of CVB's response to COVID-19 has been our effort to repurpose the NamabaBe laboratories into a PCR testing site. This project has been executed in conjunction with PIVOT, our sister organisation, and represents the largest collaboration to date between the two entities.

With the pandemic taking hold of the globe, the authorities reached out in early April to ask CVB for assistance. Given our history in the region, our list of scientific publications, and our modern laboratories, the local governor, Lova Razafindrafito, believed we could help, and we did not disappoint.

It was immediately obvious that this project needed medical expertise, and in Ranomafana this means PIVOT. PIVOT has been working for the last seven years to strengthen local healthcare systems, and the lack of PCR testing capabilities was one of the most critical component as the region faced the ravages of COVID-19. PIVOT started life in a room at CVB, so the opportunity for us to join forces with them to help the local response was one we eagerly grasped.

The first task was to assess what was needed in order for us to progress from where we found ourselves in April to the point where we had a fully-equipped PCR testing facility. This required numerous meetings involving

the medical, scientific, and logistics staff of PIVOT and CVB. Special thanks are due to Dr Matt Bonds and Dr Alishya Mayfield of PIVOT, and Dr Tom Gillespie and Dr Mark Krasnow of CVB. Thanks also are due to Mariah Donohue, a Fulbright Scholar at CVB who found herself stranded in Madagascar, who used her laboratory experience to draft the initial lists of equipment and consumables needed to operate the testing facility. Institutional help was received from Institut Pasteur de Madagascar and Partners in Health, both of whom offered advice about testing protocols and laboratory configuration.

Even with a full understanding of the requirements of running a testing site, a monumental effort was required to physically realise our shared vision. Extensive remodelling work had to be completed at the CVB laboratories, with partitions installed in order to fully segregate all stages of testing. This was supplemented by the construction of an incinerator and dedicated entranceway for the delivery of testing samples. PIVOT managed the recruitment of new staff, and both CVB and PIVOT staff attended PCR training in Antananarivo.

With the laboratory nearly ready to commence testing, not only are CVB and PIVOT excited about aiding the local response to this global crisis, we are also embarking on the first stages of a project to create a genetic testing facility in Ranomafana, cementing its status as a scientific hub in the tropics.

CVB's NamanaBe laboratory with newly-added partitions

Brett Scheffers' Sloan Fellowship

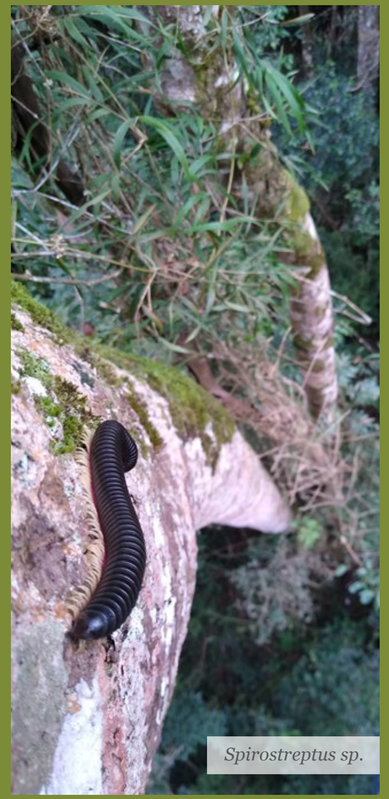
We are delighted to announce that CVB researcher Dr Brett Scheffers has been awarded a two-year Sloan Research Fellowship. These awards began in 1955, and are given by the Alfred P. Sloan Foundation. Each year 126 two-year awards are made in the fields of chemistry, computer science, Earth system science, economics, mathematics, neuroscience, physics, or a related field. The Sloan Research Fellowship Program recognizes and rewards outstanding, early-career faculty who have the potential to revolutionize their fields of study.

The aim of Dr Scheffers' research is to understand how forest canopies, and their inhabitants, will respond to climate change. As the planet warms and becomes more variable, so does the forest, but potentially not at the same rate across the vertical spectrum. The canopy is more exposed to the sun than the forest floor—perhaps arboreal herps are more tolerant of warm temperatures, and may be more tolerant to climate change than their terrestrial neighbours.

Thanks to the laboratory facilities available at CVB, Dr Scheffers and his team are able to further explore these relationships ex-situ. After capturing and identifying herps, they return to CVB to perform experimental trials: placing frogs in an arena that offers a range of temperatures, and observing where each individual relocates to, and therefore the temperatures it prefers.

After finishing these trials, they carefully return all organisms back to the exact same tree in which they were found. Then it's off on a deep dive into the data, to find patterns that may match their predictions. What species preferred the warmer temperatures? Which ones were found higher in the canopy? Who will be resilient to climate change, and who needs further attention to ensure they persevere?

We are proud that Brett's climate research in tropical canopies has been honoured by this well-deserved fellowship!



Spirostreptus sp.

Motacilla flaviventris

Donne Lucien Randrianantenaina

October 4th, 1972—November 7th, 2020

Donne Lucien Randrianantenaina began working as a research technician within Ranomafana National Park in 1991, at the age of 20. His expertise was lemurs, and he had excellent eyes for spotting and following them. Donne was always professional, honest and skilled. He was quiet and his love of the forest and the lemurs was deep. He worked tirelessly for 29 years with the biodiversity research team, and we will miss him. He died on November 7th at the age of 49 of an accident. He is survived by his wife and eight children.

The Namorona river, Ranomafana

MBG Training

In anticipation of the opening of the new collections space in AinaBe Hall—see p. 12—CVB collaborated with Missouri Botanical Garden ('MBG') and the Parc Botanique et Zoologique de Tananarive ('PBZT') to undertake training in the latest methodology for collecting and storing botanical samples.

Seven staff from the Research Department (Laza, Maminiaina, Paul, Dina, Dominique, Velo, and Jean Guy) attended training in Antananarivo, followed up by classes at CVB. 11 more CVB Research Technicians and two MNP staff were able to attend the classes at CVB.

The herbarium at CVB will serve as a reference library for botanical studies. The training covered several aspects of herbarium management: paperwork, plant collection & identification, specimen storage & mounting, etc. The team also took the opportunity while in the capital to identify (with the PBZT team) 40 botanical specimens from the Lost Rainforest of Ivohiboro as a practise exercise in plant identification, using documents from Madagascar's National Herbarium.

We are incredibly grateful to MBG and PBZT for this opportunity, and we look forward to further collaboration in the future as we grow the CVB herbarium!

ICTE/CVB's New Database

Innovation via Past Revelations

David Cyrille, Chief Research Information Officer at SBU, is helping CVB to put our 35 years of biodiversity, climate, and human community data into one archive. Thanks to our biodiversity teams for "cleaning" this data, and to Dina Andrianoely and Dr Beatriz Otero Jiménez for organizing the digitisation. By putting together so many years of research in fields ranging from health, to education, to palaeontology, and of course biodiversity, CVB is looking backwards to move forward. By uploading all of our data into one new and improved system, the work of researchers from across the world can be compiled in a way that ensures that this critical information is accessible by the next generation of researchers. A multitude of lemur statistics, botanical studies, and geographical insights will be combined with field notes and data on public health, and cultural information coming from a range of research projects from Ranomafana and also areas such as Ivohiboro, Zombitse, and Ivato Karianga, to create a one-of-a-kind interdisciplinary database. Some of the other fascinating subjects our team has enjoyed reviewing and uploading include fossil records, drone flight logs and mission data, historical maps, as well as the photos, videos, and other media files that have been collected over the years. Ultimately, we hope to utilise AI to uncover novel correlations within this comprehensive data set.

Reforestation

Introduction

2020 was a tough year for everyone because of COVID-19, and CVB's Reforestation Team were no exception. However, climate change and habitat loss do not wait for a virus, and so we made sure that we did everything possible while remaining safe.

CVB Reforestation

Our very own upper campus tree nursery produced about 7,100 samplings this year, of which more than 2,500 have already been planted. 4,600 are waiting in the wings to support CVB's reforestation campaign in 2021—by the end of the year, every member of staff will have planted the 10 trees that President Rajoelina requested of each citizen. In addition to this success, the tree nurseries in the 11 remote villages of the commune of Kelilalina have produced over 9,000 saplings despite COVID-19 disruption.

These trees have been planted in reforestation sessions conducted in conjunction with CVB staff and various partners, including: Seneca Park Zoo Society, VOZAMA, the gendarme, and the Scouting Association of Ranomafana. CVB's Reforestation Team conducted several seed collection sessions in order to satisfy the demand in seeds of all the tree nurseries, with a total of 789 kilograms of seeds collected.

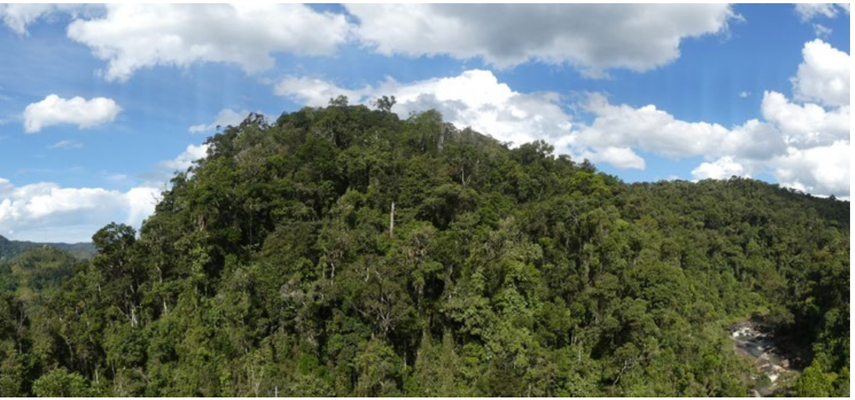
ECOSIA

CVB were honoured this year to partner with Ecosia in their efforts to regreen the world (and Madagascar!) by planting one billion trees. Ecosia is a social company based in Germany that allows users to search the internet, then uses the revenue generated to plant trees where they are needed most: Burkina Faso, Peru, Tanzania, Madagascar, and twelve other countries. You can participate at: http://www.ecosia.org/

With this partnership, we will plant over 300,000 endemic trees in around Ranomafana National Park in 2021. These trees will capture carbon, purify water, enhance soil fertility, and encourage biodiversity to return. As we always do, we selected the reforestation sites based on community enthusiasm and also the ability to connect together forest fragments. We hope to partner with Ecosia for a long time, and fulfil our dream of reforesting all the way to the Indian Ocean!

CRS & SPICES

The collaboration between CVB and CRS (Catholic Relief Services), the 'SPICES' programme, is going from strength to strength, continuing its intervention in locations adjacent to Ranomafana National Park and out towards the east coast. The main goals of the SPICES programme are to improve the livelihoods of vulnerable villagers and to protect the biodiversity in the intervention sites. To accomplish this, as most of the local community are farmers, we are introducing them to agroforestry techniques where important cash crops such as cloves, cinnamon, and vanilla are planted on or alongside endemic tree species. This allows them to access diversified sources of income, while promoting the importance of endemic trees. The intact forest becomes a source of livelihood. In this way, we are able to expand areas of natural forest in a way which is more sustainable. Across the 29 intervention sites, over 110,000 seedlings of valuable crops, 5,600 fruit trees, and 27,900 forest trees (of which over 14,000 are endemic) were produced this year. Next year, the ambitious goal will be to plant 30,000 saplings per site.

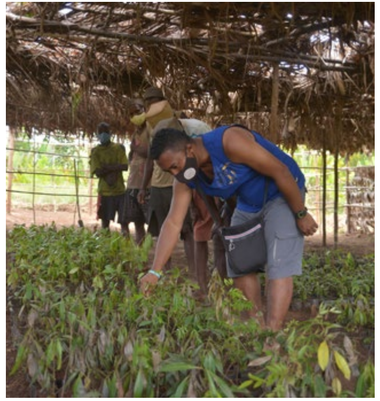


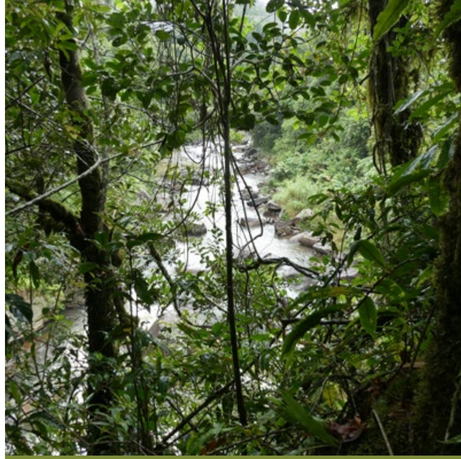
My Conservation Life

My Conservation Life ('MCL') is an innovative new project developed by the Seneca Pack Zoo Society of Rochester, New York. The aim is to create a software platform for conservation organisations that supports their efforts to track their impact and tell their stories. MCL will ultimately track a broad range of conservation assets and projects, but the initial prototype that will be deployed by CVB is built to track reforestation. The test sites will be located in existing CVB reforestation areas near Ranomafana National Park and around the wider Ranomafana region, and the focus will be on measuring the impact of reforesting as it impacts biodiversity. This technology-enabled approach complements CVB's efforts to enhance its data gathering and analysing capabilities—for more information, see the database project on p. 37. Additionally, the platform will reward local communities for their efforts and devotion to conservation, and therefore contribute to sustainable economic growth. CVB's Reforestation Team is excited to pilot this new way to value and fund trees!

Health In Harmony and Manombo Special Reserve

Health In Harmony ('HIH') is an international non-profit dedicated to reversing global warming by promoting the understanding that rainforests are essential for the survival of humanity. By intervening to help protect our remaining natural forests, as well as through reforestation, they advance the joint goals of health care and conservation. In Madagascar, their focus is on sites located around Manombo Special Reserve in Farafangana, where they partner with CVB to conduct biodiversity surveys and undertake reforestation activity around the Reserve. The goal for this first year of reforestation is that eight of the ten target villages will each produce 5,000 seedlings. HIH is planning to implement the modern 'muvuca' (mixing seeds of native trees, fast-growing legumes, and sand for direct-seeding) and 'sitriboa' (balls of native tree seeds mixed in with fertiliser generously donated by local zebus) techniques for their reforestation activities.





35,000
endemic saplings planted

110,000
valuable crop seedlings planted

5,600
fruit trees planted

789 kg
of seeds collected

Eulemur rufifrons

Can Lemurs Get COVID-19?

An interview with Mariah Donohue, CVB Fulbright Scholar and PhD student

Q: So, can we start by having you explain the basics of your PhD thesis?
A: My research explores the factors driving gut microbiome variation in lemurs. I'm especially interested in the interplay between ecology, evolutionary history, and the gut microbiome in a population of brown lemur hybrids endemic to Andringitra National Park.

Q: How has your work changed since COVID-19?
A: I had planned to spend all of 2020 in the field collecting lemur fæces. When COVID-19 hit, everything changed. I quarantined at CVB from March-late October, far from Andringitra's hybrids. So, I launched an investigation into lemur susceptibility to COVID-19. With permission from Madagascar National Parks, I was able to enter Talatakely a few times a week with a small team (shout out to Raleso, George Renee, Remy, and Lova!) to check on the lemurs and collect fæcal samples. We hoped we could use these samples to run diagnostic tests, but unfortunately the reagents didn't arrive on time. I'm hoping to return to Madagascar with the testing kits as soon as the border re-opens!

Q: Can lemurs get COVID-19?
A: Yes, lemurs can get COVID-19. Thanks to a few recent papers by Dr Amanda Melin and her colleagues, we know risk appears to vary between species; for example, blue-eyed black lemurs, Coquerel's sifakas, and aye-ayes are highly susceptible, whereas grey mouse lemurs are not.

Q: So, what are the questions moving forward with your research?
A: There are many unanswered questions. For example, we still don't know the susceptibility of many species in Ranomafana because their genomes have not been sequenced (and, as a result, they couldn't be included in Dr Melin's studies). We also don't know if risk varies between individuals or populations. This is important to figure out because if binding efficacy varies within a given species, and COVID-19 reaches the forest, we need to know the absolute worst-case scenario and act accordingly. If species have natural variation, with some high-risk and some low-risk individuals, we can anticipate differential survival and subsequent proliferation of low-risk ACE2 variants through time thanks to natural selection. That would be less alarming than one of the alternatives, that all individuals have high-risk ACE2 variants. This research is urgent because even the most isolated lemur populations live in relatively close proximity to humans, making exposure almost inevitable if this pandemic persists.

Spotlight on the Tree Book

While endemic trees are rightly valued for their importance to the future of rainforests, less is documented regarding the value of these trees as windows into the incredible microcosms of social and natural ecology. That is why educational artist Jana Grabner is working with CVB's Biodiversity and Education Teams to create educational reference material on endemic trees for CVB's partners to integrate into their planting initiatives. The reference material takes the form of a book reminiscent of historical botanical sketchbooks, with each part of the tree carefully hand painted in pencil and watercolor.

Daniella Rabino, a researcher at the University of Sussex interested in the social dimensions of education, initiated the necessary collaborations: "Approaching education from the ground up, alongside schools and families, we're able to learn from them what coordination and education resources support lasting change". This multi-disciplinary development of education resources related to native trees emerged from questioning local teachers and community partners, so that the materials developed can better support rural partnerships and ensure that tree projects become part of everyday lives.

Creating useful education resources depends on input from diverse sources. The artistic lens that Jana brings emerges from her experiences leading research on education designs with conservation projects in Madagascar. "I am grateful that the Biodiversity Team at CVB provided me with freshly collected specimens, because it is hard to find good reference materials online, as most species we work with are very specific to this region", Jana stated about her CVB field work.

To support the work, the CVB Education Team, led by Lovasoa, are meeting community partners to determine what formats will best support schools, teachers, and families. Ultimately, the books and associated posters will offer practical tools for connecting daily practices and histories with hope, so youth can enhance their futures and forests.

- Jana Grabner & Daniella Rabino

Heterixalus betsileo

Publications

Albert-Daviaud, A., Buerki, S., Onjalalaina, G.E., Perillo, S., Rabarijaona, R., Razafindratsima, O.H., Sato, H., Valenta, K., Wright,P.C., Stuppy, W., The ghost fruits of Madagascar: Identifying dysfunctional seed dispersal in Madagascar's endemic flora, Biological Conservation, Volume 242, 2020, 108438, ISSN 0006-3207. DOI:10.1016/j.biocon.2020.108438

Baden, A.L., Gerber, B., 2020, Sex-segregated range use by black-and-white ruffed lemurs (*Varecia variegata*) in Ranomafana National Park, Madagascar. DOI:10.1101/2020.03.30.016774

Baden, A.L., Webster, T.H., Bradley, B.J., 2020, Genetic relatedness cannot explain social preferences in black-and-white ruffed lemurs (*Varecia variegata*). Animal Behaviour 164:73-82. DOI:10.1016/j.anbehav.2020.04.003

Bahrainwala, L., Knoblauch, A.M., Andriamiadanarivo, A., Diab, M.M., McKinney, J., Small, P.M., et al., 2020, Drones and digital adherence monitoring for community-based tuberculosis control in remote Madagascar: A cost-effectiveness analysis. PLoS ONE 15(7): e0235572. DOI:10.1371/journal.pone.0235572

Chapman, C.A., Bicca-Marques, J.C., Dunham A.E., Fan, P., Fashing, P.J., Gogarten, J., Guo, S., Huffman, M.A., Kalbitzer, U., Ma, C., Matsuda, I., Omeja, P.A., Sengupta, R., Serio, J.C.S., Stenseth, N., Yamato, T., 2020, Primates can be a rallying species to promote tropical forest restoration. Folia Primatologica. 91:669–687. DOI:10.1159/000505951

de Winter, I.I., Umanets, A., Gort, G., et al., Effects of seasonality and previous logging on faecal helminth-microbiota associations in wild lemurs. Sci Rep 10, 16818 (2020). DOI:10.1038/s41598-020-73827-1

Deppe, A.M., Brown Mouse Lemurs (*Microcebus rufus*) May Lack Opportunities to Learn about Predator Calls. Folia Primatol (Basel). 2020;91(5):452-462. DOI:10.1159/000505953

Deppe, A.M., Kushnick, G., Olfactory predator recognition in the brown mouse lemur (*Microcebus rufus*) in Ranomafana National Park, Madagascar. Am J Primatol. 2020; 82:e23184. DOI:10.1002/ajp.23184

DeSisto, C., Park, D.S., Davis, C.C., Ramananjato, V., Tonos, J.M., Razafindratsima, O.H., 2020, An invasive species spread by endangered lemurs impacts rainforest structure in Madagascar. Biological Invasions 22: 2845–2858. DOI:10.1007/s10530-020-02293-7

Fernández-Llamazares, Á., Fraixedas, S., Brias-Guinart, A., Terraube, J., Principles for including conservation messaging in wildlife-based tourism. People Nat. 2020; 00: 1–12. DOI:10.1002/pan3.10114

Fomsgaard, A., Worsøe Rosenstierne, M., Rasmussen, M., Wright, P., Bueno, G., Noromalala, E., Bornbusch, S., Stensvold, C. R., Thomas-Poulsen, M., Hvilsom, C., 2020, Prevalence, infection intensity and genotyping of *Giardia duodenalis* in ring-tailed lemurs *Lemur catta* from European zoos and wild populations. Journal of Zoo and Aquarium Research, 8(4), 253-258. DOI:10.19227/jzar.v8i4.509

Garber, P., Chism, J., Tecot, S., Kowalewski, M., Gillespie, T.R., 2020, Best practices in field primatology in the age of COVID-19. American Society of Primatologists Conservation Action Network. August 2020

Hansford, J.P., Wright, P.C., Pérez, V.R., Muldoon, K.M., Turvey, S.T., Godfrey, L.R., 2020, Evidence for early human arrival in Madagascar is robust: A response to Mitchell, The Journal of Island and Coastal Archaeology, 15:4, 596-602. DOI:10.1080/15564894.2020.1771482

Hemingway, H.W., Burrows, A.M., Omstead, K.M., Zohdy, S., Pastor, J.F. Muchlinski, M.N., 2020, Vertical Clinging and Leaping Ahead: How Bamboo Has Shaped the Anatomy and Physiology of *Hapalemur*. The Anatomical Record, 303(2), pp.295-307. DOI:10.1002/ar.24183

Kling, K. J., Rowe, A.K., 2020, Madagascar Forests and Shrublands. In D. A. DellaSala (Ed.), Imperiled: The Encyclopedia of Conservation. Oxford, UK: Elsevier. DOI:10.1016/B978-0-12-821139-7.00001-5

Ksepka, D.T., Balanoff, A.M., Smith, N.A., Bever, G.S., Bhullar, B-A.S., Bourdon, E., Braun, E.L., J. Burleigh, G., Clarke, J.A., Colbert, M.W., Corfield, J.R., Degrange, F.J., De Pietri, V.L., Early, C.M., Field, D.J., Gignac, P.M., Gold, M.E.L., Kimball, R.T., Kawabe, S., Lefebvre, L., Marugán-Lobón, J., Mongle, C.S., Morhardt, A., Norell, M.A., Ridgely, R.C., Rothman, R.S., Scofield, R.P., Tambussi, C.P., Torres., C.R., van Tuinen, M., Walsh, S.A., Watanabe, A., Witmer, L.M., Wright, A.K., Zanno, L.E., Jarvis, E.D., Smaers, J.B., Tempo and Pattern of Avian Brain Size Evolution, Current Biology, 2020, ISSN 0960-9822. DOI:10.1016/j.cub.2020.03.060

Kshirsagar, A.R., Applebaum, J.W., Randriana, Z., Rajaonarivelo, T., Rafaliarison, R.R., Farris, Z.J., Valenta, K., "Human-Dog Relationships across Communities Surrounding Ranomafana and Andasibe-Mantadia National Parks, Madagascar," Journal of Ethnobiology 40(4), 483-498, (18 December 2020). DOI:10.2993/0278-0771-40.4.483

Papilio demodocus

Morelli, T.L., Smith, A.B., Mancini, A.N., Balko, E.A., Borgerson, C., Dolch, R., Farris, Z., Federman, S., Holmes, S., Irwin, M., Jacobs, R.L., Johnson, S.E., King, T., Lehman, S., Louis, E.E. Jr., Murphy, A., Ratolojanahary, T.H., Ratsimbazafy, J., Razafindratsima, O., Baden, A.L., 2020, The fate of Madagascar's rainforest habitat. Nature Climate Change 10:89-96. DOI:10.1038/s41558-019-0647-x

Muscarella, R., Emilio, T., Phillips, O.L., et al., The global abundance of tree palms. Global Ecol Biogeogr. 2020;00:1–20. DOI:10.1111/geb.13123

Nevo, O., Valenta, K., Kleiner, A. et al., The evolution of fruit scent: phylogenetic and developmental constraints. BMC Evol Biol 20, 138 (2020). DOI:10.1186/s12862-020-01708-2

Ramananjato, V., Rakotomalala, Z., Park, D.S., DeSisto, C., Raoelinjanakolona, N., Guthrie, N., Fenosoa, Z.E., Johnson, S., Razafindratsima, O.H. (2020) The role of nocturnal omnivores lemurs as seed dispersers in Malagasy rainforests. Biotropica 52: 758-765. DOI:10.1111/btp.12789

Reeves, H., Grandjean Lapierre, S., Razafindrina, K., Andriamiadanarivo, A., Rakotosamimanana, N., Razafindranaivo, T., Seimon, T., Blalock, B., Bello-Bravo, J., Pittendrigh, B., McKinney, J., Small, P.M., Knoblauch, A.M., Fair, E., 2019, Evaluating the Use of Educational Videos to Support the Tuberculosis Care Cascade in Remote Madagascar. Int. J. Tuberculosis and Lung Dis., Volume 24 (Number 1), pp. 28-35(8). DOI:10.5588/ijtld.19.0161

Rowe, A.K., Donohue, M.E., 2020, Lemurs: Madagascar's Endemic Primates. In M. Goldstein (Ed.), Imperiled: The Encyclopedia of Conservation. Oxford, UK: Elsevier. DOI:10.1016/B978-0-12-821139-7.00015-5

Sefczek, T.M., Hagenson, R.A., Randimbiharinirina, D.R., Rakotondrazandry, J.N., Louis, E.E., Home Range Size and Seasonal Variation in Habitat Use of Aye-Ayes (*Daubentonia madagascariensis*) in Torotorofotsy, Madagascar. Folia Primatol 2020;91:558-574. DOI:10.1159/000508620

Seidl, C.M., Basham, E.W., Andriamahohatra, L.R. Scheffers, B.R., 2020, Bird's nest fern epiphytes facilitate herpetofaunal arboreality and climate refuge in two paleotropic canopies. Oecologia, 192(2), pp.297-309. DOI:10.1007/s00442-019-04570-2

Singletary, B., Tecot, S., 2020, Multimodal pair-bond maintenance: A review of signaling across modalities in pair-bonded nonhuman primates. American Journal of Primatology, 82(3): e23105. DOI:10.1002/ajp.23105

Wright, P.C., 2019, "Deep in Time, Broad in Scope: Conservation Science Empowers Communities and Saves Species in Madagascar". In Shumaker, Robert W. Saving Endangered Species: Lessons in Wildlife Conservation from Indianapolis Prize Winners, Johns Hopkins University Press, 2019, pp. 163-196

Wright, P.C., Otero Jimenez, B., Rakotonirina, P., Andrianandoely, D.H., Shea, A., Ratalata, B., Razafimahaimodison, J.C., 2020, The Progressive Spread of the Vascular Wilt Like Pathogen of *Calophyllum* Detected in Ranomafana National Park, Madagascar. Front. For. Glob. Change 3:91. DOI:10.3389/ffgc.2020.00091

Non-academic articles

Bedard, S., 2019, Ghosts of the Everglades. Retrieved from https://www.biographic.com/posts/sto/ghosts-of-the-everglades

Dobson, A.P., Pimm, S.L., Hannah, L., Kaufman, L., Ahumada, J.A., Ando, A.W., Bernstein, A., Busch, J., Daszak, P., Engelmann, J., Kinnaird, M.F., Li, B.V., Loch-Temzelides, T., Lovejoy, T., Nowak, K., Roehrdanz, P.R., Vale, M.M., Ecology and Economics for Pandemic Prevention, Science 369 (6502), 379-381. DOI:10.1126/science.abc3189

Main, D., 2019, Discovery reveals secrets about how ghost orchids reproduce. Retrieved from https://www.nationalgeographic.com/animals/2019/07/ghost-orchids-florida-surprising-pollinators-moths/

Mock, J., 2019, These Photos Reveal the Pollination Secrets of Florida's Most Elusive Flower. Retrieved from https://www.audubon.org/magazine/summer-2019/these-photos-reveal-pollination-secrets-floridas

"How to bring conservation messaging into wildlife-based tourism". Retreived from https://www.britishecologicalsociety.org/how-to-bring-conservation-messaging-into-wildlife-based-tourism/

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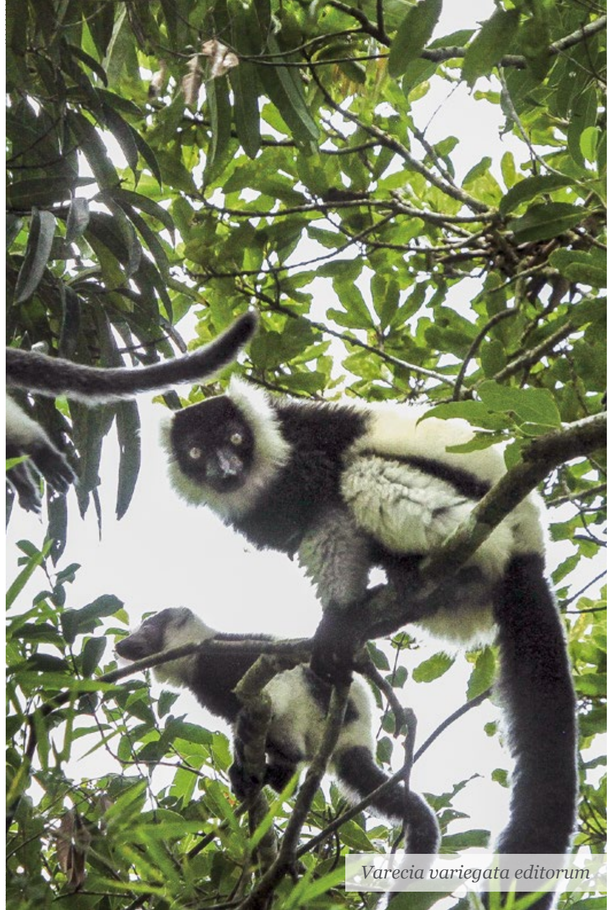

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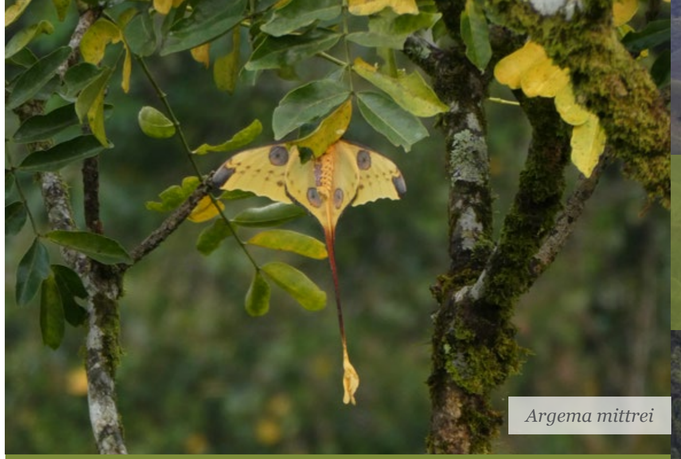

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