

Annual Report 2018





With Profound Gratitude Thank You, Dr. Eric Miller

Look carefully at the official group photo from a global zoo conference or the snapshot of the gathering of colleagues afterwards and you're likely to find the welcoming smile of Dr. Eric Miller. Through his 36-year career in the zoo field including twelve very active years as Chair of the Madagascar Fauna and Flora Group traversing our planet to provide a

better world for animals, Dr. Eric Miller has shared his experience and insights to untold numbers of professionals. And while he will continue consulting for Zoo Advisors, Eric officially retired on April 30, 2019. In preparation for this, he arranged for the nomination and vote for the new Chair to take place at the 2018 annual meeting to insure a smooth transition for MFG programs.

Back in 1981, Dr. Miller went to the Saint Louis Zoo as a veterinary resident after which he was immediately hired as a full-time veterinarian – and eventually Director of Animal Health. In 2009, he became Senior Vice President of Zoological Operations. Concurrently, he served as Executive Director of the Saint Louis Zoo WildCare Institute and helped endangered species all over the world. Among his many accomplishments, he authored or co-authored over 60 scientific articles and textbook chapters. With Dr. Murray Fowler, Eric has served as co-editor and editor of the well-known textbook, *Zoo and Wild Animal Medicine* - a guaranteed find on the bookshelf of every zoo veterinarian. Recently, Dr. Miller received the Saint Louis Academy of Science's George Engelmann Interdisciplinary Award.

During his tenure as MFG Chair, Dr. Miller introduced the MFG to institutions near and far and welcomed them into key membership roles including Missouri Botanical Garden; along with our growing reforestation, horticulture, and plant conservation efforts, this inspired him to lead the name change to add "Flora" to our name. He presented on the MFG's efforts to a global audience from the World Association of Zoos and Aquariums' meeting in New Delhi to Wellington Zoo's conservation event in New Zealand. Eric's regular participation in international conferences provided him a wonderful opportunity to engage directors and curators about the MFG's crucial work. Numerous institutions welcomed him to speak on MFG in the US and as far away as Taronga Zoo in Australia. Some of the new Managing Members connected to his advocacy for Madagascar include Perth Zoo, Taipei Zoo, and Tennessee Aquarium.



Of course, his official duties also included leading the MFG meetings which included successful gatherings in Chattanooga, Chicago, London, Madagascar (3), Paris, Durham, St. Louis (2), Taipei, and Zurich. His guidance and insights were also greatly appreciated during times of transition as we brought in new Program Directors to lead our programs in Madagascar. Through it all, Eric maintained significant contributions to the MFG through the Saint Louis Zoo's WildCare Institute and even expanded it by funding the MFG's Research Director and new Coordinator. Foundational to all of this was his core commitment to the real impacts of collaboration and sharing the credit.



And while Eric remains connected by serving the MFG as an advisor and we look forward to continuing to benefit from his wisdom, we needed to take this moment to express our gratitude for his years of thoughtful and committed service.

Eric, thank you for all you've done for Madagascar by sharing invaluable experience, insuring solid financial support, and leading with a generous spirit.



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Research Director

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Capacity Building

Environmental Education

Acknowledgments

Financial Summary

Chief Editor

Ingrid Porton

Graphic Layout

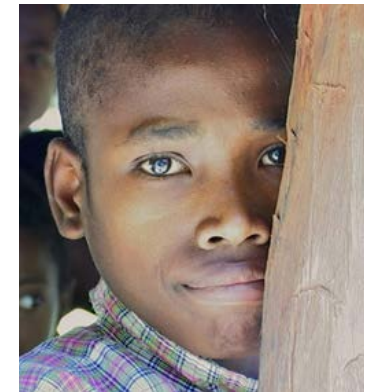
Ingrid Porton | Tim Tetzlaff

Photographers

MFG Staff | Flavien Fasy | Karen Freeman

Fulvio Licata | Roderic Mahaso

Christian Rambeloson | Fidy Rasambainarivo



COVER: Students from the University of Toamasina's Institute for Environmental and Sustainable Development (ISSED) at the Annual Green Day celebration on their plot in Parc Ivoloïna. See pg 20.

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Message from the Chair



2018 was a year of transition - and a tangible reminder of the benefits of succession planning.

The MFG has a different Chair. While I'm new in this role, I'm honored to have been associated with the MFG since the 1990s serving as an advisor since 2002. I've been able to work with each of the MFG's in-country Program Directors, promote the work of the MFG, and engage in online fundraising.

Like my predecessors, I have a full-time position serving as Director of Conservation for Naples Zoo, a Managing Member institution for many years. I hope to speak with many of you in person at various meetings like CITES, WAZA, AZA, and others.

New and familiar faces are also joining the executive committee and board. Of considerable note, Alex Rübel, the esteemed Director of Zoo Zürich since 1991, will retire in 2019. Alex has also served as MFG Treasurer for over a decade. His talents provided a fiscal soundness and tempered outlook to ensure the long-term success of MFG efforts. During the 2018 annual meeting at Tennessee Aquarium, Daniel Warsaw agreed to bring his talents to the Treasurer role working together with Alex for a year. The MFG appreciates Daniel stepping up and Alex assisting in the transition. Daniel has already shown his skills to be an asset to all of us.

Another leader who helped the MFG softly transition is Andrea Katz. In 2018, she asked that another person serve as Secretary while she takes on some additional efforts in Madagascar. Wonderfully, Andrea will remain on the board and continue to serve a crucial role given her immeasurable experience as a Program Director for 15 years followed by her ongoing involvement. I am delighted that the role of Secretary will be filled Dr. Lisa Kelley starting in January 2020. Lisa is the Executive Director of the WildCare Institute at Saint Louis Zoo, the position

that Dr. Miller held until his retirement. I am profoundly grateful for the in-country knowledge, historical depth, and subject matter expertise that is represented on the board, our advisors, and with the staff who served the MFG in 2018 - a few of which need to be highlighted below:

Jean Noel
Betampona Program Manager

George Totozandry
Head Keeper

Veronique Ravololonarivo
ICTC Manager

Franka Rasolomanantsoalo
Administrative & Financial Officer

Bernard Iambana Richardson
Ivoloina Zoo Manager

Tsiry Harison
Center for Environmental Education Manager

Jean Francois
Forestry Station Manager

Christian Rambalson
Capacity-building Manager

As you'll see in our financials, the MFG has now successfully secured a year of operational funding in savings. With the diverse and challenging variables that affect our collective work in Madagascar, this represents a huge step in providing significant assurances to our members, our staff, the communities we work with, and the security of the natural places we're helping to protect.

Reading through the report, you will see the successes and challenges we've experienced. There is so much critical work in progress with many more opportunities ahead. My focus as Chair will be serving our team in Madagascar and the member institutions that support them. The additional funding and expert resources coming from current and new members directly translates into impact on the ground.

After all, the need remains critical and our efforts make a difference. I'm grateful you're with us on this journey to create a better future for Madagascar's plants and animals as well as that of the people of this extraordinary island.

Tim L. Tetzlaff

Tim L. Tetzlaff
tim@savethelemur.org
MFG Chair



Dr. Miller and Tetzlaff in Madagascar in 2017



Cyclone Ava Hits Tamatave

On January 5, 2018, Ava was a category 3 cyclone when it moved slowly through Tamatave destroying 90% of the city's electrical infrastructure. A colleague wrote *"In our 18 years here, we have never seen a cyclone do so much wind damage to Tamatave. The trees/branches that fell took down many poles and electrical lines all over the town. It is difficult to express what the streets look like, but a drunken spider web comes to mind"*. The Zoo was hard-hit resulting in more infrastructure damage from Ava than any previous cyclone. Large trees blocked the road into the Zoo, exhibits and other infrastructure were damaged, and all the banana trees were wiped out.

Thankfully none of the animals were injured; a pair of *Varecia* whose cage was destroyed were loose but easily recovered by staff. Their home had to be torn down as did a covered sitting area for the public that was demolished. The number of downed trees and branches throughout the grounds required closing the Zoo. Additional day laborers were hired to help with the massive clean-up effort that took a full month during which time the Zoo remained closed. Crop damage led to rising food costs, negatively impacting our staff and the Zoo's budget. Rendrirendy also experienced some infrastructure damage.

According to USAID, compared to all other African countries, Madagascar is at most risk of cyclone damage. The report notes that in the 20-year period between 1996-2016, Madagascar experienced 35 cyclones, eight major floods, and five periods of extreme drought – all of which constitutes a three-fold increase over the previous 20 years. In addition, cyclones are not only more frequent but also more intense. Long-term member support allows us to better weather the financial cost of these storms.



Rescued Before Being Lost Forever

Parc Ivoloïna has a long history of hosting ex-situ plant conservation projects. During the 1990s and 2000s both the Royal Botanic Gardens, Kew (RBG) and Missouri Botanical Garden (MBG) supported work to seek threatened plant species in the wild, collect seed samples, propagate these samples and then plant the resultant seedlings within the secure confines of Parc Ivoloïna. Today, as a result of these projects, over 1,000 robust plants of thirty endangered or critically endangered Malagasy plant species grow at the Parc.



These include, for example, the majestic palm *Dypsis carlsmithii* that is known in the wild from just two locations and is classified as Critically Endangered; the delicate small tree



Leptolaena raymondii that is also known from just two locations and also classified as Critically Endangered; and, most importantly, the tree *Pentachlaena betamponensis* with its unusual butter-colored flowers that is known from just 12 individuals in the wild. Such targeted work has certainly demonstrated its value but this approach can be expensive because field trips organized to remote locations with the objective of collecting seeds of the selected species



frequently return empty handed since, at the time of the visit, the target species bore no ripe fruit. Thus between April 2016 to March 2019, with funding from the UK Government's Darwin Initiative, an alternative, non-focused approach to ex-situ plant conservation was trialed in a collaborative project, led by MFG and MBG, but including much appreciated inputs from staff of RBG Kew, the Silo Nationale es Graines Forestières, and the Parc Botanique et Zoologique de Tsimbazaza.

The objective of the Darwin Initiative project was to conserve as many species of native Malagasy plants as possible originating from remaining unprotected forest fragments in the Ivoloïna and Ifontsy River valleys in central eastern Madagascar, close to Parc Ivoloïna.

Once, in the not too distant past, these valleys would have been covered by a vast and continuous rainforest, but now, all has been converted to agricultural land except for the forest within the Betampona Reserve and a scattering of small unprotected forest fragments. These fragments are disappearing rapidly due to shifting cultivation and exploitation of forest trees for timber and fuel, and likely, within the next few years, nothing but their memory will remain. Thus, in the Darwin Initiative project, rather than endeavoring to conserve a small number of especially important plants, we aimed to grab and conserve as much botanical diversity as possible from these fragments before it was too late. Even widespread native plant species were included in the project because the subpopulations in this area are likely to be genetically distinct from sub-populations elsewhere in the country.



The Darwin Initiative project was implemented by a team of four young Malagasy field botanists (Benjamina, Giovannia, Sandy, Syde) led by MBG's star field botanist Patrice Antilahimena, and by six



young Malagasy nurserymen/women (David, Lalaina, Mickaëla, Philemond, Platini, Sandra) led by the equally brilliant horticulturalist Alexandre Mamisoa. The young people, mostly new conservation, biology or agriculture graduates, were trained for 3 months as the first stage of the project before being coached for the remainder of the project by their respective leaders. The botanists systematically visited doomed forest fragments in the project area and collected seed samples of all fruiting native plants that they encountered. Each seed sample was vouchered with



Fruits of new species of *Melanophylla*

an herbarium specimen so that the seed samples could be expertly identified. The number of this voucher also provided each seed sample, and the plants resulting from these seeds, with a unique code that anchored the collection in the project's database. The horticulturalists accessioned each of the seed collections as they arrived at the Parc from



the field and then cleaned and sowed the seeds, nurtured the resultant seedlings, and finally planted the uniquely tagged young plants out into specially prepared locations in the Parc where non-native trees had been removed and where smothering ferns had been controlled. The nursery team also weeded and monitored the young plants after planting.

The results of this project, as of March 2019, are summarized in the table. These show that 642 of the 950 seed samples that were collected by the botanists were successfully propagated, leading to the plantation of 14,129 uniquely labeled seedlings

into the Parc of which 70% were still alive after 12 months. While a good proportion of the voucher herbarium specimens have yet to be identified to the level of species, we already know that our collections include plants of great importance such as five woody plant species that are new to science and the charismatic plant *Dracaena umbraculifera* that had been thought to be extinct in the wild.

Indicator	As of March 2019
# field trips completed	19
# vouchered batches of seed samples collected	950
% vouchers identified to family, genus, species	99.9, 99.6 72.9
# families represented in batch of seed samples	87
# genera represented in batch of seed samples	230
# species represented in batch of seed samples	456
# batches of seed samples sent to seed banks	231
# batches of seed samples sown	881
# batches of seed samples germinating	642
# batches of seed samples that produced seedlings planted out in Parc Ivoloïna	418
# tagged seedlings planted in Parc Ivoloïna	14,129
% mortality after 12 months	30%

While the Darwin Initiative project has now finished, its work will continue, in a somewhat reduced form, at least until April 2020, thanks to additional financial support provided by a number of MBG's friends and grants from both the Mohamed bin Zayed Fund for Nature Conservation and the Association of Zoological Horticulture. We hope that one day these collections can provide material to contribute to the restoration of the sadly degraded landscape that was once their home.



The Connection Between Fuel-Efficient Stoves, Healthier Chickens, and Lemurs

Betampona Natural Reserve is subject to the pressures that come with a growing human population, steeped in poverty and dependent on natural resources for many of their basic needs. In an effort to lessen some of these pressures, the MFG was awarded an IUCN SOS Lemur grant to: 1) improve local chicken production by reducing deaths from Newcastle disease (NCD) and 2) reduce firewood usage through the distribution of fuel-efficient stoves.



The NCD vaccination program is built around identifying and training an individual from each village to become their village's vaccinator. In March, MFG's Program Director, Virginia Rodriguez Ponga, and Capacity-building Manager, Christian Rambeloson, met with the Commune Mayors and Chefs Fokontany of the 12 villages we targeted to discuss the new initiative. They explained that the MFG would hold a workshop to

The MFG's initiative is based on a chicken vaccination program in northern Madagascar (Makira/Masoala Landscape) piloted by Drs. Chris Golden and Graham Crawford. A thermotolerant form of the Newcastle disease vaccine is required to work in rural villages, but was not available in Madagascar. That problem was resolved when Dr. Crawford teamed up with Dr. Ando Miharifetra from the Malagasy Institute of Veterinary Diseases (IMVADET) to produce it in country.



Dr. Crawford (left), a good friend of the MFG, accompanied two of the black and white ruffed lemur groups on their historic U.S. to Madagascar flights and up to Betampona for release.

train one person from each village to be responsible for collecting all vaccine orders, vaccinating the chickens, and maintaining records. Candidates for the position were selected by village leaders based on the person being respected by others, able to read and write, physically fit, middle aged, and a chicken owner. The selection took place in April; one woman and 11 men were chosen. While overseeing the family flock is primarily a woman's responsibility, and we had hoped to have an equal number of men and women vaccinators, this was not achievable because the majority of women were unable to read and write.

The 12 vaccinators, along with two of MFG's Betampona Conservation Agents, participated in the training workshop held 24 to 27 April at Parc Ivoloïna's Conservation & Training Center.

Training Workshop

Dr. Ando Miharifetra was the workshop's lead instructor, and because he has remained intimately involved in the Makira/Masoala vaccination program, he was able to speak from experience about the challenges they have encountered. The MFG also benefitted from instruction materials that had already been translated into Malagasy, including a poultry husbandry and health care manual. Classroom time was spent learning about physical and behavioral signs chickens display when sick, NCD disease incubation time, and routes of transmission; a session was devoted to explaining how the vaccines work, the importance of maintaining the vaccination schedule, and obtaining "herd immunity." Dr. Miharifetra emphasized it was especially important for owners to understand this vaccine only protects chickens against NCD and that chickens can contract other diseases, some of which are fatal.





The remainder of the workshop was devoted to hands-on practical experience in the classroom and the field. Christian had organized an opportunity for the trainees to practice interacting with owners, answering their questions, assessing chicken health, and administering the vaccine via eye drops.

Two chicken vaccination campaigns were carried out in 2018; the first in July, the second in November. The vaccines were delivered to Rendrirendry in cold packs



First Vaccination Campaign: July 2018



Second Vaccination Campaign: November 2018



and given to the vaccinators who wrapped the vials in wet dishcloths and placed them in baskets. If kept under 28°C (82.4°F), the vaccine remains viable for 14 days; longer than the eight days it took to complete the vaccinations in the largest of the 12 participating villages. Overall, the vaccinators have been well received; the biggest challenge has been owners not capturing any or all of their chickens beforehand which then requires return visits. Dr. Fidy Rasambainarivo has developed a database and entered the survey data; the initial results look promising.



Ground Truthing Data Collection



In collaboration with Dr. Vasit Sagan and graduate student, Stephan Leard, of Saint Louis University's Department of Earth and Atmospheric Sciences, the MFG aims to test whether changes in firewood usage can be quantitatively measured through remote sensing. In order to produce a map with the fine-scale differentiation of land cover necessary to do such an analysis, two MFG teams collected ground truthing data from 378 plots in and outside of Betampona's border. In contrast and despite 23 attempts, we were unable to obtain the cloud-free,



short-wave Infrared (SWIR) and visible near-Infrared (VNIR) satellite images required to do the analysis. Our order with Digital Global will continue into 2019, and Dr. Sagan will look into the potential of combining multiple images to develop a clear map of the study area.



Joint MFG / MNP Patrols

The Betampona team has patrolled the reserve to identify infractions for at least 15 years. Neither the MFG or Madagascar National Parks (MNP) has the authority to warn or arrest people who illegally extract resources from the reserve; serious infractions are reported to the Regional Directorate for Environment, Ecology and Forests (DREEF), who has that authority.

For this project, MFG and MNP have agreed to participate in quarterly joint patrols of the entire reserve. A standardized protocol was developed to ensure good communication within the team and facilitate analysis of the results. The team is made of 4-6 people working in two teams; one team searches just outside the perimeter, the other inside the forest perimeter. All illegal activities (tavy, animal traps, tree cutting activity, signs of digging up tenrec burrows) will be described, photographed, and the location identified by GPS coordinates. The results will be analyzed to determine whether there has been: 1) a reduction in wood cutting activities and 2) a reduction in lemur traps over the course of the project.



A lemur trap placed along a branch.

Fuel-Efficient Stoves



Surveys conducted over multiple years have consistently shown that over 95% of families in the Betampona landscape rely on firewood to cook. Although much of the firewood is gathered outside of Betampona, some is collected in the reserve and, as local resources become increasingly scarce, Betampona's resources will become increasingly vulnerable. Until there is an alternative to cooking with firewood, reducing the amount of firewood required to cook is the next best step. ADES fuel-efficient stoves can reduce firewood use by up to

50%. Furthermore, the stoves provide health benefits by reducing the inhalation of smoke-related pollutants that are linked to millions of premature deaths. The IUCN Save Our Species Lemur grant provided funding to distribute 700 ADES fuel-efficient stoves per year for three years. To help distribute, advise, oversee, and encourage other women to use their new stove, the MFG had planned to fill all seven positions with women. In collaboration with village leaders, we did hire seven women, however, we once again faced the

sad reality that, in three of our target villages, none of the eligible women were able to read or write. We therefore had to recruit three men who could assist these women when reading/writing skills were needed. A two-day workshop, led by the ADES Communication Manager, was held at the Ivoloia Conservation Training Center (ICTC) in May. The 12 vaccinators and 10 fuel-efficient stove advocates were given their certificates and formally introduced to the community during Ambodirafia's World Environment Day celebrations.





Broken bridges, three different trucks, a pirogue, and then the end of the road, are some of the challenges of transporting 700 stoves to 700 families spread throughout the Betampona landscape.



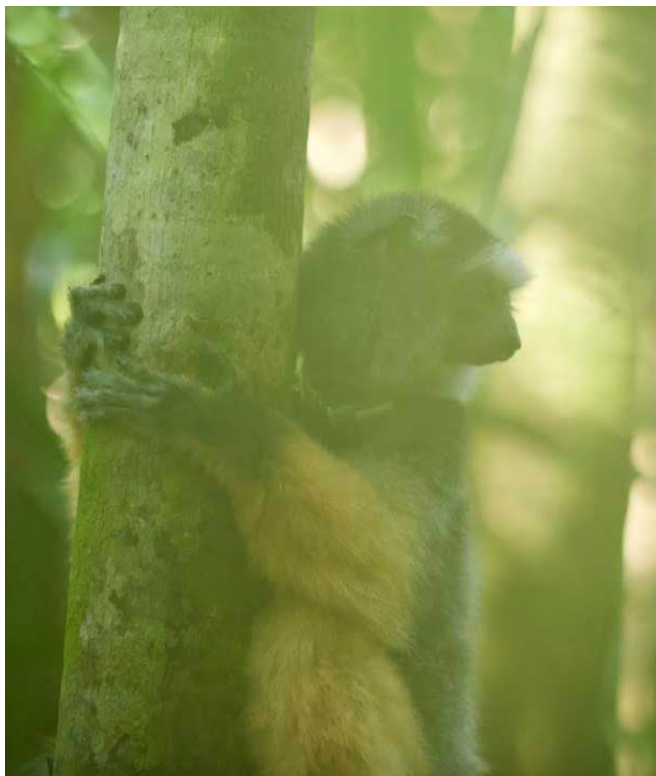


Assisted Gene Flow

Zoo professionals understand the genetic and demographic challenges of managing small populations. To address these challenges, zoo-based scientists have developed software programs that analyze pedigree and demographic data. The results allow cooperatively managed zoo breeding programs to recommend “translocations” aimed at forming breeding pairs that maximize retention of the founding population’s genetic diversity. Sadly, wild populations, isolated from conspecifics due to habitat fragmentation, are becoming more like individual zoo populations and will increasingly require a similar management strategy.



Betampona Natural Reserve has been isolated for well over 50 years. Two very small (230 ha) classified forests, contiguous with Betampona in the 1950s, were highly fragmented when visited by Adam Britt in 1998 and 2002. Four *Indri* and six *Varecia* were observed in 1998, none in 2002. This scenario is being repeated throughout the eastern rainforests. A recent study reported that 44% of forest cover that existed in 1953 was lost by 2014. The remaining 8.9 million hectares are highly fragmented and many are small (46% of the patches are only 100 meters from the forest edge).



All three of Betampona’s critically endangered lemurs (diademed sifaka, black and white ruffed lemur, and indri) will require genetic management to prevent their local extinction. A generous donation to the Saint Louis Zoo’s WildCare Institute, earmarked for this conservation initiative, has allowed the MFG to begin this important work which will focus on the two species with the smallest populations. The diademed sifaka population is estimated to be less than 20 adults and therefore our priority; the black and white ruffed lemur population is estimated at less than 40. In addition to the IUCN’s Reintroduction and Translocation Guidelines, our work is also guided by Frankham, et al. 2017, *Genetic Management of Fragmented Animal and Plant Populations*.

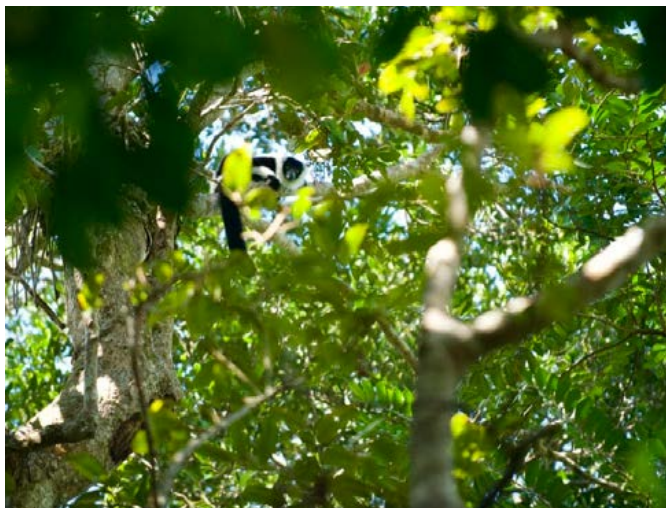
In 2018, we began to collect basic data needed to 1) develop a genetic augmentation plan for *P. diadema* and *V. variegata*, 2) evaluate the genetic and demographic outcome, and 3) serve as the basis from which to plan the next augmentation. A capture mission, primarily focused on *P. diadema*, was carried out in December to:

- Place radio collars on a subset of individuals to collect home range data.
- Place colored collars on all other individuals for census and other identification purposes.
- Collect blood samples to assess each population’s current level of genetic diversity and inbreeding.
- Collect biological samples to assess the current health status of each population.



Left: Fidy removing/collecting a nasal tick from *P. diadema*.

The December capture team was comprised of veterinarian Fidy Rasambainarivo, Jean Noel, MFG's Lead Agent and darter, and 6-8 MFG agents and guides who spread out to search for lemurs and used walkie talkies to reunite the team when darting candidates were located. In the end, six *P. diadema* representing three groups, a single male *P. diadema*, and three *V. variegata* were captured. Each individual was given a complete physical; its heart and respiratory rate and rectal temperature were monitored and its weight was recorded. Blood, fecal and ectoparasite samples were collected for genetic and/or health analyses. Three of the captured individuals were both microchipped and wearing old collars which enabled the team to identify them. Because collars can be lost, all individuals are scanned prior to receiving a microchip. Radio collars were placed on at least one member of a social group; the others received a colored nylon collar with a medallion.



Top: *Varecia* typically rest high in the canopy which makes darting them a greater challenge.



Jean Noel heading out to locate sifaka

Stephan Andrianarivo, (bottom right) had just entered ISSEDD's Master's program when Juliana (see pg 21) selected him to participate in the lemur capture mission. His drive to learn and performance in the field was so impressive, we invited him to do his Master's research on *P. diadema* and he accepted. Beginning in February 2019, Stephan will track the radio-collared groups for six months, collecting GPS points at 15-minute intervals. If additional sifaka are captured, they will be included in the study. Using the GPS data, Stephan will produce a map showing the home range of all his study groups, information that will be used to identify unoccupied sites into which a translocated group could be released.



Alicia Raharimandimbisoa, (above left) a sixth-year veterinary student, came to see Fidy at Mahaliana (see pg 21) because she wanted to do her required research project on wildlife. The timing could not have been better as Fidy was about to advertise for a veterinary student to accompany him on the lemur capture mission. Obviously self-motivated, Alicia proved to be excellent in the field – organized, efficient, and at home in the forest. Her research will focus on one component of the sifaka/ruffed lemur health evaluation: assessing the prevalence of tick-borne parasites and malaria in Betampona's populations. Alicia will do her lab work at Mahaliana, where she will be taught the molecular techniques that have significantly enhanced the probability of detecting blood parasites.



Asian Toad

Last year we reported that the Asian toad awareness raising team also took the opportunity to collect toad distribution data. These data were analyzed by Fulvio Licata, a PhD candidate who was studying the Asian toad's distribution, spread rate, habitat preferences and density. To assess the latter two, Fulvio established five 20 x 20-meter plots in each of three urban and three agricultural/seminatural sites that were surveyed four times over a period of 40 days. The results of both surveys will be published in paper titled: *Abundance, distribution and spread of the invasive Asian toad, Duttaphrynus melanostictus, in eastern Madagascar*, in the journal *Biological Invasions* sometime in 2019.



While bounded from eastward expansion by the ocean, the study's results show the toad is expanding its range to the north, west and south. Its calculated spread rate was based on whether there was a single introduction (3.3 km/year) or multiple introductions (2.5 km/year) with the former thought to be most likely based on genetic studies by Vences and colleagues.

Toad density varied from 132-263 toads/hectare with an average of 184/hectare. The highest toad densities were found in garbage dumps with organic waste (including at a palm oil plantation that composted the shells of the palm oil fruit), while the lowest densities were associated with roads.

Tracking Toads One at a Time



In a separate study funded through the Saint Louis Zoo WildCare Institute, Dr. Angelica Crottini and Fulvio Licata proposed looking at how toads use and travel in their environment by tracking individual toads. Using radio telemetry technology, toads were fitted with a bead-chain waist belt holding a miniature VHF external radio transmitter. During the dry season, from the 23rd of October to the 26th of December, Fulvio



followed the movements of 51 adult toads in urban and natural/seminatural habitats. The results showed none of the toads exhibited dispersal behaviors, instead both male and female toads showed high site fidelity and maintained proximity to water sources during the pre-breeding phase. They also noted that toads did enter a secondary rainforest and lived in dense tropical vegetation, dashing hopes that toads might avoid rainforest habitats. Another two months of data will be collected during the rainy season.



Following the toad provided opportunities to collect life history notes. Above is evidence of the toad's toxicity; it is likely the snake regurgitated the dead toad before succumbing to its toxin.

Toad Exclusion Trial

The MFG received a grant to assess the possibility of constructing a physical barrier that could prevent the toad from invading Parc Ivoloïna. The toads' range expansion is getting them closer to Parc Ivoloïna's southern border; as close as 300 meters as of September 2018. While an exclusion barrier is

not a realistic control strategy in many situations, it is nevertheless worthwhile to test whether it could be applied in certain environmental conditions.

Due to his experience and central role in the toad awareness-raising and survey work, Roderic Mahasoia was selected to coordinate the project's activities. Prior to beginning barrier construction, the MFG had to obtain a permit from the Ministry of Environment, Ecology and Forests (MEEF) authorizing the work. Thereafter, it was important to meet with local community leaders (Mayor, President of the Fokontany, Village Heads) to provide up-to-date information on the Asian toad, inform them of the strange barrier they will soon see along Parc Ivoloïna's border, and explain the purpose of the project.



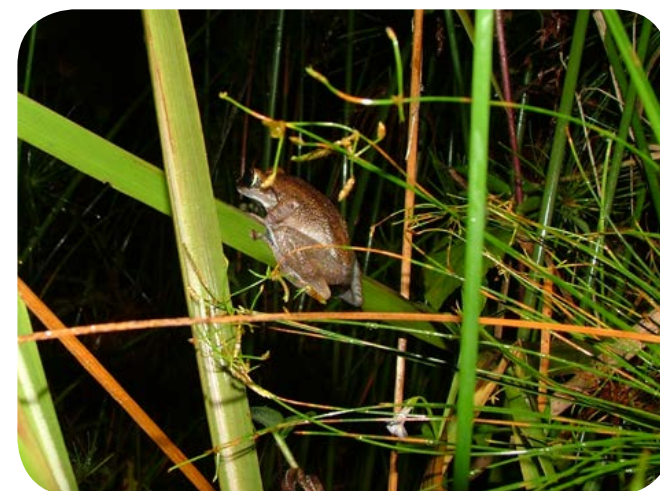
To produce an up-to-date map of the toad's proximity to Parc Ivoloïna, Roderic and a team of ISSEDD eco-volunteers walked to all the communities surrounding the Parc for the dual purpose of providing residents with posters and information on the toad and to ask for any toad sightings. If positive reports were collected, the team visited the location at night to



visually or vocally verify toad presence. The poster below was produced in Malagasy and French to inform residents how to recognize the toad and that it is toxic, invasive, and competes with native species. A "message to all citizens," it requests their help in protecting Parc Ivoloïna from the toad, contacting the MFG if they find toads, and taking actions such as removing standing water where toads can lay eggs.



Protecting its native wildlife is one of many reasons to protect Parc Ivoloïna from the toad. The vertebrate community includes 12 mammal, 51 bird, 23 reptile, and 19 frog species, of which five are considered new species, including one only known from Ivoloïna. In addition to losing carnivorous species vulnerable to the toad's toxin, the toad's capacity for rapid population growth can crowd out other species dependent on the same food and/or habitat resources.



Emmanuella Lovarisoa Faramamiarimila



A master's student from the University of Fianarantsoa, Emmanuelle was interested in assessing Parc Ivoloïna's reforestation program. To date, 23 parcels totaling 35 ha have been reforested.

Over a period of five months, Emmanuella surveyed the tree composition of 11 reforested parcels. She returned to Fianarantsoa to analyze the results and write her thesis.



Jeanne Victoire d'Arc: University of Toamasina / ISSEDD Masters

Fungi are a dramatically understudied group of organisms, a fact highlighted in a Royal Botanic Garden KEW report: *2018 State of the World's Fungi* (see <https://stateoftheworldsfungi.org/>). To illustrate the discrepancy, the report points out that the IUCN conservation status has been evaluated for 25,452 plants and 68,054 animals, but only 56 fungi. Jeanne d'Arc contributed to decreasing the knowledge gap when she decided to study the mushrooms found in and near Betampona Natural Reserve for her master's degree. More specifically, her objectives were to 1) collect and identify mushroom species in and around the reserve, 2) describe the habitats in which the mushrooms were found 3) interview local residents to identify edible mushrooms and 4) analyze the nutritional content of the edible mushrooms. Jeanne's advisors were Dr. Herizo Randriambanona, Head of the Terrestrial Ecosystems Department at National Center for Environmental Research (CNRE), and Dr. Emile, mushroom specialist at CNEP, Antananarivo. To date 86 of the 147 samples she collected have been identified, including the seven species reported as edible. Her research has piqued the interest of her advisors who would like to have the work continued.



Right: Edible mushrooms collected by local man.

Below: Jeanne and assistant in Betampona.





2018 Publications

Armstrong A, Fischer R, Huth A, Shugart H, Fatoyinbo T. 2018. *Simulating Forest Dynamics of Lowland Rainforests in Eastern Madagascar*. *Forests* 9, 214 <https://doi.org/10.3390/f9040214>

Bellati A, Scherz MD, Megson S, Roberts SH, Andreone A, Rosa GM, Jean Noël, Randrianirina JE, Fasola M, Glaw F, Crottini A. 2018. *Resurrection and re-description of *Plethodontohyla laevis* (Boettger, 1913) and transfer of *Rhombophryne alluaudi* (Mocquard, 1901) to the genus *Plethodontohyla* (Amphibia, Microhylidae, Cophylinae)*. *Zoosyst. Evol.* 94(1) 109–135.

Hawlitsek O, Scherz MD, Ruthensteiner B, Crottini A, Glaw F. 2018. *Computational molecular species delimitation and taxonomic revision of the gecko genus *Ebenavia* Boettger, 1878*. *The Science of Nature*, 105:49 <https://doi.org/10.1007/s00114-018-1574-9>

Rasambainarivo, FT, Andriamihajarivo MN, Dubovi E, Parker PG., 2018 *Patterns of exposure of carnivores to selected pathogens in the Betampona Natural Reserve landscape, Madagascar*. *Journal of Wildlife Disease*.

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Reardon JT, Kraus F, Moore M, Rabenantenaina L, Rabinivo A, Rakotoarisoa NH, Randrianasolo, HH. 2018. *Testing tools for eradicating the invasive toad *Duttaphrynus melanostictus* in Madagascar*. *Conservation Evidence* 15, 12–19.

Soutinho JG, Couto H, Andreone F, Crottini A, Rosa GM. 2018. *When camouflage fails: Predation of a huntsman spider *Damastes* sp. (Araneae: Sparassidae) on a stick insect *Antongilia* sp. (Phasmatodea: Bacillidae: Antongiliinae) from Madagascar*. *Acta Arachnologica*, 67(1): 31–33

A Deepening Partnership

Dr. Eustache Miasa has been the passionate advocate steering the University of Toamasina's Institute for Environmental and Sustainable Development's (ISSEDD) collaboration with the MFG. Our partnership, the logical outcome of our mutual objective to build local conservation and management capacity, was formalized in 2006 with an MOU. To that end, MFG and ISSEDD staff meet every year to develop an annual work plan integrating Parc Ivoloïna's facilities and select activities into ISSEDD's curriculum. The MFG covers the transportation costs of ISSEDD's class field trips to Parc Ivoloïna to, for example, practice management and research techniques they were taught in the classroom. A long-held goal of establishing a permanent site within the forestry station for ISSEDD to develop, manage and monitor over the long-term was realized when a 20-hectare site was identified in 2014 and the transfer was formalized through an MOU in 2016.



ISSEDD class at ICTC lab.



The responsibility of developing a management plan for the 20-hectare parcel presents classroom opportunities for students to grapple with: sorting competing conservation objectives, identifying those they want to achieve, planning the actions required to achieve their objectives, determining metrics, and developing protocols best suited to monitor outcomes and guide management strategies over the near and long-term. To date, a few decisions have been made. One was to develop a section of the parcel as an arboretum for endemic trees from eastern Madagascar; its conservation value is as a place to learn tree identification, to raise public awareness, and to provide seeds for reforestation efforts. The arboretum was named the Mandela Arboretum, a lovely tribute to a man who continues to inspire so many.



Green Day, which began in 2014 when students planted 500 trees in ISSEDD's forest parcel, is now an annual event. This year, Dr. Eustache Miasa and the Director of DREEF started the day by encouraging the 450 students to continue in their role as environmental stewards after which the students planted 1,000 native trees cultivated in Jean Francois' tree nursery. Earlier in the year, students planted 250 rosewood seedlings along a newly designated trail. As one student wrote *"The layout of the Mandela Arboretum progresses little by little like the bird that makes its nest."*

Juliana Rasoma, PhD



July 2017 was a busy and successful month for Juliana Rasoma. She received her PhD from the University of Antananarivo having completed her dissertation “Etude bio-ecologique d’Astrochelys radiata (Shaw 1802) dans le Parc National de Tsimanampetsota”. And she was hired as MFG Research Coordinator on a three-year contract through the WildCare Center to assist Research Director Karen Freeman in a number of areas including overseeing graduate students’ research. This is where two of MFG’s pillars, capacity building and research, are firmly intertwined; improving students’ research skills improves the quality of their research. As a lecturer at ISSEDD, Juliana not only strengthens MFG’s relationship with ISSEDD, but she is also in a position to evaluate potential candidates for projects, as was the case with Stephan Andrianarivo (below) – a win-win situation.



Mahaliana - More Than a Laboratory

Fidy Rasambainarivo, DVM, MS, graduated in May from the University of Missouri, St. Louis with a PhD in Ecology, Evolution and Systematics. For about a year prior to his July 2018 return to Madagascar, Fidy had been developing plans and writing grants to build a laboratory in Antananarivo. He understood that advances in molecular technology have not only enabled many studies to include a genetic component, they have become increasingly necessary to advance conservation science. Despite the reality that conserving Madagascar’s biodiversity requires Malagasy conservation scientists and managers to take the leading role, training opportunities are limited. Access to a laboratory where students can learn molecular techniques is but one component of Fidy’s larger vision for Mahaliana. Creating opportunities for students to learn and gain experience in all aspects of research, from designing, analyzing, presenting, and publishing their research results, to obtaining practical experience in, for example, collecting blood samples or radio tracking lemurs, is his ultimate objective. To learn more about Mahaliana’s research and capacity building work go to: www.mahaliana.org



Home Gardens and Soil Management

Beginning in 2008, Charlene Nash, Senior Horticulturist at the Tennessee Aquarium, has traveled to African countries such as Kenya, Mozambique, and Senegal at least once a year to assist farmers in improving food production. In 2016, she was named Volunteer of the Year by VEGA, a national consortium of 26 NGOs, for her dedication to the farmer-to-farmer program. In 2017, Charlene explored the potential of assisting Malagasy farmers when, after the annual meeting in Tamatave, she was accompanied by Christian Rambeloson to meet women from villages adjacent to Betampona and observe local farming practices.



The MFG has been especially interested in helping women establish home gardens since a 2016 survey by Alisha Farris, PhD found that mothers defined “nutritious food” as those foods that satisfy hunger and energy needs. As a consequence, leafy green vegetables that contain micronutrients critical to preventing childhood malnutrition are often ignored in favor of rice, meat, and cassava. The women also reported that the availability and diversity of vegetables they could purchase locally were quite limited. Once aware of the nutritional value of leafy green vegetables, a number of women expressed interest in establishing home gardens to provide their families with a more balanced and nutritious diet.

Charlene returned to Madagascar in 2018 to lead a workshop focused on home gardens and soil management. Christian organized the October 25-27 workshop which was held at Ivoloïna’s Conservation Training Center. Attendees were selected based on their history of participation in MFG’s reforestation and COKETES programs and their ability to train others. In total, 50 women and 21 men from villages around Betampona participated in the workshop; representatives from MNP, the Ministry of Agriculture and Husbandry, and the NGO SAF-FJKM also attended.



Charlene, paired with Charlie, a local translator, began the workshop in the classroom where she explained the benefits of cover crops and specific crop associations that serve to increase soil fertility and health. Demonstrations of composting and biochar production (top right) were done in the Parc.



After the workshop, Charlene and Charlie traveled to villages near Betampona where they met with some of the women who had attended the workshop. One woman (bottom photo) had a particularly impressive garden that could serve as a model for others.





Above: Training in sustainable agriculture and tree nursery management for GRET staff, an NGO working with communities neighboring Mananara Nord to diversify and improve agroforestry practices



Below: Two day training in sustainable agriculture for students from CEFTAR (Centre de Formation de Techniciens Animateurs)



Continuing Education for Staff

Amphibian Conservation Workshop



Jean Noel and Juliana Rasoma attended the Amphibian Specialist Group workshop held at Andasibe. Participants presented updates on their conservation and research activities, discussed standardized amphibian monitoring methods, and toured Mitsinjo Amphibian Captive Breeding Center.

First Aid Training



Twenty employees received First Aid training through the Tamatave Fire Department.

Environmental Education



Three members of the MFG's education team, Andre Ratsimbazafy, Rostand Rahaianasaina, and Flavien Fasy visited Association Mitsinjo in April and Valbio in November, to meet with their education teams, observe ongoing activities, and exchange ideas and experiences.

What a Year It Wasn't - the 2017 / 2018 School Year

Madagascar's school year normally runs from November to July, but this was not a normal year. In August of 2017, the country was alerted to several cases of the pneumonic plague in its two largest cities: Antananarivo and Tamatave. By September, the number of cases had grown so rapidly that a National Emergency Task Force was formed. Normal life was disrupted as social gatherings were discouraged; the school year was delayed and health services were inadequate. The new school year finally began in late November when the epidemic was officially declared over. Then on January 5th, 2018 Tamatave was hit by cyclone Ava which caused significant damage and more disruption to the school year, only to have teachers go on strike from May to July. Although the school year was extended through August, it was clearly impossible for public school teachers to complete the planned curriculum, further depriving Malagasy children whose educational opportunities are already limited. Despite holding 32 instead of the planned 30 classes, the Saturday School teachers were only able to complete, on average, 85% of the prepared program content because, during the strike, they were placed in the position of introducing new French or math lessons as opposed to reinforcing them.

Selecting Students and Engaging Parents

The 2017-2018 Saturday School program conformed to the Education Ministry's revised school calendar; the first class was held December 9 and continued every Saturday through August 11. In 2016, the criteria to select students changed from targeting the highest achieving children to those on the low end, but who demonstrated an interest in school and learning. Poverty is the primary cause of Madagascar's high absenteeism, dropout rates, and low education achievement score (as per United Nations' metric: 6.1 is the average number of schooling years). To help reduce this barrier for children attending the Saturday School program, the MFG has long provided each child with a "school kit" that includes writing and other materials they need for their schoolwork. The lunch program also serves to incentivize attendance. More recently, the Saturday School team added two initiatives aimed at raising parents' awareness of the link between absenteeism and poor school performance, and the important role they play in their child's educational achievements. This process of parental engagement begins prior to distributing the school kits when the parents are asked to sign an agreement expressing their commitment to help their child achieve a high record of school attendance. The newly created Saturday School Parent's Club works to further cultivate parents' involvement in their child's education by inviting them to participate in Saturday School activities. This year parents and children were invited to participate in a special two-day event that began on a Friday with watching a beautiful documentary film on the environment, followed on Saturday with a reforestation activity.



2017-2018 Saturday School Program Results Across Four Sites



# Eligible Students	452
# Students selected	283
# Students complete course	241
Average attendance rate for each class	80%
Average drop-out rate	15%
% Curricula completed	85%
Environmental test results	84%
Average CEPE pass rate SS students	60%
Average CEPE pass rate target ZAPs	54%



Parents of Saturday School children are invited to observe and participate in activities such as planting rice using the SRI technique.

The significant challenges, especially the flooding caused by Ava, and subsequent storms in February and March, impacted attendance. It should be noted that, although the Saturday School now selects the low achieving students, their average CEPE pass rates were, nevertheless, higher than those of their counterparts.

At the end of the school year, prizes are presented to the Saturday School's top achieving students at each of the four sites. The prizes include a small grant and school supplies that enable parents to support and encourage their child to continue onto secondary school (6th grade). In total, 22 students received prizes that were presented at a ceremony on December 8th for students in Ambodiriana, Analamangahazo, and Sahambala and on the 15th for students in Ivoloia. In addition to the parents, local mayors and school authorities were invited to attend the ceremony and afterparty where the MFG provided refreshments to recognize, reinforce, and celebrate the collaboration.

Seeing Through a Different Lens



Every June, fourth grade children who attend one of the five primary schools near Parc Ivoloïna are invited to spend a day touring the Parc with our Center of Environmental Education (CEE) team. The staff initiated the program to reduce the apprehension some Saturday School students experienced in an unfamiliar setting, as the majority of children have never visited Parc Ivoloïna. In the end, however, the program benefits all children who spend a day filled with new experiences such as seeing lemurs up close,

hearing passionate and committed teachers talk about the environment and the role we can all play in protecting it. Unfortunately, the teachers strike resulted in many children missing the opportunity to participate this year; only 120 children attended as compared to 258 in 2017 and 211 in 2016.

Becoming Green Ambassadors

The CEE team has continued to advance the MFG's Camp program from one in which secondary and high school students learn about the environment, to one in which they raise students' awareness of environmental issues and potential actions to mitigate them. The students are encouraged to identify environmental problems at their school and/or community, suggest and discuss potential solutions, come to a decision, and then take action. By taking action they become Green Ambassadors who can apply this same problem solving approach at a regional, national or even international level.



Camp takes on projects



The selection of students for MFG's Camp program is primarily based on two criteria: 1) high achieving students who have the potential to become leaders in their school and 2) an even ratio of boys and girls. Two five-day Camps were held this year; the first Camp comprised 40 secondary students from Ambodiriana, Sahambala, Antetetzambara and Sahandahatra. The second Camp comprised 30 students from Tamatave II high school. The CEE team is making a big effort to increase the success and positive impact the program can have on students and the environment by inviting school teachers to create a Green Ambassador club at their school. To help the teachers better understand and guide the club, they held a two-day training for one teacher from each of the five participating schools.



Girl's Leadership Camp

Vero Ravololonarivo, ICTC Manager, has organized and led the Girl's Leadership Camps since they began in 2013. In June, twenty girls from high schools in Tamatave took part in the two-day Camp. The Camp's broad theme and objectives remain the same: to raise girls' awareness of women's rights; the importance of staying in school; understanding that an education not only benefits her life, but also the life of her future children; and, avoiding unplanned pregnancies. The girls are encouraged to include a wide range of science-related occupations when they consider their career aspirations. The Camps vary in how messages are delivered because the women who participate as role models have different stories to tell, and different styles of communicating their stories. This year's group included two high school teachers, an education counselor, six members of Tamatave's Human Rights Club, MFG's Juliana Rasoma, PhD, and Franka Rasolomanantsoa.



Girls often ask the professional women who come to speak with them, how are they able to balance work and family life. Vero brought her son, who was still nursing, and a babysitter to the Camp. When he got fussy and wanted to be with his mom, Vero took over while continuing her lab lesson. If a picture is worth 1,000 words, a demonstration must be worth even more.

A particularly inspiring participant was Lova Navalona Rakotoarisoa, a certified human rights trainer, recipient of a Mandela Washington Fellowship, and founder of an NGO to “empower Malagasy youth to become advocates for social justice and human rights.”

The second Girls' Camp was held in December for 32 secondary school-aged girls. Half of the girls came from Antetetzambaro and Sahandatra, villages close to Parc Ivoloina, the other half from Sahambala and Ambodiriana, villages near Betampona. The need to help girls living in rural villages stay in school was reinforced by MFG's goal to recruit more women for the IUCN SOS project being foiled because too few women were able to read and write.

In addition to Vero, the women participants for this Camp included two ISSEDD students, a teacher, and a school administrator. The first day was devoted to the Camp's key messages and the stories of the invited speakers. The second day was focused on providing the young girls with hands-on lab experience.

At the end of both Camps, girls from each school elected to develop a project aimed at passing on what they had learned at Camp to their classmates and teachers.



World Environment Day - A Time to Celebrate and Take Action

A creation of the United Nations, World Environment Day (WED) has been internationally celebrated since 1974. Each year the UN selects a theme in order to bring attention to a pressing environmental problem and encourages people to do something for the environment. In Madagascar, the Ministry of the Environment announces the theme; this year's theme was "Beat Plastic Pollution." For communities neighboring Betampona, WED celebrations were held June 15th and 16th in Ambodirafia. Despite the rain, families came out to hear speeches, watch

dancers, and see who won awards. The next day began with speeches from local officials followed by the announcement of the SOS project and the presentation of the training diplomas to the chicken vaccinators and stove animators. The MFG team called on people to act by cleaning the area of tossed plastic, and distributed saplings that were planted in select locations. Many local government officials attended Parc Ivoloïna's June 7 WED celebration, which included a carnival and a series of popular workshops on using plastic "waste" to make new products.



World Lemur Festival

In 2018, the MFG and our indispensable partner, Club Varecia, organized two festivals, the first on November 10 and 11 in Tamatave. A booth was set up on Independence Avenue to raise awareness of lemurs' ecological role and conservation status, give children books from the Ako series, and, using masks and face paint, transform children and adults into lemurs.

The second festival was on November 17. Club Varecia handed out masks and caps to primary school and scout groups, and members of Club Vintsy who joined them for a 12 km parade from Tamatave to Parc Ivoloïna. The rest of the day was filled with activities from puppet shows and a lemur drawing contest to observing local dance groups who had created songs and dances about lemurs. Many families toured the zoo that was free and open to all. The Lions Club of Tamatave dedicated the day to offering free diabetes screening – Africa has the world's highest proportion of undiagnosed diabetes at 69%.



Our Members: The Foundation of MFG

All of what you read in this report is truly only possible because of our Members' ongoing support. If you'd like to join our collaboration of zoos, botanical gardens, aquariums, and universities, see the benefits of each membership level at www.madagascarfaunaflora.org.

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Guhl Foundation

Thank you for supporting the MFG's Saturday School Program for 12 years.



Planet Foundation

Thank you for supporting the MFG's capacity building programs for 10 years.



MFG Financial Summary for 2018

Revenue	2018
Membership dues	193,523.97
Donations	32,333.08
Madagascar in-country income	27,047.52
Grants	274,085.80
Total Revenue	526,990.37
Expenditures	
Personnel & Operations	329,681.16
Dedicated grant expenses	155,353.05
Total Expenditures	485,034.21
Net Surplus/Deficit for the Year	41,956.16
Balance of cash and equivalents on 31st Dec/ USD	542,779.47
Accounts payable/USD	83,473.13
Accounts receivable/USD	53,120.19



Greenville Zoo AAZK Chapter

Thank you for donating the profits of your black and white ruffed lemurs' artwork sales to the MFG. And, of course, please thank the artists Rowdy, Radar, and Maz, who, when not busy developing new beer flavors, produced art to support their critically endangered kin in the wild.



Thank you to **Little Rock Zoo AAZK Chapter** for their continued support of the MFG.

Thank you to the **Zoo Atlanta keepers** for donating their Wild Encounter funds to the MFG.



Madagascar Fauna and Flora Group

Madagascar Office

BP:442 Morafeno, Toamasina (501)

Tel: (+261) 20 53 308 42

e-mail: mfgmad@moov.mg

International Headquarters

MFG c/o Naples Zoo

1590 Goodlette Rd, Naples FL 34102 USA

e-mail: info@savethelemur.org

www.madagascarfaunaflora.org