DUKE LEMUR CENTER

MAGAZINE | 2022-23

Issue 4

THE WOMEN'S ISSUE

MAPPING HERSTORY: STUDIES IN FEMALE DOMINANCE

PRIMATOLOGY'S FOUNDING MOTHERS

WOMEN IN STEM, THEN AND NOW

EMPOWERING WOMEN FARMERS IN MADAGASCAR

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A fat-tailed dwarf lemur feeds on wild grapes. *Photo by David Haring.*

DUKE
LEMUR CENTER
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EDITORS:
Sara Sorraia, Rhiannon See, and David Haring

Special thanks to Glenna Rowe, whose success as a minority in the field of science education 40 years ago has been both inspiring and empowering. With love, Sara.

Comments, feedback, or something you'd like to see in our next edition? Email **sara.sorraia@duke.edu**. We'd love to hear from you!

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ON THE COVER:
Hermione, a black and white ruffed lemur. On warm days, Hermione free-ranges in Natural Habitat Enclosure #8 with her mate, Herschel, and their daughter Ripley. *Photo by Sara Nicholson.*

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LETTER FROM THE DIRECTOR

THIS YEAR'S MAGAZINE features the stories of the formidable women leading the Duke Lemur Center's research, science communications, data management, animal care and welfare, veterinary, and education programs. Each has forged her own path, and many have navigated career fields previously dominated by men. The impact that these professionals have had on the Lemur Center, and on their respective fields, is immeasurable. In addition to initiating powerful and innovative programs that have amplified the DLC's mission and its impact on the scientific community, they have guided and mentored countless young women hoping to follow in their footsteps. I hope you find their stories as inspirational as I do.

I also want to recognize and celebrate the 10-year anniversary of our conservation program in the SAVA region of Madagascar. We're all extremely proud of what has been accomplished through our collaborations with our Malagasy colleagues, and we're committed to continuing these partnerships for many years to come.

As always, thank you to all of you, our loyal supporters, for your continued generosity and kindness. I hope you share our sense of accomplishment and pride as your read the stories within.

GREG DYE
Executive Director
Duke Lemur Center

ABOUT THE DLC

PROTECTING AND CARING FOR EARTH'S MOST ENDANGERED MAMMALS

Founded in 1966 on the campus of Duke University in Durham, NC, the Duke Lemur Center is a world leader in the study, care, and protection of lemurs—Earth's most threatened group of mammals.

LEMUR CARE

What began as a small primate menagerie 56 years ago, has grown to become one of the most precious collections of endangered primates anywhere in the world.

Throughout its history, the Duke Lemur Center has cared for nearly 4,000 animals, including lemurs, lorises, bushbabies, and tarsiers. Today, it houses more than 200 lemurs across a dozen different species—**the most diverse population of lemurs on Earth**, outside their native Madagascar.

The DLC works within a network of other AZA-accredited institutions worldwide to develop and adhere to Species Survival Plans (SSPs). These cooperatively-managed conservation breeding programs are critical to lemur conservation, and the DLC maintains the world's largest **genetic safety net** for lemurs. We're proud to have celebrated over **3,405 births** since our founding in 1966.

Our signature Natural Habitat Enclosures enable our lemurs to **roam freely in multi-acre tracts of forest** and live in natural social groups, fostering the same behaviors and social structures seen in the wilds of Madagascar.

The DLC's daily enrichment program promotes lemurs' **curiosity, exploration, and mental stimulation** and is a critical component of our animals' care and welfare.

Positive reinforcement training is used to teach lemurs to enter a kennel, sit on a scale, and other behaviors that may seem like play to the lemurs but enable us to provide the best care with minimal handling or stress to the animals.

RESEARCH

By studying the variables that most affect lemurs' health, reproduction, and social dynamics, we learn how to better care for them in captivity and how to most effectively focus our conservation efforts in Madagascar.

The DLC is an internationally acclaimed hub of scientific discovery, conducting and facilitating research that spans a remarkable array of disciplines, from behavior and genomics to conservation biology and paleontology. The Center is also recognized as a global authority on lemur veterinary medicine.

All of the DLC's research, both in Durham and with wild lemurs in Madagascar, is non-invasive. **We do not allow any research that will harm the lemurs.**

The DLC also houses **35,000+ fossils** and subfossils at the DLC Museum of Natural History, enabling students and researchers to study the evolution of primates and the species that lived alongside them for millions of years.

Because lemurs are our primate relatives, we share many of the same diseases, susceptibilities, and health concerns. Thus, studying lemurs can help us find solutions to combat serious problems facing humans.

CONSERVATION

Lemurs are found in the wild only in Madagascar. At least 17 species of lemur have gone extinct, and the existing lemurs are the most threatened group of mammals on Earth. In fact, **98% of lemur species are endangered**, and 31% of species are critically endangered.

For over 35 years, the DLC has worked on-the-ground in Madagascar to **protect lemurs and their natural habitat**. Most of these activities are community-based, encouraging biodiversity conservation in northeastern Madagascar by supporting the livelihoods of rural people in forest-bordering communities.

Many of the DLC's community-based conservation projects involve partnerships with students and faculty at Duke and at the Centre Universitaire Regional de la SAVA (CURSA) in Madagascar, **educating and inspiring the next generation** of conservation leaders and environmental stewards.

At the invitation of the Government of Madagascar, the DLC is **assisting Madagascar's zoos and wildlife parks** in developing a conservation breeding program and establishing best practices in lemur care. In doing so, the DLC is improving the care and welfare of over 600 lemurs representing 20 endangered species housed in 14 licensed zoos across the island.

PUBLIC OUTREACH AND EDUCATION

Our Student Projects Program connects students with **volunteer, work-study, research, and internship opportunities** at the DLC. Our goal is to provide hands-on experiential learning opportunities that allow students to take part in the DLC's research, education, animal husbandry, and conservation programs here on Duke's campus and in Madagascar.

Through a variety of onsite tours and programs, the DLC's Education Department hosts tens of thousands of visitors annually. Online, we connect anyone, anywhere in the world to science, conservation, and lemurs through our full-length virtual tour, presentations and videos, and other educational resources—available free at **lemur.duke.edu**.

Conservation breeding programs are critical to lemur conservation, and the DLC maintains the world's largest "genetic safety net" for these endangered primates. We're proud to have celebrated more than 3,405 births through our conservation breeding program since our founding in 1966—including Atticus, pictured here. *Photo by Bob Karp.*

MAPPING HERSTORY:

Studies in Female Dominance

By **ANDREA TEJADA**,
2022 Communications Intern and **DLC STAFF**
Illustrations by **KARIE WHITMAN**

Since its inception, the field of primatology has been dominated by a star-studded cast of influential women, from ape researchers Jane Goodall and Dian Fossey to the lemur-loving Alison Jolly, Patricia Wright, and Dame Alison Richard.

Likewise, the non-human constituents of the primate order are notable for their instances of female dominance. Although many primates, including Goodall's chimps and Fossey's mountain gorillas, exhibit male-dominant social structures, female dominance is encountered in nearly all **strepsirrhines**—the suborder that includes lemurs, lorises, pottos, bush babies, and tarsiers and comprises more than 20% of all primate species.

In nearly all of the 108 species of lemur, females are the respected royalty. One wrong look given by a male lemur to a female could provoke a smack, hair pull, or a tail yank. And it's not just the most dominant female who holds the power: Any female within the troop, even juveniles, can outrank any male—including the breeding (dominant) male.

Fittingly, the staff at the Duke Lemur Center is overwhelmingly comprised of women. In 2015, women held only 28% of all science and engineering jobs in the U.S., but at the DLC, more than 80% of staff identify as women.

As a young woman of color pursuing a career in STEM, I've experienced personally the challenges of entering a field dominated by people who don't look like me. Research has shown that girls tend to lose interest in STEM-related careers around age 15 for reasons that include social pressure, lack of female role models, and an overall misconception of what "real world" STEM careers can look like. My goal in sharing the stories of the DLC's strong and successful women is not just to spotlight them and their achievements, but also to inspire and encourage others to follow their dreams with fearlessness and tenacity.

The advice given to me most often by these women was that there is no one "right" way to end up in a career you love. Learning to accept that you may not know in advance the trajectory your career path will take, has been a common theme in many of these journeys. I hope that by sharing these stories we can empower other women in the exploration and pursuit of their passions.

ERIN EHMKE, PH.D.

Director of Research
11 Years at the DLC

"When I was younger, I didn't really know how to pursue a career with animals," Erin recalls. "I thought the only two paths were veterinarian and zookeeper. I grew up wanting to be Jane Goodall; I just didn't know how to become Jane Goodall."

After graduating high school, Erin opted to pursue becoming a veterinarian—and quickly realized that a pre-vet focus just wasn't for her. She volunteered in a lab for a professor studying Old World monkeys, helping analyze fecal samples for intestinal parasites. This was Erin's introduction to research, and it helped her see a clearer path toward her career goal.

Ultimately, it was her experience at a primate sanctuary that solidified Erin's path. After years of working at a sanctuary that rescues abused or unwanted monkeys from the pet and entertainment industries, "I was craving to learn how different these monkeys' behavior was from their wild counterparts'," says Erin. "It was then that I realized: I was ready for my Jane Goodall moment."

Through her varied experiences, "I had learned about opportunities that I never knew existed that could make that dream possible," Erin recalls. After attending a month-long primate ecology field school in Panama, she became a field assistant for an ongoing study in Suriname. "That position focused on capuchin monkey behavioral ecology and gave me the opportunity to do what I craved: to experience the natural lives of the monkeys I had worked with in captivity.

"That year was one of the best of my life. Afterward, I enrolled in a Ph.D. program in Biological Anthropology and returned to Suriname for additional fieldwork. I studied female support and stress in wild capuchin monkeys, learning just how important social bonds are for the health of primates—humans included."

Today, Erin's favorite part of working at the DLC is her ability to combine all of her career interests into one role. "When I was teaching after graduate school, I loved it, but I missed working with primates and the excitement of asking scientific questions and collecting data to answer them."

In her role as Director of Research, Erin combines her passion for student mentorship with the non-invasive study of lemurs. "My vision is to expand our research programs in both Durham and Madagascar, serving as a model institution that prioritizes animal welfare, high-impact research, and access to opportunities for all students and scientists.

"When I was younger, I dreamed of this path but I didn't know how to achieve it—partly because I didn't realize the breadth of opportunities that were out there. I encourage all students, of any age, to try new experiences. And I make it my personal mission to make opportunities accessible for students trying to find their own paths."

> **"I GREW UP WANTING TO BE JANE GOODALL; I JUST DIDN'T KNOW HOW TO BECOME JANE GOODALL."**
>
> ERIN EHMKE, PH.D.

FOUNDING MOTHER

JANE GOODALL, Ph.D., DBE
(1934-)

One of the best-known names in primatology, Goodall pioneered an immersive, hands-on approach to studying wild chimpanzees in the forests of Gombe in Tanzania. Her field observations showed that chimpanzees have unique personalities, eat meat, wage war, and make and use tools—"one of the most important scientific observations of modern times."

"It was hard for me to believe," Jane recalled in an interview with The Guardian in 2010. "At that time, it was thought that humans, and only humans, used and made tools. I had been told from school onwards that the best definition of a human being was 'man the tool-maker.' Yet I had just watched a chimp tool-maker in action."

Today, Goodall travels the world raising public awareness of wildlife and conservation, and her Gombe Stream Research Centre has launched the careers of hundreds of primatologists—many of them women who have played a leading role in the study of chimps and other great apes.

Said Gilbert Grosvenor, chairman of The National Geographic Society: "Jane Goodall's trailblazing path for other women primatologists is arguably her greatest legacy."

FUN FACT

Goodall's vast collection of field data, chronicling nearly 50 years of research in Gombe, is housed at Duke University.

LAURA ELLSAESSER, D.V.M.

Veterinarian
5 Years at the DLC

"I've always been drawn to zoos, wildlife, and conservation," says Laura. "I knew from a young age that I wanted to be a veterinarian." She tailored her education in pursuit of that goal, graduating from Auburn University with a B.S. in Zoology and Wildlife Biology and accepting a husbandry internship with the Lemur Conservation Foundation.

"In Florida, I became fascinated with lemurs and developed a soft spot for mongoose lemurs in particular," she recalls. "When I started vet school at North Carolina State University, I knew the DLC was just down the road. Initially I hoped to volunteer, but a busy school schedule didn't permit that, so I took advantage of every class and rotation that brought NCSU students to the Lemur Center."

In doing so, Laura developed a strong professional relationship with DLC veterinarian Bobby Schopler, D.V.M., Ph.D., who encouraged her to stay involved at the Lemur Center even after completing her degree.

After earning her D.V.M., Laura completed a year-long internship in small animal medicine and surgery at Texas A&M University. While there, she worked closely with a nearby zoo, indulging her interest in wild animals while honing her skills in dog and cat medicine and surgery.

Her next position, as a small animal ER doctor in Virginia, not only brought her closer to home but also had a highly appealing schedule. "I had every third week off," says Laura. "What better way to spend that week than by driving to the Triangle to visit friends and spending time with the veterinary department at the DLC?" The DLC's veterinary team welcomed these trips and invited Laura to assist whenever she was available.

Two years later, she received a call from Bobby. "He told me the staff veterinarian position was opening up at the DLC," Laura remembers. "I was floored. He had invited me to apply for my dream job. This is the stuff that happens in the movies. It was unbelievable."

After a three-month application and interview process, Laura's dream came true. She's been with the DLC for five years, and "I couldn't be happier!"

Even though she knew early on that dog and cat medicine wasn't for her, Laura values the jobs and internships she held before coming to the DLC, as those positions gave her the opportunity to practice clinical skills that are all applicable to lemur health and care. There is no handbook for lemur veterinary medicine, and the Lemur Center's veterinarians draw upon their experience with domestic animals while working closely with husbandry staff, researchers, and small animal specialists to determine the best courses of action for many of the more challenging lemur health issues.

That challenge is part of the appeal for Laura, and she's happy to be working in such a collaborative environment. Her advice for people interested in non-traditional career paths? "There's no one way to do it, and that can be really intimidating. Just dive in and chase anything that's interesting to you, and see what sticks!"

"I'VE ALWAYS BEEN DRAWN TO ZOOS, WILDLIFE, AND CONSERVATION. I KNEW FROM A YOUNG AGE THAT I WANTED TO BE A VETERINARIAN."

LAURA ELLSAESSER, D.V.M.

MEGAN MCGRATH

Education Programs Manager
6 Years at the DLC

The one thing Megan knew she didn't want to be when she grew up? A teacher. "The irony is not lost on me," says Megan. "I thought of education as a narrow, specific field—a teacher in a classroom, as opposed to the exciting, informal education we do at the DLC."

A driven and motivated kid, Megan was always interested in animals. "I was christened 'The Encyclopedia of Useless Animal Information' by one of my good friends," she laughs. Yet she never connected her love of animals to the field of science. "To me, science was just microbiology and looking through a microscope."

As an undergrad, Megan opted to study Psychology and International Studies. After finishing an independent research study her senior year, she discovered to her dismay that she didn't enjoy the process of research—upending her dreams of an eventual Ph.D. in Psych. "It was a real blow to realize that what I thought I was going to do, I didn't like. I felt like a failure."

That same year, Megan had accepted an animal care internship at the Conservators Center, a nonprofit wildlife education center focused on large carnivores such as lions, tigers, and wolves. "It became increasingly clear to me how invested I was in my unpaid internship versus the research I was supposed to be doing in psychology," she recalls. "I was more excited to wake up at dawn to scoop lion poop than I was to write my honors thesis."

In retrospect, Megan says, "I wasn't a failure; psychology was just the wrong path for me. It's okay to acknowledge when something you thought you wanted, something you've worked toward, just doesn't feel right.

"I had no idea how heavily my own expectations had been weighing on me. It took a long time to let them go, but once I did, I felt an immediate release. I could move on."

Megan didn't apply to Ph.D. programs. Instead, after graduation, she juggled three animal-related, part-time positions: animal care at the Conservators Center, pet sitting, and front-desk assistance at a veterinary office. "It was tough, but it allowed me to explore my career interests until I could find something full-time," she says. "I was fortunate to have supportive parents."

Ultimately Megan progressed from keeper to tour guide to Education Programs Supervisor, overseeing all tours and special events at the Conservators Center. She joined the Lemur Center in 2016 after the DLC's then-Education Manager, who was moving into a new role, notified her of the opening and encouraged her to apply.

"Treat every interaction as a job interview," says Megan. "If I hadn't met the previous manager through environmental education events, I never would've applied for this position. This is a small field, and we want to see each other succeed. We're all happy to recommend wonderful people we've worked with as candidates for great roles."

"I WAS MORE EXCITED TO WAKE UP AT DAWN TO SCOOP LION POOP THAN I WAS TO WRITE MY HONORS THESIS."

MEGAN MCGRATH

KARIE WHITMAN

Fossil Preparator
2 Years at the DLC

"There's no degree for this job. It just kind of happened," laughs Karie, who began her undergraduate education on a pre-med track, which required employment in a campus laboratory. After interviewing for numerous positions, she was hired by a fossil lab to make casts of whale bones—a chance job that served unexpectedly as the foundation for her career.

After graduating from the University of Michigan with a B.S. in Ecology and Evolutionary Biology, Karie traveled to the Buckeye State to pursue a master's degree in Environmental Studies at Ohio University. For her master's thesis, she worked in Madagascar studying rice agriculture, collaborating with the Peace Corps on educating local communities about sustainable and efficient farming techniques. After publishing her thesis, Karie received a Fulbright grant to continue her research and outreach to local Malagasy farming populations.

After returning from Madagascar, Karie received a call from Dr. Matt Borths, Curator of Fossils at the DLC Museum of Natural History. He and Karie had met in OU's fossil lab, and he invited her to apply for an opening for a fossil preparator at the DLC. She was hired in 2020.

Today, working at the Lemur Center enables Karie to embrace additional roles such as designing exhibits for the fossil museum and infographics for educational projects, including illustrations featured in this article; as well as maintaining contact with partner individuals and organizations in Madagascar. "One thing that always comes up with my career journey is that you can do lots of things at once," says Karie—and that suits her perfectly.

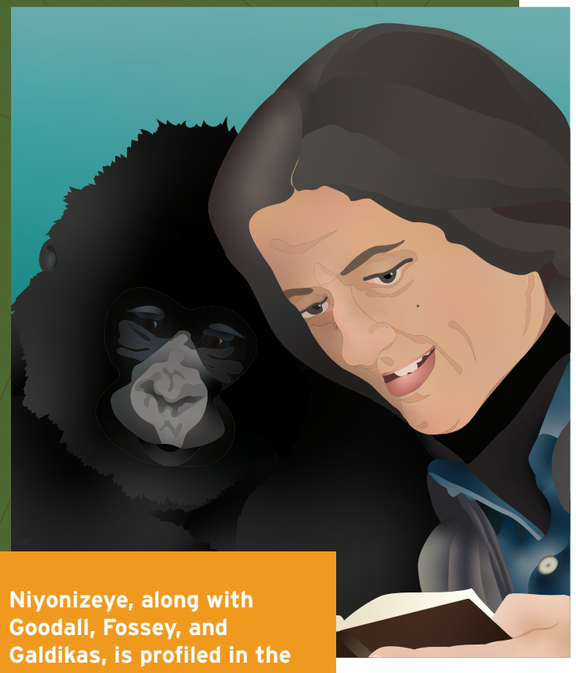
FOUNDING MOTHER

DIAN FOSSEY, Ph.D.
(1932-1985)

A leading authority on mountain gorillas, Fossey patiently habituated wild gorillas to her presence so she could gather data on their behavior, communication, and social structure.

After the poaching of a gorilla named Digit, Fossey used increasingly drastic (and today, highly controversial) methods of deterring poachers to protect the endangered gorillas of the Virunga mountains. She was murdered in her cabin on December 1985, likely by the poachers she had fought for so long.

The Karisoke Research Center, which Fossey founded in Rwanda in 1967, continues her work with wild mountain gorillas. Today, Nadia Niyonizeye, a research assistant at the Dian Fossey Gorilla Fund, is one of the new generation of scientists studying and protecting the descendants of Fossey's beloved great apes.



LEARN MORE

Niyonizeye, along with Goodall, Fossey, and Galdikas, is profiled in the documentary *She Walks with Apes* (2020). Learn more at trimatesdoc.com.

SARA SORRAIA

Director of Communications
6 Years at DLC

Sara is the daughter of a seventh-generation farmer, an all-around farm kid hailing from the Appalachian foothills of southern Ohio. Her parents' neighbors are Amish. "If you'd told 12-year-old me that someday I'd be a communications director at a globally-ranked university just outside the 'Silicon Valley of the East,' I wouldn't have believed you," she laughs.

She started taking college classes after her sophomore year of high school: They were free, thanks to an agreement with the local schools—and finances were a big factor for the family. She banked all the credits she could and, later, finished her BA in a swift three years, concentrating in the eminently practical field of… classics. "I couldn't resist," says Sara. "I like my artwork ancient and my languages dead."

At the time, she wanted to be a professor. But she was painfully shy, and she knew she couldn't lecture in front of a class. Before pursuing graduate school, "I decided to look for a job that would force me to talk to strangers. I opened the classifieds and a local Nissan dealership was hiring salespeople. I applied and surprise! I was hired."

She sold Nissan cars and trucks for three years. That experience—sales, negotiation, customer service, even repping Nissan at auto shows—was invaluable. She didn't know it then, but it would form the foundation of her future career.

Sara enrolled in graduate school at Duke in 2007. "I was probably the only Blue Devil who could read in four languages, hawk a pickup truck, AND castrate a goat," she jokes. "Around the same time, my parents put our land in a conservation program and planted 17,000 trees in former cattle fields. My brother began transitioning to organic farming, and Dad became interested in bobwhite quail conservation. I began to understand more deeply the importance of caring for the land and the wild creatures it supports."

After graduating from Duke (where her thesis focused on the "language" of art in the Middle Ages), Sara co-managed an undergraduate admissions department before accepting a position in sales, marketing, and editorial development at Oxford University Press. Later, she managed tours, visitor relations, and special events at Duke University Chapel for four years before joining the DLC in 2016.

"My professional background grew into a blend of sales and marketing and interfacing with the public, which transitioned perfectly into my 'dream job' here at the Lemur Center," says Sara. "Now, for the first time in my life, I'm working at a job that unifies the two worlds that I live in and love—professional and personal. Not only am I back around animals, but I get to use the skills I've developed over the past 16 years to help spread the word about lemurs."

Her advice? "Be insatiably curious. Ask questions. I heard once that in every interaction, you're there either to learn or to teach. Sometimes both, of course; but wherever you are, always think about the things you can learn. Those experiences can have surprising impacts on your future career."

> **"I WAS PROBABLY THE ONLY BLUE DEVIL WHO COULD READ IN FOUR LANGUAGES, HAWK A PICKUP TRUCK, AND CASTRATE A GOAT."**
> SARA SORRAIA

AMANDA MAZZA

Data Manager and Registrar

3 Years at the DLC

Amanda Mazza originally set out to pursue a career as an animal rights lawyer. But jobs in that field were scarce, and no other field of law interested her; so Amanda, ever practical, explored other options.

Although intrigued by primatology, evolution, and biology, Amanda struggled with math, and teachers and counselors discouraged her from pursuing a career in STEM. "Even though I fully believed I'd never have a job in this field, I was still passionate about it," she recalls. Nevertheless, she strayed from the sciences and earned a bachelor's degree in history.

After several long years as a substitute teacher, Amanda obtained a position in public health, later earning a Master of Public Health from West Chester University's College of Health Sciences. By that time, Amanda was working full-time running a program that provided assistance to those with HIV—a program she describes as her "biggest achievement in public health."

A major component of that position was data management, and Amanda realized she wasn't as bad at math as her advisors had convinced her she was. She used math and statistics daily; it was just presented in a way that was easier for her to understand. After a promotion to a supervisory role, Amanda missed the data management aspect of her work, and an opening for Data Manager and Registrar at the DLC caught her attention.

Amanda has now been with the DLC for three years, working with all departments to create databases that store a wide variety of information on all the strepsirrhines housed at the Lemur Center, and striving constantly to devise new ways to organize the data. "Looking back, it makes sense that all the skills that I developed in public health were applicable here. I was told years ago as a kid that this would never happen for me, but here I am!"

FOUNDING MOTHER

BIRUTÉ GALDIKAS, Ph.D.

(1946-)

A Lithuanian-Canadian scientist, conservationist, and educator, Galdikas studies orangutans in Tanjung Putting Reserve in Indonesian Borneo. Her biography on orangutan.org notes that "before she left the U.S., she was told by her professors and others that it 'couldn't be done'; she wouldn't be able to study orangutans in the wild. They were too elusive and wary, living almost entirely in deep swamps." But Galdikas shattered that belief, spending more than 40 years in Borneo—the longest continuous study by one principal investigator on any wild mammal in the world.

MEG DYE, MSc

Curator of Behavioral Management and Welfare

11 Years at the DLC

"I always wanted to do something with animals," says Meg, "but as a kid, I wasn't sure what that would entail." When the Monterey Bay Aquarium opened nearby, Meg was in high school and was hired as a cashier. "I learned I did not want to be a cashier," she laughs, "but the aquarium was fascinating."

When she enrolled at the University of California, Irvine, Meg didn't have a solid plan yet for her future. She became increasingly interested in marine biology and, after two years at UC Irvine, transferred to the University of California, Santa Cruz. She'd been drawn to UCSC's Joseph M. Long Marine Laboratory, a facility for non-invasive research much like the Duke Lemur Center. "That's where everything clicked," Meg says.

At the Long Marine Lab, Meg learned the principles of positive reinforcement training through her involvement with a sea lion cognition project. "I was introduced to training and given hands-on experience working with marine mammals, and the rest is history!"

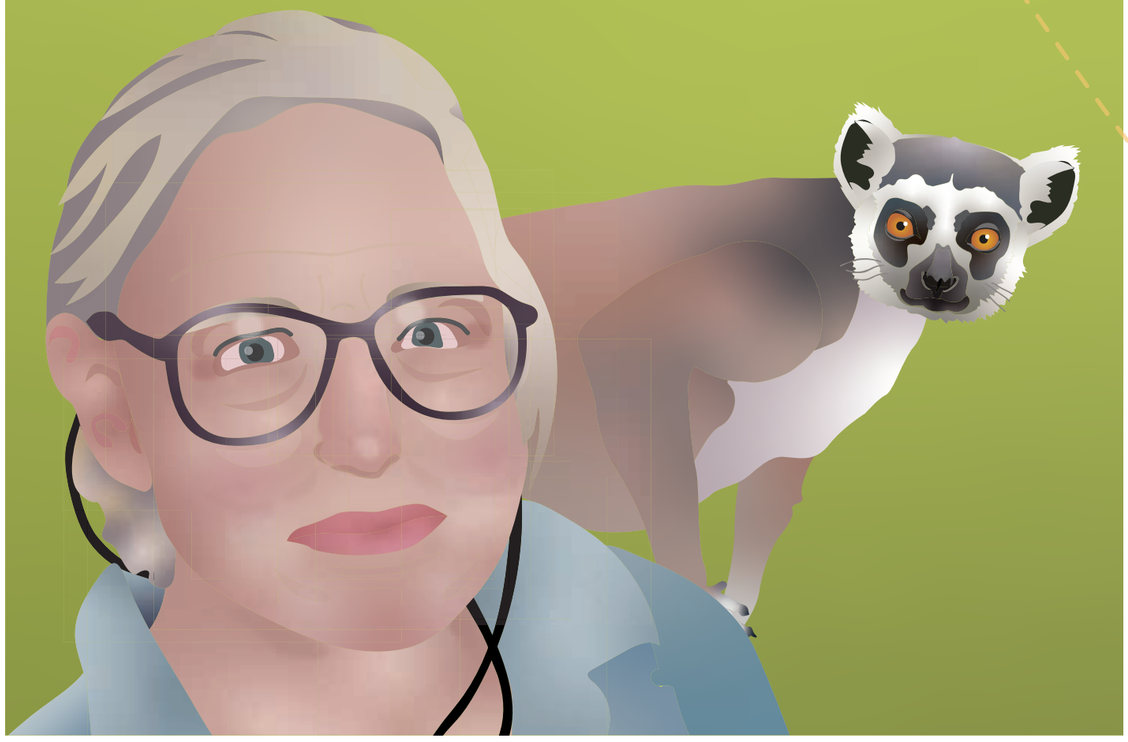
After graduation, Meg worked for ten years as a lead dolphin trainer at the Shedd Aquarium in Chicago, then launched a consulting business specializing in positive reinforcement training in zoos. At the same time, the Duke Lemur Center launched a training program to complement its husbandry and non-invasive research projects. The DLC's then-Director, Dr. Anne Yoder, hired Meg as a consultant for five years, then as a full-time staff member in 2011.

Today, Meg holds a master's degree in Animal Welfare, Ethics, and Law and oversees the DLC's behavioral management program. In doing so, she collaborates across departments to promote positive animal welfare—a top organizational priority of the DLC, and a key component of the highest quality lemur care.

> **"I WAS INTRODUCED TO TRAINING AND GIVEN HANDS-ON EXPERIENCE WORKING WITH MARINE MAMMALS, AND THE REST IS HISTORY!"**
>
> MEG DYE, MSc

FOUNDING MOTHER

ALISON JOLLY, PH.D.
and the Discovery of Female Dominance
(1937-2014)



DID YOU KNOW?

Jolly was a member of the Duke Lemur Center's Board of Visitors and its External Scientific Advisory Committee.

Primatologist and conservationist Alison Jolly pioneered in-depth field research on lemurs in Madagascar. Her discovery of female dominance in ring-tailed lemurs—and, as it turned out, most other species of lemur—"upended a bedrock assertion in evolutionary biology," the *New York Times* reported in her obituary in 2014.

Prior to Jolly's field studies in the 1960s, it was believed that males dominated females in every primate species, including humans. But in ring-tailed lemurs, Jolly wrote in *Lemur Behavior: A Madagascar Field Study*, "all females, whether dominant or subordinate in the female hierarchy, are dominant over all males."

Elsewhere in the text, she referred to subordinate males as the "Drones' Club."

In some primate species, like mountain gorillas, males are larger than females, making it visually apparent which sex has the upper hand. Lemurs, however, are **monomorphic**: There are few physical differences between males and females.

Female lemurs may be the same size as their male counterparts, but they don't need to throw their weight around to get priority access to food and safe sleeping spots. Acts of dominance like tail pulling, chuffs, bites, and other agonistic gestures keep male lemurs in line, and it's clear by the males' submissive behavior that they know who's in charge.

Dominance in the lemur world usually means not having to share. "Females have social, spatial, and feeding priority over males," Jolly observed.

But with great power comes great responsibility. Lower-ranking females are likely to challenge the current dominant female at some point, and these transfers of power between females are rarely peaceful, and sometimes deadly. Dominant females may also have to deal with the added stressors of defending their territory from other groups, chasing off unwelcome outsiders, and bearing the brunt of reproduction.

So what are the benefits to being dominant at all, female or not? There are a number of theories on how dominance develops and why it is beneficial, but nearly all behavioral strategies boil down to one thing: babies. Female lemurs are the primary caretakers of their infants: After birth, they carry the babies around on their bellies and backs and nurse them for up to six months, all of which requires a great deal of energy. Without preferential access to the best resources, the mother may not maintain her strength well enough to keep her baby healthy, or may become so weak that her own future reproductive capabilities are compromised.

Whereas many primate social strategies employ dominant males to act as protectors to their female counterparts, lemurs keep the females on the front lines, relying on their strength and aggression to keep themselves and their infants safe. There's much to learn about dominance structures in primates, but in lemurs it appears that putting mom in charge gives her and her infants a better chance of survival.

"THIS WAS A REAL SURPRISE TO PEOPLE IN THE '60S. FEMALE LEADERS WERE STILL SO RARE. AND HERE COMES A WOMAN PRESENTING A MODEL OF PRIMATES WHERE THE FEMALES ARE LEADERS–EFFECTIVE LEADERS."

PATRICIA WRIGHT, PH.D.
quoted in the *New York Times* in remembrance of Jolly's life and work February 19, 2014

Pictured: Sprite, the dominant lemur in her troop, carries her twins on her back. *Photo by David Haring.*

Staff SNAPSHOTS

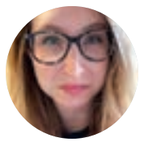
The Lemur Center has more than 50 staff members, working in a variety of roles to care for our animals, educate the public, and lead local and global efforts to study and protect lemurs. Each and every one makes our mission possible—and here, we'd like to introduce you to a few whose stories haven't been shared yet within these pages.

FAYE GOODWIN
Lead Educator
10 years at the DLC

If you could be any lemur species, which would you be?
I would definitely be a blue-eyed black lemur, particularly of the Kidman/Poots variety. Kidman and Poots are both older female blue-eyed black lemurs living at the DLC, so they are redheads with blue eyes. Both are generally easygoing ladies, and enjoy each other's company out in the forest. I would love to live my life as a stunning redhead in the DLC's forest enclosures, like Kidman and Poots!

ERIN HECHT
Student & Volunteer Program Coordinator
10 years at the DLC

What's the coolest thing about your job?
I get to work with an incredible group of students and community members who are eager to contribute to the mission of the DLC!



ALANNA MARRON
Lead Educator
8 years at DLC

What advice would you give to someone interested in your field?
Experience as many aspects of the field as possible: research, education, conservation, husbandry. You might discover you like a different part of the field than you initially thought!

JENNA BROWNING
Primate Technician
5 years at the DLC

If you could be any lemur species, which would you be and why?
Aye-aye! I know I would enjoy the lifestyle of making big cozy nests, tapping around, listening for my dinner, and staring up at the moon and stars at night.

MELISSA DEAN
Business Manager
30 years at the DLC

If you could be any lemur species, which would you be?
A sifaka. They're so beautiful and graceful when jumping through the trees. Of the species we have onsite, they also climb the highest. I'd love to be able to climb that high and watch over all the Center grounds.

GREG DYE
Executive Director
15 years at the DLC

What advice would you give to someone interested in your field?
Working with animals requires one to work *really* well with people. This is a field that requires great teamwork every single day. And, don't be afraid to try new things! I worked with dolphins and whales for the first 20 years of my career before making the leap (pun intended) to lemurs. I never thought I'd work with anything other than marine mammals, but when the opportunity presented itself, I took the chance and I'm so thankful I did. It opened up a whole new world of experiences I never would have had if I'd stayed on my previous career path.

BECCA NEWTON
Primate Technician
7 years at the DLC

What's the coolest thing about your job?
I love being able to work with the lemurs while they're free-ranging in our forest enclosures!

GRAYSON PELLERITO
Primate Technician
3 years at the DLC

What advice would you give to someone interested in your field?
Pick this job for the love and passion. The hard work, sweat, bruises, and poison ivy we get allows for these animals to live the best life in our care.

CHARLIE WELCH
Conservation Coordinator
25 years at the DLC

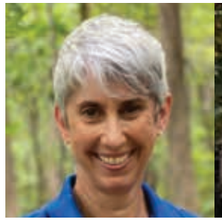
What advice would you give to someone interested in your field?
Diversify what you learn at the university level, and be prepared for 90% of conservation work to be people work at all levels. 💀

STEM, THEN AND NOW

By **ANDREA TEJADA**, 2022 Communications Intern and **DLC STAFF**

THE FIELDS OF science, technology, engineering, and math (STEM) have evolved in many ways over time, and although many of the most prominent early leaders in these fields were men, today more women than ever are pursuing careers in STEM.

This fall, I sat down with four of the most seasoned female members of the Lemur Center staff, eager to learn more about their personal experiences and the changes they've seen their decades-long careers in the sciences.



MEG DYE, MSc.
DLC Curator of Behavioral Management and Welfare

B.S. in Psychobiology, University of California, Santa Cruz; MSc. in Animal Welfare, Ethics, and Law, University of Edinburgh

BRITT KEITH, MSc.
DLC Colony Curator

Associate's Degree in Zoo Animal Technology, Santa Fe Teaching Zoo; B.S. in Wildlife Ecology, University of Florida; MSc. in Ecology, University of Miami

CHRISTINE (CHRIS) WALL, Ph.D.
DLC Assistant Director of Research and Research Professor Emerita of Evolutionary Anthropology, Duke University

B.S. in Human Biology, Stanford University; M.A. and Ph.D. in Physical Anthropology, State University of New York, Stony Brook

CATHY WILLIAMS, D.V.M.
DLC Senior Veterinarian

B.S. in Comparative Nutrition, University of California, Davis; D.V.M., UC Davis School of Veterinary Medicine; Diplomate of the American College of Animal Welfare

Photos clockwise from top:

Chris Wall, Ph.D., joined Duke University's Department of Evolutionary Anthropology in 1994, first as a post-doctoral researcher, then as a research professor. She started as a Senior Research Scientist at the DLC in 2018, and is now the DLC's Assistant Director of Research. "Many of my favorite research experiences developed in unexpected ways," says Chris, "and I encourage students to embrace opportunities even if they don't seem to fit perfectly within their career plans." Chris's current work combines research mentoring and STEM outreach.
Photo courtesy of Chris Wall.

The Curator of the DLC's colony, Britt Keith, MSc., in Uganda as a young zookeeper and researcher. Britt started in the zoo field when she was 16, having cleaned stalls at her local horse barn since the ripe old age of seven. "The Bronx Zoo got me hooked after I attended a summer internship," says Britt. "Back then, it was just a couple of us young women in a sea of young men." *Photo courtesy of Britt Keith.*

Cathy Williams, D.V.M., examines an infant indri in Madagascar. For the first 10 years of her career, Cathy honed her skills in medicine and surgery in traditional domestic animals, including cows, horses, and companion animals like dogs and cats. A long-standing love of wildlife and the environment led her to the Lemur Center in 1996.
Photo courtesy of Cathy Williams.

Meg Dye, MSc., is profiled on page 15.

EARLY IN YOUR CAREER, DID YOU EXPERIENCE ANY DISCOURAGEMENT OR PUSHBACK?

CHRIS: I grew up in Florida in the 1960s, where my grandfather was a master solderer and helped put together the Apollo rockets. I loved spending time with him, and he and my family supported my interests in the sciences. The women's liberation movement in the 1960s and '70s helped, too.

After college, I took classes at a major West Coast university with a prominent male anthropologist. I was interested in pursuing an advanced degree in human evolution, and I needed a letter from him for my graduate school applications. When I asked him, he said 'I'll write a letter for you, but I'm going to tell you something. The sum total of contributions by women to physical anthropology is'—and he held up his hand—'zero.' It was the first time anyone had ever spoken to me that way. I think because of all the early support I'd had, I could brush it off: 'Well,' I thought, 'you're old, so what do you know?' And I did it anyway.

MEG: I'll always remember working at the Monterey Bay Aquarium in high school, and a security guard asking me what I wanted to do when I went to college. I told him I wanted to work with dolphins, and he said, 'That will never happen. There's no way.' And that cemented it for me: 'No,' I thought. 'Now I will, because you aren't going to tell me I can't.' It sounds like many of us have been motivated by that.

CATHY: I agree. Veterinary school is highly competitive, and I was told over and over that I wasn't going to get in, that I wasn't smart enough. Well, of course I had to prove them wrong! 'I'll show you,' I thought. Growing up, my parents had never told me I couldn't do something, so I felt empowered that I could.

BRITT: My mom was active in the women's movements and ultimately, she was appointed Director of Women's Studies at a college. She was like, 'Hell no, no one's going to tell you that you can't do something! You go out and make sure you do!'

So like the rest of us at this table, I was never going to be outdone—I was going to sling that bale of hay, or that 50-pound bag of feed, just like a man would. There were a lot of men in the zoo field at the time and very, very few female mentors. It looked like I might never gain any ground. When I applied to grad school, my brother asked me, 'What are you doing that for? What's the point?' So I proved them all wrong, and now here I sit.

FROM THE TIME THAT YOU BEGAN YOUR CAREER 'TIL NOW, WHAT CHANGES HAVE YOU SEEN IN THE FIELD?

BRITT: In the early days, the zoo field was more of a physical labor job, whereas today it's more scientific: We don't just feed and clean. We're interested in research, species survival plans, conservation, and so much more. We're also actively recruiting men, because the field is now strongly dominated by women! When I started, it was overwhelmingly male. I've watched it change, and that's really cool.

CATHY: I was in the first class at the UC Davis School of Veterinary Medicine that was split 50/50 between women and men; all classes prior to that had had a higher percentage of men than women. Today, the applicant pool is predominantly female and many veterinary schools are actively trying to recruit male students. I was right within that transition period.

CHRIS: I think there's more awareness now that women and people of color weren't *dropping out* of STEM fields. They were, at least in prior generations, *never being introduced* to STEM opportunities in the first place.

MEG: When I started as a marine mammal trainer, it was not scientifically acceptable to talk about an animal's feelings. While those of us working with animals knew, of course, that they had personalities and emotions, it wasn't a topic you would find in a scientific journal. Since the emergence of animal welfare science, that has changed. Today, animal welfare science is heavily based on understanding the emotions of an individual animal. I think that is a great advancement in our understanding of how to provide an environment to promote positive welfare.

CATHY: The field of animal welfare is taking off not just in the zoo field, but also in the agricultural field. More consumers are becoming aware of how their food is produced and demanding that animals lead a humane existence before they end up on someone's plate.

In addition to there being a greater emphasis within the profession on the welfare of animals over the years, there has also been a shift for professionals in the field to want jobs that allow for better work-life balance and flexible schedules. This wasn't even on the radar when I graduated from vet school.

WHAT ADVICE WOULD YOU GIVE TO STUDENTS INTERESTED IN STEM CAREERS, OR TO ADULTS SUPPORTING THEM IN THE PROCESS?

BRITT: Adults, share your experiences. Talk to your daughters, your sons, your grandchildren. If you work in a STEM field, give outreach talks to school groups, classrooms, and clubs. This field is going to be more important than ever in the next 25 years, and sharing what we do, particularly as women, can go a long way toward shaping students' ideas of what's needed and what's possible.

CHRIS: Academic departments and universities can be very hierarchical and competitive; there's a pecking order; they're set up as male systems, whether men are in charge or not. One of my role models tells young faculty to focus on what they want and need to pursue their passions, and to try not to focus on the political stuff. That can be difficult to do, and for women especially, it can be a hard line to walk—even more so if you feel the socio-political stuff is an implicit or explicit bias. There are points within our careers where a woman is in danger of thinking, 'I can't walk this line anymore. I need to do something else.' Mentors within academia should be aware of that. How can we stop this from happening? What's the best way to handle it?

CATHY: Think about what you find exciting and what really stimulates your interest and curiosity. There are many ways to be involved with animals and many ways to be involved in science. Follow your curiosity and be open to different opportunities when they arise, even if you didn't consider them initially.

MEG: If you're a student hoping to get into the field of animal training and behavior, volunteer somewhere. You don't have to have a zoo or aquarium in your hometown; you can volunteer at a veterinary clinic, an animal shelter, or a wildlife rehabilitation center. Volunteer because learning about behavior with any type of animal is excellent experience.

For STEM fields more generally, just try them! Don't be intimidated by STEM classes or STEM camps. I tell my daughters—and I think this is easier advice now than it was when I was in middle school—you've just got to try it, because you don't know what you're going to like. There are so many opportunities in school, afterschool programs, and summer camps, and you might just find that you love engineering or computer programming. Don't be scared.

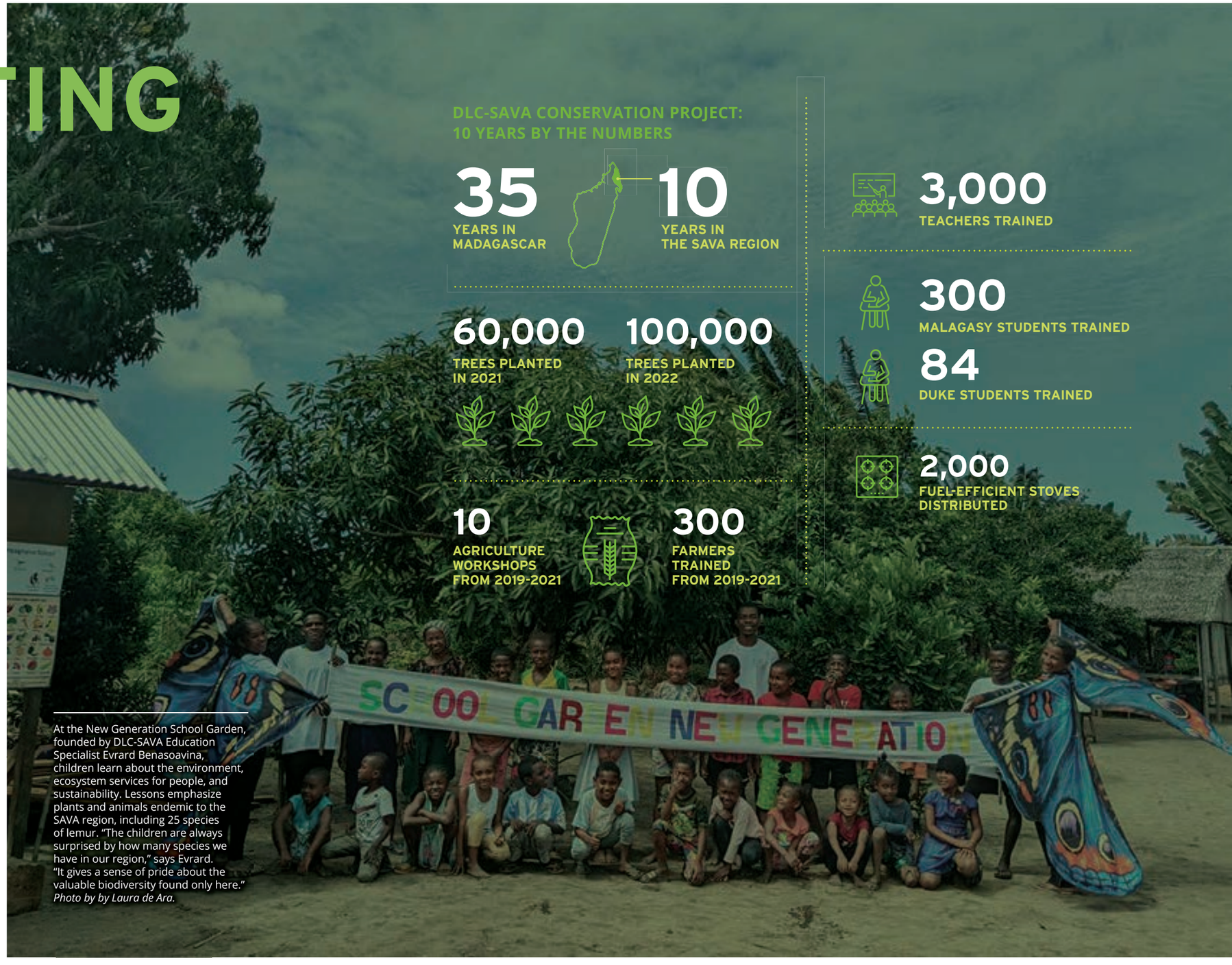
CELEBRATING 10 YEARS *of* CONSERVATION *in the* SAVA

By **CHARLIE WELCH**

Last fall, we were thrilled to celebrate the 10th anniversary of the DLC-SAVA Conservation project!

The DLC's first conservation actions in Madagascar were undertaken more than 30 years ago in collaboration with the Madagascar Fauna and Flora Group (MFG), a nonprofit conservation consortium with projects at Parc Ivoloina and Betampona Reserve.

The MFG continues to do important multi-faceted conservation work, and the DLC remains a founding and managing member; but we felt that the Lemur Center could (and should) expand its conservation footprint in Madagascar—so 10 years ago we embarked upon a brand-new conservation initiative.



At the New Generation School Garden, founded by DLC-SAVA Education Specialist Evrard Benasoavina, children learn about the environment, ecosystem services for people, and sustainability. Lessons emphasize plants and animals endemic to the SAVA region, including 25 species of lemur. "The children are always surprised by how many species we have in our region," says Evrard. "It gives a sense of pride about the valuable biodiversity found only here." *Photo by by Laura de Ara.*

When the DLC's then-Director, Dr. Anne Yoder (2006-2018), gave the go-ahead to explore undertaking a DLC conservation project in Madagascar, we carefully examined where we could have the biggest impact. Supported by several generous donors, we spent two years consulting with conservation and research professionals about which areas would be best suited to a DLC conservation project.

After site visits and extensive discussions with experts and people on the ground, we chose the SAVA region for the following reasons: the SAVA is exceptionally high in biodiversity, even for Madagascar; the SAVA has more forest remaining, relative to other areas of the country; people in the region seemed receptive to a community-based conservation project; roads within the region would allow logistically for project activities throughout the SAVA; and at that time, there were no other conservation organizations working in the SAVA in a significant way. The choice was clear, and DLC-SAVA was born!

Since the town of Sambava is the hub of the region, an office space was located there and has remained as the DLC-SAVA headquarters ever since. The office space is ideal as it also includes several spacious rooms for equipment storage, plus a bedroom and kitchen. A secure garage provides space for the project vehicle (a rugged Toyota Hi-lux), purchased several years into the project once funds became available.

In terms of personnel, we are fortunate to have had Lanto Andrianandrasana with DLC-SAVA since the very beginning of the project. Lanto was already working in the area as a research assistant with Dr. Erik Patel, who also joined the team as DLC-SAVA's first project coordinator. For years the DLC-SAVA team consisted only of Erik and Lanto, who together capably carried the project forward on the ground. After Erik, Dr. Marina Blanco and Lanto led the project. Dr. Blanco remains with the DLC, now in a position focused on her research. At present, we are extremely fortunate to have Dr. James Herrera leading the project in tandem with Lanto. We are also grateful to have James's partner, Laura De Ara, kindly donating her time to the project as a liaison.

DLC-SAVA project activities have evolved over the years. We knew that with poverty-driven forest degradation, we would need to use the same community-based approach to conservation as the MFG did, and still does today. Our first activity was **environmental education** (EE), focused on primary school students. Through collaborations with local school districts, we carried out workshops for teachers across the region, focused on integrating EE into the curriculum. 10 years later, having trained thousands of teachers, DLC-SAVA EE programs have expanded to planting trees, growing vegetable gardens, fish farming, and lemur awareness. We believe strongly in the importance of EE, and this year hired an education specialist, Evrard Benasoavina, onto the DLC-SAVA team. We are very excited about where our future EE programs will go with Evrard.

Project activities in addition to EE were undertaken over time, with almost all providing benefits to local people, in addition to contributing to our conservation goals. Through use of **fuel-efficient cook stoves**, wood and charcoal consumption is cut by at least half, hence reducing pressure on forests. Improved stoves have been distributed to more than 2,000 households by the project. **Reforestation** is one of our staple projects and provides edible fruits, marketable commercial products, and firewood while putting trees back onto a barren landscape. Supporting women's **reproductive health** through collaboration with NGO Marie Stopes, we have served over 1,500 women—critical for women's health and empowerment.

An activity that has become increasingly important to DLC-SAVA has been the support for improved agriculture. Culturally ingrained, but low-productivity techniques of agriculture (swidden) must eventually yield to better management of cultivated soil as the human population continues to grow. If not, all forest cover outside of the protected areas will surely disappear. That is why we have invested so heavily in recent years in activities related to soil management for **regenerative agriculture**. Enriching the soil so that it can be cultivated repeatedly, year after year—rather than clearing forest for a mere year or two of growing crops—is essential to forest protection.

Research is another important component of our project. Learning about the forest and wildlife of the SAVA is crucial to our understanding of how it can be protected. Our research activities have provided an excellent platform for collaboration with the regional university of the SAVA, known as CURSA. The DLC-SAVA/CURSA "lemur conservation team," which has been conducting surveys in the COMATSA protected area, is entirely made up of local students and forest managers, and led by CURSA faculty member Edgar Rabevao. CURSA researchers Nestorine Manantenasoa and Ardhilles Andriantinefiarijaona are studying the relationships between environmental stewardship, socioeconomics, and public health in rural communities to better understand and focus development on improving livelihoods, food security, and nutrition.

Likewise, we partner with our CURSA collaborators in **reforestation**, **sustainable agriculture**, and **environmental awareness**. Without them, our conservation achievements would be greatly limited, as would the project's critical monitoring and evaluation component. We have learned over the years in Madagascar about the importance of capacity strengthening at all levels, and our collaboration with CURSA is an excellent way to develop that aspect of the project. We strongly believe that the environmental and conservation future of Madagascar must ultimately have a strong push from within.

That is a brief and incomplete nutshell of the path that DLC-SAVA has followed up to today. 10 years down the road, I could not be more optimistic about the future of the project. With both Lanto and James leading the project in tandem, along with important personnel like Evrard, plus accountant Mbola Ramaka and a blossoming collaboration with CURSA, the future is bright indeed. The beginning of a conservation project is its most challenging point, but now after 10 years of building relationships and trust in the communities of the region, we are prepared to promote sustainable conservation in the SAVA for the decades to come!

I would especially like to recognize the importance of our steadily growing number of loyal project supporters who so generously enable us to keep our conservation activities going at full speed, even during the COVID pandemic. Without you, there would be no DLC-SAVA. Thank you!

Thank you, Lanto!

DLC-SAVA PROJECT COORDINATOR Lanto Andrianandrasana has been with the project since we started conservation work in the region in 2011. Simply put, the DLC-SAVA Conservation project would not be what it is today without Lanto's strong and steady on-the-ground management of project activities.

It's difficult to describe the vast array of project components that Lanto has juggled over the years, from our relationship with CURSA (the university of the SAVA) to agroforestry to family planning and so much more. Add to that personnel management and accounting, and it's difficult to imagine how he does it all. Yet he does it capably and in a manner that has won DLC-SAVA respect in the region. Without local relationships built on that respect and trust, we would be able to accomplish very little in terms of conservation. We are greatly indebted to Lanto for his long-term exceptional leadership of the project in Madagascar, especially during the difficult pandemic times when the DLC's U.S.-based conservation staff couldn't be onsite.

A tip of the hat and a heartfelt thank you to Lanto for his 10 years of service to the DLC and DLC-SAVA!

Photo by Sara Sorraia.

DLC-SAVA Program Coordinator Dr. James Herrera with local CURSA university students during a workshop in Marojejy National Park. *Photo by Laura de Ara.*

WOMEN'S FARMER ASSOCIATION:

Empowering Women in Sustainable Agriculture, SAVA-style

By **EMILIEN RAZAFINDRABOZY**, **ROSTELLA CHRISTINE**, **MELSA STEPHANIA RAZAFINDRASOA**, and **NESTORINE MANANTENASOA**
of Centre Universitaire Regional de la SAVA (CURSA)

Translated by **JAMES HERRERA, Ph.D.**,
Program Coordinator the DLC-SAVA Conservation Project

Globally, women are essential to the agricultural workforce. Despite this, they have minimal rights to land and are underrepresented in opportunities such as education and formal training, as well as loans and subsidies. This problem is causing greater disparities in health and socioeconomics among genders, and has repercussions in food security, poverty, and public health.

In Madagascar, women have less access to land than men, receive less education or business training, and are underrepresented in extension services. Women need more development opportunities to close the gender gap, which will have cascading effects in improving other aspects of sustainable livelihoods.

Agriculture is a significant cause of deforestation and climate change across the globe. In places like Madagascar, people practice traditional techniques such as swidden agriculture (also called slash and burn agriculture or tavy) for rice, beans, corn, cassava, and other annual crops. There are many agricultural opportunities in Madagascar, especially in the northeastern SAVA region. The climate is tropical with long wet, hot seasons and short dry seasons. Many crops can grow well here, including the most important foods like rice, beans, and bananas, as well as cash crops like coffee, cloves, vanilla, cacao, and ginger. We also have many fruit trees like mangos, coconuts, lychees, avocados, papayas, citruses, and more.

Madame Fredette attended our first agroecology workshop in 2019. Since then, she has enthusiastically implemented new techniques, such as amending soils with homemade compost and planting diverse crops together, even in a small space. She has already rotated and harvested diverse crops over six seasons, and she enjoys a daily harvest of her favorite green leafy vegetables, eggplants, squash, ginger, and corn. *Photo by Laura de Ara.*

Despite these opportunities, many farmers have not maximized their productivity. For example, most farmers grow only rice or vanilla. They grow rice to feed their families, but often it is not enough for the whole year. Profits made from the sale of vanilla, typically less than USD 6,000 per year per household, are used to buy rice in the lean season, to pay school fees for the children, or to make improvements on the home. Vanilla prices are extremely volatile, making it an unpredictable income source. There is an untapped opportunity for agricultural diversification that can also lead to income diversification, while decreasing the pressure on natural resources such as forest and soil.

FROM SLASH-AND-BURN TO SUSTAINABLE AGRICULTURE

The university in the SAVA (Centre Universitaire Regional de la SAVA, or CURSA) has developed an Agronomy department with the goal of teaching sustainable agriculture as well as agribusiness entrepreneurship. Through a collaboration with DLC-SAVA Conservation, CURSA has been leading workshops to train farmers about **agroecology**. Like the related disciplines of regenerative agriculture and permaculture, agroecology promotes sustainable farming to improve soil health and water management, and to minimize environmental degradation.

In our agroecology workshops, we teach about market vegetable farming with diverse and nutritious foods like beans, green leaves, ground fruits, tubers, and more. We also teach about **agroforestry**: planting trees in the agricultural landscape for multiple benefits, including diversified crops and improved soil fertility, water management, and on-farm biodiversity.

Thus far, we have reached over 150 farming families in six villages. Some farmers have reported 100% increases in yields of both food and cash crops using these new agroecology techniques, compared to plots using traditional practices. The results are especially encouraging because these early adopters are now teaching their families and their neighbors, spreading the skills throughout their communities.

OVERCOMING OBSTACLES TO WOMEN'S PARTICIPATION

Though we strive to create an inclusive space for both women and men, young and old, we have seen that there are many obstacles that preclude women from participating in the workshops. Women have many chores at home, including cooking, cleaning, caring for the young and elderly, and fetching water. They often cannot leave their homes for a full day to participate in educational events, because there would be no one to tend the home. In addition, men in Madagascar tend to be more outspoken and to dominate social situations with mixed genders. Women tend to be quiet and reserved, reluctant to voice an opinion in the presence of men.

Within the cooperative Mamy Tia, women share resources and results. Here, four of the members work together to farm a hillside with several other members who don't have land. With garden beds amended with locally-sourced compost, they plant green leafy vegetables, which are a staple in their diets. They also have comparison beds, highlighting how using mulch produces a better harvest than beds with no mulch. The group is also planting rainfed hillside rice without cutting and burning vegetation or tilling the soil. Instead, they grow cover crops, which they cut and leave lying on the soil surface to decompose slowly. Rice is then planted directly into this mulch cover. The women of Mamy Tia have been impressed with the rapid growth of the rice stalks and are excitedly anticipating their yield. They are especially pleased because the last two rainy seasons have been atypically late and dry, and most rice farmers have been suffering as their crops failed. *Photo by Laura de Ara.*

Fresh produce markets, such as the one pictured above in Sambava, are a major market for Madagascar's rural cultivators. *Photo by Sara Sorraia.*

To overcome some of the barriers that women face, we initiated a series of workshops focusing only on women. We recruit from existing women's interest groups, as well as the family and friends of female participants from previous workshops. The team of trainers include ourselves as the DLC-CURSA Agroecology Extension Interns, as well as selected female trainers from each village who have proven during evaluations to successfully implement the agroecology techniques.

Thus far, we have conducted workshops at two target communities with 70 participants. The women engage in hands-on demonstrations to create model home gardens. They practice techniques like making compost from locally-sourced materials, amending soil with the compost they create, covering the soil with mulch and cover crops, and designing the garden to capture rainwater run-off. All these methods can be performed easily with free, local materials and can be done in a small, unused corner of the yard.

We also provide notebooks and pens so women can take notes, and guide women in creating a garden diary to track their work and yields. The women receive starter-packs of seeds including beans, greens, and other vegetables. We teach about crop rotation and distribute garden calendars specific to the SAVA region to promote rotation in relation to the appropriate seasons.

Our goal is to develop a network of women who engage with agroecology principles and practices. Through this network, we want to create a cooperative of women farmers who can be certified and market their produce as organic, sustainable, and improving the livelihoods of women in the countryside. Through these efforts, we can meet our sustainable development goals for closing the gender gap, ending hunger and poverty, and safeguarding biodiversity.

THANK YOU!

DLC-CURSA'S AGROECOLOGY WORKSHOPS are funded by a grant from General Mills, and the Kathryn McQuade Foundation supports our work with women's agroecology as well as professional development for women trainers and researchers involved in the project. We're very excited about these unique opportunities to partner with both of these organizations to improve livelihoods and protect forests in the SAVA region.

All of the DLC's conservation projects in Madagascar are run exclusively on grants and donor funding. If you'd like to contribute to our work there, please consider making a tax-deductible donation today.

LEMUR.DUKE.EDU/DONATE

Dwarf lemurs are the only obligate hibernators among primates. By promoting successful hibernation in the DLC's dwarf lemur colony, our Hibernation Research Program will not only improve lemurs' care and health, but could also inform biomedicine, in the treatment of diabetes and other metabolic disorders. Pictured: A dwarf lemur feasts on figs. *Photo by David Haring.*

TUBBY TAILS

By **ROBIN SMITH, Ph.D.**

Holiday weight gain: It's a real thing in this season of bread stuffing and pumpkin pie.

Many of us haven't yet looked up from the pantry or holiday table to consider what all those extra calories can do to our waistlines. But one group of creatures at the Duke Lemur Center has been overindulging and plumping up for weeks already, and they're not the least bit guilty about it.

Since August, the DLC's 42 fat-tailed dwarf lemurs have been busy gorging themselves to pack on the pounds they need for winter hibernation.

These squirrel-sized primates are our closest genetic relatives known to hibernate for extended periods of time. By studying how they withstand months of inactivity and yo-yo weight gain with no ill effects, researchers hope to find lessons for humans dealing with prolonged bed rest, diabetes, and other challenges to metabolic health.

Some of us carry extra weight in our thighs. Others stash the stuff in a muffin top or a beer belly. As its name suggests, the fat-tailed dwarf lemur stores surplus fat in its sausage-like tail. After two months of feasting, a healthy dwarf lemur's well-padded appendage can blimp out to 40% of its body weight.

After two months of feasting, a dwarf lemur's tail can blimp out to 40% of its body weight. *Photo by Sara Sorraia.*

Every week, DLC scientists have been monitoring the lemurs' girth and watching the numbers creep up on the scale. Now the lemurs are the heaviest they've been all year. Nine-year-old Francolin is this year's champion, having layered on enough fat to boost his weight by some 60% and double the chub in his tail.

All this weight gain is a good thing, says research scientist Marina Blanco, Ph.D., who leads the project. It's a matter of survival in their native habitat of Madagascar, where their fat reserves help sustain them through the leanest months of the year.

Soon, the animals will curl up and enter a state of suspended animation, dropping their heart rate from 180 beats per minute to as few as eight in order to stretch their onboard fuel for the months-long food coma ahead.

But for now, the lemurs still have business to attend to: breakfast.

On a crisp November morning, they smack and slurp as they wolf down what's in their bowls: sweet bits of melons, peaches, and nectarines, sprinkled with dried cranberries.

Nine-year-old Kiwi is the first to scurry to the food, followed by her daughter, Starling.

"As usual, Jaeger the dad is the last one to get up," says researcher Lydia Greene, Ph.D.

Their breakfast menu is part of a new project: to steer them towards a more "natural" seasonal diet. The idea is to see if the researchers can make the physiological swings and cycles these lemurs experience in captivity closer to what their counterparts experience in the wild.

Marina has been ferreting out their wild counterparts in slumber chambers in Madagascar for years to understand how they pull it off.

While we humans might gain weight overdosing on cookies and eggnog, dwarf lemurs get fat on fruit. Wild dwarf lemurs fill up on persimmons, Grewia berries, and other sugar-rich fruits during the rainy season, in preparation for the subsequent dry season when such foods are in short supply.

It's not possible to feed North Carolina's lemurs exactly what they would eat in the tropical forests of Madagascar, so the researchers come up with alternatives that come close in terms of nutritional content.

A typical menu at the DLC might include 12 grams of fruits and veggies, six grams of primate biscuits, and a couple of mealworms. But their fall fattening diets follow a different recipe: half the protein, and twice as much sugar in the form of finely chopped pears, figs, kiwi, mangos, or papayas. Topped with dried apricots, raisins, dates, and the occasional drizzle of honey, this bounty is delivered each morning and midday by their keepers.

"I feel like that's the only time I cook, basically—preparing the food for the lemurs," laughs Marina.

Both diets contain the same number of calories. But they've found that dwarf lemurs fattened on a diet high in sugary fruit prior to hibernation followed more natural patterns of weight ups and downs, building up and then burning through their tail fat more like their wild peers. Their fat tissue was also more similar to the wild lemurs in composition.

Most of us want to get off the weight roller coaster. But for dwarf lemurs, such seasonal swings are the norm.

"I love the fattening. It's one of my favorite times of year," Lydia says.

THANK YOU!

THE ONLY PLACE of its kind in the world, the DLC's hibernaculum was donated by an anonymous Duke alumnus as a major part of the Anna Borruel Codina Center of Lemur Medicine and Research.

Dedicated in April 2022, the hibernaculum allows researchers to control all aspects of the lemurs' environment, such as temperature, to mimic the natural conditions that modulate hibernation in the wild.

For the first time, "we're able to replicate, to a degree, the dwarf lemurs' experiences in Madagascar," says DLC research scientist Marina Blanco, Ph.D. "We can bring a little bit of Madagascar to the DLC."

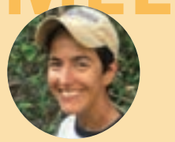
"The Lemur Center is the only place outside of Madagascar with a breeding colony of dwarf lemurs—the only primate that truly hibernates," says the DLC's Director of Research, Erin Ehmke, Ph.D. "This makes us uniquely able to study the behavioral and physiological mechanisms that enable this extreme metabolic strategy in a primate.

"Thanks to the donation of the Borrel Center and the DLC's first true hibernaculum within it, our Hibernation Research Program is set to truly embark on a path of innovative research with applied value to dwarf lemurs' care and health, as well as translational value to human medicine and technology."

Research scientist Marina Blanco, Ph.D. measures the tail circumference of a juvenile dwarf lemur. All research at the DLC is non-invasive: Our lemurs' health and welfare are our top priorities, and we do not allow research that will harm the animals. *Photo by Sara Sorraia.*

BY STUDYING HOW DWARF LEMURS WITHSTAND MONTHS OF INACTIVITY AND YO-YO WEIGHT GAIN WITH NO ILL EFFECTS, RESEARCHERS HOPE TO FIND LESSONS FOR HUMANS DEALING WITH PROLONGED BED REST, DIABETES, AND OTHER CHALLENGES TO METABOLIC HEALTH.

MEET THE SCIENTISTS



MARINA BLANCO, Ph.D.

Marina originally studied biological anthropology at the Universidad Nacional de La Plata, Argentina, where she researched prehistoric human populations. Ready for change, she obtained a M.A. degree and a Ph.D. from the University of Massachusetts, Amherst, USA under the mentorship of **Dr. Laurie R. Godfrey**, who instilled in her a lifelong passion for lemurs and Madagascar.

Today, Marina has more than 15 years' experience conducting research in Madagascar. Her current projects are focused on the ecology of hibernation in dwarf lemurs on the island and the physiology of hibernation of dwarf lemurs at the DLC.

LYDIA GREENE, Ph.D.

Lydia was raised in New York, New York by two classical musicians and spent years training to be a professional ballet dancer. "Ballet was everything to me during my teenagehood," reflects Lydia, "and the rigorous training gave me much that I carry as a scientist today"—including a strong work ethic, self-motivation, strength and stamina, and the ability to think creatively within structure.

A career in ballet ultimately didn't work out, and Lydia enrolled at Duke University in 2007. She needed a job to help fund her education, and a chance work-study position as a tour guide brought her to the Duke Lemur Center. "I left the ballet world and found lemurs," she recalled in an article in 2017.

Lydia earned her B.S. from Duke's Evolutionary Anthropology Department in 2011 and her Ph.D. from Duke's Program in Ecology in 2019. Her advisor was another female scientist, **Dr. Christine Drea**, whose research focuses on female-dominant species such as lemurs, hyenas, and meerkats.

Today, Lydia remains fascinated by the diversity of lemurs in Madagascar, and especially by the proliferation of leaf-eaters. Her research focuses on the gut microbiome and nutritional ecology of Coquerel's sifakas. Lydia most enjoys team-based projects, mentoring American and Malagasy students, and engaging with the general public through science-based communication and storytelling. (Follow Lydia's adventures **@lemurscientist** on Instagram.)

HOW DO THEY DO THAT?

THE SCIENCE OF POSITIVE REINFORCEMENT TRAINING

By **MEG DYE, MSc** and **SARA SORRAIA**
Photos by **SARA NICHOLSON**, **BOB KARP**, and **DAVID HARING**

Teaching animals to voluntarily participate in their own health care was revolutionized by Karen Pryor, the marine mammal biologist who founded clicker training, in the 1960s while working with dolphins at Sea Life Park in Hawaii. Since that time, the use of operant conditioning, predominately positive reinforcement, has become the industry standard for working with all sorts of animals, from giraffes, polar bears, and flamingos to domesticated animals like horses and dogs.

In fact, kennel training a dog using positive reinforcement is nearly identical to the process used to kennel train lemurs. "It's the exact same science," says Meg Dye, MSc, Curator of Behavioral Management and Welfare at the DLC.

Just as with dogs, kennel training is beneficial to both the lemur and her caretaker—especially when the animal needs a regular check-up by a veterinarian. Lemurs are trained to voluntarily enter their kennels for transportation from their enclosures to the veterinary hospital. By using this method, neither sedation nor handling of the animals is required, allowing for a relatively stress-free trip.

There are differences, of course. "The biggest difference with dogs is that they're domesticated, so you have a different relationship working with them than you do with a wild animal," explains Meg. "For a lemur, we may need to use numerous small steps to teach, or shape, the desired behavior. But with dogs, we can generally take larger training steps as dogs are good at reading our body language."

In both lemurs and dogs, "**positive reinforcement** is an incredible tool, as animals want to participate in the learning," Meg says. "When we add something to the animal's environment that increases the probability that the desired behavior will occur again, that is positive reinforcement.

"A critical aspect of our lemur husbandry program is a 'hands off' policy, so we rely heavily on **primary reinforcers**: rewards that are *inherently* desired by the lemur, like pieces of apple. With dogs, on the other hand, a trainer could use a wide variety of **secondary reinforcers**: rewards the dog has *learned* to enjoy such ear and belly rubs, encouraging words like 'good dog!', and the personal interactive relationship we have with our beloved friend." Of course dogs also love food, and in the following illustration, both Ranomasina and Apache are being rewarded with pieces of their daily diet.

But overall, the use of shaping to train new behaviors is applicable across species, as illustrated by the kennel shaping protocol below. If you're looking for a fun indoor project this season, we challenge you to train a new behavior with your pet using positive reinforcement. One of the great things about using these methods are that they are customizable for your learner: You can add more steps or adjust with fewer steps. Regardless, the training path will be fun!

Here's a bonus: Shaping is hard work! It's excellent mental exercise and a wonderful way to tire out your pet without leaving the house—perfect for rainy days when those "walkies" just aren't possible. A tired but clean and dry dog may just reinforce you to train him even more!

PREPARE
Always clearly identify your behavioral goal and shaping plan prior to training. It helps to write it down. Give it to a friend to read and see if they can relay back to you what your goal and plan are.

TRAINING GOAL: Ranomosina and Apache will choose to enter their kennels when cued by their caretakers. Once inside, the kennel doors will be closed and they'll remain calm and quiet until the door is opened.

APPROXIMATIONS are small, incremental steps toward the training goal. Ranomasina and Apache may not enter the kennel right away, but with your mindful approximations they won't even know they are learning—they are just having fun! In time your approximations will bring them to the end goal of enjoying the kennel.

CRITERIA are the "rules" of the training game for each approximation. As Apache and Ranomasina climb the staircase of approximations leading to the final goal, they successfully complete one approximation and then move up the staircase as the criteria is slightly increased to successfully complete the next approximation, and so on, until they have climbed all the stairs to achieve the criteria identified in your training goal definition.

SHAPING PLAN: Just as a teacher has a teaching plan for their students, write out the approximations you think you will need to take. Shaping plans are designed to be flexible and help you spend time thinking about being a teacher before you start a session with either of your students, Apache or Ranomasina.

LEARNERS

RANOMASINA
with trainer Jodi

APACHE
with trainer Sara

1 BEGIN!

Introduce the presence of kennel by the method—habituation or desensitization—that works best for Apache or Ranomasina. Once they're comfortable with the presence of the kennel, begin approximations into the kennel.

DESENSITIZATION is the active process of exposing the animal to the kennel a little bit at a time. For the kennel, you may start with it a far distance from Apache or Ranomasina during a training session. After the training session, the kennel goes away. In time, you can bring Apache or Ranomasina closer to the kennel, just enough where they continue to be relaxed and not fearful. When they are fully desensitized to the kennel, they will be able to comfortably walk right up to it!

HABITUATION occurs when a kennel is put into the environment of the animal (Apache's living room or Ranomosina's living space) and left there. Over time, the animal becomes more accustomed to it. You can assist the process by adding blankets and toys for Apache and enrichment for Ranomosina, or by opportunistically reinforcing curiosity behaviors such as sniffing at the entrance or poking their noses inside.

2 PROMPTING

Begin to prompt Ranomasina or Apache to enter the kennel by placing a small piece of food near the entrance. As their body language tells you they are comfortable eating a piece of food from the front of the kennel, you can gradually approximate the food toward the back of the kennel by tossing it further inside.

Some animals take naturally to a crate, whereas others are not as eager. Always look for a relaxed body position. If the animal is displaying signs of nervousness or fear, return to an earlier approximation and relax your criteria.

TIP:

A great way to reinforce entering the kennel is to ask them out of the kennel before they leave on their own. This is especially helpful if an animal is fearful. This technique helps to build the animal's trust that the new part of the training session will be brief and will be followed with fun behaviors.

3 REINFORCING DURATION

Once they are comfortably going to the back of the kennel, begin to reinforce through the kennel's back window once they have eaten the prompt. In time, begin to gradually fade out (take away) the food toss prompt and reinforce only through the kennel's back window. Continue to use the hand motion of tossing in the prompt, but this time, do not toss in a piece of food and instead meet them at the kennel window and reinforce them there. Once they have been reinforced, you can ask them to come back out and repeat the process.

Vary the amount of reinforcement at the window to increase the duration in the kennel at a pace that is appropriate for Apache or Ranomasina.

TIP:

If they are confused, the prompt may have been removed too soon. Return to using your food toss prompt the majority of time and occasionally remove the prompt and reinforce at the window. Increase the ratio of no food toss as Apache or Ranomasina understand to look to the back window for reinforcement.

In time, the hand motion of tossing the food will become your cue for Apache or Ranomasina to enter the kennel. When the prompt of food has been faded away, the motion of tossing food into the kennel can transition into a pointed finger given in the same manner as tossing a piece of food. Adding a verbal "kennel" to the hand motion is optional and can be very helpful depending on the final use of the behavior.

Finally, begin to incorporate the closing of the door into the process. Start by simply touching the door and reinforcing Apache or Ranomasina for continuing to take reinforcement from you at the back of the kennel. If they remain calm, approximate toward a brief closing of the door, gradually increasing the amount of time the door is closed. Reinforce for remaining calm and quiet during all approximations.

4 PUTTING ON THE FINISHING TOUCHES

In time you can approximate your distance from the kennel when cueing Apache or Ranomasina to enter the kennel. When they enter on cue, always reinforce them for entering and again for allowing you to close the door. As the behavior gains a good history of reinforcement, you can increase your criteria and reinforce for the complete behavior of entering on cue and calmly allowing the door to be closed.

Congratulations! Now you know how to successfully shape a behavior in both wild and domestic animals!

If you train a new behavior with your pet using these techniques, we'd love to hear from you! **Send photos to sbb12@duke.edu.**

LEMUR DREAMURS:

Student Collaboration for Enhanced Animal Welfare

By **MEG DYE, MSc**

ANIMAL WELFARE requires a multidimensional approach to providing an environment for optimal physical and mental health. A key aspect of this approach is collaboration. Collaboration can take many forms, including inter- and intra-departmental teamwork, expertise from an array of scientific disciplines, and applied animal welfare science. Over the years, the DLC has benefited from several collaborations with the Duke community, including expertise from medical, lighting, and engineering specialists.

A recent collaboration between the DLC and Duke Engineering Design and Technical Communication (EGR 101) students proved highly successful. The DLC turned to the first-year engineers with a design challenge for weighing tiny nocturnal mouse lemurs. (Adult mouse lemurs weigh just 1.5-2.5 ounces, or 43-71 grams.)

While the DLC's husbandry staff had the expertise to train the mouse lemurs to voluntarily stand on a scale for their monthly weighings, the design of the current habitats made the task challenging. So, the students were asked to design a door modification that would allow the mouse lemurs to easily access a scale from their home enclosure while maintaining safe containment.

A group of students, with the team name "Lemur Dreamurs," stepped up to the challenge. At the start of the semester, the team visited the DLC to get a better understanding of the challenge and to take initial measurements of the mouse lemurs' enclosures. A few weeks later, the team brought a carboard prototype to the DLC to test their initial design. With some modifications, the team then returned to the DLC with an acrylic prototype. After final safety testing and DLC approval, the device was used to successfully create an environment in which the mouse lemurs could easily participate in their own health care by voluntarily stepping onto the scale.

This collaboration with young engineers is a great example of crossing disciplines to overcome a challenge with a direct impact on animal care. The DLC is fortunate to have access to and support from the Duke community as we strive to continuously find new ways to advance animal welfare at the DLC.

Top: Duke student Lily measures the doors of the lemurs' enclosures. **Bottom:** Begonia voluntarily stands on a scale inside the acrylic chamber engineered by the students. During weighings, the chamber is placed against the open door of an enclosure, enabling the lemur to walk onto the scale. This eliminates the need for handling, significantly reducing stress on the animals.

ALL WORK AND LOTS OF PLAY:

THE VALUE OF ENRICHMENT

By **LAURA JONES**, 2018 Communications Intern and **DLC STAFF**

Lemurs are intelligent, and because they're intelligent, they can get bored. So, for 365 days of the year, the DLC's dedicated Primate Technicians help ensure that our lemurs' lives are interesting—including providing novel sources of enrichment for the DLC's lemurs every day.

Daily enrichment is an essential part of animal welfare and promotes curiosity, exploration, and mental stimulation. Its benefits are myriad: reduced stress, enhanced promotion of natural physical and cognitive skills, increased activity levels, and strengthened trust between the lemurs and their caretakers.

The DLC uses a holistic approach to enrichment, as there are many opportunities and methods to create a stimulating environment. For example, enrichment can pertain to changing the structure and complexity of the environment around the animals; training the lemurs to participate in their own health care, such as walking onto a scale; and introducing new smells, puzzle boxes, or sights, such as mirrors. Additional opportunities that can be very enriching to a lemur include the arrival of new neighbors, painting with non-toxic water-based paint to create DLC artwork, and non-invasive research such as touch-screen puzzles.

Although animal care staff have a large number of pre-approved items and methods to choose from, creating brand-new forms of enrichment is rewarding for both lemurs and staff. The creation process begins by defining an objective. "When I'm trying to think of a new [enrichment] item, the first thing I think is: What's my goal?," says Kate Byrnes, an enrichment specialist. Goals might be trying to get the lemur to be more active or to promote certain natural behaviors like foraging.

"A lot of people think that enrichment is just throwing toys to the animals," says Kate. "But we're actually trying to elicit a certain behavior or response. A lot of thought goes into it."

Once the goal behind the enrichment is established and the specifics of the new enrichment have been identified, it is time for the next step. Any time a new item is created, it must go through a structured approval process. The approval process assures that the veterinarians and animal care team have reviewed the item for safety concerns including any potential for ingestion, entrapment, or injury to a lemur. "The number one priority is making sure the item is safe," Kate says.

Once the item is approved, Kate moves to the best part: seeing what the lemurs think of the idea. "It's a lot like research," she explains. The lemurs are monitored closely, and any interactions with the enrichment are recorded. If the enrichment is not eliciting the desired response or is not as exciting and novel to the lemurs as it could be, the technicians will revise it and reintroduce it.

Behavioral-based enrichment is essential to promoting species-specific behaviors, encouraging lemurs to act and behave as they would in the wild. Presley, a male blue-eyed-black lemur, regularly has the tree branch installations in his enclosure scrubbed down. Why?

▲ By using positive-reinforcement training to teach husbandry behaviors such as voluntarily sitting on a scale, health exams become positive interactions with the animal care staff and help us provide the lemurs with the highest quality of care—with as little stress on the animals as possible. (And of course, plenty of tasty treats!) *Photo by David Haring.*

▶ Grendel works on his personalized "worm feeder" presented to him by summer intern Morgan. It's chock full of the yummy mealworms that aye-ayes relish and encourages natural foraging behaviors like tapping, chewing, and spearing. *Photo by David Haring.*

SEND A LEMUR A PRESENT!

Photo by David Haring.

SEND TOYS AND TREATS to the DLC's playful prosimians! Our lemurs love soft beds for nesting, stuffies for snuggling, and dried fruits for training. Select an item from our amazon.com wishlist, and your present will be sent directly to the Lemur Center. Be sure to include your name and email address in the notes field so the lemurs can send a thank-you!

LEMUR.DUKE.EDU/WISHLIST

Presley is a keen scent-marker. Like most other lemurs, he spends a lot of time dispersing his unique scent by rubbing specialized glands on his forehead, wrists, and the base of his tail onto the various structures inside his enclosure.

In the forests of Madagascar, scent-marking is critical behavior for lemurs. It allows for communication between animals, can announce when a female is ready to breed, and establishes territory, among many other things. When Presley's keepers wipe away the scents left in his enclosure, it prompts him to work on restoring them.

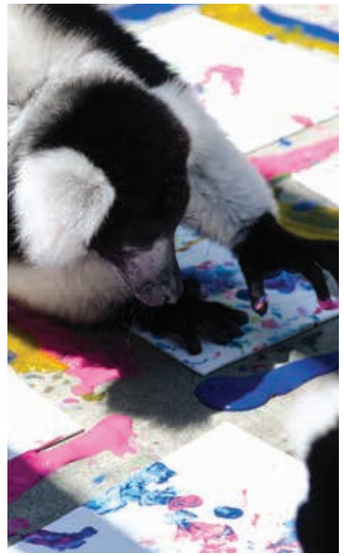
POSITIVE REINFORCEMENT TRAINING

Likewise, training is an excellent form of enrichment! In 2006, the DLC established a lemur training program to complement our husbandry and research programs. Utilizing positive reinforcement training (also known as reward-based or force-free training), the animal care staff began teaching the lemurs how to participate in their own health care and in non-invasive research. Today, behaviors such as voluntarily entering a kennel or allowing a pregnancy check by a DLC veterinarian have become positive interactions with the animal care staff and help us provide the lemurs with the highest quality of care.

"The training is 100% voluntary for the lemurs," Kate says. "If they don't want to participate, they don't have to. But if they do, they get an extra little [usually food] reward."

Additionally, choosing to participate in research, such as learning to touch a red square for a color discrimination project, allows the lemurs to be relaxed and confident while simultaneously allowing researchers to collect data in a time efficient manner. Both the husbandry and research training sessions double as a stimulating form of enrichment for the lemurs as they become engaged students who eagerly participate in the opportunity to learn something new.

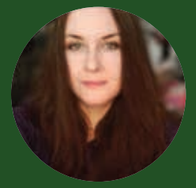
"Training is based on mutual trust between the technician and lemur," says the DLC's Curator of Behavioral Management and Welfare, Meg Dye, MSc. "Similar to students in a classroom, training sessions consist of small achievable steps that set the lemur up to succeed. We've all experienced that wonderful teacher who made learning fun. That is exactly what each technician does as they teach the lemurs to participate in husbandry and research behaviors."



Primate Technicians have many, many options for providing enrichment to the DLC's lemurs—including painting! Not only does painting promote natural foraging behavior, but the feeling of paint between the toes, the new smells and colors, and the springiness of the canvas are fun ways to keep the lemurs both physically and mentally engaged. *Photo by Banks Clark.*

VOLUNTEER SPOTLIGHT:

Photographer Sara Nicholson



We asked the DLC's newest volunteer photographer, Sara Nicholson, to share her favorite photo of the season—and this one of Coquerel's sifaka Camilla, then four months old, takes the prize! Here's what Sara says:

"Everyone tells me how lucky I am being able to photograph the lemurs at the DLC, and I agree! This is a dream come true. This photo of Camilla swinging like a wild child is just one example of the playful nature of these animals. They always put a smile on my face with their antics. I'm hoping that by sharing these images, more people will want to get involved with their conservation."

NURTURING *the* EXTRAORDINARY:

HOW AN INTERNSHIP INSPIRED A CAREER

By **RHIANNON SEE**, 2022-23 Undergraduate Fellow in Communications

Each summer, the DLC's field research internships provide a select group of students with an introduction to lemur research and conservation, instilling in them the importance of teamwork and preparing them for future research-related careers. At summer's end, the DLC is presented with dozens of intern projects, many of which give insight into the current state of lemur welfare, allowing the Center to take steps for continued improvement.

A PEEK INTO LISA MCCULLOUGH'S LIFE

Lisa McCullough was a summer '18 field research intern who carried her internship skills abroad and back again to continue to work alongside the DLC. Lisa applied to the field research internship with little research experience, hoping that the program would give her a better understanding of what to focus on for the remainder of her time at Cornell University, where she was a rising junior.

"The field research internship is designed specifically for students who don't have much prior experience in field research but want to learn about it to see if it's a possible career path for them," says Erin Ehmke, Ph.D., Director of Research at the DLC. With acceptance to the program, Lisa traveled to North Carolina for the summer.

Erin Hecht, the DLC's Student and Volunteer Program Coordinator, recalls that "Lisa's interests were broad and she was ready to throw herself into everything the intern program had to offer"—a great recipe for success.

NEW BEGINNINGS AS AN INTERN

The field research internship cohort that summer included Lisa, two additional undergraduates, and two people preparing for a post-graduation career change.

They were taught early on how to do a research method called group scan sampling, a process consisting of following lemurs through

Photos on opposite page (clockwise from top left):

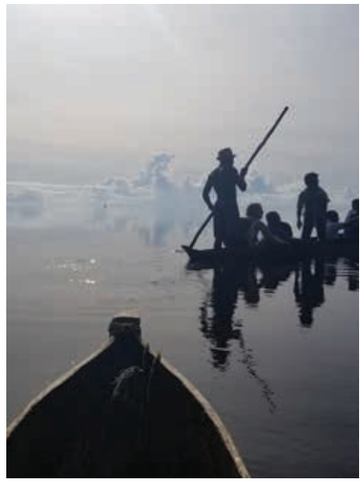
Lisa and fellow interns. Erin Hecht, the DLC's Student and Volunteer Program Coordinator, is on the far right. *Photo courtesy of Lisa McCullough.*

A golden-crowned sifaka (*Propithecus tattersali*) at the SAVA region field site in Madagascar. *Photo by Lisa McCullough.*

American and Malagasy students cruising toward mangroves in Madagascar. *Photo by Lisa McCullough.*

Lisa and her family on vacation in 2004. Lisa became interested in the environment as she went on family vacations where she backpacked, hiked, and camped. *Photo courtesy of Lisa McCullough.*

Lisa (blue dress) and students in Madagascar. *Photo courtesy of Lisa McCullough.*



YOU CAN HELP!

IN 2021, the DLC launched a new opportunity for donors to give a targeted impact gift that goes directly toward student support for summer internships. A gift of $8,000 fully covers one student for the 10-week internship at a living wage, opening the door to candidates who might otherwise be unable to consider the internship experience because of cost and the need to earn a summer income to support themselves or their families.

This summer, the DLC awarded nine of its 21 interns with fully paid internships. Selection was based on financial need applications submitted by candidates.

"My hope is that with donors' help, this scholarship can expand exponentially," says Lisa. "To support the next generation of scientists in this decade of climate action, we need to nurture young people in an inclusive and diverse setting. The DLC's supportive, intern-centered, open-door atmosphere directly inspired and empowered me to pursue a research career focused on the environment. We need to make this experience accessible to all students, not just those of independent means. Funding need-based scholarships is a game-changer."

Lisa McCullough

To learn more about this giving opportunity, please visit the Targeted Impact Gifts page on the DLC website: **LEMUR.DUKE.EDU/TIGIFTS**.

their forested enclosures and documenting their behavior every 10 minutes. The group connected quickly, becoming "one of the most cohesive intern cohorts we've had in the program," says Hecht.

A main goal of the field research internship is for students to design and complete their own independent projects over the course of the program. "As Lisa learned more about lemur research and what's been studied at the DLC, she started churning out her own research questions," Hecht recalls. "She'd light up with excitement at each new idea and potential pathways to explore it."

Lisa's project idea was so big, "I felt overwhelmed doing it alone," she says. "But doing it together felt exciting and achievable." She and two members of her cohort, Kyle Taylor and Megan Sinclair, teamed up to do a joint study. The study observed how four species of lemur were using their space and whether the plants they were consuming were based on the lemurs' preference or the plants' availability.

"Based on a short pilot study, we hypothesized that Coquerel's sifakas at the Lemur Center do forage preferentially," Lisa recalls. "Basically, we think that sifakas' foraging preferences are not, apparently, guided only by forage availability."

Theirs was the first student project at the DLC that examined how the sifakas were utilizing their enclosures. Ultimately, studies by later researchers led to the discovery that the lemurs in Natural Habitat Enclosure #4 were utilizing only 1/3 of their 14.4-acre forest. The DLC is now in the process of developing a plan to redraw the enclosure boundaries to provide space for new lemurs to free-range, utilizing the area unused by the enclosure's current inhabitants.

"Lisa and her cohort were an extremely successful group at doing their independent study," says Ehmke. "Their research began a conversation that led to the start of important changes at the DLC."

TRAVELING TO MADAGASCAR, RETURNING TO THE U.S.

Following the end of the internship program, Lisa felt much more confident in her research abilities and wanted to continue to build her experience. She was inspired to carry her skills abroad and was accepted into a program in Antalaha, a city in the SAVA region of northeastern Madagascar, for her spring semester. Here Lisa worked alongside five American students and seven Malagasy students from the local university, the Centre Universitaire Régional de la SAVA (CURSA).

After completing her field-based classes, Lisa planned, proposed, and completed a month-long research study in the Loky-Manambato Protected Area, three days' travel north of Antalaha and home of the rare golden-crowned sifaka.

Lisa used her independent study project from the DLC as a baseline for her research in Madagascar, where she compared the ranging and feeding behavior of lemurs in Loky-Manambato with free-ranging lemurs at the DLC. For this project, Lisa did group scans and observed lemurs' behavior and diet variety as well as what parts of the plant they were consuming, the lemurs' relative height in the trees, and the ambient temperature. This data was used to compare the forest environments of northeastern Madagascar and North Carolina, and to determine whether the enclosure size and feeding options at the DLC impacted the behavior of its lemurs.

After finishing the Madagascar program, Lisa returned to the Lemur Center for a second summer, where she furthered her research using similar techniques and continued to learn from mentor relationships that had begun at the DLC.

During her internship, Lisa discovered a new passion for plant and animal ID and turned this interest into a resource for the DLC. With the help of Kyle and Megan, the group created an online dichotomous key for the current and future interns to use when identifying in the field. With 73 slides, the interactive presentation allows the user to learn about plant characteristics and identify 40+ different species.

IMPACTS OF THE INTERNSHIP PROGRAM

The DLC's internship program was the first step on a long journey toward research knowledge for Lisa, and it has continued to be a resource for many aspects of her career. "The relationships I forged at the DLC as an intern were what made me want to do field research, and the skills I learned there were what made it possible," says Lisa. "I want to be the kind of colleague our DLC interns and staff were for each other. We were determined to work, sweat, laugh, celebrate, and discover as a team."

Lisa is now a Science Coordinator in Conservation International's Center for Natural Climate Solutions, where she coordinates a team whose purpose is to implement ways to work with nature to mitigate climate change.

"The research techniques taught and relationships built during my summer internship compounded into so many amazing and rewarding experiences," says Lisa. "It was such a privilege to participate."

> **"THE RELATIONSHIPS I FORGED AT THE DLC AS AN INTERN WERE WHAT MADE ME WANT TO DO FIELD RESEARCH, AND THE SKILLS I LEARNED THERE WERE WHAT MADE IT POSSIBLE."**
>
> **LISA MCCULLOUGH**

DID YOU KNOW...

The DLC summer internship program provides undergraduate students with experiential learning opportunities in primate field research, lemur husbandry, animal welfare, paleontology, environmental education, and science communication.

Former DLC summer interns have gone on to study primate field ecology, become veterinarians, serve in the Peace Corps, work as zookeepers, attend graduate school, teach environmental education, and much more. Fun fact: Eight of the DLC's current Primate Technician staff members are former DLC interns.

A PERFECT SCORE

☆☆☆☆☆☆☆☆☆☆☆☆☆

THE DLC EARNS A FLAWLESS AZA ACCREDITATION INSPECTION

By **RHIANNON SEE**, 2022-23 Undergraduate Fellow in Communications and **SARA SORRAIA**

Photos by **DAVID HARING**

◀ The DLC is one-of-a-kind in its expert care of lemurs. No other zoo or research center—except us—is accredited by both research and animal welfare organizations, including the Association for Assessment and Accreditation of Laboratory Animal Care (AAALAC) and the AZA. These accreditations testify that the Duke Lemur Center meets the highest standards of animal care.

Pictured: Primate Technician Elizabeth Warren and veterinarian Laura Ellsaesser give a wellness exam to an infant Coquerel's sifaka.

▼ AZA accreditation provides the DLC with access to resources needed to better manage its lemur colony and to strengthen the North American safety net for lemurs by exchanging animals with other accredited facilities. This ensures that the facilities the DLC partners with have a high standard of animal care and welfare, just like we do.

This summer, the Duke Lemur Center completed an inspection through the Association of Zoos and Aquariums (AZA) Accreditation Commission and received an extremely rare perfect score.

As of November 2021, only four facilities had received a perfect score in the AZA's nearly 50 years of accreditations. The DLC is proud to be the fifth.

Not only did the visiting committee find no major or minor concerns, it also recognized 18 practices and achievements they agreed were "especially well done and notable."

"It's highly unusual for a facility to go through our certification process without inspectors finding at least a few things that need to be addressed," says Denny Lewis, AZA Senior Vice President of Accreditation Programs. "But in this case, inspectors found nothing but excellence, and zero non-compliant issues—a truly remarkable accomplishment!"

"I am so proud of what we have achieved, and I couldn't be more grateful to our staff and volunteers who are the absolute best at what they do," says the DLC's Executive Director, Greg Dye. "The Lemur Center may be a small organization, but we lead the way when it comes to caring for and protecting the lemurs of Madagascar. I couldn't be prouder."

WHAT IS THE AZA?

The AZA is the accrediting body for the top zoos and aquariums in the United States and 12 other countries. "AZA certification is considered the 'gold standard' within the profession," explains Denny.

Fewer than 10% of the approximately 2,800 animal exhibitors licensed by the United States Department of Agriculture are AZA accredited. Look for the AZA logo whenever you visit a zoo or aquarium. This is your assurance that you are supporting a facility dedicated to providing excellent care for animals and a better future for all living things.

AZA INSPECTION & ACCREDITATION

The inspection process includes a detailed application and an on-site inspection by a committee of professionals who review animal care, veterinary care, safety for animals and visitors, conservation efforts, and more.

"The AZA's standards are the highest in our profession," says Greg. "The application and required documentation take several months of effort even before the team of inspectors arrives to evaluate our operations and programs. Staff recruitment and development, what kind of food we provide the animals, how we train and enrich the animals, our maintenance program, the types of research we support, our efforts to protect wild lemurs and their forests, our financial situation—everything is put under a microscope to ensure compliance."

▶ "The entire DLC team—every staff member and volunteer—is committed to providing the best animal care and welfare to every single animal in our care," says DLC Executive Director Greg Dye. "They are the absolute best at what they do. This rare achievement is the result of their hard work and uncompromising commitment to upholding the highest standards."

Pictured: Lead Primate Technician Danielle Lynch calls a free-ranging troop of ring-tailed lemurs to breakfast.

AS OF NOVEMBER 2021, ONLY FOUR FACILITIES HAD RECEIVED A PERFECT SCORE IN THE AZA'S NEARLY 50 YEARS OF ACCREDITATIONS.

◀"The Lemur Center does amazing work with lemurs and is a highly valued certified related facility of the AZA," says Denny Lewis, AZA Senior Vice President of Accreditation Programs. "The DLC has been certified by the AZA since 2016, and recently underwent a full review and inspection that they passed with flying colors!"

Pictured: Mouse lemurs feast on persimmons.

NOTABLE PRACTICES AND ACHIEVEMENTS

AZA's visiting committee recognized 18 practices and achievements that they found to be "especially well done and notable." They are:

- Institutional commitment advancing an exemplary lemur research and conservation science program.
- Long history of impactful in-situ conservation programs in Madagascar.
- Widespread leadership in AZA scientific, husbandry, veterinary, and conservation breeding programs.
- Dedicated, experienced leadership mentoring young career scientists, veterinary students, and animal care staff.
- Loyal, experienced, long-tenured, and well-trained volunteers.
- International resource for collaborative, non-invasive research from the physiology of torpor to lifetime studies of cognitive change.
- A model Diversity, Equity, Accessibility, and Inclusion (DEAI) program using rubrics for improving diversity of prospective interns, enhancing educational collaborations with community partners, and measuring progress achieving goals.
- Paid animal care internships providing access to diverse, marginalized community members.
- Beautiful old growth forested habitats enjoyed by free-ranging lemurs.
- Healthy, well-cared-for breeding population of the world's most endangered group of mammals.
- Highly enriched animals using a comprehensive evaluative and tracking program.
- $8M state-of-the-art, well-equipped research and animal health center.
- $2M investment replacing all indoor and outdoor animal holding pens.
- Significant financial subsidy of DLC operations through two years of Covid-related budget shortfalls while also avoiding any staff furloughs or lay-offs.
- Extensive animal training program meeting veterinary, research, and husbandry needs.
- Engaging guest experiences in escorted tours behind the scenes, along an exhibit trail, and in the forests.
- Multi-faceted animal welfare assessment program using an online database accessed by smart phones.
- Masterplan under development mapping out significant program and facility expansion over five to 10 years.

HIGHLIGHT:

STUDENT RESEARCH WITH THE DLC FOSSIL COLLECTION

By **ORION KORNFELD** with **KARIE WHITMAN** and **MATT BORTHS, Ph.D.**

THE DUKE LEMUR CENTER Museum of Natural History (DLCMNH) is the only fossil preparation lab at Duke University. "The fossils at the DLC teach us when, where, and how the ancestors of lemurs and humans adapted to an ever-changing world," says Curator Matt Borths, Ph.D. "By studying our ecological past, we can discover how to cultivate a more biodiverse future."

At the DLCMNH, Duke students can work with DLC paleontologists in all stages of paleontological research, from collecting fossils to fossil stabilization, accessioning, scanning, sampling, and publication. One such student is Orion Kornfeld, a Duke sophomore who began working at the DLCMNH as a freshman.

Where are you from and what do you study at Duke?
Orion: I was born and raised in St. Louis, Missouri. I've always been interested in both psychology and paleontology, so I currently study evolutionary anthropology, which is probably the only major in the world that combines the two.

How did you learn about the DLCMNH fossil collection?
Orion: I originally learned about it through its website. Dr. Matt Borths was kind enough to meet with me via Zoom before I even applied to Duke, and he told me all about the collection. The collection became one of the main reasons I applied to Duke.

What interested you about the collection – why did you want to work with us?
Orion: Truth be told, before speaking with Dr. Borths, I mostly only knew about Mesozoic paleobiology (i.e., the time of the dinosaurs). Our conversation gave me an appreciation for mammal paleobiology that has grown since then. I was particularly interested in the collection's fossils from organisms that went extinct very recently, such as giant lemurs. It's mind-blowing to think that such giant mammals were seen by human beings.

What is something fun you've learned or done in your time working with us so far?
Orion: I've done a fair amount of work photographing fossil hyrax jaws. Along the way, I've learned a lot about mammal dentition more broadly. I'm fascinated by the amount of dietary detail that can now be revealed by teeth alone. And I'm very excited to see what conclusion will ultimately be drawn from the data!

How might working with fossils fit into your future education and career goals?
Orion: I may try to pursue a career in paleontology or an adjacent career in evolutionary biology. I've always been drawn to paleontology because of the horizons it opens up; when I think that there have been millions of biospheres as complex and interesting as our current biosphere, I feel like I'm on the edge of something truly vast. In addition to helping others with their research, this work at the DLCMNH gives me the opportunity to learn first-hand what it's like to explore these horizons.

Duke sophomore Orion Kornfeld in the DLC fossil preparation lab using an Airscribe to remove rock from a 50-million-year-old jaw of a rhino-like creature. The jaw was discovered in Wyoming, USA in July 2022 by the DLC field crew.

STREAMING NOW!

ANNOUNCING THE OFFICIAL PODCAST OF THE DUKE LEMUR CENTER:

AYE-AYE POD

Join your hosts, DLC Museum of Natural History Curator Dr. Matt Borths and Education Programs Manager Megan McGrath, as they dive into all things lemur and lemur-adjacent!

Listen on Spotify · Listen on Apple Podcasts · Listen on Google Podcasts

lemur.duke.edu/DLCpodcast

ON AIR NOW!

NEW ADOPT A LEMUR COMMERCIAL FEATURING JOHN CLEESE

Legendary British comedian, *Monty Python* star, and lemur aficionado John Cleese returns this year to voice his second annual charity commercial in support of the Duke Lemur Center's Adopt a Lemur program!

Conceived and produced by Secret Station Films founder Joe Whelski, the project is a labor of love for all those involved. This year's spot is an animation, created by Titmouse and spearheaded by director/animator Parker Simmons and producer Lauren Siller.

As in the past, John Cleese and all others involved in the project lent their time and talent to the commercial *pro bono*, without charge to the DLC. We are so incredibly grateful, and we hope you love the final result just as much as we do!

lemur.duke.edu/cleese

Voiceover: John Cleese
Conceived and produced by Joe Whelski of Secret Station Films
Animation produced by Titmouse, Inc.
Director/Animator: Parker Simmons
Animation Producer: Lauren Siller
Digital Compositor: Steve Gallant
Written by Alyssa Briddes, Nick Goodey, and Joe Whelski
Sound design by Marcus Rice and Charlie Pelling of Hungry Tapes
VO sound recording by BtOven Music, NYC
Associate Producers: Mila Milosevic and Alan J. Carmona
Music courtesy of Audio Network
Special thanks to: Margaret Doyle

ADOPT ME!

The Adopt a Lemur program helps fund the $8,400 per year cost to care for each lemur at the DLC, as well as aiding our conservation efforts in Madagascar. TO LEARN MORE, PLEASE VISIT **LEMUR.DUKE.EDU/ADOPT**.

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