UCLA
Institute of the Environment and Sustainability

Center for Tropical Research

NEWSLETTER

Fall 2015

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Letter from the Director

This past year marked two landmark achievements for the Center, the creation of the Congo Basin Institute and the launch of the Bird Genoscape Project.

After a long-term effort between UCLA and the International Institute of Tropical Agriculture, the Congo Basin Institute (http://www.environment.ucla.edu/ctr/initiatives/cbi/) was opened on June 20th in Yaoundé, Cameroon. The Institute, UCLA's first foreign affiliate in its 96 year history, provides a multidisciplinary base to tackle some of the toughest problems facing Sub-Saharan Africa, such as food and water security, climate change, biodiversity loss and emerging diseases.

In October, working with our partners, we also launched the Bird Genoscape Project. Since its inception in 1997, a major emphasis of the Center has been focused on research and conservation of migratory birds. With the development of new genomic approaches and generous funding from donors and First Solar Inc., the project was launched with the goal of developing migratory maps to provide critical information for conserving populations. Assisted by the Center's large feather collection, our goal is to develop "genoscapes" for 50 species over the next five years.

We hope you enjoy the three feature articles in the CTR newsletter. The first, by Professor Susan Perry, celebrates her extraordinary 25-year study of the behavioral ecology of a population of white-faced capuchin monkeys in Costa Rica. Her detailed ecological and behavioral research covering five generations of monkeys has already yielded many groundbreaking discoveries and is certain to yield more in the coming decades. The second, by Allison Fritts-Penniman, illuminates the evolution of nudibranchs - one of the most fascinating groups of marine invertebrates with over 2300 species. She explores how switching to a new coral prey promotes divergence and speciation and helps explain the remarkable diversity of this group of spectacular organisms. Finally, Emily Curd takes a penetrating look at how the conversion of California's coastal annual grassland from native to non-native species is altering soil biodiversity. She shows how these relationships are particularly interesting and complex especially with respect to soil depth and microbe type.

Very best wishes,

Tom Smith
Director CTR

FEATURED ARTICLE

Lomas Barbudal Monkey Project Celebrates Its 25th Anniversary

By SUSAN PERRY
Professor of Anthropology, UCLA

This year marks the 25th anniversary of the Lomas Barbudal Monkey Project, a long-term study of the behavioral ecology of a population of white-faced capuchin monkeys (*Cebus capucinus*) in Costa Rica that I began studying when I was a graduate student at the University of Michigan. As it turns out, 25 years isn't nearly long enough to study organisms as complex and interesting as these monkeys. Every year yields new surprises and a wide range of questions that can be answered only with further study.

My training is in biological anthropology, and I was initially attracted to this species because of its many evolutionary convergences with humans. Capuchins have the largest relative brain size of any nonhuman primate. They are omnivores and particularly like to hunt vertebrates. At the time I began my study, we knew something about their diet and overall social structure (which is typically composed of multi-male, multi-female social groups varying in size from about 5-40 individuals). But very little was known about their social dynamics, and I was eager to find out whether capuchins exhibited the same sort of social complexity and social intelligence (aka "Machiavellian intelligence") that is prominent in apes and cercopithecines.

The research project began as a six-year study of social dynamics of a single group of about 20 animals. It seemed to be a classic female-bonded primate society, in which the females associated and groomed more than the males and frequently formed coalitions with one another. The highest-ranking male was the most central group member and the preferred grooming and coalition partner of both males and females. However, subordinate males mated with females as often as did the alpha male. Relationships between adult males were tense, but males reliably cooperated with one another in joint attacks on predators and members of other capuchin groups. Coalitionary aggression was a regular feature of daily life, even for infants, and the monkeys had a rich repertoire of signals for requesting aid and for signaling whose side they were taking in a conflict.

Brothers Duende and Elmo migrate together to Abby's group; in this photo they are forming an aggressive alliance.

The high frequency of coalition formation enabled me to probe capuchin psychology with the aim of seeing what the monkeys understood about the structure of their society. Patterns of requests for coalitionary support

showed that contestants preferentially solicited aid from monkeys who were higher-ranking than their opponents and also better friends with themselves than with their opponents. Patterns of solicitation for aid could not be explained by simpler rules, e.g. requesting aid from the best friend. These results suggested that capuchins have a solid understanding not only of their own relationships within the group, but also of the quality of relationships that do not include them.

As the study progressed, we added three more social groups, some of which expanded in size and fissioned along matrilines, eventually ending up with the ten groups that we regularly monitor today. We also added noninvasive biomedical components to the study, by collecting feces for extraction of DNA and hormones. The genetic data, analyzed by MPI graduate student Laura Muniz and UCLA graduate student Irene Godoy at Linda Vigilant's lab in the Max Planck Institute for Evolutionary Anthropology, yielded three surprises that made capuchins stand out as being an unusual species.

Alpha female, Mezcla (left), and alpha male ,Pablo (right), nap with their daughter, Mooch, and granddaughter, Pod.

First of all, the paternity data demonstrated that although mating was equally distributed among males, and we never observed males guarding fertile females, alpha males sired a disproportionately large share of offspring: 92% during their first 6 years at top rank. The second surprising discovery, enabled by the genetic data in combination with our behavioral observations, was that some alpha males maintain their rank for up to 17 or 18 years (the equivalent of three generations). This meant that they were co-residing with their daughters and granddaughters, a rare pattern in group-living mammals. However, alpha males did not breed with their female descendants, although they monopolized breeding with unrelated females. It is not yet entirely clear whether the primary responsibility for father-daughter inbreeding avoidance is by the male or the female. Irene Godoy's work indicates that the monkeys are using cues of male rank at the time of infant birth, combined with social familiarity, to avoid close inbreeding. As alpha male tenures progress, and a larger proportion of the females in the group are descendants of the current alpha male, a larger number of mates become available to the males who have loyally helped the alpha male defend the group, providing a delayed reproductive payoff to their efforts.

The third surprise that we discovered, again via combination of genetic and behavioral data, was that when males emigrate, they prefer to emigrate together with their male kin, as lions do. Takeovers of the alpha male position are often achieved by alliances of related males immigrating into the group. This pattern of migration and takeovers often results in groups that are composed of two close kin networks: a group of matrilineally related females and a group of patrilineally (and sometimes matrilineally) related males who originated in a different natal group. Males may disperse multiple times with the same males, maintaining these alliances over multiple decades. This means that much of the effort that subordinate males expend in the protection of the alpha male's mates and offspring may be partially explained by kin selection, as they are often the uncles of the infants in the group they are defending.

Discoveries such as those described above, in which we are able to document life-long alliances and the role of kinship in structuring the population over multiple generations, are only possible in a long-term study. Another major discovery by our research team that was only possible due to long-term study was the discovery of several social traditions. Longitudinal study, as well as cross-site comparison with researchers of other populations, has revealed that the patterning of behavioral repertoires over time, as well as within and between social groups, can only be explained by invoking a strong influence of social learning. The most striking socially transmitted behavior patterns are bizarre rituals such as "eyeball-poking," in which monkeys insert their friends' fingers deep into their own eye sockets, up to the first knuckle, and leave them there for several minutes. These rituals are unique to particular groups, invented by creative individuals who then spread the ritual through their social networks. Typically these rituals remain within a group's communicative repertoire for about 3 links in a social transmission chain, and for about a decade, before vanishing and being replaced by different rituals. It is not clear why white-faced capuchins are so much more prone to inventing these sorts of traditions than other animals are.

Rumor and Miffin exhibit their group's bond-testing tradition by probing one another's noses and eyes.

These rituals share the feature of imposing discomfort and/or risk on one or both parties, and may function to test the quality of social bonds. Thus, they may be particularly common in capuchins because of the unusually strong dependence that these monkeys have on their allies. Reliable allies are crucial for attaining high reproductive success.

For the first 22 years of research on this population, the main contributing factors to capuchin survival and reproductive success were social factors (costs and benefits imposed by other capuchins) rather than ecological factors such as predation or food shortages. Lethal coalitionary aggression was the leading cause of adult male mortality, and infanticide by adult males (a strategy to hasten the victim's mother's return to ovulatory cycling) was the leading cause of infant mortality. The prevalence of infanticide probably explains adult females' loyalty to the current alpha male, who is the father of most of their offspring and will protect them from attack.

1-handed alpha male Pitufo searches for new bromeliad shoots to eat after his home range is devastated by fire.

Three years ago a major fire swept through our study area, severely damaging some groups' home ranges. For the first time, we witnessed noticeable food scarcity, and the monkeys changed their diets and ranging patterns as they adapted to the new circumstances, pulling through this crisis without suffering major reductions in fertility or survival. In 2014 and 2015, however, the forest experienced major droughts. Again, the monkeys were creative in their coping strategies, adopting new foods, but they visibly lost weight, and mortality rates rose dramatically. For the first time in 25 years, we saw mothers abandon their weakened infants – a startling observation, given that capuchin mothers are normally fiercely protective of their infants even for a day or two after they have died. For the first time, it appears that nutritional stress, rather than within-species aggression, is the leading cause of mortality. Another drought year is predicted for next year, and we are seeking funding to study the monkeys' responses to these extreme ecological conditions. We are particularly interested in documenting shifts in maternal strategies, social structure, diet, and hormonal profiles.

Alpha female Celeste searches the charred forest floor for food.

Projects such as the Lomas Barbudal Monkey Project are important because there are so few projects of long-lived animals for which multiple generations of individually recognized individuals are continuously studied. With five generations of genotyped monkeys, long-term ecological monitoring, and ~100,000 hours of behavioral data to serve as baseline data, we are well positioned to document the impact of rare ecological events and longterm climate change on population dynamics and behavioral strategies.

Susan giving a talk to community members at the 25th Anniversary celebration of the monkey project in Costa Rica in July 2015.


Children from Pijije public elementary school proudly display photos of their adopted monkey, Outlaw.

Longterm field sites offer more benefits than just scientific opportunities, of course. Having worked in this Costa Rican community for 25 years, we are well established in the community and have developed strong collaborative ties with the park service and other local institutions. We collaborate in developing management plans for the forest, providing the vigilance needed to keep forest fires and poaching under control, reforesting areas damaged by human development (e.g. gravel mining and cattle ranching), and assisting in biological monitoring. We also provide valuable training for young scientists of all ages. 145 people from 18 countries have been interns with the monkey project, and we have provided employment to Costa Ricans. We visit K-12 schools in Costa Rica to enhance local awareness of the endangered status of the tropical dry forests, and children are enchanted by the stories of the monkeys' lives, which give them an incentive to help preserve the forests that are the monkeys' homes.


Susan leading Costa Ricans on a nature walk, showing them the new self guided tour (from a monkey's perspective).

More information about the project and the monkeys can be found at:
http://lbmp.anthro.ucla.edu/
https://www.youtube.com/watch?v=Xv73xCYpJ3A&feature=youtu.be

https://www.facebook.com/The-Capuchin-Foundation-562696977141027/timeline/
or by reading the book *Manipulative Monkeys: The Capuchins of Lomas Barbudal*, (authors S. Perry & J. Manson), which is a book written for the layperson, describing the life stories of the monkeys as well as the process of doing field primatology research.

FEATURED ARTICLE

Speciation In Action On Coral Reefs

By ALLISON FRITTS-PENNIMAN

The water is calm and clear in the back-reef lagoon. I swim with my face down, snorkel up, scanning the sea floor for the familiar shape of a Porites coral colony. With 500 species of reef-building corals in the Coral Triangle, it can be tricky to find any particular one. That is, unless you are adapted to hone in on that species like your life depends on it. For some nudibranch larvae, that is exactly the case.

Nudibranchs are an incredibly diverse group of sea slugs found throughout the world's oceans. While their cousins, the garden slugs, are drab and unappreciated, nudibranchs are anything but. Their small size makes them difficult to find, but their magnificent colors and shapes makes them worth the hunt, and they have become a popular subject of underwater photographers. If you haven't seen them, stop reading right now and do a Google images search. Like many marine taxa, the highest concentration of nudibranch species is in the Coral Triangle, the world's epicenter of marine biodiversity. The region's amazing reefs provide a home for thousands of other species, and corals are an integral part of the food chain. My research focuses on nudibranch species that live and feed upon common coral species. However, they do not feed generally on all corals. They are adapted to prey on specific types of coral, and they also make that coral their home. As larvae, they find their future coral host by detecting its unique chemical signature in the water, kind of like its scent.

Phestilla minor, the most commonly found species in the *Phestilla* genus.

I am interested in whether this special relationship with corals contributes to the formation of new nudibranch species, a process called speciation. To answer this question, I went to Indonesia, the country spanning the largest area of the Coral Triangle. I wanted to know what processes separate nudibranch populations, which is the first step of speciation. When populations are separated, breeding between them is limited, so over time they become genetically distinct. One common mechanism for population divergence is geographic isolation, when a great distance or a physical barrier prevents movement between populations. However, switching to a new coral prey and host may also be a mechanism for isolation. Once nudibranchs have colonized a new host, natural selection may lead to specialized adaptations to living on that host. Over time, the advantages to specializing on a certain host may outweigh the advantages of having multiple different hosts, and selection will favor what we call ecological isolation of the populations. Many species have been shown to arise from geographic isolation, while evidence for ecological isolation is more rare.

To figure out the relative importance of coral host and geography in the divergence of coral-associated nudibranchs, I focused on one genus, Phestilla. Unlike their many flashy relatives, these nudibranchs are well camouflaged. Some species blend into their host so well that they had never been found until I went looking, such as this new species on a Pavona coral. I focused on *Phestilla minor*, the most commonly found species in the genus, to look for drivers of population divergence. I collected *Phestilla minor* from many different locations across Indonesia, and from as many different coral hosts as I could find. Using next generation sequencing, I have identified genomic divergence between the Indian and Pacific Oceans, confirming the existence of a geographic barrier. However, I have also identified genomic divergence between populations on coral hosts that have either branching or mounding morphology, revealing what appears to be recent ecological speciation. This is the first study to use genomic data to demonstrate this phenomenon in nudibranchs.

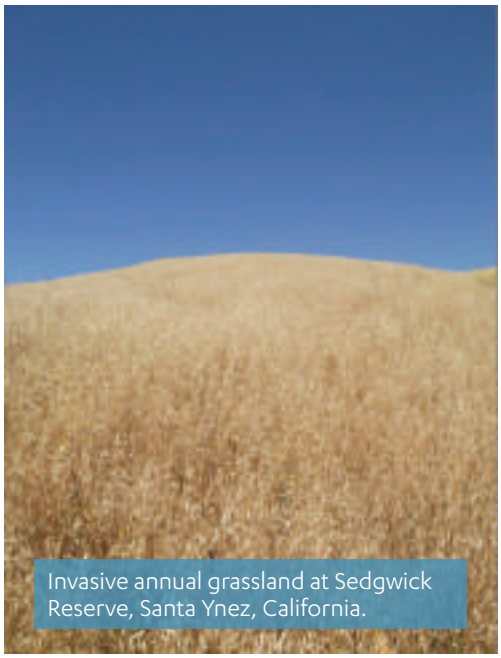
New species found on a Pavona coral.

FEATURED ARTICLE

The Long-term Effects of Habitat Conversion On Soil Microbial Biodiversity and Function

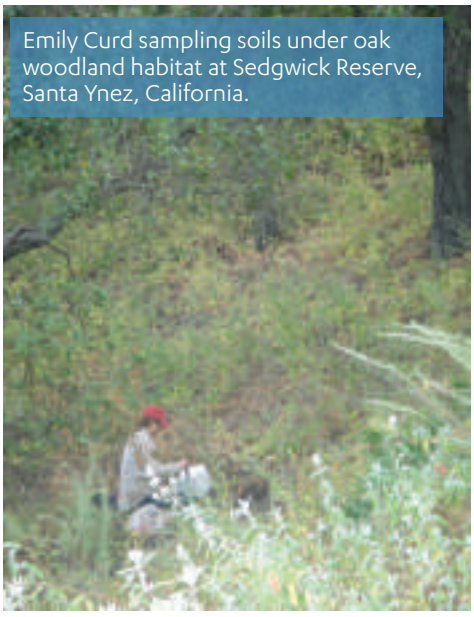
By EMILY CURD

Native Californian habitats are being invaded by exotic annual species. Exotic grasses like compact brome (*Bromus madritensis*), ripgut brome (*Bromus diandrus*), and oat grass (*Avena spp*) have replaced the majority of native perennial bunch species in grasslands, and they are infiltrating native shrublands and other woody habitats including coastal sage scrub habitat (one of the most endangered habitats in the United States) and oak woodlands. Grassland invasion of woody habitat alters water availability in soils, and homogenizes the distribution of soil resources. Grass litter and plant density crowds (or shades) out the seedlings of woody species, and increases in fuel can lead to higher frequencies of fire in these habitats. This habitat alteration typically benefits grass species growth and regeneration. In the long run, this can result in habitat conversion to annual grasslands that reduces local plant biodiversity. This land conversion can lead to declines in the biodiversity of native animals that rely on native habitats for food and shelter.



Invasive annual grassland at Sedgwick Reserve, Santa Ynez, California.

It is not clear how conversion to annual grassland affects soil biodiversity. Soils are some of the most diverse habitats on the planet. A few grams of soil can sustain many thousands of species of bacteria, archaea, and other microscopic organisms. These soil communities are responsible for the majority of terrestrial organic matter turnover, and they are also critically important drivers of other ecosystem processes (e.g. biogeochemical cycles) as well. The conversion of native woody habitats can lead to changes in ecosystem processes, and these changes are influenced by the interactions between plants and microbial communities in soil. We currently know little about the effect of habitat conversion on the biodiversity of soils, or how changes in soil biodiversity may affect ecosystem processes.



Emily Curd sampling soils under oak woodland habitat at Sedgwick Reserve, Santa Ynez, California.

It is also unclear how deep the effects of land conversion will be on soil communities. Deep communities are considerably smaller, in terms of biomass, than surface communities; however much of the organic matter stored in soils is located below 20 cm. Changes in function in deep soils due to habitat change could have large effects on ecosystem processes.

The goals of my project were to identify the changes in soil biodiversity and function to a depth of one meter under California native habitats (i.e., coastal sage scrub and oak woodland) and annual grasslands. My study site, Sedgwick Reserve in Santa Ynez, CA has examples of each habitat that have been stable for at least 80 years. I expected soils under annual grasslands to be more homogenous, have lower biodiversity, and very different functional profiles than native woody habitats.

I found that the soil's physical and chemical characteristics under annual grasses were more homogenous than those under native woody species, as predicted. Biodiversity was also lower in annual grassland soils, but surprisingly the largest differences in biodiversity between grassland and woody habitat occurred in deep soil rather than surface soils. I also found that the functional pattern was more similar across woody habitats than in grasslands, but functionally the soils became more similar with depth. I also found that similar groups of microbes are responsible for performing functions in soils and these groups are similar across habitats.

What does this mean of habitat conversion from native woody species to exotic annual grasslands? Changing soil biodiversity by habitat conversion could shift the relative abundance of the decomposition microbes and have a profound effect on soil ecosystem services.

CTR Updates

FIELD RESEARCH TRIPS

Nicola Anthony, with colleagues from the University of New Orleans (UNO) and Universite des Sciences et Techniques de Masuku (USTM) co-organized another successful professional development workshop from July 20-25 in Franceville, Gabon. Topics covered included leadership training, getting your science published, grant writing, statistical analysis of genetic, ecological and demographic data as well as training in socio-economic inquiry, ecological niche modeling and Geographic Information Systems. Educators gathered in Franceville, Gabon from a number of institutions including UNO, USTM, the University of California Los Angeles, Universitat of Halle-Wittenberg (Germany), University of Stirling (UK), University of Michigan, University of Wisconsin and the University of Albany.

Scott Carroll and **Jenella Loye** investigated rapidly evolving Australian insects in the tropical outback of northern Queensland during June-August. They found that native Soapberry Bugs are adapting to feed on introduced environmental weeds, suggesting that new conservation opportunities can evolve surprisingly quickly. They also participated in a study of the ethno-ecology of little-known insect larvae that some aboriginal Australians use for food. After surgically chopping the impressively large grubs from the roots and branches of desert trees and shrubs, the local hunters fire-roasted them over embers and presented them to the researchers. The mega-vermin tasted nothing like chicken, and much more like a cross between shrimp and bacon.

Trevon Fuller helped teach an undergraduate field course in Cameroon in June that was held at Ebo Forest and Mbam and Djerem National Park. He also organized focus groups with villagers at these sites to assess their perceptions of climate change and biodiversity. The focus group results are being used to develop conservation plans that incorporate social and economic factors as part of the PIRE project. In July, Trevon taught at a Professional Development Workshop for graduate students at Masuku University of Science and Technology in Francev-ille, Gabon. While in Gabon, he carried out interviews about climate change with villagers in the buffer zone of the Bateke Plateau National Park as well as Crystal Mountains National Park.

Jenella Loye continues to work with blood-feeding insect repellents and traps with emphasis on mosquitoes, ticks, fleas and bedbugs. Carroll-Loye Biological Research is still the sole testing group associated with registration of repellents with the EPA. The use of repellents in the control of malaria and other vectored diseases has ever growing importance as resistance grows in the disease causative agents. Jenella has also taught tropical biology for American students in Central America. The interest of the students caused the courses to evolve into conservation and development with an emphasis on permaculture techniques. Permaculture draws strongly on traditional milpa, as well as dry-land farming management that was developed long ago by native peoples. She has taken her students to S. Belize to a particular-ly rich area for agriculture and worked there with permaculturists in San Pedro, Columbia near the Lubantuun ruins.

Kevin Njabo, **Thomas Smith**, and field assistant **Francis Forzi** carried out a small-scale sampling of wild birds via mist nets this past summer as part of the NSF-PIRE undergraduate field course. The overall aim of the course was to provide training in the fundamentals of tropical field research. US and African students worked collaboratively in teams to: 1) design an independent research project in tropical ecology; 2) collect data and analyze results; 3) write a report in the format of a scientific publication summarizing the aims, methods, results and conclusions of the research project; 4) present project findings to participants and instructors at the end of the course. Samples were also collected at the San Diego Zoo Global/Ebo Forest Research Project research station at Ebo Forest and the WCS training center at Mbam et Djerem National Park in Cameroon, and included PIRE target species, Olive Sunbirds (*Cyanomitra olivaceae*) and Little Greenbuls (*Andropadus virens*).

Kevin Njabo and field assistant **Francis Forzi** carried out a small-scale sampling of wild birds via mist nets at selected sites sampling in Gabon (Lope and Mont de Cristal National Parks) in July-August 2015. They were accompanied by postdoc **Alison Hamilton** and a graduate student from the Universite de Sciences et Techniques de Masuku. Alison led the reptile sampling in Lope National Park in Gabon.

Ravinder Sehgal and **Kevin Njabo** in collaboration with scientists at the University of Buea and the University of Dschang in Cameroon are working on a large project studying how deforestation affects the transmission of avian malaria. The project is groundbreaking in that they will measure malaria at the same sites, before and after deforestation. They will also monitor mosquito diversity with the prediction that insects transmitting human diseases may become more common in the deforested areas. The project is funded by USAID and has been awarded to Dr. Damian Anong at the University of Buea. Collaborators include Dr. Anton Cornel from UC Davis, and Dr. Julius Ndukum at the University of Dschang.

Corey Tarwater and **Patrick Kelley** received a National Geographic grant to conduct research in Panama. The work is titled "Demographic variation along environmental gradients in Panama and the fate of future populations."

CTR Updates

OTHER NEWS

Nicola Anthony was recently awarded the Leopold Leadership Fellowship by the Woods Institute at Stanford University. She has also taken a sabbatical and is dividing her time between the University of Stirling (hosted by Dr. Kate Abernethy) and USTM in Gabon. The main aim of her sabbatical is to develop a common educational platform in the biodiversity sciences that can be shared between national institutions, government agencies, NGOs and foreign university researchers working in Central Africa. She is also running a series of workshops for faculty and students at USTM in various aspects of professional development including the preparation of scientific publications and grants.

Vanessa Apkenas was awarded the CTR Betty and E.P. Franklin Grant in Tropical Biology & Conservation in support of her thesis research. She also received several travel awards to attend meetings such as the Society for Systematic Biologists Standalone Meeting, the 95th Annual Meeting of the American Society of Mammalogists (ASM), and the annual Evolution Meeting in Guaruja, Brazil. During the meeting, she presented a poster on CTR's latest work with the little greenbul, "Spatial patterns of genomic and morphological divergence with gene flow in a Central African rainforest bird." She has also been sharpening her skills as a science communicator over the past year through the creation and management of CTR's new Twitter feed (@UCLA_CTR) and as a new member of ASM's Informatics Committee.

Paul Barber was one of only ten University of California faculty to receive the Award for Outstanding Faculty Leadership in Presidential Initiatives by UC President Janet Napolitano for his efforts on the "Pathways to Ph.D.'s in Marine Science" summer program for students from historically black colleges and universities focused on coral reef ecology.

Rachael Bay joined CTR in October as a postdoctoral scholar. She is the recipient of a two-year Postdoctoral Research Fellowship in Biology from the National Science Foundation and she will be using genomic tools to examine population structure and migratory connectivity in yellow warblers.

Rayna Bell recently started a new position as a Research Zoologist and Curator of Amphibians and Reptiles at the Smithsonian/Natural Museum of History.

Emily Curd is in the final stages of completing her dissertation research on the long-term effects of habitat conversion on soil microbial biodiversity and function. In June, she received a UCLA Office of Instructional Development Teaching Assistant Mini-Grant.

Ryan Harrigan was an invited speaker at the TEDx Venice Beach event held in February. Ryan presented the audience with a novel perspective on emerging infectious diseases in a talk entitled "Ideas Aren't the Only Thing Spreading." This presentation can be seen at (https://www.youtube.com/watch?v=bj2n7IJyTRI). Ryan also participated in the 2015 La Kretz Center Fall Collaborative Projects Meeting at the Santa Monica Stunt Ranch in September. This meeting brought together a group of top scientists and agencies from around southern California to discuss research opportunities and motivate further collaboration between groups working on the conservation, management, and understanding of local taxa.

Rachel Johnston received a UCLA Dissertation Year Fellowship in May 2015. She is using the award to investigate genes associated with bird migration in Swainson's thrushes and to study gene expression variation in gray wolves in Yellowstone National Park.

Brenda Larison is now an Assistant Adjunct Professor in the Department of Ecology and Evolutionary Biology. She continues to work on the question of why zebra are striped and is also working to understand the genetic control of striping.

Thomas Smith and **Kevin Njabo** attended the 15th Meeting of Parties and Anchor Conference of the Congo Basin Forest Partnership (CBFP) in Yaoundé, Republic of Cameroon from June 17-20, 2015. This meeting provided a forum not only for reviewing, analyzing key issues and sharing ways to address them, but also to create and innovate with all regional and international partners. The meeting offered partners of the Congo Basin a key opportunity to meet, share their expertise and experiences, and to plan ahead. Organized with financial support from the Governments of Norway, Cameroon, the United States, Germany, France, and technical support from IUCN, the Meeting of CBFP Partners had as its central theme "Ecosystems of the Congo Basin: natural capital, producer of economic value for the well-being of its people." Kevin Njabo facilitated the AC-CBFP (Ecosystem Services Stream) and read out the Policy Recommendations at the plenary session while Thomas Smith lead a workshop and gave a lecture during the plenary sessions. The meeting concluded on June 20th with a signing ceremony and the launch of the Congo Basin Institute (CBI) by the University of California Los Angeles (UCLA) and the International Institute of Tropical Agriculture (IITA).

CTR Updates

OTHER NEWS, CONTINUED

Hilton Oyamaguchi joined Drexel University in August for a postdoctoral appointment with Dr. Mary K. Gonder to work on diversification process along the elevational gradient on Bioko Island (Equatorial Guinea) and with the Central African Biodiversity Alliance.

Kristen Ruegg gave a research seminar at Oxford University and she also served as a lecturer at a CAnMove (Center for Animal Movement and Migration) workshop in Lund, Sweden in November. She also gave a departmental seminar at Tulane University in December. Kristen was recently appointed to the Editorial Board at Ecology Letters and the AUK, Ornithological Advances.

Thomas Smith and colleagues from UCLA, in collaboration with Drexel University, co-organized an undergraduate field course. The field course was held from June 21-July 25 in Yaoundé, Cameroon where students learned hands-on the fundamentals of tropical field research in Ebo Forest and Djerem National Park. The field course is part of the Central African Biodiversity Alliance (CABA) that enables international collaborations in research and education to advance scientific solutions to daunting global challenges. See Workshop Report II for more details.

Thomas Smith presented two lectures in March 2015 entitled "Challenges to Conserving the Congo Basin Rainforest: Climate Change and the Second Scramble for Africa" as part of a special series at the University of Wisconsin-Madison.

PUBLICATIONS AND PRESS

Rayna Bell published a paper on overseas dispersal of Hyperolius reed frogs from Central Africa to the oceanic islands of São Tomé and Príncipe in *the Journal of Biogeography*. A second paper on reed frog diversification in the Gulf of Guinea was published in the journal *Evolution*.

Ryan Harrigan and colleagues recently published work on "Persistent Impacts of West Nile virus on North American bird populations" which appeared on the cover of the Nov. 17th issue of the *Proceedings of the National Academy of Sciences* (www.pnas.org). This work involved a sample set of over 250,000 birds banded by the Institute for Bird Populations (http://www.birdpop.org), and examined how the arrival of West Nile virus to North America in 1999 has decreased the survivorship in nearly half of the 49 species of birds investigated. The paper received much public attention, and was a feature story from Science (http://news.sciencemag.org/health/2015/11/west-nile-virus-still-wiping-out-birds-across-north-america).

Brenda Larison recently co-authored a paper with **Ryan Harrigan** and **Thomas Smith** of CTR and Daniel Rubenstein of Princeton University entitled "How the zebra got its stripes: a problem with too many solutions." The paper was published in *Royal Society Open Science* and received worldwide media attention for it's novel conclusion that the best explanation may be an association between temperature and stripe pattern variation.

Kelly Swing and colleagues published a 46-page review article on the value of scientific collections in Spanish in September 2014 that essentially serves as a call for re-evaluation of policies across Latin America in relation to attitudes associated with how research and collecting permits are managed/issued. Although their paper focuses on Ecuador, the idea is that anyone working anywhere in the Neotropics could use this as a support document for the justification of specimen collection for Spanish-speaking (or Portuguese-speaking, for that matter) authorities across the region. The co-authors work with collections on a regular basis and include various specialists (2 ichthyologists, a herpetologist, a coleopterist, an aquatic entomologist/limnologist, a bat specialist, a marine mammal specialist, 2 botanists, a marine invertebrate specialist, several ecologists, 12 conservationists) from several institutions. Their perspectives and arguments touch on all these taxa and more.
http://www.usfq.edu.ec/publicaciones/bitacora/Documents/bitacora_001/bitacora_academica_001_articulo_001.pdf

ANNOUNCEMENTS

Bird Genoscape Project

CTR is pleased to announce the launch of the Bird Genoscape Project. CTR is developing innovative molecular tools that can be used to inform migratory bird conservation in a changing world. Neotropical migratory birds are declining across the Western Hemisphere, but conservation efforts have been stalled by the inability to assess where migrants are most limited – the breeding grounds, migratory stopover points, or tropical wintering areas. Historically, efforts to correlate breeding, wintering, and migratory populations have relied on large-scale banding programs or small tracking devices, however, these efforts have been met with limited success because recapture of small-bodied birds is rare. Thus, there is an urgent need for a tracking technology that is minimally invasive, reliable, and capable of characterizing migratory patterns on a broad scale.

CTR Updates

ANNOUNCEMENTS, CONTINUED

In a significant breakthrough, CTR has developed a high-resolution molecular tag for tracking migratory birds on hemispheric scales. Our method uses genetic and chemical (isotopic) information from a single feather to track where an individual was born, and where it molted its feathers. As a consequence, a feather collected at one stage of the migratory cycle can be used to make essential links between where that bird may be going and/or where it came from.

Our method is a significant advance over current methods because it:
1) Provides a non-invasive method of attaining tracking information from all birds (dead or alive), without the need for recapture.
2) Harnesses recent advances in genomic sequencing and statistical methods to identify populations at spatial scales that are critical for conservation planning.
3) Utilizes a rapid, efficient and reliable genotyping platform that can rapidly screen thousands of birds at a low cost per individual.

We are working with a variety of government and non-profit partners to expand the development of high -resolution molecular tags to species and populations of conservation concern across the Western Hemisphere. The resulting information can be used to help address current and future challenges facing migratory birds.

Progress on the Establishment of the Congo Basin Institute (CBI)
As we have reported the last several years, UCLA and the International Institute of Tropical Agriculture (IITA) have formed a partnership to create the Congo Basin Institute (CBI) in Yaoundé, Cameroon. We are pleased to announce that the CBI is now UCLA's first foreign affiliate! Doors were officially opened following the CBI Inauguration event held onsite on June 20, 2015.

Please see article below that was featured in the UCLA Newsroom as it beautifully illustrates the event and current progress on the CBI.

Reprinted with permission from Alison Hewitt:
http://newsroom.ucla.edu/releases/ucla-partners-in-new-congo-basin-institute-a-game-changer-for-environmental-protection

UCLA professor Tom Smith has conducted research in Cameroon for more than 30 years, and preserving and improving the region is more than a career to him. It's his life's work, and now he and a major African institute have created an international partnership that could save the Congo rainforest and transform the troubled Congo Basin.

On June 20, 2015, Smith and the International Institute of Tropical Agriculture (IITA) officially launched the Congo Basin Institute. More than 200 officials including ambassadors, ministers, African scientists, UCLA researchers and representatives of universities from around the world gathered at IITA in Yaoundé, Cameroon for the event.

The Congo Basin Institute at IITA will provide a one-of-a-kind center to address the challenges of food and water security, climate change, biodiversity loss, public health and emerging diseases. Cameroon is a microcosm of the world's environmental challenges, giving researchers an opportunity to study and test solutions to address deforestation, mining, fast-growing urbanization, poverty, poaching, lack of sanitation and clean water, infectious diseases and more.

"This is a game-changer for the Congo Basin," said Smith, an evolutionary biologist in the UCLA College and director of the Center for Tropical Research at UCLA's Institute of the Environment and Sustainability.

The new institute is a partnership between UCLA and IITA, one of the world's largest tropical agriculture agencies with more than 20 stations and campuses across Sub-Saharan Africa. While UCLA has agreements with more than 300 international partners, the Congo Basin Institute is UCLA's first foreign affiliate, meaning the university will have a permanent presence in Cameroon.

"Many institutes that focus on the developing world are based elsewhere, such as Paris or New York, not in the developing world," Smith said. "Researchers typically parachute in to address a single issue for five years at most, but once the program ends, the projects are not carried forward. The CBI has tremendous capacity to address Central Africa's education, environmental and health challenges in a substantive and sustainable fashion, and to build something with a lasting impact."

The distant Congo Basin affects lives from Cameroon to California. The 1.4 million square miles of Congo rainforest — the second largest in the world after the Amazon — inhales massive amounts of carbon, keeping it out of the atmosphere and slowing climate change. All

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in the world after the Amazon — inhales massive amounts of carbon, keeping it out of the atmosphere and slowing climate change. All that is threatened by deforestation, Smith said. The region is also home to many emerging and infectious diseases, such as the recent Ebola outbreak that found its way to a hospital in Texas, he added.

The institute seeks to address those and other societal challenges, while also slowing the brain drain of African scientists relocating to more developed economies, Smith said. Currently, only 20 percent of the young scholars who go overseas for higher degrees return.

A five-year test version of the Congo Basin Institute successfully hosted more than 2,000 researchers from 15 countries at the IITA campus, assisting the scientists with obtaining permits, cobbling together grants and more. UCLA students studying conservation biology, public health and medicine are among those who have already had the opportunity to use the site for field research experience and to study tropical diseases. Like Smith, UCLA environmental health professor Hilary Godwin hosts a number of programs there, and also teaches a distance-learning class that takes place simultaneously at UCLA and at IITA in Cameroon. Key to the success of the pilot program and the new institute is Kevin Njabo, a Cameroonian biologist who is also an assistant adjunct professor at UCLA. Njabo was instrumental in working with the Cameroonian government to lead the effort to protect the area and in getting the city of Yaoundé to host the Congo Basin Forest Partnership meeting.

The new Congo Basin Institute aligns with and expands upon UCLA's Sustainable L.A. Grand Challenge, a university-wide research initiative to develop clean energy, local water solutions, and preserve biodiversity in order to transition the Los Angeles region to 100 percent renewable energy, 100 percent local water and enhanced ecosystem health by 2050.

U.S. Ambassador to Cameroon Michael Hoza met with the organizers June 19 in support of the launch of the institute. The launch event the next day was attended by Essimi Menye, Cameroon's minister of agriculture and rural development, and ambassadors from other African and European countries. Key representatives from UCLA and IITA also attended, including Mark Gold, UCLA's associate vice chancellor of the environment and sustainability, and Kenand Namanga Ngongi, vice chair of the IITA Board of Trustees. Also attending were Kevin Reed, UCLA vice chancellor for legal affairs; Kenton Dashiell, IITA deputy director of general partnerships and capacity development, Bernard Vanlauwe, director for IITA's Central Africa Hub and Rachid Hanna, resident representative, IITA-Cameroon.

The new Congo Basin Institute is expanding the existing IITA campus, and the launch event marked the addition of a GIS (geographic information systems) and remote-sensing laboratory, and a molecular genetics laboratory. The architecture firm Gensler has completed pro-bono designs for green buildings to enlarge the campus with a conference center, a distance-learning center, and lodging for visiting students and researchers. Together, the facilities will enable scientists in Cameroon to develop global-scale solutions related to agriculture, health, human resource development and more, Ngongi said. "These will impact the lives of millions of people in the Congo Basin and also contribute to the sustainable management of the Congo Basin ecosystem," Ngongi said.

In addition to providing state-of-the art facilities, the program will assist researchers with permits, finding grants and other logistics. It will be funded with a fee-for-use charge that proved successful in the pilot program. Long-term, Smith has also partnered with the government of Cameroon and several non-governmental organizations in an effort to get a large swath of the Congo protected by the United Nations' Reduction in Emissions from Deforestation and Forest Degradation program. The REDD program funds alternative land uses for people who might otherwise live off the Congo through poaching or deforestation, but it's unusual for a professor to lead the charge, Gold said. "I've never heard of a professor creating the largest REDD project in Africa to protect biodiversity and develop an institute like this," Gold said.

Additional partners in the Congo Basin Institute include the World Agroforestry Center, the Centre Pasteur du Cameroun, the University of Wisconsin-Madison, the University of New Orleans, Drexel University, several Cameroon ministries and universities, and other corporate partners and local and international NGOs, such as the Jane Goodall Institute, and the Center for International Forestry Research. "The Congo Basin Institute gives UCLA a permanent home in one of the most biodiverse areas of the planet, and an opportunity to save the Congo," Gold said. "It's not just about the loss of elephants and gorillas and chimps. To slow climate change, we need to vigorously protect the resources we have that uptake carbon. The future of the Congo is completely tied up in the future of the planet.

WORKSHOP REPORT I

Annual Professional Development Workshop for the National Science Foundation's Partnership in Research and Education

BY BENJAMIN KRAEMER
Graduate Student at the University of Wisconsin-Madison

Geraud Tasse training a participant.

The University of Science and Technology at Masuku (USTM)—a public institution of science and technology near the Ogooué River in southeast Gabon served as the backdrop to this year's Professional Development Workshop. Members of the Central Africa Biodiversity Alliance (CABA) built on the success of their previous Professional Development Workshops in 2013 and 2014 to organize and implement this year's workshop from July 20-25. Their primary goal was to provide professional development opportunities to students of USTM and other early career scientists from Central African institutions who study biodiversity conservation. The core of these professional development opportunities included several concurrent sessions on applying state-of-the-art computer programs to address problems of conservation concern.

Another goal of the workshop was to strengthen international partnerships for research and education between Central African research institutes and other institutions from abroad. To that end, researchers from the Center for Tropical Research at UCLA and the University of New Orleans were present at the workshop among other American and European researchers. Researchers from abroad taught and learned alongside their Cameroonian, Congolese, and Gabonese colleagues in the concurrent sessions and in plenary discussions of leadership, communication, and networking.

Highlights of the workshop included a personalized feedback session on writing manuscripts and grant proposals and a group conversation about Chinese economic expansion in Africa. In the context of learning about collaboration, all 33 attendees also worked together to assemble a wooden elephant jigsaw puzzle. The workshop ended with a field trip to a nearby reserve where attendees observed local species of plants and animals firsthand before returning home. The workshop was a major success and we look forward to the next CABA Professional Development Workshop to be held at the Congo Basin Institute in Yaoundé, Cameroon in July 2016.

Ben Kraemer leading a session.

Partnership in Research and Education workshop group photo.

WORKSHOP REPORT II

Undergraduate Study Abroad Field Course for the National Science Foundation's Partnership in Research and Education

From June 21-July 25, 2015, 20 undergraduate students from the U.S., Cameroon, and Equatorial Guinea met in Yaoundé, Cameroon to participate in a study abroad in Africa field course sponsored by the National Science Foundation as part of a Partnership in Research and Education (PIRE) grant. The overall aim of the program was to provide training in the fundamentals of tropical field research. Instructors from Drexel University, UCLA, University of Hong Kong, University of Buea, National University of Equatorial Guinea, IBAY, and University of Halle-Wittenberg provided an intensive three and a half week field course for undergraduate students that focused on hands-on experiential learning and training in biodiversity research.

U.S. and African students worked collaboratively in teams to: 1) design an independent research project in tropical ecology; 2) collect data and analyze results; 3) write a report in the format of a scientific publication summarizing the aims, methods, results and conclusions of the research project; 4) present project findings to participants and instructors at the end of the course.

Amancio Motove Etingüe taking morphometric measurements of a bird.

Alexandra Ley providing field instructions on plants.

The research projects were focused around a choice of taxonomic groups that included large mammals (great apes, forest antelope), plants, amphibians, birds and butterflies. Students also had the opportunity to conduct socio-economic surveys of communities surrounding the field sites and received hands-on training in the research methods required to undertake their studies. Under instructor supervision, students formulated hypotheses, collected and analyzed field data, and provided a short scientific report on their findings. The first three days of the program included classroom-based lectures, literature discussions, and guided seminars focused around the development of their team research project.

For the field component of the course, the entire class and instructors travelled to the Ebo Forest and stayed for five days at the San Diego Zoo Global/Ebo Forest Research Project research station. They then travelled to the WCS training center at Mbam et Djerem National Park for five days. During this time, students were expected to collect field data in teams, organize their data for analysis, and kept a field log. Upon return to Yaoundé, students analyzed their data, presented their research findings, and wrote up their project report.