UCLA
Institute of the
Environment and Sustainability

Center for Tropical Research

NEWSLETTER

Summer 2017

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Letter from the Director

The Congo Basin is the second largest tropical rainforest in the world, stores an estimated 25-30 million tons of carbon stocks, and is home to nearly 20% of Earth's species. It is ground zero for the potentially devastating impacts of climate change on food and water security, human health, and the environment. Of the poorest billion people on Earth, 70% live in Sub-Saharan Africa, including some of the most extraordinary indigenous groups. Meeting ambitious global conservation goals requires that we succeed in conserving the Congo Basin. The **Center for Tropical Research (CTR)** along with partners is helping to lead efforts to build the **Congo Basin Institute (CBI)**, a new network that drives research in Central Africa through technology development, scientific excellence, capacity building, and local participation. CBI conducts the science needed to make smart conservation decisions. Recently, CBI opened two **research stations** at Somalomo and Bouamir. The village of Somalomo sits on the edge of the Dja Biosphere Reserve, and represents the human side of the interface between people and forest. The second site, the Bouamir Research Station (that operated for 8 years in the 1990's), is located at the western center of the Dja Biosphere Reserve. The station hosts researchers and students for research and classes. Reaching the station requires a 30-km hike from Somalomo; it is not accessible by motorized vehicle. To inaugurate the Station, last February, Professor Greg Grether and myself were delighted to teach a three-week UCLA undergraduate field course. Embedded in this remote rainforest setting, the UCLA students partnered with Cameroonian students to carry out an array of group research projects. It was a wonderful life changing experience for all. Go to pages 5-7 to read the story or **click here**.

I hope you enjoy reading our latest newsletter that features CTR postdoctoral fellow, Rachael Bay, working on the **Bird Genoscape Project**, and her penetrating research on corals (our lead-in photo was taken by her) illustrating why an evolutionary perspective is essential for understanding and mitigating the effects of climate change.

Best wishes,

Tom Smith
Director CTR

FEATURED ARTICLE

Evolution in a Changing World

by Rachael Bay

Coral reefs on Ofu Island, American Samoa experience much higher temperatures than the rest of the region

People change the environment in many ways. We build large concrete structures, we plant vast fields of crops, we cut down trees, we plant other trees, we drain waterways, and we dam others. All of these changes impact wildlife. Sometimes change can be detrimental, especially if animals can't live in the new environment we've created. In effect, we are introducing brand new conditions that have never before been seen in history; in order to survive, animals must come up with novel ways to deal with them.

Evolution can sometimes help animals adapt to the novel environments that we've created. Rare traits that suddenly help them survive in new conditions can become more common and new creative solutions sometimes arise. A classic example of adaptation to human-altered environments is coloration in peppered moths. Historically, most of the moths were white, but some individuals had a rare mutation that made them black. It's likely that being white helped the moths blend into tree trunks and avoid predators. During the industrial revolution, however, dark-colored moths blended into surfaces covered in soot and became much more common, probably because they had better camouflage. At one point, 98% of moths were dark-colored in areas with coal-burning factories. This is a prime example of how evolution made moths better able to survive in an environment that had been dramatically altered by human activities.

Perhaps one of the most dramatic and far-reaching environmental shifts that humans are causing is climate change. Carbon emissions have been increasing steadily in recent decades and experts estimate that most places will be 0.3-4.8°C warmer by the end of this century. But temperature isn't the only change we expect to see. Rainfall patterns are changing, with dry places getting drier (as evidenced by the current drought in California) and sea levels rising. This all means that many animals will experience climates that are hotter and drier than they have ever seen – some already have. One major focus of my research has been to examine and predict how animals will respond to these unprecedented changes.

During my PhD, I studied adaptations of corals to warming oceans. Coral reefs are an extremely important

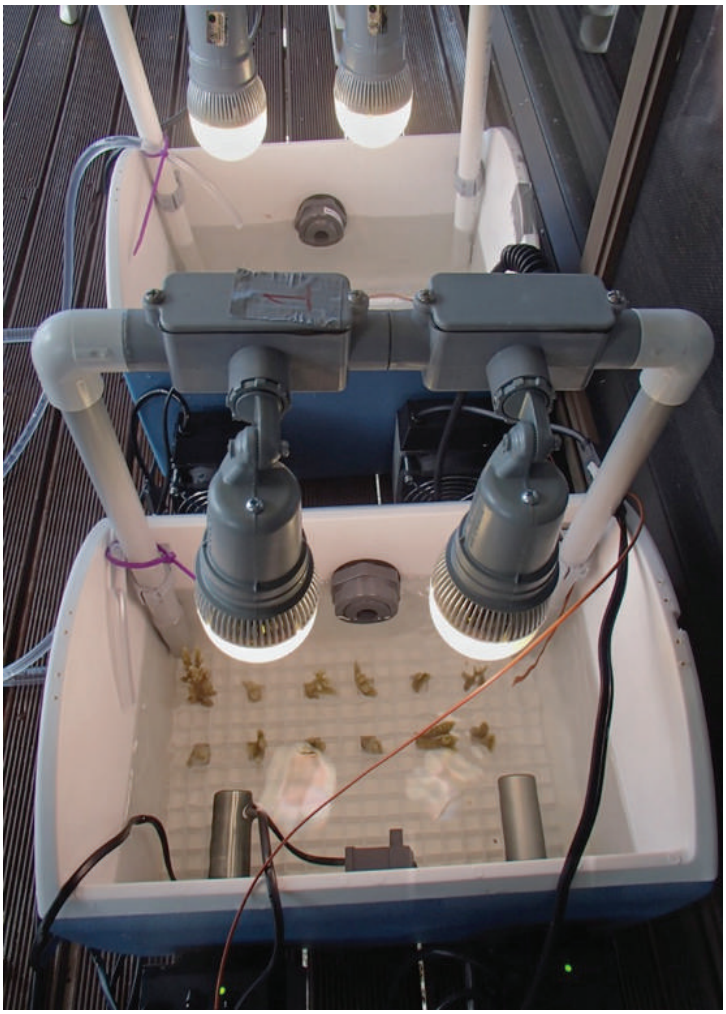
Rachael Bay monitors corals on Ofu Island, American Samoa
Credit: Megan Morikawa

ecosystem. Between providing food, an ecotourism industry, and coastal protection for over a billion people, the services that coral reefs provide are valued at $29.8 billion annually. Corals, the animals that build these tremendous reefs, are extremely sensitive to changes in their environment, especially temperature. Most research shows that warming of 1-2°C will cause ocean temperatures to surpass the tolerance of most coral reefs. Some reefs, however defy this rule, and tolerate much higher temperatures than is usually expected. In American Samoa, on a remote island called Ofu, there is a reef where the temperatures reach 3-4°C hotter than the rest of the region, but the corals there are still healthy. What make these corals so special? Studies I did focused on figuring out why corals on this particular island are so resistant to heat and what this means for these and other reefs in the future.

Coral transplants on the Ofu reef

By transplanting corals from the heat tolerant population to a nearby, cooler location, my colleagues and I were able to examine the traits that made this reef so special. First, we found that corals from this reef kept their heat tolerance no matter where they were transplanted. We tested heat tolerance using modified coolers rigged as temperature-controlled aquariums to subject the corals to hotter temperatures after they had been transplanted for an entire year. The fact that these corals did not lose their heat tolerance suggests that there is a genetic basis for resistance to the abnormally high temperatures they experience. We also found that these corals were strong survivors: transplanted corals from the heat tolerant population had 22% higher survivorship than corals from a cooler nearby reef. Although they were better at surviving, however, the heat tolerant corals were the slowest growing. All of this evidence together led us to believe that corals on this reef had evolved a heat tolerant, high surviving, slow growing physiology that was better adapted to life under warmer conditions.

I looked into the genome to understand how these corals



Portable aquariums made from coolers are used to test coral heat tolerance

may have evolved resistance to heat. By comparing the genomes of corals from the warm location to those from a cool location, I saw some differences that could explain the unexpected tolerance to high temperatures. Very rare mutations in about 100 genes were more common in the heat tolerant corals. We think that these rare mutations could unlock higher tolerance to warming oceans. Because these mutations already exist, perhaps they will spread to other nearby reefs as they become more needed. Whether this can help coral reefs persist into the future will depend on whether these mutations can spread fast enough to keep up with the rate of ocean warming.

Uncovering genes that could make corals pre-adapted to warming oceans made me wonder what other systems have this type of climate-change-ready mutations. Because we can now look at the genome of any animal or plant, we can now answer this question in any organism. As a postdoc at CTR, I am working on the Bird Genoscape Project. I am using genomic techniques to look at migration and climate adaptation in North American migratory birds. My main project focuses on a very broadly distributed bird, the Yellow Warbler.

Although Yellow Warblers are quite common, habitat destruction has led to their decline in some areas. In California, they are now listed as a species of concern. Yellow Warblers spend the winter in Central and South America and then migrate to North America, where they spend the summer breeding and delivering offspring. During the breeding season, they can be found anywhere from California to Alaska to Nova Scotia. This extremely broad range means that breeding Yellow Warblers occupy a wide variety of habitats during the summer, from the temperate rainforests of British Columbia and Seattle to the dry inland plains of the midwest. One of the questions I am addressing is: do Yellow Warblers have genetic differences that make them better suited to different habitats?

To answer this question, I am sifting through the genome. But first, I needed to build a genome! Our Yellow Warbler genome is the very first for this species and the second for any warbler species. With this genome, I was able to look at mutations in over 200 Yellow Warbler individuals from across North America. After sorting through about 5 million mutations, I uncovered some mutations that were related to climate. In this case, birds living in wet places had quite different genetic makeup than birds living in dry places. Hundreds of genes across the genome had different mutations depending on how much precipitation occurred at the bird's breeding site.

So what does this tell us about climate change? The fact that "wet" and "dry" genes exist tells us that evolution has already created mutations to deal with these types of environments. But can these mutations spread and become common rapidly enough to keep up with climate change? One way to ask this question is to see whether it has happened in the past. The next step of this project is to see whether mutations that differ between birds that inhabit different environments now have become more or less common over the last century, tracking climate change that has already occurred. We can look at genes in museum specimens to track changes in climate genes over time.

Understanding how and whether animals can evolve to deal with changes in their environment can help us make decisions to protect them. Knowing which genes are important to future survivorship, we can prioritize conservation of tolerant populations that harbor these important genes, for example the heat resistant corals on Ofu. Ultimately, understanding how these mutations spread will help us predict whether species will survive the new conditions we humans have created.

Yellow Warblers have genes that help them adapt to wetter and drier climates
Credit: Daniel Karp

FEATURED ARTICLE

Students re-establish vital foothold for research deep in African rainforest

by David Colgan with contribution from Jessica Arriens

UCLA and Cameroonian students re-open a long-shuttered field station in the jungle

Please see article below that was **featured in the UCLA Newsroom** about the re-opening of the Bouamir Research Station and a recent field course held on-site.

Reprinted with permission from David Colgan.

In February 2017, a motley crew of college students from UCLA and Cameroon left modern-day conveniences behind and plunged into the rainforest. Their objective: to reopen a remote field station that had been shuttered for two decades and take the pulse of local wildlife.

Through their efforts and UCLA's Congo Basin Institute, the Bouamir research station is again open for business – welcoming researchers from around the globe who want to learn about the diverse life in the Dja Reserve, a rainforest sanctuary in south-central Cameroon.

As the students traveled from the capital city of Yaoundé to their destination, local Baka and Bantu villagers greeted them with dancing and celebrations. The fun quickly gave way to hard work as they confronted the realities of doing field research in a jungle. The station itself is 18 miles from the nearest village, so getting there required a daylong hike. Then, starting at dawn each day, the students conducted field work at a primitive site that no one would confuse with the Ritz-Carlton: The latrine was a simple hole in the ground. To bathe, they went to a creek with buckets. For someone used to measuring hikes in terms of Pokémon Go rewards, it was challenging, UCLA student Emily Chen admitted. "The first few days, my mentality was just trying to make it through," Chen said. "Then I embraced it."

Emily Chen, a UCLA student, and Honourine Mengwi, a Cameroonian student, relax for a moment after a day of field research.

The students conducted wildlife surveys, researched butterflies and compared local birds they studied to other populations in Africa. The work was part of a Field Biology Quarter class offered by UCLA's Department of Ecology and Evolutionary Biology and taught by professors Greg Grether and Tom Smith. Their efforts paid off in surprising good news: Despite a growing market for bush meat and other threats to biodiversity, most species in the reserve appeared to be thriving.

During the 1990s, biologists, using the Bouamir station as their research headquarters, published nearly 50 papers on the region's rich biodiversity that includes forest elephants, hornbills, endangered western lowland gorillas, chimpanzees and pangolin. Smith, director of the Congo Basin Institute and a professor with UCLA's Institute of the Environment and Sustainability (IoES), was one of those early researchers. "We lived right in the middle of [the reserve] for eight years," Smith said. "It was fabulous."

The reopening of Bouamir falls in line with the institute's broader goals. The basin of the Congo River in west central Africa has long suffered from brain drain, leaving it without the human resources it needs to confront major problems, such as food insecurity, infectious disease outbreaks and the effects of climate change. The institute aims to change that, and the first step, Smith said, is to retain scientists by giving them proper facilities and support to do their work.

UCLA and Cameroonian students meet with Baka guides at the Bouamir research station.

Unfortunately, the nongovernmental organization that provided logistical support for the researchers went belly-up, and the site, which was not under the purview of UCLA at that time, was abandoned. It was a big loss for the scientific community as well as a potential threat to local wildlife – the constant presence of scientists was a powerful deterrent against would-be poachers.

But, Smith said, "It just got too difficult to maintain." When he launched the Congo Basin Institute seven years ago as a regional base for scientific research and education through his Center for Tropical Research, part of the IoES, he said, "We decided that one of the things we wanted to do ... was re-establish this station."

In addition to the new field station, the institute has modernized its research facilities in Yaoundé with laboratories for remote genetics, a geographic information system, remote sensing, as well as analytics labs for water, soil, plant tissue, entomology and pathology.

The institute also helps visiting scholars navigate a complex web of local and national governments. Institute biologist Kevin Njabo, who grew up in Cameroon, has become an expert at bridging the gap between scientists and local officials. "We have a huge language barrier," Njabo said. "And, at times, the bureaucracies in these areas can be very slow, so we start working with government way in advance."

Since the institute opened a small center in Yaoundé, it has steadily grown. More than 2,000 scholars from 20 countries have now passed through. By partnering with the International Institute of Tropical Agriculture, the Congo Basin Institute seeks to grow further to develop a network of hubs that will protect biodiversity and improve residents' lives.

As a Cameroonian, Njabo said, "We are very blessed and lucky to have this university coming in and wanting to stay. We put in everything we've got at every level to make sure this program is successful."

Romeo Kamta Tchoffo, a Cameroonian graduate student who helped reopen the field station, said he relished doing field work with UCLA scientists. "In our country there is a lack of application," Tchoffo said. "You are asked to read a book and understand how biology works, but you do not have the opportunity to be in contact and practice what you have learned."

For UCLA students, the trip was a chance to become totally immersed in the environment they are studying – a lush rainforest with vine-covered trees inhabited by screeching hyrax – small, herbivorous mammals. Students took their morning baths in a creek as white-nosed guenons – forest monkeys – peered down at them from the forest canopy.

Smith wasn't sure what he'd find in the Dja Reserve upon returning to the place he grew to love in the 1990s. With a rise in poaching, he feared entire species could be wiped out. He was immensely relieved to discover a stable, lively ecosystem with elephants, monkeys and birds. The reopening of Bouamir will ensure it stays that way. "This time, we need to hang on to the site and maintain it," Smith said.

Through the Congo Basin Institute, Smith hopes to extend that kind of support across a region that's home to 70 percent of the poorest inhabitants on Earth, numbering about 1 billion people, where diverse wildlife lives directly on the front lines of environmental threats. From there, he said, the entire continent can be transformed.

"My hope is that we will see an Africa that is feeding itself, using sustainable approaches on energy and preserving the natural environment," Smith said. "There's this mantra that you get from aid organizations: 'The trouble with central Africa is that it's bad governance, and it's never going to get any better until they democratize.'

"The flipside of that is that they're never going to do that if the best and brightest aren't living there," Smith said. "The more you can keep those people there, engaged and contributing, the more effective you're going to be in the long run."

Students taking a Field Biology Quarter class offered by UCLA's Department of Ecology and Evolutionary Biology prepare nets to capture butterflies in the Dja Reserve.

News from the Congo Basin Institute (CBI)

Two years ago, UCLA and the International Institute of Tropical Agriculture (IITA) formed a partnership to create the **Congo Basin Institute (CBI)** in Yaoundé, Cameroon. CBI became UCLA's first foreign affiliate in 2015 and has been growing rapidly ever since. CBI is now serving as a regional hub of research, innovation, and capacity building in the Congo Basin.

Our existing facilities include accommodations and research facilities in Cameroon's capital of Yaoundé, and a research camp that was developed in the south east of the country. **Accommodations** for researchers and students visiting Cameroon are available at CBI Bastos in Yaoundé, Cameroon. There are furnished individual and bunk rooms, kitchen, bathrooms, workspaces and WIFI internet access. The accommodation is in a gated complex with 24-hour security guards in the Bastos neighborhood of Yaoundé. Over 2,000 researchers from 15 counties have stayed at the facility since it opened. CBI Bastos is becoming a hub for collaborations between African and international researchers. In addition, CBI's existing **research facilities** are available for rent. Existing facilities include a remote GIS/remote sensing research and training facility, a plant tissue culture laboratory, and a molecular genetics laboratory.

In even more exciting news, CBI is pleased to announce the re-opening of a **Research Field Camp** located in the Dja Biosphere Reserve. In 1993, the Bouamir Field Camp was established in a 25km^2 study area, and the Field Camp was operational for eight years as part of an integrated study of forest regeneration and the birds and mammals that disperse rainforest tree seeds. Officially redeveloped and now open, the Bouamir Research Camp provides a one-of-a-kind opportunity for researchers and students to collect data in situ in one of the most biodiverse ecosystems in the world. It offers a research tent for sample processing, as well as camp sites for sleeping, cooking, and eating and will accommodate groups of up to 20 researchers and students. An adjacent Somolomo field station is also open for those that wish to work in secondary forest. **Click here for more information.**

The Field Camp includes three large platforms—one for use as a laboratory, one for dining and a kitchen. There are four additional platforms for sleeping.

Sustainable Ebony Project

We are pleased to announce the launch of the **Sustainable Ebony Project** with funding from Bob Taylor of Taylor Guitars. Despite its economic importance, the ecology of West African Ebony (*Diospyros crassiflora*) remains poorly understood and there is no sustainable agroforestry or plantation-based production of ebony currently being implemented in Central and West Africa. Models for production are available but the basic life history characteristics such as phenology, pollinators, seed dispersers, and environmental requirements for optimal growth remain largely unknown. Thus, there is an urgent need for implementing production models while testing and developing approaches that can inform long-term sustainable management.

Under the umbrella of the Congo Basin Institute (CBI), including: 1) UCLA's Center for Tropical Research (CTR), directed by Dr. Thomas B. Smith, 2) the International Bilingual Academy/High Institute of Environmental Science (IBAY SUP), directed by Dr. Zachary Tchoundjeu, and 3) the International Institute of Tropical Agriculture – Cameroon (IITA), directed by Dr. Rachid Hanna, we are implementing an integrated program to develop West African Ebony stocks and to provide essential information for sustainable harvest practices of the species in Central Africa. Work will take place at CBI's Yaoundé campus and Bouamir Research Camp.

The goal of the program is to enhance ebony stocks through community engagement while collecting crucial data to refine techniques for production and management.

To achieve this goal we are undertaking four integrated activities:

1. Create a scalable program for the sustainable production and stewardship of ebony seedlings in rural areas.
2. Model West African ebony distributions to identify suitable harvesting and planting areas.
3. Understand the basic ecology of ebony, including identification of pollinators and dispersers necessary to enhance natural reproduction and dispersal; test alternative restoration approaches to determine the most successful methods.
4. Test alternative production approaches, including tissue culture laboratory experiments, to identify optimal conditions for cultivating ebony.

The Congo Basin Institute (CBI) also invited Taylor Guitars to act as a client for a UCLA Institute of the Environment and Sustainability (IoES) Senior Practicum project to develop an outline for a sustainable ebony market. Five environmental science majors spent three quarters conducting a literature review, collecting data, and developing a draft work plan for how the ebony market in Cameroon could be sustainable. The undergraduates traveled to Cameroon in March 2017 for a hands-on experience addressing this complex environmental challenge, working with people from other cultures.

Click here for more information on the ebony project.

Click here for more information on the Taylor gift.

Students learn the art of planting ebony trees in Cameroon to aid sustainability efforts.

WORKSHOP REPORT

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

by Jessica Arriens

For the past four summers, a group of young conservation professionals – from the U.S. and Central Africa – have gathered for a workshop. They've learned how to run statistics packages in R, fuse phylogenetic trees onto maps, and give an effective presentation. But the strongest lesson from these annual gatherings may be something less tangible, and more powerful: Sometimes, global scientific collaborations are forged not over email, or in academia's hallowed halls, but over a cup of lemongrass tea.

The professional development workshops were held as part of the Central African Biodiversity Alliance (CABA), an international research partnership developing a conservation framework for Central Africa, one both evolutionary-based and rooted in the region's socio-economic realities.

The 2016 five-day workshop was held in Yaoundé, Cameroon, on the Congo Basin Institute campus. The workshops began in 2013 – the year CABA received funding through the National Science Foundation's PIRE program – and have been held in both Cameroon and Gabon. Click here for a recap of the 2014 workshop.

A student works on data visualizations in the R programming language

I am a relative latecomer to the world of conservation professionals – young or otherwise – having studied and worked in media fields for the better part of the last eight years. So I arrived at the workshop puppy-dog eager while also buzzing with nerves. Meeting the students eased those nerves. We celebrated small coding victories together (merci, Ruth!). They taught me about the abounding challenges and opportunities that come with doing research in Central Africa. I saw relationships form, the seeds of collaboration sprouting as shared interests were discussed.

This may be the most lasting legacy of these workshops. Before 2013, it was often easier for students in Central Africa to collaborate with researchers in the U.S. than their African neighbors. CABA has helped change that, with these opportunities to learn and connect (and yes, share lemongrass tea).

The goals of the workshops are at once simple and grand: train students on the tools and technology required for research today, build relationships between young scientists and seasoned conservation practitioners, and establish long-term, robust international collaborations.

At the 2016 workshop there were young scientists of all levels – first-year graduate students to post-docs and employed researchers – from Cameroon, Gabon and Equatorial Guinea. They had research interests as varied as the region's biodiversity: botany, pollinators, skinks, butterfly speciation, avian malaria, and on and on.

The intense coursework included lessons in GIS, population genetics and statistical analysis; sessions on conservation action plans and scientific communication helped students learn how to apply their research as a conservation professional. Evening lectures from distinguished researchers offered insight into specific CABA-related projects. To see so many bright young people, eager to learn, hungry to protect their country's rich biological resources, was nothing short of inspiring.

Students celebrate with their certificates of achievement at the end of the workshop

FIELD REPORT

Field Biology Quarter – An Undergraduate Perspective

by Kayla Arjasbi

I've studied science in school for many years, but never like I did this quarter at UCLA. I've read through scientific textbooks, lecture slides, and taken classes in ecology, genetics, physiology, microbiology, endocrinology, and many others. I love science and always have. I continue to be fascinated by the things scientists have discovered and are still discovering. But there's a problem with my science education—I've never tried to do science! Yes, there are labs at school, but those are premade and have instructions, and have been performed hundreds of times before by many students who have found similar results. What we find from those labs cannot be anything but ancient and automated. Isn't science about making new discoveries and being creative? Thankfully, the 2017 Field Biology Quarter (FBQ), a class offered by UCLA's Ecology and Evolutionary Biology department, gave a lucky group of students the opportunity to do something different with science.

During FBQ, students were not asked to do the typical things a student may be asked to do in a science course. We read published scientific articles and discussed their strengths and how they could be improved in seminar-like settings. We learned how to use advanced statistical software used by scientists to analyze our data. We spent hours hiking in the tropical rainforest of southeast Cameroon and collected our own data using actual field equipment. We worked in groups, made mistakes, and worked through them. Most importantly, we got the chance to use our creativity by designing our experiments ourselves.

FBQ students, Cara Newberry, Adrian Lizardo, Honourine Mengwi, Kayla Arjasbi, take a break from butterfly catching.

When I think about scientific experiments and discoveries, I think of Darwin's discoveries in the Galapagos, or Mendel's experiments in his pea garden. I also think about the definition of the scientific method, which includes making a hypothesis and outlining a procedure to test this hypothesis. As science students, this is what we learn and this is what we know. But what if my procedure doesn't work? What if I find my hypothesis is not actually something I can test? These are questions scientists may ask themselves frequently, but they are not the questions asked to science students. We learn about science ideally, not practically. We learn about the successful experiments and the well-accepted theories without truly ever understanding the creativity, unpredictability, and collaboration that goes into science. In other words, what we gain is only a surface-level understanding of science.

FBQ student Taylor Roswall poses with a chameleon found near the FBQ field camp

One FBQ group researched butterfly biodiversity across different microhabitats.

To truly have a deep and profound understanding of a subject requires much more than hearing about it. It requires practice, and trial and error. It requires attempting to carry out an original project by applying background knowledge, making mistakes, and collaborating with others. The FBQ at UCLA gives students this opportunity: to apply what they know in a realistic and professional setting with guidance from experts. In my opinion, this is what it means to learn and it is an integral part of education—something more students should get the opportunity to explore during their academic careers.

The Bird Genoscape Project Update

CTR is pleased to announce that we have two new graduate students, Michaela Brinkmeyer (Mikki) and Kelly Barr, taking the lead on making the goals of the **Bird Genoscape Project** a reality. Mikki is working on building a genoscape for American Kestrels while Kelly is working on Burrowing Owls and Tricolored Blackbirds.

American Kestrel

Credit: Julie Heath

All species of North American raptors, including the American kestrel (*Falco sparverius*), are monitored during migration by counting individual birds at watch-sites that are stationed along major migratory flyways. We use migration-count data to estimate and monitor changes in population trends. However, American kestrels are shifting the timing and patterns of their migratory movements, which could make inferring population trends from migration-counts difficult. If we want to maintain the utility of migration-counts into the future, we need to develop methods for understanding which populations of American kestrels are being monitored at migration watch-sites, and how migratory movements of those populations are changing over time. Once we have the ability to track specific breeding populations across the annual cycle, then we will be able to determine which populations are declining and where they are most limited.

Researchers at CTR have partnered with Boise State University, The Peregrine Fund's American Kestrel Partnership, and HawkWatch International to develop high-resolution molecular markers to identify breeding populations of American kestrels in North America. In 2016, we sampled nine locations on the peripheral edges of this species breeding range. This year we are trying to develop new partnerships so that we can sample as many breeding locations as possible. The more locations we can sample, the better our tools for tracking populations will be in the future. If you monitor American kestrels during the breeding season, we need your help! If you would like to contribute to this large collaborative project, please contact me, Michaela Brinkmeyer at michaelabrinkmeyer@boisestate.edu. Thank you!

Burrowing Owls

Burrowing owls (*Athene cunicularia*) are a declining species that has been directly impacted by habitat loss and novel structures in flyways, such as wind turbines. These small birds of prey are heavily managed, with numerous captive breeding and capture and release programs throughout its North American range. These efforts are presently conducted without vital information about fine-scaled genetic relationships among groups. Working with cooperators such as the Global Owl Project, San Diego Zoo Institute for Conservation, and San Jose State University, collaborating with the Institute for Bird Populations, and with funding from the California Energy Commission, we are obtaining samples from Burrowing Owls range-wide and will be using cutting edge conservation genomic techniques to analyze genetic and migratory connectivity. With the resulting genoscape, we can provide an invaluable resource for future conservation and recovery efforts and determine the level of impacts of individual wind energy sites on local populations. As with the American Kestrel, the resolution of the genoscape can only be improved with additional samples and sample locations. Should anyone have access to Burrowing Owls, please contact Kelly Barr at kellybarr@ucla.edu.

Credit: Alex Houston

Credit: Daniel Karp

Tricolored Blackbirds

Credit: Robert Meese

A near endemic to California, Tricolored Blackbird populations throughout the state have crashed over the previous century. Whereas the colonial songbird was once thought to number into the millions, recent surveys in the state accounted for ~150,000 Tricolored Blackbirds in 2014. This most recent survey suggested a 44% decline from a previous survey in 2011 which itself had captured a 34% decline since 2008. The species was recently listed as Endangered by the state of California and is currently under review for federal protection. With funding from the UC Conservation Genomics Consortium and the UCLA La Kretz Center, we are analyzing population structure and genetic diversity patterns among extant Tricolored Blackbird breeding groups to facilitate the considerable on-going conservation efforts by state and federal agencies, non-governmental organizations, and private companies. We will provide a genoscape that will identify current genetic connectivity patterns throughout the songbird's range and identify trouble spots, such as restrictions to gene flow and populations in isolation.

Common Yellowthroats and Lights Out Program

A significant part of the Bird Genoscape Project involves collecting feathers of our target taxa from across their breeding, migrating and wintering range. A project of this scale would not be possible without our collaboration with hundreds of bird banders and researchers across the continent. More recently, we have also partnered with Audubon's Lights Out program to specifically obtain feather samples of Common Yellowthroats along their migration routes. The Lights Out program is a national effort initiated by Audubon to reduce the number of nighttime bird-window collisions by simply encouraging building owners and managers to turn off or reduce excess lighting during prime bird migration months. They also work with volunteers to collect birds that were either injured or killed by such collisions and take them to wildlife rehabilitation centers and museums respectively. By collaborating with local Lights Out programs or with the associated museum directly, we are able to acquire the feather samples we need to build a genoscape for Common Yellowthroats.

Credit: Gerrit Vyn

CTR Updates

New Websites

We are pleased to share with you a newly redesigned **Center for Tropical Research** website, as well as new websites for the **Congo Basin Institute** and the **Bird Genoscape Project**.

CTR Updates

Field Research

Nicola Anthony organized an undergraduate Topical Biology and Conservation field course from July 17-August 7, 2016 held in the Gamba Complex of Protected Areas in Southern Gabon in collaboration with the Smithsonian Conservation Biology Institute and the Université des Sciences et Techniques de Masuku (USTM). Ten students from a broad range of institutions across the U.S. were partnered with ten students from USTM on a diverse array of biodiversity related projects. Students were placed into five research teams made up of two U.S. and two African students each with its own research and taxonomic focus including reptiles, birds, small mammals, insects and plants, and large mammals. Instructors also came from a broad range of institutions including across the U.S., Gabon, Cameroon, and Europe.

Scott Carroll and **Jenella Loye** have been testing many repellent products against tropical mosquitoes this year due to the increased interest in Zika virus and its vectors in their lab.

Vincent Deblauwe has joined the Congo Basin Institute as its first official postdoctoral researcher in Yaoundé, Cameroon. Vincent will be performing fieldwork and research on the sustainable ebony project on CBI's campus and the newly re-opened Bouamir Research Camp.

Trevon Fuller helped teach the NSF Professional Development Workshop 2016 at the Congo Basin Institute in Yaoundé, Cameroon lecturing to Cameroonian, Gabonese, Equatoguinean, and US graduate students about GIS, R, and statistics. He also conducted focus group interviews with cacao farmers in Nguti in southwestern Cameroon to assess their perceptions of the impacts of climate change on agriculture.

Piotr Jablonski and his collaborator conducted field research in Vietnam on the world's largest species of water striders, *Gigantometra gigas*. The expedition resulted in finding a viable population of this species in the area of the Pu Mat National Park that described the biomechanics of their jump locomotion on the water surface.

Brenda Larison continues to work on the question of why zebra are striped and is also working to understand the genetic control of striping. She received a new grant from the National Geographic Society allowing her to conduct further studies on the subject and travel to South Africa to collect new field data.

Jenella Loye spent a term at Stellenbosch University in South Africa working with scientists there on the invasive Neotropical Balloonvine *Cardiospermum grandiflorum* and the native South African soapberry bugs that have switched to using it as a host. This extends work conducted in Australia on a similar system. In a different term, Jenella and her research team worked in remnant subtropical forests of the lower Rio Grande Valley of Texas to study both mosquito response to spatial repellents and to establish study sites for a long term project on Sapindaceous hosts of soapberry bugs in the Americas.

Thomas Smith and **Brenda Larison** served as field instructors for the PIRE undergraduate Tropical Biology and Conservation field course from July 17-August 7, 2016 held in the Gamba Complex of Protected Areas in Southern Gabon. Thomas was also a co-instructor for UCLA's Field Biology Quarter held deep in the remote forests of the Dja Reserve in Cameroon at the newly re-opened Bouamir Research Station this past February.

Kristen Ruegg, Jasmine Rajbhandary and **Winnie Le,** with collaborators from the Institute for Bird Population (IBP), carried out a field trip in Point Reyes, California in June 2016 to collect blood samples for the Bird Genoscape Project. They used mist nets and song playback to specifically target Common Yellowthroats, but also participated in the IBP Monitoring Avian Productivity and Survivorship (MAPS) banding session in Marshall, where they collected feather and blood samples from several other species as well.

CTR Updates

Field Research

Borja Milá has obtained a grant from the Spanish government to work on the ecology and evolution of birds that have become differentiated on Guadalupe Island, in the Mexican Pacific. These species include the endangered Island Junco (*Junco insularis*) or the Guadalupe House Finch (*Haemorhous mexicanus amplus*). They are using morphology, colorimetry, song, physiology and genomics to understand how birds adapt to extreme environments and why birds on islands look so different from their mainland relatives. This work is conducted in collaboration with Grupo de Ecología y Conservación de Islas (GECI), a Mexican conservation NGO.

Ravinder Sehgal and **Kevin Njabo** in collaboration with scientists at the University of Buea and the University of Dschang in Cameroon continue to work 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.

Kevin Njabo is teaching an intensive 3 week field course in Tropical Ecology and Conservation Biology in Cameroon from July 5-27, 2017. This course, geared towards university students, will have a strong focus on hands-on experiential learning and training in biodiversity research. The course is organized by the Tropical Biodiversity and Conservation Program, an NSF PIRE-sponsored program jointly coordinated by Drexel University, the University of California Los Angeles (UCLA), and the Central Africa Biodiversity Alliance (CAB Alliance). A total of 25 undergraduate/MSc 1 students will participate in this course, half of which will be from U.S. institutions and the other half from Cameroonian and Equato-Guinean universities. It will include activities at the UCLA Congo Basin Institute/International Institute of Tropical Agriculture (CBI/IITA), International Bilingual Academy of Yaoundé (IBAY-SUP), the Njuma research station of the Ebo Forest Research Project (EFRP) in the Ebo Forest, and the training center of the Wildlife Conservation Society (WCS) at Mbam and Djerem National Park.

CTR Updates

Other News

Kelly Barr joined the Center for Tropical Research as a Ph.D. student. He will be working on the Bird Genoscape Project focusing on Burrowing Owls and Tricolored Blackbirds and has received grants from the Pasadena Audubon Society and the UCLA La Kretz Center. His research will facilitate future conservation and recovery of these two declining species by providing information about range-wide genetic and migratory connectivity. Kelly is collaborating with biologists throughout each bird's range to obtain genetic samples, and is also filling in gaps with sampling efforts of his own.

Scott Carroll spent a quarter as a Senior Research Fellow at the Centre for Invasion Biology at Stellenbosch University in South Africa where he worked on evolutionary approaches to improve species management in the biotic communities of mixed native and recently introduced species that are coming to dominate much of the biosphere. He is also co-chairing a two-year international working group called 'Living with Resistance' sponsored by the National Socio-environmental Synthesis Center in Annapolis. Its aim is to devise socio-ecological systems that can better support and reward resilient stewardship of susceptibility traits in pests and pathogens.

CTR Updates

Other News

Emily Curd received her Ph.D. from the Department of Ecology and Evolutionary Biology at UCLA in June 2016 where she studied the long-term effects of habitat conversion on soil microbial biodiversity and function. She started a postdoctoral fellowship at UCLA where she is cataloging California's biodiversity using environmental DNA (eDNA) shed into soils. She is also using eDNA to monitor populations of invasive species and also endangered species.

Trevon Fuller received a research grant from the Pan-American Health Organization to interview adults hospitalized with Zika virus in Rio de Janeiro to identify behaviors and environmental factors that lead to the transmission of mosquito-borne viruses in cities. Trevon also gave a lecture at the Leonel Fernández Foundation for Democracy and Development in Santo Domingo in the Dominican Republic entitled "Using Modeling to Predict Spread and Minimize Impacts of Arboviruses."

Ryan Harrigan was invited to the California State University, Northridge Biology Colloquium where he presented "The Past, Present, and Future of Vector-Borne Diseases in a Changing World" to an audience of young scientists, students, and the public. Ryan met with graduate students after the talk to advise on modeling methods, advances in spatial analyses, and modeling framework design to assist in their future work.

Rachel Johnston received her Ph.D. from the Department of Ecology and Evolutionary Biology at UCLA in December 2016. She investigated genes associated with bird migration in Swainson's thrushes and studied gene expression variation in gray wolves in Yellowstone National Park. She started a new position as a postdoctoral scholar in Jenny Tung's lab at Duke University where she plans to use genomic techniques to study how social environment influences the immune system in primates.

Ying Zhen received the UCLA Collaboratory Fellowship from the Institute for Quantitative and Computational Biology. Postdoctoral fellowships are awarded to a select group of young scientists who have expert bioinformatics skills, a track record in collaboration and mentoring, and an aptitude and interest in developing further teaching experience. She also gave a poster presentation at the Southern California Evolutionary Genetics & Genomics meeting, USC in 2016.

Jasmine Rajbhandary joined CTR in June 2016 as the new Collections Manager. In addition to managing and organizing the bird samples at UCLA, she is also involved in outreach and communication with bird banders/researchers to coordinate collaborative sampling for the Bird Genoscape Project.

Virginia Zaunbrecher joined the Center for Tropical Research as Associate Director. As a lawyer with a scientific background, Virginia works to find funding for CTR's research and helps translate scientific findings into policy and regulation. Virginia also manages development of the Congo Basin Institute and coordinates its partnerships.

Kristen Ruegg gave a presentation at Tulane University in December of 2015 and at the National Geographic Society in Washington DC in May of 2016 on the Bird Genoscape Project. She was awarded a grant from the California Energy Commission in collaboration with Thomas Smith for their work on the population specific impacts of alternative energy development on migratory birds. She was also awarded a grant from the Department of Defense in collaboration with Boise State University, the Peregrine Fund, and Hawkwatch International for their work on migration and climate change in the American Kestrel.

Ravinder Sehgal is working with Cameroonian scientists at the University of Buea, and Dr. Anton Cornel at UC Davis on a project studying the impacts of deforestation on disease transmission. The work focuses on rainforest birds and mosquitoes and sets out to determine how rapid clearcutting affects the prevalence and host specificity of malaria. He traveled to Cameroon twice in 2016 with funds he received from the National Geographic Society.

Kevin Njabo was elected to the position of Vice President of the Society for Conservation Biology (SCB). This is a global community of conservation professionals devoted to scientific study of the maintenance, loss, and restoration of biological diversity. Kevin was also awarded the IoES Pritzker Environment and Sustainability Education Fellow for 2017, reserved for outstanding teaching contributions. Fellows are selected by their level of expertise, scholarship, potential to contribute to the IoES academic program teaching needs, commitment to providing innovative, and forward thinking courses that focus on environmental and sustainability issues.

CTR Updates

Other News

Kevin Njabo and **Virginia Zaunbrecher** attended the 16th annual Meeting of the Parties of the Congo Basin Forest Partnership (CBFP) in Kigali, Rwanda, November 21-26, 2016. The partnership aims to enhance natural resource management and improve the standard of living in the Congo Basin, and the annual meeting provides an opportunity for stakeholders from government, academia, civil society, and business to gather. Kevin and Virginia lead Stream 5: Knowledge-Based Decision Making, which developed recommendations for increasing the use of scientific findings in regional decision making. The two also spearheaded an effort to conduct semi-structured interviews with stakeholders about the state of knowledge-based decision making in the Congo Basin. The results are being used to inform CBFP activities, and improve conservation decision-making. Virginia was also elected to represent Academic and Research institutions on CBFP's Advisory Council; she will serve a two-year term.

Whendee Silver was elected a Fellow of the Ecological Society of America this year for expanding foundational understanding of carbon, nitrogen, and iron biogeochemistry in tropical forests as well as carbon stabilization and loss from grassland soils and applying this understanding to inform policy and research decisions.

Thomas Smith presented lectures on the "Importance of Preserving Environmental Gradients in a Changing World" at UC Davis and the University of Florida this past Spring 2017, and "Building the Congo Basin Institute" at UC Davis and at UCLA's College Luskin Endowment Inaugural Symposium in 2016.

Corrie Moreau was selected as a Kavli Fellow of the National Academy of Sciences in 2016. The Kavli program honors young scientists who are considered leaders in their fields and have made significant contributions to science. Fellows are invited to attend, present and network at the U.S. and international Kavli Frontiers of Science symposia. Moreau presented a talk titled "The Role of Gut Microbes in Ant Evolution" in the "Microbial Control of Host Behavior" session at the 20th German-American Kavli Frontiers of Science Symposium in Potsdam, Germany in March 2016.

Jessica Arriens joined the Center for Tropical Research as a master's student. She is working on exploring genetic diversity in olive sunbird populations. She recently received a DACOR Bacon House Foundation Fellowship for the advanced study of foreign affairs. This fellowship is awarded once every three years to a UCLA graduate student seeking an internationally focused career; in Jessica's case, she is interested in international conservation policy.

Rachael Bay presented her work using genomic tools to examine population structure and migratory connectivity in yellow warblers to the North American Ornithological Conference and the International Coral Reef Symposium. She also organized a special session on using genomics to predict adaptation at the American Society of Naturalists Meeting.

CTR Updates

Publications & Press

Franck Courchamp and co-authors published a study in *Nature Communications* on the massive yet grossly underestimated global costs of invasive insects that garnered significant attention from the press with over 100 newspaper, magazine and radio hits. This study compiled a comprehensive database of economic costs of invasive insects and by taking all reported goods and service estimates, they found invasive insects cost a minimum of US$70 billion per year globally, while associated health costs exceed US$6.9 billion per year.

Rachel Johnston published work on "Seasonal Gene Expression in a Migratory Songbird" in the journal *Molecular Ecology*. This study assessed regulation of over 11,000 genes as Swainson's thrushes transitioned from the non-migratory to migratory condition, providing evidence that seasonal brain remodeling may be important for birds to migrate. She also published a paper entitled, "Pervasive Effects of Aging on Gene Expression in Wild Wolves" in the journal *Molecular Biology and Evolution*. This study identified broad changes in the immune system of aging wolves in Yellowstone National Park.

CTR Updates

Publications & Press

Sandy Harcourt published several chapters in the textbook *Humankind. How Biology and Geography Shape Human Diversity* (Pegasus Books, 2015). He contributed (Ch.2) Humans originated in the tropics, and initially spread east through the tropics, (Ch.5) The tropics differ from higher latitudes, and so therefore tropical peoples' anatomy and physiology, including reaction to medicines, differ from those of people of higher latitudes, (Ch. 7) Human cultural diversity varies latitudinally in the same way as does biological diversity. I.e. cultural diversity is greater in the tropics, (Ch.9) Diet affects physiology, and so tropical peoples' physiology can be different from others', and (Ch 10) The effect of other species - disease and parasites - on where humans can live is probably stronger in the tropics than elsewhere.

Ryan Harrigan and colleagues recently published work on "Why are Nigeria-Cameroon chimpanzees (*Pan troglodytes elliott*) free of SIVcpz infections?" in the journal *PLoS ONE*. Their work identifies a particular group of chimpanzees in Central Africa that seem to be largely free of SIV infections. SIV, or simian immunodeficiency virus, is the pre-cursor to HIV in human populations, so the finding that some chimpanzees are not infected with this virus could have important public and wildlife health consequences. While there are several factors affecting the prevalence of this disease in chimpanzees, it appears that infection with another virus, simian foamy virus (SFV) occurs in the SIV-free chimpanzees, and it is possible that complex viral competition prevents these chimpanzees from simultaneously acquiring both of these viruses.

Kelly Swing wrote the foreward and several chapters in the new textbook *Mathematical Advances Towards Sustainable Environmental Systems*. This textbook is meant to broaden your understanding of modeling approaches to understand various environmental systems. Kelly also contributed seven chapters and many images to a new book just published in Spanish. "Secrets of Yasuni" is a compilation of some of the most important research that has been carried out at the Tiputini Biodiversity Station in the Yasuni Biosphere Reserve of Amazonian Ecuador over the last couple of decades.

Alex Kirschel and co-authors published a paper in the *Journal of Experimental Biology* on "Smithornis broadbills produce loud wing song by aeroelastic flutter of medial primary wing feather" which garnered press in the *New York Times*, *Science Magazine*, the Audubon Society and the British Ornithologists' Union.

Jaime Chaves and co-authors published a paper in *Molecular Ecology* on genomic variation at the tips of the Darwin's finch radiation, where important genes that shape beak size in these birds via a genome wide approach were identified. This work supports the notion of the importance of few genes of large effect (2 genes in this study) shaping the size of finches and that some of the allelic combinations found in different species might have been the result of alleles "moving" from one species to another via interspecific hybridization. A second paper published in *Molecular Phylogenetics and Evolution* studied the origin of an endemic gecko in Galapagos, the Gecko of the Island of Wolf where the authors performed a phylogenetic study and found that the gecko of Wolf is the last lineage to evolve (as recently in time as 300,000 years ago) and is the result of an independent colonization to the islands. With this data, they completed the evolutionary history of the group and concluded that the diversification of the Galapagos geckos (8-12 species) is the result of 3 independent colonizations (previous to their work it was shown that there were 2 colonizations that gave rise to the diversity of geckos in Galapagos), and these occurred at very different times (12 Million years, 3 Million years, and 300,000 years).

Paula White published a paper with colleagues entitled "Age estimation of African lions (*Panthera leo*) by ratio of tooth areas" in *PLoS ONE*. The method, which has been extensively used in forensic science, has not been previously applied to lions and provides substantial improvement for individual age estimation to within six months on average. A second publication entitled "Individual variation in dental characteristics for estimating age of African lions" in *Wildlife Biology* reports on the surprising result that cementum line counts varied between individual lions' left and right tooth pair. This has important implications for lion aging research, as well as other studies that rely on cementum line counts to age individual animals.