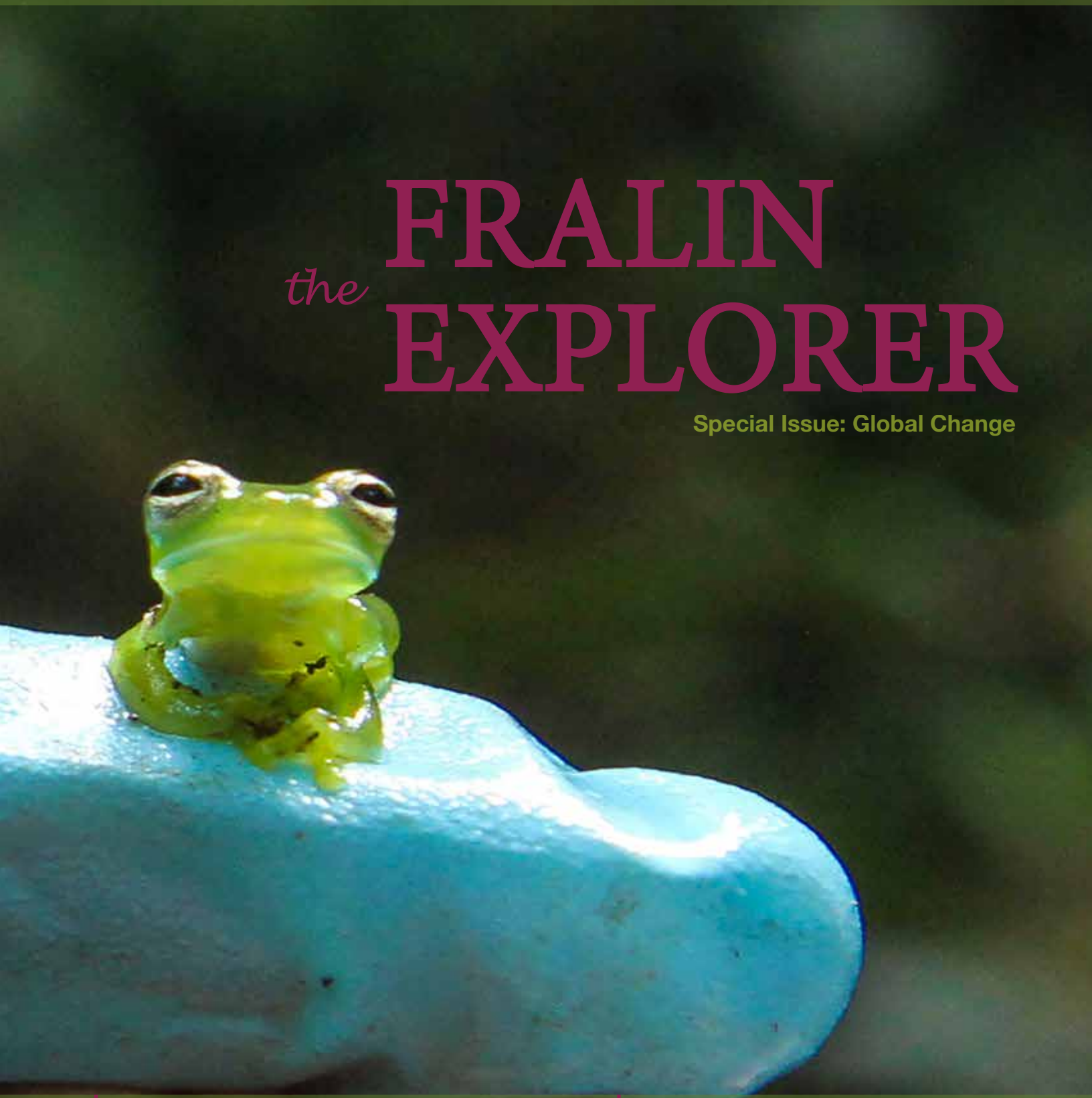
VirginiaTech
Fralin Life Science Institute

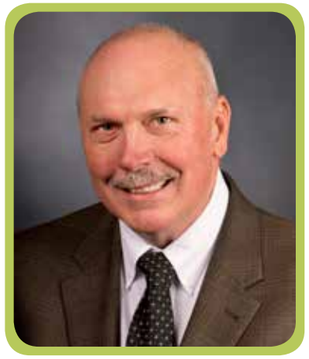
Spring 2015



the FRALIN EXPLORER

Special Issue: Global Change

WELCOME TO FRALIN



Dennis R. Dean
Interim Vice President for Research
Director, Fralin Life Science Institute

I am very pleased to provide reflections about the establishment of the Virginia Tech Global Change Center that is described in this special issue of the Fralin Explorer. For the past several decades Virginia Tech faculty members have been preeminent contributors to disciplines that analyze various environmental and societal trends— for example, urbanization, agronomic practices, water management and energy production— that ultimately lead to significant global change.

The recently chartered center represents a dynamic group of Virginia Tech faculty that now seek to leverage this remarkable heritage in a way that brings biologists, toxicologists, geochemists, engineers, climate modelers, and social scientists together, as a cohesive and highly collaborative group. The overriding philosophy of the center is to gain deep and practical knowledge about the origins and interacting aspects of habitat loss, invasive species, pollution, disease, and climate change.

The Global Change Center is grounded in a rich tradition of research at Virginia Tech involving the natural and environmental sciences, but is now also rapidly gaining momentum through the recruitment of a particularly strong group of new faculty and talented graduated students. These individuals have been attracted to Virginia Tech as a result of the opportunities presented by such an interdisciplinary and team oriented approach towards research and education.

As you read some of the activities described in this edition of the Fralin Explorer I am sure that you will gain an appreciation of why I am so excited about the Virginia Tech Global Change Center. Indeed, I believe this group is an exemplar of the spirit and innovative and integrated approaches towards research and education that is now pervasive on the Virginia Tech campus.

It represents the outcome of impressive leadership by a group of talented and motivated faculty, and a campus wide commitment from numerous participating Colleges and Departments. It is grounded in significant existing strengths, and, perhaps, most importantly, it was launched by development of a highly innovative graduate program made possible by Virginia Tech's commitment to practical interdisciplinary training.

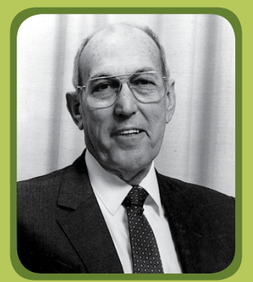
ABOUT US

The Fralin Life Science Institute is an investment institute committed to supporting *research*, *education*, and *outreach* in Virginia Tech's life sciences community. Residents of the institute's four flagship buildings are automatically considered affiliated faculty members and all other life science researchers on campus are invited to become affiliated faculty members.

Affiliated faculty members are given resources necessary to explore new, innovative science that benefits people in the New River Valley, the Commonwealth of Virginia, and the world.

Through seminars, conferences, and research group support, the institute serves as a meeting point for progressive ideas involving multidisciplinary research. It is closely aligned with Virginia Tech's other six research institutes, which include the Virginia Tech Carilion Research Institute, Virginia Tech Transportation Institute, the Institute for Critical Technology and Applied Sciences, the Virginia Bioinformatics Institute, the Institute for Society, Culture and Environment, and the Institute for Creativity, Arts and Technology.

Research initiatives within the life sciences receiving the highest priority for support include vector-borne disease, infectious disease, plant sciences, ecology and organismal biology, obesity, and cancer biology. The Fralin Life Science Institute is also actively engaged in cooperative partnerships with colleges, departments, and other institutes that support the life science community.



Horace Fralin

The mission of the Global Change Center at Virginia Tech is to address the challenges to the environment and society resulting from global change by providing a framework that encourages, facilitates, and rewards interdisciplinary research, education, and outreach across the intellectual landscape of Virginia Tech.

Editor - Lindsay Key Writers - Cassandra Hockman, Lindsay Key Designer - Yelena Djakovic

WHAT'S INSIDE

The Global Change Center at Virginia Tech was officially chartered by the university as a center under the Fralin Life Science Institute.

Serving as director is Bill Hopkins, a professor of fish and wildlife conservation in the College of Natural Resources and Environment and a Fralin affiliate.

The center's aim is to confront large-scale environmental problems such as habitat loss, invasive species, pollution, disease, and climate change with interdisciplinary, innovative team science, drawing on the diverse expertise of researchers in the College of Agriculture and Life Sciences, College of Architecture and Urban Studies, College of Engineering, College of Liberal Arts and Human Sciences, College of Natural Resources and Environment, and the College of Science.

"We have incredible expertise at Virginia Tech on each of these problems, but this talent is scattered around campus in different colleges and departments," said Hopkins. "The Global Change Center at Virginia Tech will foster interactions among experts in a diversity of fields so that we can approach global change problems with a more holistic, interdisciplinary perspective."

A recent example of a global change issue, according to Hopkins, is the sudden, rapid growth of phytoplankton in lakes and reservoirs in the United States, which impairs community drinking water. These toxic blooms are caused by a series of human-related factors such as climate change, altered land use, and pollution.

"To effectively mitigate such complex environmental problems, research teams comprised of biologists, toxicologists, geochemists, engineers, climate modelers, and social scientists are needed," Hopkins said.

In addition to establishing a core group of faculty researchers, the center is administering the Virginia Tech Graduate School's Interfaces of Global Change Interdisciplinary Graduate Education Program, established in 2013, which already supports 15 doctoral fellows from multiple colleges who are committed to research at the science-policy interface.

Together, faculty and student researchers aim to make the best science available to policymakers at the state, federal, and international levels. A key objective is to form meaningful partnerships with external stakeholders, including federal agencies, nongovernment organizations, and industry.

The center is a faculty-driven initiative with broad support from college deans and the upper university administration.

Don't plant invasive species in quest for greener pastures

Few agribusinesses or governments regulate the types of plants that farmers use in their pastures to feed their livestock, according to an international team of researchers that includes one plant scientist from Virginia Tech. The problem is most of these so-called pasture plants are invasive weeds.

In a Proceedings of the National Academy of Sciences study this month, the scientists recommended tighter regulations, including a fee for damage to surrounding areas, evaluation of weed risk to the environment, a list of prohibited species based on this risk, and closer monitoring and control of natural area damage.

The findings were also highlighted Nov. 12 in Nature.

The research team — led by scientists at the Australian National University — surveyed agribusinesses in eight countries on six different continents to see what species are planted in pastures, what traits are selected for, and what measures are taken to guard against invasion.

In response to human population boom and increased global food demand, some farmers resort to planting aggressive, fast-growing species in order to increase their herd size without breaking the bank.

This extensive growth allows for greater cattle forage, but has a long global history of escaping the paddocks and invading natural areas, where they squelch out biodiversity, suck up available water resources, enhance fire cycles, disrupt the behavior patterns of pollinators, and alter nutrient and trophic levels.

In turn, about $34 billion per year is spent annually in the United States on invasive weed management, said Jacob Barney, an assistant professor of plant pathology, physiology, and weed science in the College of Agriculture and Life Sciences, Fralin Life Science Institute affiliate, and third author of the study.

Buffelgrass, an invasive weed in Australia, is also invasive in the southwestern United States. Photo courtesy of Don Driscoll/Australian National University.

"Meat consumption is increasing globally, which will increase animal production, and thus increase demand for forages improved for forage quality, productivity, and tolerance of poor growing conditions — all traits that may facilitate invasion into the natural ecosystem, making the invasion problem worse," said Barney, who is also a core faculty member in Virginia Tech's Interfaces of Global Change program.

"The weed problem faced by the USA and other countries is already enormous," said Don Driscoll, an associate professor at the Australian National University and lead author. "It makes sense to have new regulations that discourage agribusinesses from releasing more aggressive varieties of these existing weeds. A polluter-pays system applied across the livestock and feed industry would be an important disincentive that could help to solve this escalating weed problem."

Virginia Tech scientist partners with Ecuadorian researchers to study nose of rare 'Pinocchio Lizard'

For more than 50 years, scientists thought that the horned anole lizard — sometimes called the "Pinocchio Lizard" for its long, protruding nose — was extinct. But it turns out this is a tall tale.

Scientists re-discovered the lizard in 2005 living elusively at the tops of tall trees in the cloud forests of Ecuador — the only place in the world that it is known to exist.

A team led by a Virginia Tech scientist recently uncovered new information about the role that the lizard's long nose plays. Only the males have long noses, and they appear to be used in social interactions, both among males and between males and females.

Previous investigators had wondered if the nasal appendage served as a weapon of some sort in male-male interactions.

"It's important that we learn as much as we can about the natural history, social behavior, and ecology of this lizard, in order to save it from true extinction," said Ignacio Moore, an associate professor of biological sciences in the College of Science, a Fralin Life Science Institute affiliate, and a faculty member with the new Global Change Center at Virginia Tech. He is also an affiliated faculty member with the Interfaces of Global Change interdisciplinary graduate education program.

While in Ecuador on a research sabbatical, Moore partnered with Omar Torres-Carvajal, a faculty member at the Pontificia Universidad Católica del Ecuador in Quito, and Torres-Carvajal's undergraduate student Diego Quirola.

Moore and his colleagues presented their findings at the 2015 Annual Meeting of the Society for Integrative and Comparative Biology in West Palm Beach, Florida. Quirola is now preparing an article about the findings.

"This data sheds light on one of the most fascinating apparent specializations in the animal kingdom and opens new doors to future research," said Duncan Irschick, a professor of biology at the University of Massachusetts-Amherst.

Since it's rediscovery in 2005, the Pinocchio lizard is quickly becoming a commodity for its strange beauty and rareness, with pet smugglers offering large sums of money for its capture.

"It's important for scientists to educate the public about the biological importance of this lizard. It is not a pet but a truly remarkable product of nature," said Moore.

Late at night, wearing head lamps and shimmying up trees, the team was able to catch a few dozen lizards. They held them in an outdoor facility built to mimic the lizards' natural habitat and observed them for a couple days, after which the lizards were returned to the exact branch where they were found.

"We were able to observe and videotape 11 copulations and two male-male combat scenarios," said Quirola. "The nasal appendage was not used as a weapon in these interactions but was used as part of the social displays. The appendage is lifted during the social interactions although what role this specific movement plays is unclear."

What is becoming clear is that the appendage is an important part of their social interactions and a unique aspect of the natural history of this remarkable lizard.

"Ultimately, we are interested in knowing about the evolution of this appendage, which is only found in two other species of anole lizards from Peru and Brazil. Do males with larger appendages dominate those with smaller ones? Do females prefer males with larger appendages? Did the appendix evolve under sexual selection? We hope to get some answers," said Torres-Carvajal.

Researchers seek to know more about the rare horned anole lizard to save it from extinction. Photo courtesy of Ignacio Moore.

SAVING FROGS

Not only is frog skin breathtaking to humans—from the kiwi-green glow of the glass frog to the firecracker popsicle hues of the blue-jeans frog— it is also, quite literally, breath-taking.

Many frogs and other amphibians can breathe through their skin. Frogs also take in water and other important particles through the skin, and it serves as an important physical barrier to pathogens.

A skin disease known as chytridiomycosis, which is caused by a chytrid fungus, is a severe threat because it disrupts frog skin when it invades, and can result in respiratory failure, a heart attack and death.

"Chytrid fungus is responsible for many amphibian population declines and extinctions across the world, to the point that scientists have claimed it to be the greatest disease-associated loss of biodiversity in recorded history," said Lisa Belden, an associate professor of biological sciences in the College of Science, Fralin Life Science Institute affiliate, and a faculty member with the new Global Change Center at Virginia Tech. "The disease has already contributed to the decline of the Panamanian golden frog, which is now thought to be extinct in the wild."

Belden and her research team are interested in how a frog's skin microbiome—or the collection of bacteria on its skin—contributes to the likelihood of a frog surviving exposure to chytrid fungus. She and other conservation biologists believe that this bacterial community could be used to help stop the spread of the disease.

But first, scientists need to understand how the skin microbiome interacts with the fungus.

Two of Belden's Ph.D students—Angie Estrada and Daniel Medina—are going on a series of field research trips to Panama to collect samples of the bacterial communities found on frogs living in the rainforests there. The students are fellows in the Interfaces of Global Change program at Virginia Tech, which provides Ph.D. students with training, funding, and outreach opportunities relating to global change and the science-policy interface.

Estrada's dissertation is focused on understanding how the incidence of chytrid fungus infection varies during the wet and dry seasons in the lowlands of central Panama, and why some frogs in this area are particularly good at surviving infection.

During the dry season in that region, frogs congregate around streams and ponds because the forest floor is very dry and many amphibians need to stay wet to survive. These types of close quarters can facilitate transmission, but some of the frogs there survive infection.

"There are some species of frog that seem to be doing well at a few sites, while disappearing from many other sites," said Estrada. "I want to try to understand why they can persist and what is special about these sites so that we can try to mimic that success in other places."

Every three months for a year, Estrada is visiting the same stream and pond sites to assess the state of infection.

Meanwhile, Medina wants to understand the role of amphibian skin microbes in the incidence of the chytrid fungus between low and high elevations. Frogs in warmer, lower elevations are generally able to withstand infection better than those in cooler, higher elevations.

"Understanding how the environment, particularly temperature, influences these microbial communities and their interactions with the chytrid fungus is key for the development of conservation techniques using protective bacteria, and to increase our ability to predict the outcomes of this disease in non-infected areas," Medina said.

The need to thwart the fungus is urgent. Mass amphibian loss impacts other animals such as birds and snakes that rely on amphibians for food. Amphibians are also useful to humans because they control insect populations, including those that transmit diseases to humans, and produce chemicals that are useful for the production of human medicines.

"But ultimately," said Belden, "we should save frogs because they are amazing animals, and it's the right thing to do."

The red-eyed tree frog pictured is often found lounging on tree leaves and can use its bright eyes to startle prey.

Daniel Medina (left) and Angie Estrada swab frogs at a makeshift laboratory they've established on the back of a pick-up truck at Ocelot Pond

Facing fear headlamp-on at Ocelot Pond

Around 8:30 p.m. —Frog Prime Time— we embark on another field excursion that is a first time for me: night swabbing.

It takes a great deal of convincing for me to step into my rubber boots, long sleeved shirt, pants, and bucket hat with net (not pictured: massive amounts of Deet-filled mosquito spray). To say that shuffling around an unfamiliar jungle at night is unnerving to me would be an understatement. As a kid I spent a lot of time playing outside in the dark, but adding jaguars and venomous snakes into the equation is a game changer for me.

Nevertheless, I decide to go because this is an important part of the research project that Angie and Daniel want me to see.

We drive about ten minutes out of Gamboa and park on the side of the road in a spot that Angie and Daniel must know by memory, because it all looks the same to me. Angie pulls aside a branch on the side of the road and there it is: Ocelot Pond glimmering in the moonlight. It's a short but steep trek down to the small pond and the researchers tell me which trees to grab onto and which to avoid (the spiny ones).

We are three little headlamps in the night moving towards the water, some of us more gracefully than others. I feel like a water buffalo in my big rain boots on the uneven ground. We have to be sure to shine our lights on any branch we aim to touch or pull for leverage—that's the nature of a rainforest at night. On the forest floor, we see colonies of leaf-cutter ants hoisting their leaves overhead and marching in the straightest assembly lines: nighttime shift work.

Our first spotting isn't a frog at all—it's a Common Basilisk, more commonly known as a Jesus Christ lizard for its ability to run on water. We saw one sprinting over a stream at the Pipeline site, but this one is in no mood for exercise: he has found a comfy spot on a branch partially sunk in the pond. Up close, he is fascinating and bigger than I imagined, about the size of a small iguana. I am struck by the fact that he lets us get within inches of him and Angie tells me it is because he is sleeping.

It's not long before Daniel is clued into the calls of the frogs—he is an expert at this—and he is able to name the species based on their calls. We continue around the pond, with Daniel and Angie combing branches, leaves, and the pebbly soil for signs of webbed feet.

We are looking for two key species at the pond: the hourglass frog and the glamorous red-eyed tree frog that has long served as a rainforest poster child. These species are important because there is two years' worth of swabbing data for them, and therefore a strong line of comparison.

Luckily, we find both of these species for swabbing, but not without also finding the grandfather of the frog pond (pictured left): Leptodactylus savagei (Savage's thin-toad frog). This frog is HUGE, anything but thin! And also fast. We try to catch him for swabbing but he makes a getaway.

In the back of the truck, Angie and Daniel organize the supplies to ensure a quick and efficient swabbing station. It's not good to keep the frogs in their sampling bags for too long. Daniel handles each frog with laboratory gloves, turning it so that Angie can swipe its belly, back and legs. The procedure must be exactly the same for each frog.

They sample a total of seven, and this is low, even for the dry season. During the rainy season, the forest is full of frog calls, Daniel explains.

The swabs are important because they reveal the microbial communities on the skin of the frog and whether or not the frog is infected with chytrid fungus throughout the dry and wet seasons. The researchers are also interested in the frog population dynamics of each site, because it helps them understand the spread of chytrid fungus in the same way that human population dynamics help us understand how we spread of the flu to each other.

Many factors are at play, including frog behavior, biological defenses, and environmental conditions. This is complicated by human-driven changes such as climate change, invasive species, pollution, and habitat degradation.

It will take a team of scientists studying many angles of these factors in order to get a handle on the disease that has infected approximately 500 frog species so far. Scientists have claimed chytrid fungus to be the greatest disease-caused loss of biodiversity in recorded history.

Daniel, Angie, and other scientists studying the disease across the world have their work cut out for them, but we are done for tonight. The frogs are released back into Ocelot Pond and we head back to Gamboa with a cooler full of samples.

-Originally published in the Virginia Tech Research Blog.

People, science, and science communication: a look inside the Interfaces of Global Change Interdisciplinary Graduate Education Program

Virginia Tech's motto, Ut Prosim, "That I May Serve," seeks to unite research, education, and outreach locally, regionally, and globally. In staying true to this mission, graduate students around campus are learning to apply their research to confront social and political issues, as well as impact policy.

Recent initiatives at the Virginia Tech Graduate School encourage students to create and transform knowledge by putting it into productive practice. This translational approach to graduate education requires thinking across disciplinary divides, considering alternative perspectives, and developing an awareness of diverse belief systems and cultures.

Faculty and students alike recognize the need to improve communication skills in order to achieve this. "Communicating research effectively in order to address local and global needs requires a transformative approach to graduate education," said Karen DePauw, vice president and dean of the graduate school. "We want to equip graduate students with the ability to think critically as researchers, educators, and citizens in an ever-growing global context."

The Interfaces of Global Change program is one of fourteen interdisciplinary graduate education programs that have been established throughout the university to carry on this transformative approach. A major part of this program's mission is to help budding scientists and engineers identify different positive roles they can play in society in order to transform research into real-world solutions.

"Effective communication of scientific information to audiences with diverse backgrounds and values will be central to the success of our graduate students, regardless of what roles they pursue," said Dr. Bill Hopkins, the director of the Global Change Center and the IGC graduate program. "We believe that by equipping young scientists and engineers with skills to make accurate science accessible to broader audiences, we can help citizens make informed decisions that affect their own health, the environment, and society."

As part of their graduate education, the Ph.D. fellows in this program participate in regular science communication workshops, attend seminars, discuss political and public perceptions of science, and learn to negotiate their complex roles as researchers and as people. Here are some of their stories.

Establishing the Personal Connection: Daniel Medina

Daniel Medina grew up in Panama, where he was immersed in nature. He knows the land is home to countless species of amphibians, like salamanders and frogs, many of which are rare and endangered. During his undergraduate coursework, he identified four new species of frogs, and he knows that disease, like chytridiomycosis, threatens them.

But Panama is also home to many native groups, such as the Emberá-Wounnan community, an indigenous group living in poor economic conditions. In search of income, they turn to the forest, which is rich in timber. And although it is not well supported by their cultural principles, they harvest the wood and use it for currency.

As a conservationist, Medina found himself in a tense and intimidating position: how could he reach these people in order to talk about environmental threats like habitat loss and the importance of biological conservation?

Heather Governor
Ph.D. Candidate
Department of Biological Systems Engineering

Medina took on this challenge by participating with NGOs in the creation of a sustainable forestry management program with the group's members and leaders. When communicating with local members, he established a personal connection and common admiration for their land. He told them about the land's rich biological diversity and the endangered frogs that live in their forests. This made the community feel special and privileged, he said, so they listened. In turn, Medina heard their perspective and developed a better understanding of their needs.

"After one of my conversations with the leaders, the amount of trees to be harvested was reduced to 55% of what was going to be harvested initially," Medina said. "That was very rewarding. Now I believe that establishing a connection or a common concern with a non-scientist public and identifying yourself as one of them in terms of somebody who cares for their interest are key aspects when communicating science."

Communicating in the trenches: Tony Timpano

Policy advocacy is a tricky thing for scientists, as it can lead to a loss of credibility and research funding, as well as political scrutiny. But this is not a threat to Tony Timpano, also known as the "bug guy" for his interest in aquatic insects, who keeps the focus on his research and his stream-bottom curiosity.

Daniel Medina
Ph.D. Candidate
Department of Biological Sciences

His research, he explained, was born from the needs of state and federal regulatory agencies to understand how Appalachian coal mining affects stream water quality and aquatic life. In fact, the Virginia Department of Mines, Minerals, and Energy has already applied data from his master's work to guide its policies on monitoring and managing salt pollution in streams.

His doctoral work will also be considered when policies need to comply with the Clean Water Act, which is a federal law designed to restore polluted waters and sustain water quality. His current work focuses on how salt pollution effects stream life and how best to account for these changes when developing compliant water quality management policies.

Timpano envisions his science serving as an accurate resource for policymakers. Since he communicates "'in the trenches," meaning in and around people who do science and policy, he mostly uses language appropriate for scientists, engineers, lawyers, and state and federal regulators. But even within these conversations, he says, he has found the need to present science in a context that fits this audience because, ultimately, the heart of his interest lies in "improving the science of water quality management to enhance the capability of regulators to make sound science-based policy decisions."

Why is Timpano so interested? Because "water, as a human and ecological resource, is facing mounting threats globally, and the problems are only becoming more complex. I think good science is critical to managing water resources for greater sustainability."

Creating Dialogue: Heather Govenor

Heather Govenor was already well versed in talking to people about science when she started her doctoral work at Virginia Tech. For several years, she worked as an ecological science consultant for an engineering firm, which required versatility in language.

She regularly wrote and spoke about the relationships organisms have with each other and their environments, a subject that has interested her since as far back as she can remember. This interest flourished as she communicated with other scientists and engineers, industry and governmental professionals, state environmental offices including the U.S. Environmental Protection Agency, and with the broader public.

Now Govenor is the president of the IGC's graduate student organization and organizes the spring reading group, during which the students collaborate on ideas and share experiences.

"We have a lot of talks about what role we want to play as scientists in public dialogue about climate change," she said. "Do we want to be the scientists behind closed doors? Do we want to advocate for change? Or do we want to provide information without advocating for any particular solutions?"

Good questions. Hard questions. But Govenor does not plan to ignore questioning solutions nor how best to communicate. She believes humanity is the largest threat to global health, and in order to change this, she must examine the best ways to explain these threats to people with different educational levels, different interest levels, and different age levels, and somehow still be understood. Learning to translate her message to diverse audiences is key, she says, to contributing to sustainable resource practices, effective policymaking, and productive public dialogue. "Scientists have to listen as much as they can," she says, "because the public can teach scientists, too."

Tony Timpano
Ph.D. Candidate
Department of Forest Resources and Environmental Conservation

Forming the flock:

Virginia Tech is a long-time powerhouse for bird research, but scientists studying these dynamic creatures are dispersed across multiple colleges and departments.

"Virginia Tech has a sometimes overlooked strength in integrative organismal biology - the study of how animals cope with environmental challenges through physiology, behavior, and evolution," said Kendra Sewall, an assistant professor of biological sciences in the College of Science. "In particular, a group of researchers who use birds as their study systems have put Tech on the map for addressing questions about how animals are coping with environmental change."

Luckily, with the recent push for interdisciplinary programs like the Interfaces of Global Change graduate program and the Global Change Center, scientists are beginning to talk and realize exciting new collaborations.

In spaces like these, a neurobiologist, an ecologist, and a conservation biologist can come together to share and create a more holistic knowledge about one particular bird species. By talking to colleagues with different backgrounds and interests, scientists can compare how human-induced threats like habitat loss, invasive species, pollution, disease and climate change affect species down the line.

Dana Hawley
Associate Professor, Biological Sciences, College of Science

Dr. Hawley studies disease transmission in birds from a multi-disciplinary perspective in order to understand how individual physiology, pathogen virulence, social behavior and environmental context interact to influence infectious disease dynamics. She is particularly interested in how global changes may alter both organismal susceptibility and exposure to pathogens, and how these changes may scale up to influence population-level disease dynamics.

Bill Hopkins
Professor, Fish and Wildlife Conservation, College of Natural Resources and Environment

Dr. Hopkins studies the development and early growth of birds, and has a special interest in how water pollution and maternal behavior affect offspring health. For a current research project, he investigates the connection between the incubation behavior of wood ducks and the characteristics of their offspring, such as body size and condition.

Kendra Sewall
Assistant Professor, Biological Sciences, College of Science

Dr. Sewall seeks to understand how neural and behavioral processes— and the environmental and developmental factors that impact those processes— contribute to birds' survival and reproductive success. Her current research projects are dedicated to further understanding the neural mechanisms underpinning bird cognition, social behavior, and communication that influences their survival and fitness.

Ignacio Moore
Associate Professor, Biological Sciences, College of Science

Dr. Moore studies the hormonal stress response of wild birds in order to understand how the environment affects the ability to parent. He is also interested in what environmental and social cues birds use to time reproduction and how those cues are integrated into physiology and behavior.

Story by Lindsay Key
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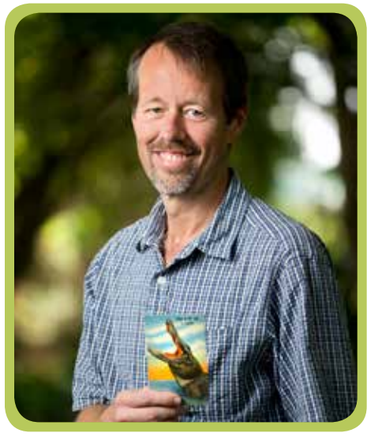
Jeff Walters
Professor, Biological Sciences, College of Science

Dr. Walters' research focuses on avian behavioral ecology and conservation biology. He has worked with a number of endangered species around the world, most notably the red-cockaded woodpecker in the southeastern United States. In relation to global change he studies how habitat loss affects dispersal behavior and other aspects of population dynamics, as well as impacts of climate change on populations.

COFFEE BREAK WITH A SCIENTIST



Mark Barrow

What is the focus of your current research?

My current research is an environmental and cultural history of the American alligator. I am exploring how we have both perceived and interacted with this charismatic reptile, from the time of initial European contact in the New World to the very recent past.

What I am finding is that Americans have developed numerous and sometimes contradictory ways of thinking about the alligator. The most basic and prevalent of these is that we have tended to see the creature as a fierce predator, a man-eater that seems bent on attacking and devouring humans whenever it gets the chance.

This perception remains quite widespread among the general public even though scientists and those who live closest to the species have long understood that it rarely attacks humans. This fear of the alligator as an extremely aggressive species is reinforced by the lurid media coverage following those relatively rare instances when the reptile does injure or kill someone, and by numerous movies that invariably portray crocodilians as ferocious beasts. It turns out that some crocodilians actually deserve that reputation, but the American alligator is not among them.

Layered on this most basic understanding of the alligator, though, are a series of other meanings: the species is also widely appreciated as a symbol of the landscape it inhabits (wetlands of the southeastern U.S., especially Louisiana and Florida), a valuable commodity, an endangered species, and an environmental indicator.

So unlike the wolf in the western U.S., which continues to be reviled by many locals, the alligator is not just tolerated but quite valued by the residents of Florida, as long as they have confidence if will continue to be aggressively managed by state wildlife officials. They want to know that whenever it wanders into their lakes, ponds, and backyard pools, they can call someone and have it promptly removed. As long as that continues to happen, they seem quite content to co-exist with this species, which is thriving in one of the fastest growing states in the nation.

My work brings into sharp relief the many ways we have perceived the alligator, but I think the same thing is true of most other wildlife. We tend to have complex, multifaceted understandings of most species. For those who are interested in finding a way to co-exist with those species and allow them to thrive in a world that is increasingly dominated by humans, it is important to understand and come to grips with those multiple meanings.

How did you become interested in your line of research?

My work lies at the intersection of the histories of natural history, wildlife conservation, and American culture. While finishing my second book, Nature's Ghosts, which looks at how naturalists engaged with the issue of wildlife extinction from the eighteenth century to the modern environmental movement, I discovered that the sharp decline in the population of the American alligator was one the chief concerns that lead to passage of the Endangered Species Acts of 1966, 1969, and 1973.

That discovery got me to thinking about my own childhood, growing up in North Central Florida, where alligators were (and remain) ubiquitous. As a kid, we regularly fed the alligators at Lake Alice, on the campus of the University of Florida, which of course, has the gator as its mascot.

I also vividly remember an unusual character who went by the name of "Gator Man" and who would go out to swim among the alligators there. At the time, this would have been in the late 1970s, I thought he was completely crazy. We now know that feeding wild alligators is a bad thing, because it acclimates them to humans and increases the chance of attacks on humans, and we also know that these creatures are nearly as aggressive as most people think.

So, in a certain way, this research project represents a kind of homecoming, my attempt to come to know a charismatic species that I regularly encountered during my youth and that many people continue to find enormously captivating and quite scary.

Why do you think it is important to study the environment from a historical perspective?

On the most basic level, I think history of all sorts provides the long view we need to get a better handle on our current world. One analogy I often make with my students is to consider an individual who has amnesia, no memory of who they are and where they have come from, and how debilitating it can be for someone to become completely unmoored from their past. The same is true for societies.

Without a strong sense of our collective historical trajectory, we lose an understanding of where we have come from, who we are, and how we got here. Our ability to act effectively and wisely is severely compromised without a fairly strong grasp of our past.

Historical modes of thinking stress what are sometimes referred to as the 5 C's: change over time, context, causality, contingency, and complexity. The simplest of these is change over time, which is a pretty easy concept to understand and what most people usually associate with history.

Context is also pretty straightforward. Historians attempt to interpret primary sources (words, images, sounds, etc.) from the perspective of the time in which they were created. And while they construct what are hopefully accurate and accessible narratives about those sources, they do more than simply try to tell stories. They are interested in trying to establish how and why events unfolded the way they did, in drawing out the lines of cause and effect.

Historians also understand that events might have occurred quite differently, that the historical trajectory that actually occurred was not in some sense foreordained, but is rather highly contingent. Finally, historians try to provide a sense of the complexity of the past.

As one historian recently put it, history is "messy, complicated, and not easy to summarize." Yet some kind of summary is absolutely necessary to communicate the complexity of the past to readers, whether they be specialists in the field or the general public.

Studying the environment from a historical perspective also provides critical insights into the habits of thinking, practices, and values that have led Westerners to approach the natural world as an inexhaustible resource and/or a bottomless sink for our waste products.

Acting alone, science and technology can only go so far in addressing the many environmental challenges we face in the twenty-first century. We need to understand much more about how and why people have come to behave the way they do, why they hold the values they do, and the opportunities we might have in shaping more sustainable ways of living on this earth.

One of the exciting things about the Global Change Center is its explicit recognition that the complex environmental problems of today cannot be solved by science alone. Rather, what is needed is an interdisciplinary approach that brings together a variety of fields of science with the humanities and social sciences, like history, that provide invaluable insights into practices and thinking in particular contexts.

Your books examine in different ways the relationship between scientists and conservationists/environmentalists. Do you feel that there is a divide or disconnect between these two demographic groups in America, and why or why not?

One of the things both of my previous research projects demonstrated was how deeply involved naturalists have been throughout the long history of the American wildlife conservation movement. As individuals who actively and early on sought out contact with the natural world, scientists were among the first to document and to decry the decline in wildlife populations, especially birds, mammals, and fish, and to propose various regulations and laws that aimed to stem that decline. This started to happen on a fairly large scale toward the end of the nineteenth-century.

To be sure, there were sometimes tensions between scientists and other conservationists (and later environmentalists) over such issues as what species could be collected and when, but my research has shown that scientists provided knowledge and leadership that proved crucial to the success of the American wildlife conservation movement.

The situation is obviously more complicated today, since environmentalists are a varied lot in terms of their backgrounds, basic philosophies, and concerns. And though tensions between environmentalists and scientists do flare up from time to time, at the end of the day, the environmental community continues to fundamentally rely on science to make authoritative claims about transformations to the natural world and human bodies in the modern world. They also tend to rely on science and technology to find possible solutions to the environmental challenges we face.

FUN FACTS

Where are you from?
Hometown: Gainesville, FL

What is your educational background?
B.A. in History, University of Florida; Ph.D., History of Science, Harvard University

What are your hobbies?
Running, playing guitar, cycling, reading, listening to folk music, getting outdoors, enjoying good food

What is your favorite thing to do in Blacksburg?
See a movie or live music at the Lyric

What are your favorite books?
William Cronon, Changes in the Land; Aldo Leopold, A Sand County Almanac

What is your favorite quote?
"Never doubt that a small group of thoughtful, committed citizens can change the world. Indeed, it's the only thing that ever has."—Margaret Mead

STUDENT SPOTLIGHT

Ben Vernasco
Photo courtesy of Brandt Ryder.

Social dynamics and physiology: a Ph.D. student studies the biology and behavior of the male wire-tailed manakin

Ben Vernasco knew he wanted to pursue a Ph.D. in conservation biology while studying tropical birds in Peru. After his trip, he got in touch with his mentor, Brandt Ryder, a research ecologist at the Smithsonian Migratory Bird Center at the Smithsonian National Zoological Park in Washington, D.C.

Ryder and his Virginia Tech colleague Ignacio Moore, an associate professor of biological sciences in the College of Science, had just received a National Science Foundation grant with a spot for a graduate student. Vernasco was in luck.

Now, Vernasco is a doctoral student in biological sciences at Virginia Tech, and studies the wire-tailed manakin, or Pipra filicauda – a tropical bird named for the wired filaments on its tail and known by researchers for its unique social display: the males perform to attract the females.

To some researchers, this display looks like a dance – these birds perform with quick, smooth moves, back and forth on a branch, while flicking their wings to make sound. Some people have likened the movements of the red-capped manakin to Michael Jackson's moonwalk: a seamless backward slide. And another species, the club-winged manakin, rubs its wings together over its back to make a buzzing noise, a movement so fast it is invisible to the naked eye.

As part of their display, manakins perform on the same designated perches within their territories. They even alter the habitat around their perch by tearing down leaves to make it a better arena to dance in, said Vernasco.

But dancing to attract females is not the only thing unique about these manakin displays – they also display with other males. Within a particular territory, males will display with each other in order to form the basis of what Vernasco explained are social coalitions. Within these coalitions, the same males display together for years in order to develop social hierarchies.

Want the full story?
Visit our website at www.fralin.vt.edu/student-spotlight/ben-vernasco.

MEET BEN

Hometown:
Sacramento, California

Research Focus:
Physiological and life-history trade-offs; more broadly Ecology and Evolutionary Biology

Academic Year:
1st year Ph.D. student
Fralin Advisor: Ignacio Moore

Other academic degrees:
B.S. in Applied Vertebrate Ecology

What interests you most about science?

Science is the path to discovery, and there is still a lot to be discovered. Ecological research allows one to examine an ecosystem or organism and work toward understanding how it works, changes, and/or came to be. The natural world is capable of creating amazingly complex patterns and existing in some extremely challenging environments. Working toward understanding the complexities of the natural world is what interests me most about science.

What is your favorite thing about the wire-tailed manakin? Why?

The wire-tailed manakin's complex reproductive biology is probably my favorite thing about it. People generally think of non-human primates when social complexity is brought up, but these little birds actually have relatively complex social dynamics.

Which of the following qualities do you consider the most important for a scientist working in conservation to possess -- open-mindedness, precision, time management skills, optimism, cynicism, integrity, or a good sense of humor? Why?

Integrity. A conservationist is ultimately conducting science that will hopefully end up influencing policy, thus it is important to present honest results to policy-makers. Policy-makers and the public have to be able to trust the scientists, thus a conservationist must be trustworthy.

What is one of your favorite hobbies outside of school?

Exploring new places. Travelling to new places and ecosystems always leads to adventure.

Knowing what you do about graduate school and research, what advice would you give to an incoming graduate student?

Graduate school is like a roller coaster; there are ups and downs. Be ready for both.

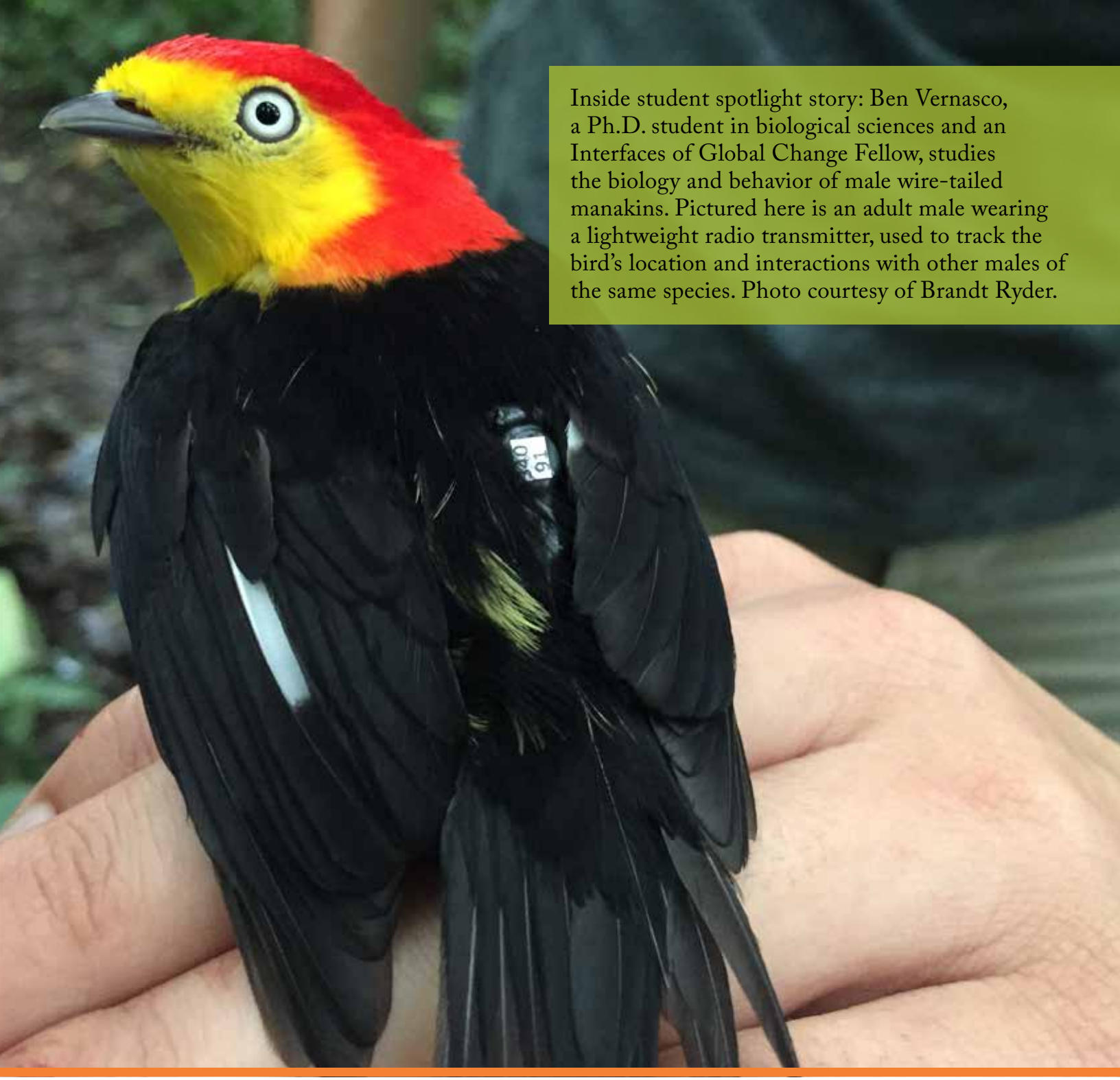
Cassandra Hockman
Communications Coordinator
Fralin Life Science Institute
chockman@vt.edu

AROUND THIS CENTER

The fellows also met with Dr. Jimmy O'Dea, an AAAS fellow for U.S. Senator Brian Schatz of Hawaii, and his wife, Dr. Julia Mundy, an AAAS fellow in the U.S. Department of Education, on Feb. 16, 2015. The group met to discuss how scientific research relates to policy and how the fellows might explore alternative research-based career paths, like working as a research scientist on Capital Hill.

The IGC Graduate Student Organization participated in a science fair at Gilbert Linkous Elementary School in Blacksburg on March 19, 2015. Pictured are IGC Fellows Laura Schoenle (left) and Heather Govenor, who served as judges for the students' science projects.

On March 20, 2015, the Interfaces of Global Change fellows met with Dr. Michael Mann and Susan Hassol, both highly regarded in global change science and communication. Together Mann and Hassol developed a science communication workshop on effective strategies for talking to the media, engaging diverse audiences, and addressing misinformation about climate change science.



Inside student spotlight story: Ben Vernasco, a Ph.D. student in biological sciences and an Interfaces of Global Change Fellow, studies the biology and behavior of male wire-tailed manakins. Pictured here is an adult male wearing a lightweight radio transmitter, used to track the bird's location and interactions with other males of the same species. Photo courtesy of Brandt Ryder.

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