BELIZE FOUNDATION FOR RESEARCH AND ENVIRONMENTAL EDUCATION

THE BLADEN REVIEW 2015

Letter *from the* Executive Director

160,000 people, three paved roads, one broken traffic light, 70% forested; this is how I described Belize 20 years ago. Now, the population has more than doubled, the highways are all paved and there are at least 5 traffic lights, though they don't always work. When BFREE began, the land was surrounded by a continuous forest that extended as far as the eye could see. Bordered on three sides by Protected Areas, and the fourth side by National Lands, BFREE was truly nestled within a forested landscape. But if there is one thing you can count on, other than death and taxes - it's change. Over the past 10 years, a lot of change has come to the area. The de-reservation of a portion of Maya Mountain Forest Reserve to the east of BFREE in 2006, in combination with a growing population primarily due to immigration from neighboring countries, has changed the landscape. Increased demand for agricultural land, plus the impacts of unregulated poaching and logging, are having negative effects on the forests and wildlife.

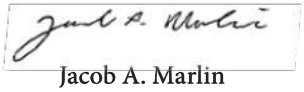
Sounds like the end of the world? It's far from it. BFREE takes our mission seriously, and we work hard every single day to protect the BFREE land and surrounding areas and to have a positive impact and influence on the changes taking place nearby. We achieve this in a number of ways. Among them, by monitoring the BFREE land and nearby forests with regular patrols, boundary demarcation, and strategic communications with individuals encountered during these patrols. Additional rangers were hired in early 2015, and a new conservation outpost has been constructed on the eastern boundary of BFREE to provide a base for patrols and a permanent presence.

We also implement long-term programs like Belize Cacao-based Agroforestry Restoration Project (BCARP) to create environmentally friendly farming practices in areas that otherwise would be cleared of forest. Environmental education programs targeting nearby communities, and programs for International student groups, continue to improve and expand. Materials such as the books, "Biodiversity of the Maya Mountains," the "Cacao-based Agroforestry Handbook," and the film, "Wings of Hope," are all tools we use to send the message that these forested landscapes are treasures we all must conserve for future generations.

The BFREE Education Committee is actively developing long-term study sites and curriculum to be utilized by educational groups both local and foreign. On-going and new research projects are underway, all contributing toward our better understanding of the diverse tropical forests and wildlife. For example, our first ever documented captive bred Hicatee turtles at the Hicatee Conservation & Rearch Center (HCRC) is a testament to the commitment and capacity of BFREE and our dedicated staff.

The challenges of conserving these tropical ecosystems have always been immense. They always will be, and BFREE is always working to meet them. With the tireless efforts of our staff and the support of so many individuals and organizations, BFREE continues to focus on our mission: to conserve the biodiversity and cultural heritage of Belize, now more important than ever. I invite you to get involved. Please join us in our efforts.

In stewardship and conservation,



Jacob A. Marlin
Executive Director

Above are three satellite images of BFREE (the purple polygon) and surrounding areas taken in 2001, 2006, and 2014 respectively. They show the enormous changes in land use and land tenure that has happened in just 10 short years. Images provided by Lex Thomas.

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Chelsea Hetelson

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Heather Barrett

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Kelly Logan, University of Florida

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BFREE Staff
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WINGS OF HOPE

Juvenile Harpy eagle photographed by Steven Brewer in March 2014.

BY HEATHER BARRETT
Dir. of Organizational Development, BFREE

"Wings of Hope" is a 20-minute documentary that chronicles the re-discovery of a population of wild Harpy Eagles in the Maya Mountains of southern Belize. The film showcases the history of the BFREE and University of North Carolina, Wilmington initiative born from this discovery

"The story captures the essence of BFREE's mission. I think of this program as a model for integrating science, education and conservation."
– Jacob Marlin, Executive Director of BFREE.

– the Integrated Community-based Harpy Eagle and Avian Conservation Program. Created by Emmy-award winning filmmakers, Richard and Carol Foster of Wildlife Film Productions, and narrated by Jacob Marlin, this film is rich with breath-taking footage of adult and juvenile Harpy Eagles and other wildlife and vistas found in the pristine tropical forests of the Bladen Nature Reserve. Over the seven year duration of the project, the Fosters followed the local people involved as they transitioned from trainees to conservationists and watched as their lives are changed through their collaborative efforts to save this rare bird and its diminishing habitat.

During September 2015, DVDs of the film were distributed to schools, news media outlets, NGOs and government agencies throughout Belize in order to raise awareness of the significance of continuing to protect wilderness areas like the Bladen Nature Reserve and the greater Maya Mountains.

A student from Bladen School poses with her Harpy Eagle T-shirt. In September, BFREE showed the film in 14 schools & villages in Toledo District reaching over 1,100 people.

BIODIVERSITY UPDATE

BY HEATHER BARRETT
Dir. of Organizational Development, BFREE

Biodiversity of the Maya Mountains: a Focus on the Bladen Nature Reserve by Daniel C. Dourson has been updated and is once again available. The new edition features a beautiful painting of a Red-eyed Tree Frog by Belizean artist, Grayson Sierra, and expanded content including nearly every major taxa in Belize and hundreds of detailed, colorful photographs.

Dourson's sheer wonder of all creatures great and small is translated beautifully in this book — making any reader love and respect the parasitic botfly as much as they might the regal jaguar.

During its first printing, over 300 copies of the book were donated by BFREE to schools, students, teachers, non-profits, and government agencies throughout the country. The book has been a valuable tool used to pass along the message of the importance of conservation and to educate both young and old about the amazing biodiversity that exists in the tiny country of Belize.

For every book purchased, one is donated. Books are available through the BFREE website, www.bfreebz.org, or at the BFREE field station in Belize.

Biodiversity author, Daniel C. Dourson, with cover artist, Grayson Sierra.

FLOATING TREASURES

Nichole Bishop at the HCRC collecting samples. Photo by Mark Mummaw.

BY NICHOLE BISHOP
Interdisciplinary Ecology PhD Student,
University of Florida

Floating on the surface of the pond at the Hicatee Conservation and Research Center at BFREE was a brown mass about the size of a lump of coal. This floating treasure was the main reason I had traveled thousands of miles to a jungle in Belize. What was I so excited about? Hicatee poop! These little packets of digested and partially digested food are a wealth of information that are (relatively) easy to obtain. Fecal samples are important because they provide an unobtrusive way to access the microbial communities in the digestive tract. Animals lack the ability to break down plant material and therefore rely on bacteria in their gut to break down plant cell walls and metabolize nutrients that would otherwise be unavailable. By studying an organism's gut microbes, one can learn a lot about the host's diet, health, immune system, and metabolism.

Rick Hudson, Thomas Pop and Shane Boylan measure carapace depth of a male hicatee during a routine health check. Photo by Carol Foster.

So how does this apply to the Hicatee turtles at BFREE? The Hicatee turtle is unique in that it is an herbivorous reptile. Herbivory in reptiles is relatively rare because of the specialized physiology of ectothermic animals. Therefore, gut microbes are particularly important to the Hicatee turtle and ensure the turtle is capable of obtaining the proper nutrients from its plant-based diet.

Diet is also an important factor in the reproductive biology of turtles. In reptiles, reproductive physiology is linked to body size, and body size is a product of nutrition. Many species of freshwater turtles continue to grow throughout their entire lives; therefore, proper diet and nutrition can lead to larger, more fecund turtles. By understanding how Hicatee turtles acquire and maintain their gut microflora, we can better care for the turtles at HCRC and hopefully produce many healthy hatchlings.

This past summer, I had the opportunity to get my hands on some brown gold (aka Hicatee feces). I also had the privilege of working with the first hatchlings ever produced at BFREE. With the help of Jacob Marlin and HCRC Manager, Thomas Pop, we were able to set up a gut microflora inoculation experiment and begin collecting fecal samples from the hatchlings.

Knowledge obtained from that initial visit will expand our understanding of early life stages of Hicatee turtles and provide a more complete picture of their nutritional ecology; it will also inform husbandry techniques for future hatchlings. Studying the gut microflora of Hicatee turtles can help us understand their nutritional ecology, reproductive biology and aid in the overall conservation effort at HCRC and BFREE. Who knew poo could do so much?

SUCCESS

COMES IN SMALL PACKAGES

BY HOWARD GOLDSTEIN
Independent Researcher

A small geographical range, a culturally entrenched prerogative for local wild harvest and consumption, and a dismal captive breeding record are among the worst combined circumstances to battle in the war to conserve a critically endangered species. Like many turtle species across the globe, the Central American river turtle (*Dermatemys mawii*) – locally known as the "hicatee" – faces geography/habit availability constraints and intensive culturally ingrained overhunting by local people, but unlike most endangered chelonians, the unusual ecology and embryology of *D. mawii* has made captive breeding of this species an extremely rare event. While many turtles confront grave challenges to their survival in the wild, few are as vulnerable to complete global extinction as a species that cannot be preserved even in captivity.

"The work we are doing in Belize at the HCRC can potentially be a game changer for the Hicatee, not only here but throughout the region. The recent hatching at the HCRC has put us ahead of where we thought we would be at this stage, and we are now well on our way to providing a model for sustainable captive management." – Rick Hudson, President of Turtle Survival Alliance

Over a five-day period in mid-June, a critical tide turned in favor of the continued existence of the last extant member of the ancient family *Dermatemydidae* when seven eggs laid in captivity successfully hatched at the Hicatee Conservation and Research Center (HCRC). These are the first hatchlings in the captive breeding program established by Turtle Survival Alliance (TSA) at the HCRC based at the BFREE Field Station and among the few hicatee hatched at any captive facility anywhere.

The discovery in December 2014 of a nest containing eight eggs (seven fertile, one unviable) in the HCRC enclosure was a huge milestone in hicatee conservation, not only because hicatee did indeed successfully nest at the facility, but because for the first time conservationists could actually study the details of hicatee nesting and apply the findings to continued captive breeding protocols of a species so poorly known that all previous knowledge of hicatee nest configuration/sites consisted of a handful of vague anecdotal descriptions of questionable accuracy. Still, this was only half the battle, as the hicatee's complex embryology and unknown captive prenatal requirements persisted as potential obstacles.

On June 14, 2015 it was apparent that these obstacles were overcome when the first hicatee hatchling fully emerged alive and healthy from its egg, and immediately added a new datum to hicatee biology: *D. mawii* hatchlings have spots!

Hatchling at approximately one week old. Hatched in early June, the seven turtles have more than doubled their size and weight over the past three months.

GREENING BELIZE BANANAS

BY JACOB MARLIN
Executive Director, BFREE

Recently, BFREE was approached by the Belize banana farm industry. It seems that market forces, driven by consumer desires for more organic and environmentally friendly produce, in this case bananas, are finally trickling down to Belize. Almost all bananas in Belize are shipped to Europe. The European Union, the Belize Banana Growers Association, Walmart, and the Rainforest Alliance, are partnering to reverse the negative environmental impacts of the industry.

As of 2015, 13 of the 24 banana farms in Belize must comply with requirements for reforestation of buffer areas surrounding the farms, watershed protection, wildlife monitoring, riverine restoration, reduction of toxic chemicals used in the industry, and solid waste management. Audits will be conducted annually by the Rainforest Alliance and others, and compliance regulations have been put into effect. Some of the activities already being implemented include: recycling, construction of nurseries for reforestation efforts, inventories of fauna and flora, environmental education programs in nearby communities, planting of trees and beautification projects, and the donation of waste bins and trash pickup at local schools.

Liberato Pop, an experienced Avian Technician who was trained by BFREE, was hired to conduct bird inventories. Mr. Pop conducted the bird surveys for all 13 farms and also made recommendations on better habitat for birds, educational outreach programs to communities, and other Belizean flora and fauna experts to assist with further surveys. Because of these recommendations, Mr. Thomas Pop and Mr. Sipriano Canti, both BFREE staff, were invited to do plant and tree inventories for the farms.

BFREE is honored and excited to assist the banana farm industry in every way we can, and will be providing training to the industry staff in environmental monitoring, and assisting with reforestation and restoration efforts. We hope that with many partners, we can help reverse the trends of decades of environmentally negative impacts of the banana industry, and secure a healthier future for Belizeans and a "greener" banana for the consumer.

Top: *Liberato Pop performing a bird survey on a banana farm.*
Left: *Black-headed trogon. Photo by Liberato Pop.*
Bottom: *Rufous-tailed hummingbirds. Photo by Jorge Machado.*

PVC stakes with metal tags indentify grid points.

THE SCIENCE COMMITTEE

The Science Committee at BFREE initiated the Mapping Project in 2014 during their annual meeting in Belize. Science Committee Members: Mr. Jacob Marlin, Dr. Rob Klinger, Dr. Jamie Rotenberg, and Dr. Steven Brewer.

MAPPING BFREE

BY GENTRY MANDER
BFREE Consultant

BFREE is beginning to realize a long-time dream; creating a multi-layered, standardized base mapping system of the entire 1,153-acre property! Under the guidance of Alexis (Lex) Thomas, Director of the GeoPlan Center at the University of Florida and the BFREE Science Committee, the project is well underway. The large-scale mapping project will culminate in a spatial database of the diverse habitats, natural features, and research sites at BFREE. In essence, the BFREE property will be viewed and managed as one large research plot.

The project employs the military grid referencing system (MGRS), which is made up of nested cells to allow for simplification, comprehensiveness, and consistency. A canopy and ground cover classification system was developed for the entire property and was tailored to the characteristics of Belize's tropical lowland rainforest.

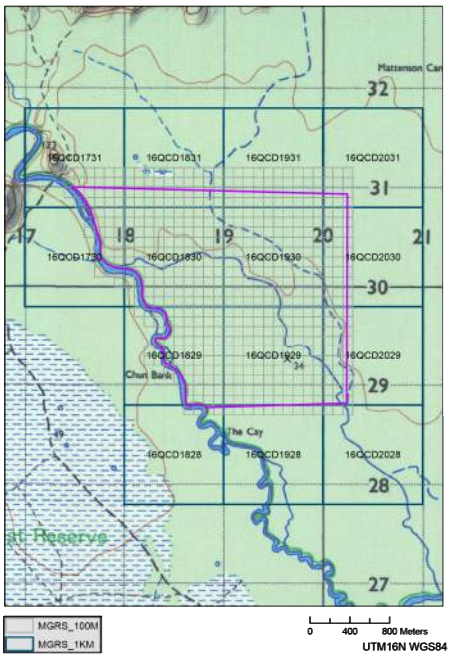
Through the project, the property has been broken down into 100m2 grids. To put this in perspective, if two (densely forested) football fields were side by side, they would include 100 of these smaller 100m2 plots. There are approximately 46,660 of these 100m2 plots on the BFREE property, so initial sampling has been focused on the approximately 460 - 100m * 100m (1 hectare) grid squares.

Sipriano Canti, BFREE's head ranger, was trained specifically for the project and has been collecting these data points since October 2014. To collect the data, Canti walks to the center point of each grid, hammers a PVC post with a numbered metal tag into the ground, determines which of the ten habitat/cover classification best describes the plot, takes digital images in the four cardinal directions, then estimates the height of the canopy, and takes note of any unusual characteristics or features. We expect it will take several years to complete this extensive project.

The most immediate and utilitarian impacts of such a comprehensive map are that it will allow researchers to keep track of where ongoing research is being carried out, provide a visual tool to understand the characteristics and natural resources within the property, create a method to reference less frequented areas, and will allow future researchers to pick out potential research sites before they even arrive at BFREE.

More broadly, this initiative puts BFREE in a good position to monitor and document environmental changes over time—information that is crucial for BFREE and its researchers, as well as Belize and the world, especially in the face of climate change. A standardized base map of BFREE within the context of a large research plot will be a valuable contribution to science on a global scale. For more information on this project and participating, contact Jacob Marlin at jmarlin@bfreebz.org.

BFREE Gazetteer 2015



*Map showing BFREE property demarcated with a purple line including all 460 100M*100M Grids. Map provided by Alexis Thomas.*

STUDYING SMALL MAMMAL COMMUNITIES

BY Dr. SARA ASH
Professor of Biology,
University of Cumberlands, Williamsburg, KY

Chocolate is an appealing focal point for students to learn about culture, history, ecotourism, and agriculture in Belize. Whether learning about cacao production at BFREE, processing it from bean to bar in San Felipe, or studying its uses in local cuisine, students come away with at least a rudimentary scaffold for understanding some cultural and economic issues in Belize and Central America.

Using chocolate as a platform for learning is not limited to the humanities and social sciences. For faculty who lead more field-biology oriented courses, the cultivation of cacao prompts ecological and conservation questions that can serve as a common theme for field curricula or as fertile research fodder for students and/or professional scientists. Central among these questions is the potential contribution of cacao farms to the maintenance of biodiversity across human-modified landscapes in the tropics. The current scientific literature about biodiversity of cacao farms lacks a comparative focus, thereby limiting application to management of these systems. Comparative research paradigms have been suggested to ameliorate this. Specifically, it would be helpful to compare species composition and

Head BFREE Ranger and Tour Guide, Sipriano Canti, holds up a spiny pocket mouse. Canti has been instrumental in establishing the research grids. Photo by Dr. Sara Ash.

FIGURE 1

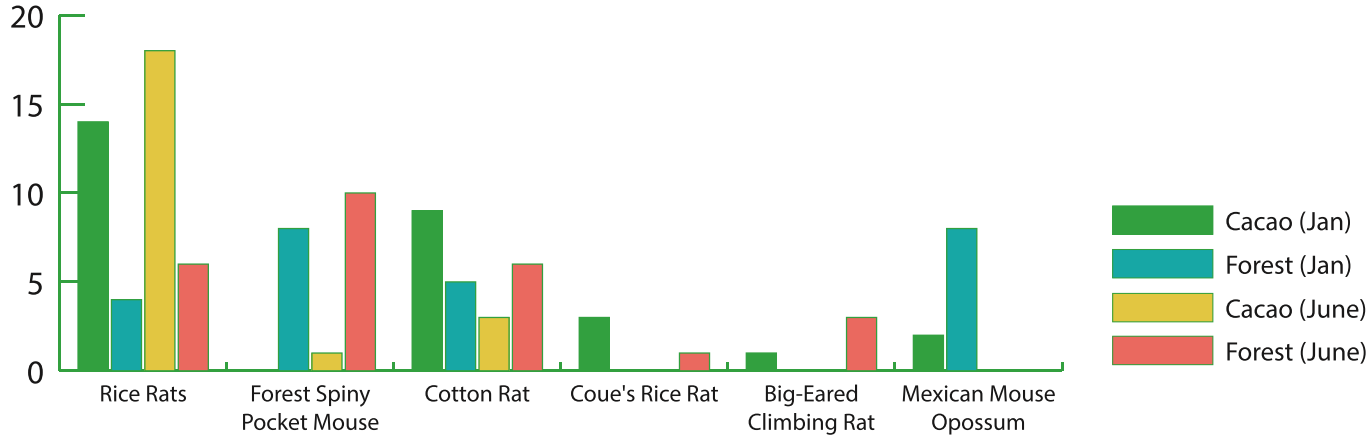


Figure 1. Numbers of individuals of small mammals trapped in January and June 2015 in cacao and forest habitats at BFREE.

Hatt's vesper rat is common around the BFREE reserve but has not yet been identified in the two grids. Photo by Dr. Sara Ash.

diversity of cacao farms and alternative farming practices; cacao farms and natural forests; and among cacao farms under different management strategies.[1]

BFREE's education committee is charged with creating long-term educational and research projects and data sets for student groups visiting the field station. Our hope is that we can identify questions that are principal to BFREE's mission of conserving biodiversity of Belize and are amenable to the development of field activities and research for student groups. To this end, BFREE's rustic cacao plantation surrounded by natural forests can serve as an ideal location for comparative studies. In January 2015, I along with Cory Clark, student at University of the Cumberlands, and Sipriano Canti, BFREE staff member, initiated a pilot study to compare the small mammal communities between BFREE's cacao plantation and nearby forest habitat. We established permanent trapping grids with 100 trap stations in the center of the cacao farm and in the forest approximately 0.5 km south. Figure 1 summarizes number of individuals caught in each habitat. We identified the small rice rats only to genus (Handleyomys spp.) because of difficulty in distinguishing them in the field. Other species caught included forest spiny pocket mouse (Heteromys desmarestianus), hispid cotton rat (Sigmodon hispidus), Coue's rice rat (Oryzomys couesi), Mexican mouse opossum (Marmosa mexicana), and big-eared climbing rat (Ototylomys phyllotis).

This comparative study of small mammal communities will be a valuable curricular focus for visiting student group. In my own courses, I will use it as a model for demonstrating the scientific method and students will assist in collection of data during their stay. In doing so, they will learn small mammal identification, handling and processing techniques, skills important for students interested in careers in ecology and conservation. The education committee is currently developing curriculum documents that will facilitate participation in this study by other student groups during the upcoming field season. We hope the data collected across the dry season will contribute to the understanding of small mammal community structure in these habitats. Because this project is focused on the comparison of agroecosystems to natural habitats, it will also serve as a good example to students of the importance of integrating human needs and concerns in the disciplines of ecology and conservation biology.

1 Greenberg, Russell. Biodiversity in the Cacao Agroecosystem: Shade Management and Landscape Considerations. Smithsonian Migratory Bird Center. http://nationalzoo.si.edu/scbi/migratorybirds/research/cacao/greenberg.cfm

THE EDUCATION COMMITTEE

BFREE formed an Education Committee in Fall of 2014. Members include Dr. Sara Ash, Dr. Maarten Vonhof, Dr. Stewart Skeate, Mr. Mark Cline Lucey and Dr. Peter Esselman, Chair.

Audrey Ash and Dr. Sara Ash weigh one of the small mammals trapped in the forest grid during June 2015.

WOOD THRUSH: North and South

A freshly released wood thrush with his brand new color bands and radiotag, which is just barely visible except for a tuft of white feathers on the bird's back. Photo by Laura Duval.

BY CALANDRA STANLEY
PhD Student,
University of Maryland and Smithsonian Migratory Bird Center
MSc Biology, York University

One of the most common Neotropical migratory songbirds you can see at BFREE, hopping along the trails in the early mornings or evenings, is the wood thrush (Hylocichla mustelina). Although they do not sing their distinctive flute-like song while at BFREE, if you listen, you will most certainly hear them chuckle at you when you are in your cabin, tent or at the kitchen. Even though they are found in abundance at BFREE, this species along with many Neotropical migrants have been declining over the last 40 years. For wood thrush, their numbers have declined by 2.1% per year since the 1960s. Understanding these declines has been difficult largely because there has been no way to study these populations across the whole year due to their annual migration to and from North and Central America. But recent studies using light level geolocators (some even deployed at BFREE by Dr. Emily McKinnon!) to track wood thrush in Central and North America have begun to unravel the mystery of where wood thrush populations go between their breeding and wintering periods.

Using the tracking data gathered from these light level geolocators, the Smithsonian Migratory Bird Center began a new project to study wood thrush across their annual cycle to pin point what factors are critical to the survival and success of this

Wood thrush with a radiotag backpack, barely visible except the antenna sticking out below the wings. The radiotag is used to keep track of the birds movements throughout the winter period. Photo by Calandra Stanley.

Calandra Stanley crossing at Blue Pool after a morning of radio-tracking wood thrush in the Bladen Nature Reserve. Photo by Lucy Welsh.

species. Starting with a breeding population in southern Indiana, we discovered using geolocators that individuals tracked from Indiana spent the winter in the northern region of Central America, such as Belize and Guatemala. Furthermore, wood thrush tracked from BFREE were also found to breed in Indiana and Kentucky. It was a perfect fit! BFREE could serve as a representative wintering location for our breeding population in Indiana. Now it was time to study these birds in Central America.

Little is known about the lives of migratory songbirds during the wintering period. For my PhD project that is one of the big questions I wanted to explore. In order to do so I needed a way to follow our birds all winter long in order to figure out what factors (eg. diet, habitat, predation) influence the survival and health of this species. Anyone who has tried to watch a wood thrush will know they are a very secretive bird, suspicious of everyone! To ensure I could follow them all winter long, until they departed for North America, my field crew and I placed radio transmitters like little backpacks on them so we could find them from day to day. I will then try to see if the type of habitat birds occupy and the amount of food available to them influences their survival and when they decide to leave for their breeding grounds in the spring. By working with wood thrush on both their breeding and wintering grounds, I hope to find out what is happening to this declining species. Stay tuned for the results!

Above: *Stanley retrieving a light-level geolocator from our breeding population of wood thrush in Indiana. The data retrieved from these geolocators revealed birds traveled to northern Central America, which is why she started her project in Belize! Photo by Dana McCoskey.*
Left: *2015 field crew (L to R: Lucy Welsh, Calandra Stanley, Jessica Hightower) after a long afternoon of fruit and insect surveys to determine the amount of food available to the wood thrush being radio-tracked. Photo by Paul Spitzer.*

EATING LOCALLY THINKING GLOBALLY

The University of Richmond group after visiting the banana plantation.

BY Dr. AMY TREONIS
Associate Professor of Biology,
University of Richmond, Virginia

This season, my colleague, Elizabeth Ransom, and I taught a new course called "Eating Locally, Thinking Globally." My whole career, I've been a desert ecologist, most recently studying soils in the Mojave. So, it was with some nervousness on my part that we identified the tropics of Belize as the destination for our class trip. Belize and its ecosystems were terra incognita until we connected with BFREE, but the cultural narratives and unique environments of the country were the perfect backdrop to experience food in both intellectual and yummy ways.

Every day of our trip, students encountered something that made them think. Some found inspiration in the gentle teachings of Gomier, whose health food we feasted on in Punta Gorda. Others were struck by the plight of Mayan citrus growers, trying to stay competitive as their groves were decimated by disease. In learning about cacao, we saw a way for agriculture to integrate into the natural environment, rather than replacing it. Finally, all of us fell in love with the hicatee, a turtle threatened due its value as a culturally important food.

"Although we had discussed the biodiversity of Belize and the tropics as a whole in class, I was still dumbfounded by the sheer number and variety of creatures I saw that called Belize home."
– Dylan Fox, Student

Of personal significance to me were the ways that food, agriculture, and the environment intersected so vividly in Belize. In class, we discussed how bananas were grown, and I read a great book about the topic entitled *Banana: The Fate of the Fruit That Changed the World*. But it didn't really impact me until I had stood in a plantation surrounded by 300 acres of banana monoculture, learned about the intensive pesticide and fertilizing regime from the foreman, and observed the depleted soils underfoot.

"Our trip took us from coastal fishing towns to the heart of the rainforest, and at each stop I felt myself becoming more connected to my food. Bananas were no longer the yellow option in the fruit basket, citrus became more precarious than ubiquitous, and chocolate bars stopped being friendly tenants of vending machines."
– Emily Gove, Student

I didn't expect to love the tropics so much given the stark contrast to the wide-open, dry expanses of deserts that I am used to. However, I can't wait to return to Belize with a new group of students!

Chef Gomier emphasizes the importance of choosing food wisely.

2015 BFREE Field Courses

University of Massachusetts, Amherst hiking out. Photo by Sean Werle.

New York City College of Technology
Architecture Study Abroad in Belize
Instructor Lia Dikigoropoulou

Nebraska Wesleyan University
Tropical Biology
Instructor Jerry Bricker

University of Richmond, Virginia
Eat Locally: Think Globally
Instructors Elizabeth Ransom and Amy Treonis

Independence Junior College, Belize
Protected Areas of Management
Instructors Abigail Parham-Garbutt and Godfrey Arzu

University of North Carolina, Wilmington
International Field Experience in Environmental Studies
Instructors Jamie Rotenberg and Vibeke Olson

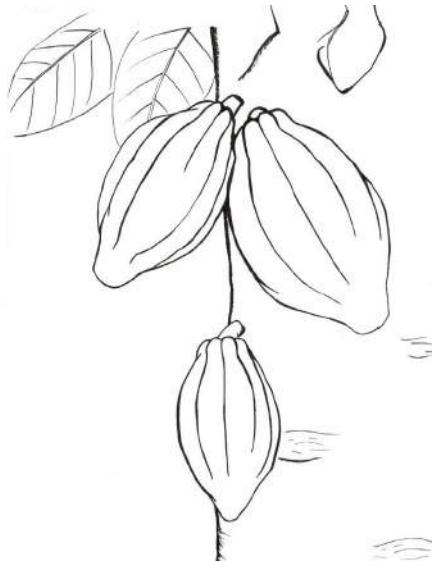
University of Massachusetts, Amherst
Tropical Field Biology
Instructors Sean Werle, Nuno Goncalves, Adam Porter, Steve McCormick, Paul Sievert, Tristram Seidler and Frank Carellini

Field Guides
Birding in Belize
Group Leader Peter Burke

Emory and Henry College, Virginia
Belize: Environment and Sustainability
Instructors Ed Davis and Laura Hainsworth

Otterbein University, Ohio
Tropical Biology
Instructor Harold Lescinsky

CACAO-BASED AGROFORESTRY HANDBOOK



The handbook will be filled with simple and clear illustrations to supplement and enhance written material. Illustration by Katherine Weeks.

BY HEATHER BARRETT
Dir. of Organizational Development, BFREE

Now in its 3rd year, the Belize Cacao-based Agroforestry Restoration Project (BCARP) is on the path to broadening its reach by producing an illustrated handbook to be distributed around the country. The BCARP seeks to expand habitat for over-wintering migratory birds and other wildlife by converting environments such as farmland and secondary growth forest to wildlife-friendly agroforests with cacao as the dominant understory.

To date, this BFREE project has helped farmers in the nearby agricultural community of Trio Village to plant over 20,000 trees. Support has been offered in the form of training, labor, materials, and extension services. From the very beginnings of the project, interest in cacao and organic farming far surpassed BFREE's expectations, in spite of the great desire to continue to expand by adding more farmers to the project, it also exceeded the financial and human resources dedicated to the project.

Always up for a challenge, BFREE decided a handbook illustrating specific methods could be one valuable component of a larger effort to address the ever-growing interest in cacao. Working with Dr. Jamie Rotenberg, BFREE board member and professor, BFREE engaged students at the University of North Carolina, Wilmington to help with the development and design of the handbook.

Nine graduate students in Dr. Rotenberg's class, EVS: 530 "Graduate Tropical Environmental Ecology," embraced the opportunity to produce something lasting and useful to farmers. Over the fall semester, the team worked to vet and compile resources for the handbook content. The clear priority was to design a guide specific to Belize that was thorough and complete yet simple to understand and illustration-based rather than text-heavy to account for varying levels of literacy and language.

In December, the team presented their final products to BFREE. Both students and staff were thrilled with the results; the handbook was attractive, comprehensive, clear, and included both English and Spanish translations. Unanimously, the group agreed the handbook was a great beginning and the next step was fine tuning.

Elmer Tzalam, BFREE Cacao Farm Manager, and Gentry Mander, recent University of Florida graduate and long-time BFREE collaborator, along with other BFREE staff, edited the handbook content and compiled recommendations for a final version. Those edits were given to former EVS:530 students, Sara Marriott, Katherine Weeks, Danielle Frank, and Carmen Johnson, who eagerly accepted the opportunity to work with BFREE to complete the project. We anticipate publication of the handbook by early 2016, and distribution in Belize immediately following.

We are most grateful to Dr. Jamie Rotenberg and his students: Karissa Bearer, Johanna Colburn, Lindsey Cole, Danielle Frank, Evan Gruetter, Carmen Johnson, Bretton Little, Sara Marriott, and Katherine Weeks. Their investment of time, energy, ideas and enthusiasm spurred on this meaningful project.

Above: *A flowering cacao tree.* ***Left:*** *Cacao pods appear on a growing cacao tree.*

Left: *Elmer Tzalam shows a student from Emory and Henry College how to properly harvest a cacao pod during a field course.*
Below: *A cacao tree marked for harvest.*

BENEFITS OF AN AGROFORESTRY SYSTEM IN BELIZE

BY GENTRY MANDER, BFREE Consultant
& JACOB MARLIN, Executive Director of BFREE

Belize is being deforested at an alarming rate. In 2013, the country was stripped of an estimated 9,290 hectares of forests, and Belize's forest cover has diminished from nearly 75% of the country's land area in 1981 (the year Belize gained independence) to 60.7% in 2014. Although most of this deforestation has taken place outside of protected areas, it is clear that agriculture, especially large-scale monocultures, is a major culprit.

In contrast to monocultures and traditional slash-and-burn (milpa) agriculture, cacao-based agroforestry provides environmental benefits such as carbon sequestration, conserving soils from erosion and runoff, providing habitats for wildlife, as well as allowing for the cultivation and extraction of non-timber and timber resources from the forest.

All forest inhabitants appreciate and benefit from the habitat provided by an organic, cacao-based agroforestry system that retains the canopy forest structure. In exchange for a home, these inhabitants balance the agroforestry system ecologically by regulating insect pests, which eliminates the need for expensive and harmful chemical pesticides. Even the canopy structure itself is important to organic agroforestry, as the leaf litter and woody debris from the shade trees provide fertilizer to the cacao trees and other understory crops.

In the face of climate change, a country susceptible to extreme (and changing) weather conditions, such as drought, hurricanes, rising temperatures, and rising sea levels will benefit immensely from retaining carbon sinks and healthy productive forested agricultural system; it benefits people, wildlife, and the country as a whole.

2016 CAPITAL CAMPAIGN

"Please help make 2016 a transformational year for BFREE"

During 2012, BFREE worked with University of Florida to create a five-year tourism plan for the field station including staffing improvements and infrastructure development. These developments will allow us to generate a constant revenue stream through increased visitation and by providing amazing educational experiences for students of all ages, which ultimately will enable us to focus on our mission of "conserving the biodiversity and cultural heritage of Belize."

We are thrilled to report that as we embark on the 4th year of the plan, we are right on track! Following this plan and with your help, we have: built researcher cabins and composting bathroom facilities to more comfortably accommodate our non-student visitors; hired new staff members including a Field Course Leader, two Rangers, and, most recently, a Site Manager; re-established the Protection Program and constructed an associated Observation Post along the eastern boundary line of the property; completed construction of the Hicatee Conservation and Research Center, which is now active with 29 critically endangered Central American river turtles; constructed and opened a small store at BFREE – the Cool Spot; and all the while have continued to host student groups, researchers, and other visitors receiving wonderful feedback throughout!

We want to make the final push in years four and five to improve the overall infrastructure at the field station. Although we have lofty goals, we are ready! We plan for three major infrastructure improvements that will push BFREE operations to the next level of professionalism, these include: 1) installation of a large, centralized photovoltaic solar system for increased electricity throughout BFREE facilities; 2) renovation of the kitchen and dining area with new, industrial appliances and more space to better accommodate all of our guests; and 3) construction of a staff house with separate male and female wings and an attached laundry facility.

To fund these improvements, we are embarking on a capital campaign and we are asking that, you, our long-time friends and supporters, contribute. With your donation, you have the opportunity to make a direct and positive impact on the long-term conservation of the rainforests and other wilderness areas of Belize.

Thank You to All Our Donors

We are grateful for both the financial and in-kind donations received from summer 2014 to summer 2015.

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Please let us know of any omissions or errors on this list.

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BFREE has become a member of the Fine Chocolate Industry Association and we are currently experimenting on a very small scale with making chocolate using the beans produced from our cacao and coffee agroforest. Visitors to the field station can participate in harvesting and processing both coffee and cacao and are able to taste the fruits of their labor.