

Amigos

Newsletter

No. 80, November 2013

Wilson Botanical Garden

Las Cruces Biological Station

Apdo. 73-8257 San Vito, Coto Brus, COSTA RICA



Organization for
Tropical Studies

Who We Are

The Las Cruces Biological Station is one of three tropical field stations owned and operated by the Organization for Tropical Studies (OTS) in Costa Rica. Along with the Wilson Botanical Garden, Las Cruces was acquired in 1973 and is a hidden jewel that offers natural history visitors and researchers alike an extraordinary place to visit and conduct research.

Far from the noise and bustle of the country's capital city San José, Las Cruces is located in the remote southwestern corner of the country between Corcovado National Park on the Osa Peninsula, and the enormous La Amistad Biosphere Reserve (472,000 hectares) that spans south-central Costa Rica and western Panama. In 1983, UNESCO declared Las Cruces and the Wilson Botanical Garden part of the Reserve due to its incredible diversity and proximity to La Amistad.

The Wilson Botanical Garden, founded in 1962 by Catherine and Robert Wilson, is arguably the most important botanical garden in Central America and a "must see" stop on the itineraries of plant lovers, birders, and other natural history groups. It is famous for its worldwide collection of tropical plants which include palms, aroids, bromeliads, ginger, marantas, heliconias, and ferns. More than 3,000 exotic species of plants can be found in the 10-hectare (~25-acre) garden, including one of the largest collections of palms in the world.

There is an incredible diversity of animals at Las Cruces, and in the immediate area surrounding the station. The most recently updated bird list includes 410 species; close to half the number of birds found in all of Costa Rica. There are also over 100 species of mammals, of which 59 are bats. Some of the more commonly sighted mammals include agoutis, white-faced capuchin monkeys, kinkajous, olingos, and tayras. Reptiles and amphibians also thrive in this moist, cloud-laden habitat and there is an impressive diversity of insects, and in particular moths and butterflies.

Las Cruces protects over 200 hectares of primary forest (home to over 2,000 native plant species) and several smaller adjacent areas that are in various stages of forest recovery. The forest is surrounded by a mosaic of mixed-use agricultural fields and forest patches, and it is this fragmented setting that makes Las Cruces an ideal place to study the effects of forest fragmentation and isolation on animal and plant communities. The landscape surrounding Las Cruces is also ideally suited for research on biological corridors and restoration ecology; key fields of research that are of ever increasing importance. Part of our mission at Las Cruces is to continue to purchase land for reforestation and, in doing so, expand our protected areas and connect some of the isolated forest fragments around the station. For further information on this campaign please visit our website.

At approximately 1,200 meters elevation (3,900 feet), the prevailing temperatures at Las Cruces are cooler than one might expect. Temperatures range from 21-26 °C (70-80 °F) during the day and 15-21 °C (low 60's) at night. Mean annual rainfall is ~4,000 mm (157 inches)! The dry season runs from January – March, and the rainy season from May – November. Most visitors and researchers come during the dry season.

The station is well known for its visitor-friendly amenities: comfortable private sleeping quarters, delicious meals, knowledgeable and enthusiastic staff, and a well-maintained network of paths and trails.

We also provide internet access to overnight visitors.

The nearest town is San Vito, the capital of Coto Brus County. It was settled in the 1950's by Italian immigrants and to this day there is a strong Italian presence. There is an excellent pizzeria, and the Dante Alighieri Italian-Costa Rican Community Center provides language instruction. Indeed, Coto Brus is the only county in Costa Rica where Italian forms part of the elementary curriculum!

We invite you and your family and friends to come visit us for an afternoon, an overnight stay or a week to see and experience firsthand the splendid tropical diversity of the Las Cruces Biological Station and Wilson Botanical Garden.

For more information please visit the OTS website at <http://www.ots.ac.cr/> or contact us directly by email: lcruces@ots.ac.cr. Postal mail can be sent to: Estación Biológica Las Cruces/Jardín Botánico Wilson, Apdo. 73-8257, San Vito de Coto Brus, Costa Rica. Telephone (from the U.S.): 011 (506) 2773-4004.

Reservations can also be made by contacting the OTS office in San José by email edu.travel@ots.ac.cr; postal mail: ESINTRO/OTS, Apdo. 676-2050, San Pedro de Montes de Oca, Costa Rica, or by telephone (from the U.S.): 011 (506) 2524-0607.

The North American OTS office is located at Duke University, telephone: (919) 684-5774 or email: nao@duke.edu.

The Organization for Tropical Studies is a nonprofit consortium of universities and research institutions in the U.S., Costa Rica, Peru, Mexico, South Africa, and Australia.

Founded in 1963, OTS is dedicated to providing leadership in education, research and the responsible use of natural resources in the tropics. To this end, OTS offers graduate, undergraduate and professional education, facilitates research, participates in conservation activities, conducts environmental education programs and maintains three field stations in Costa Rica: La Selva Biological Station in the Atlantic lowland rain forest; Palo Verde Biological Station in the Pacific deciduous dry forest; and Las Cruces Biological Station in the premontane cloud forest near the Panamanian border.

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Front Cover: A grainy and mysterious image of a Puma (*Puma concolor*) taken as it saunters past a camera trap placed along the Gamboa forest trail in the Las Cruces forest (see article in What's New). Photo Ángela Mejía.

Back Cover: A Great False Vampire Bat (*Vampyrum spectrum*), the largest Neotropical bat, captured for the first time in our area (see article in Flora y Fauna). Photo Hannah Frank.

Editorial Committee: Alison Olivieri, Rodolfo Quirós, Emilce Ramírez, Ariadna Sánchez, Zak Zahawi.

Director's Keys and Notes



The river Lot in its sheet of glass rendition. Photo Zak Zahawi.

Zak Zahawi/zak.zahawi@ots.ac.cr

To the non-discerning eye, one might think that a river is simply a river. A channel through which a large body of water flows until it reaches the sea. But if you happen to live next to a river, and you took the time to visit it at least once a day, then one's opinion would likely change. But this might not occur to you if you had never had such an experience, which is what happened in a recent 2-week vacation to the south of France. I know I know, this is the Amigos newsletter and an article on a river in the south of France (the Lot to be precise) seems a bit out of sorts. But rivers are ubiquitous features of the landscape in most parts of the world and what struck me is the incredible dynamic and 'personality' of a river from day to day. I realized that I had never really

taken the time to sit and observe a river repeatedly over a short time span, although I have obviously seen many rivers and always admired them, even if for just a few minutes as I passed by, so this inspired a 'plug' for rivers anywhere in the world!

The Lot is a 481 km long river that starts out in Cévennes and winds its way in a westerly direction until it hits the town of Aiguillon where it joins the Garonne that later empties into the Atlantic near the city of Bordeaux. Needless to say any river of this size would be dynamic and varied along its length but what was remarkable about my experience is the fact that all the observations I made were in the same place. They differed only in terms of the day I sat there and the time of each visit. It helped that we were staying in a house that sits along the Lot and the river was just a 2

minute walk – so frequent visits were easy and possible. But what started out initially as a sporadic set of visits to jump in for a swim or a walk along the river, turned into directed visits to see what the river was up to whenever I had a chance to go and take a quick look.

One of the more routine changes was the level of the water, which rose and fell on a daily basis. The Lot, as with many rivers in mainland Europe, has numerous weirs and small dams along its course to control the flow of water. The Lot also runs through highly productive agricultural areas and large quantities of water are pumped out by generators on the banks of the river to irrigate fields during twilight hours. As a result water is released upriver periodically and this alters the depth of the river quite frequently. While that may not seem particularly intriguing, the way the river flows is altered dramatically, although for some reason this is not entirely dependent on the water level. At times the river is bursting and flows very rapidly. I have swum during these high flow periods and been swept downstream to such an extent that it was extremely difficult to get back to my starting point. When the river is swift it swirls and twists and the water appears to submerge and rise, carrying uprooted aquatic plants and other plant debris down to the sea. On other occasions the river is just as high but, strikingly, there is almost no flow at all and one stands there puzzled looking at a glassy surface as if it were a lake. My investigative mind was at once set at trying to figure out why this was so – could it back up at the downstream weir/dam until the water is

released there? Is it some sort of bottleneck effect in other words? Do boats need to go through the sluice gates to alter the level rapidly? Whatever the cause the difference in appearance is dramatic. Then when the river recedes aquatic plants are exposed along the shallower banks and sway with the movement of the water only to disappear when the river rises again.

Foraging is another popular activity on the river. Humans are eager participants as fisherman sitting in plastic chairs on the banks of the river, standing knee-deep in the water, or drifting in a small rowboat as they repeatedly cast a line into the water. The fish are quite subdued for most of the day and seem well-versed in the language of hook and bait avoidance. But come dusk there is a feeding frenzy as fish capture the aquatic insects darting along the surface and the many mosquitoes and other airborne critters that hover just above. On several visits this has looked like a silent orchestra on a slate of water. Fish all across the river's surface popping their heads out of the water to capture an insect, creating an asynchronous but continuous series of inverted drops as far as the eye can see. The effect is truly spellbinding. On other evenings I saw swans, typically a group of three in my viewing spot, feeding on the aquatic plants. Gracefully they submerge their heads and emerge soon after, nipping their beaks gingerly as they look about to see if anything has changed above the surface in their brief visual absence. They always seemed to stay close together and by doing so increased their vigilance to impending

threats as at least one of the three would invariably have their head above water while the others went under. But what are they being vigilant about I wondered – what creature would attack a swan? Perhaps they are still attuned to the dangers from long ago extinct felines that once roamed southern France? “Instinct,” you say. This relative calm on display is punctuated periodically by a big splash and ripples as a larger fish presumably eats a smaller one, only to disappear below the surface once again.

At night the river is calm... even when it is fast moving there seems to be a decision by all that it is time to rest. The scenery is complemented by the cottonwood trees on the banks of the river silhouetted in the water in what looks like an abstract artistic rendition. Even at night it is still inviting and I found myself jumping into the river on several occasions for a swim in the dark. Apart from the ever changing dynamic of the river, it also harbored an incredible meditative effect and, at times, after sitting next to the river for 20 minutes or so I would find myself reluctant to leave. Indeed it felt very sad to say goodbye at the end of my stay and I knew I was going to miss having it in my back yard. All told it makes me wish I could adopt a river closer to home to observe but unfortunately the T erraba is just a little too far away for repeated frequent visits, important if you want to notice the subtle nuances that I saw in the Lot. So, if you are lucky enough to live near a river, I would highly recommend frequent visits as the results may be quite surprising and rewarding.

What's New at Las Cruces?

Zak Zahawi / zak.zahawi@ots.ac.cr

More Cats

It seems as though they want to make their presence known and this newsletter is turning into a report on cats (see article in Flora and Fauna)! We reported on the recent camera trap photos of Ocelots (*Leopardus pardalis*) in the Las Cruces forest in the May 2012 Amigos newsletter. But much to our delight a graduate student doing camera trap surveys in the AmistOsa corridor area captured an image of a Puma (*Puma concolor*; same species as in North America) in the Las Cruces forest in late July (front cover photograph). Though the Puma is on our species list and is listed as rare, this is the first reported sighting in almost a decade, and certainly the first confirmed report for Las Cruces. These cats are considerably bigger than Ocelots and are second only to Jaguars in size. They have extremely large home ranges so this individual is likely just passing through and may be coming down to the Las Cruces fragment from the ridge where there is considerably more forest to be found. Certainly makes for a strong plug to continue our drive for land acquisition and protection along the Las Cruces – Guaymí Biological Corridor!!



Bridge Over Troubled Roadside

Amid great fanfare (music, clown theatrics, lots of rowdy kids), ICE [Instituto Costarricense de Electricidad] set up an aerial bridge to span across the main road that passes by the station. Though not directly in front of Las Cruces, the bridge inauguration was the opening ceremony for this year's Eco-cultural Festival and was a big draw. Amazingly, it only took a few months for the bridge to be put to use and now at least arboreal critters moving from one fragment to the next have an alternate route that they can take.

A White-faced Capuchin (*Cebus capucinus*) makes the crossing along the new aerial bridge spanning the main road in front of the station.

Photo Ariadna Sánchez.

Abiotic Transects

During this year's NAPIRE (Native American and Pacific Islander Research Experience) program, an initiative to establish two climatic transects was hatched by Cindy Sagers and Alice Hughes, two researchers who served as mentors for the program. At both Las Cruces and Las Alturas *ibuttons* were placed at 100 m elevational intervals (Las Cruces 1000-1400 m; Las Alturas 1500-2200 m). Ibuttons are nifty little gadgets about the size of four quarters stacked together. The gizmos have a tiny battery inside and a sensor that records temperature and humidity at programmed intervals. These have been set to take a reading every 6 hours and can do so for up to 4 months before the data need to be downloaded. The idea is that the data can serve as baseline information for research projects that may be established in the area, and for long-term monitoring of climate variability. Data will be made publically available on the OTS website.

Zzzzooooom!

Hot off the press: Las Cruces moves to ****4MB**** internet bandwidth!! And it really makes a notable difference. This upgrade is due to the installation of fiber optic cable, which will also allow us to change our bandwidth to whatever needs we might have in the future. Up until recently, installation of fiber optic cable was prohibitively expensive but it has finally become within reach and, as remote as we might be geographically, we are now well integrated into the grid. Of course that doesn't mean that 100 students can download movies without clogging the system but hopefully we won't have the same problematic issues that we had this summer! Come with your laptop next time you visit LC!

Research at Las Cruces

Tracking the Responses of Understory Herbs to Changing Light Environments

Andrea Westerband / acwester@bio.miami.edu

Tropical rainforests are highly dynamic environments. The amount of available resources fluctuates over space and time, forcing rainforest inhabitants to cope with these changes in a myriad of ways. For understory plants, capturing enough resources to grow, survive, and reproduce, is further complicated by their lack of mobility. Light, the most crucial resource for plants, is patchy within rainforests. Trees often fall, creating large gaps in the canopy that allow vast amounts of light to hit the once dark forest floor. These gaps will then shrink slowly, as new plants grow up and into the gap. Studying how individual plants cope with these changes allows us to predict how entire populations will respond to changes in the environment. We can answer questions such as: Does the importance of light change as a plant ages? Do different species use light similarly in all light environments? What specific adaptations allow these plants to live in such dynamic environments?

To answer these questions, I will monitor a suite of morphological and physiological traits during various stages of the life cycle of two herbaceous plant species. I will follow individuals of various ages in the Las Cruces forest to find out how they respond to the forest light, and I will conduct a series of experiments using a shade house built at the station. The goal is to construct a mathematical model that predicts how plants will respond to changes in the environment, using information about their morphology and physiology. Similar studies have focused on particular developmental stages, or life stages, and attempted to infer responses over a lifetime. Unfortunately, such studies often fail to

provide a complete picture of how plants respond to change, especially for long-lived plants such as trees.

The two focal species are *Heliconia tortuosa* and *Calathea crotalifera*. Both are part of a taxonomic group commonly referred to as gingers (Order Zingiberales), which includes bird-of-paradise flowers, bananas, arrowroot, and the commonly used ginger, turmeric, and cardamom, among others. These widespread herbs inhabit a variety of light environments, grow quickly, and many reach heights comparable to those of small trees. Gingers are abundant in the Las Cruces forest, making it an excellent study site for those interested in this diverse group.

In June of 2012, I tagged approximately 1200 individual plants of various sizes. Year after year I return to the forest and find the tagged individuals that are still alive using a series of maps I created (and many hours searching the forest floor for small aluminum tags). For those that are living, I measure various indicators of size, how much they are reproducing, and how much light they receive from the canopy. Results from last year indicate that *Calathea* are growing more than *Heliconia* in the same light environments (based on canopy openness), but that reproduction was not significantly higher in high light environments.

In addition, I have been measuring the physiological responses in a subset of these plants, using a machine known as a LICOR. The LICOR has highly sophisticated sensors that measure small changes in gases per unit of leaf tissue per time, essentially telling us the rate at which gases are taken up or released by the leaf. As carbon dioxide concentration decreases, we know that the plants are photosynthesizing, and we can see how much water and oxygen



Using the LICOR to measure photosynthesis in a *Calathea* plant.

My two study species *Calathea crotalifera* (left) and *Heliconia tortuosa* (below). Photos Andrea Westerband

they release at the same time. Results from last year show that the maximum photosynthetic rate depends on both species and size, where *Heliconia* juveniles photosynthesize at much higher rates than *Calathea* juveniles but adults of both species have very similar photosynthetic rates. These results suggest that juveniles have adapted to constantly living in the shade of larger plants, by photosynthesizing more than the larger adults. Results from more extensive sampling done over the summer are currently being analyzed.

The next stage of my project will involve rearing nearly 1000 plants in a shade house at Las Cruces. We collected seedlings of both species and will grow them in both high and low light conditions to study their morphology (size) and physiology, as we have done for the forest populations. The shade house experiments allow us to control many factors that could affect results, such as soil conditions, moisture, and temperature, and will allow us to take more detailed physiological measurements that have been too time consuming to take in the field. This research would not have been possible without the help of the Las Cruces staff, who built the shade house in a matter of weeks.

Lastly, in addition to being a tremendously valuable research site, Las Cruces is also a popular ecotourism destination, which facilitates outreach to the public. Recently, I had the wonderful opportunity to work with the Boekschoten family from the United States. The Boekschotens, and their youngest son Rudi, were interested in living a day in the life of a researcher. Together they helped me collect more than a hundred seedlings for my shade house experiment. Both parties benefited from this field day; I had some much needed extra help and at the same

time Rudi, a budding young scientist, was able to experience true field research. I hope to continue to engage the public with my research while at Las Cruces, and hope that other researchers will see the tremendous benefit involved in such activities.



Being a “Bee Mother” in the Tropics

Hanna Eberlein / hanna.eberlein@gmx.net and Urs Kormann / urs.kormann@agr.uni-goettingen.de

When I visited the La Selva OTS field station I heard a rumour that all the Germans coming to Costa Rica do so to study bats. Well, that’s not exactly true. There exists at least one master student of geo-ecology from southwest Germany who came to the tropics to investigate the effects of deforestation on a huge insect group: the hymenopterans. In my case, this basically means bees and wasps, and that’s why a friend of mine called me “loca,” as he believed insects in the tropics to be huge, poisonous and extremely aggressive. Even my parents were afraid I would get severely stung. Fortunately, nothing of that happened; I’m still alive and not stung (at least not by wasps or bees), but rather happily feeding up little bee and wasp babies in the lab of Las Cruces. But maybe I should explain how this all happened...

So, what exactly are hymenopterans?

Bees, wasps and ants form this highly diverse group of insects. Worldwide there are more than 250.000 species scientifically described, but the fact is that there is still a huge question mark in their taxonomy, especially in tropical species, where the total number is estimated to reach half a million or more species. In Costa Rica there are over 17.000 hymenopteran species, which are, for tropical circumstances, relatively well described in the book by Paul Hanson and Ian Gauld: *The Hymenoptera of Costa Rica*. Thanks to this seminal identification book (also known as “Hanna’s lab bible”), the identification of specimens to genus level was quite feasible. In contrast, the identification to species level remains quite a challenge, and that’s why tropical bee and wasp scientists specialize on just one small group, because no human being can tell apart all the species of all groups.

Some of you might associate bees and wasps mainly with some displeasing encounters while you were enjoying some sweetish and sugary drink on your veranda at home or in Las Cruces. Especially those will wonder why we choose wasp and bees to study. One reason is that bees and wasps can provide important ecosystem services: bees are important pollinators of wild herbs and also of human crops, and there is currently a large discussion going on related to the worldwide pollinator decline, the so called pollinator crisis. Wasps on the other hand can potentially provide pest control for agriculture, as the adults collect caterpillars and other pests in the thousands as a food source for their larvae. Another reason why we chose bees and wasps was that they are present in almost any ecosystem. So they can be used as indicators for the “health” of landscapes.

In my master’s project at the University of Göttingen, Germany, I use these properties to examine how fragmentation and isolation of tropical forests influence bee and wasp community structure and trophic interactions among them. In collaboration with Oregon State University, my supervisors Urs Kormann and Teja Tscharntke already investigated the links between hummingbirds and hummingbird pollinated plants in some of the forest fragments around Las Cruces Biological Station last year, and so we thought it would be a good place for my study as well. And, after having crossed the Atlantic Ocean, I found out that Las Cruces with all its large and tiny tropical forest fragments is indeed a perfect place for this.

And this is how it works:

The bees and wasps are collected in forests and nearby pastures with so called trap nests. These nests consist of a bundle of reed tubes, and they work like little



artificial houses. Bees and wasps are invited to build their nests in there and also put their eggs in. I sometimes get asked if I use some kind of pheromones to attract them, but no. They just come because the nests are so comfortable and they don’t have to fly around and look for appropriate wood or dead plant sticks to use instead. The sad part is, that most of their offspring will never reach the wild again, because we come and collect the occupied nests and let the larvae hatch in the lab of Las Cruces for identification purposes. However, this is also one of the most thrilling parts: especially when wasps plug the most interesting organisms in their nests such as cockroaches and colorful spiders. One of the most stunning facts is probably also the most morbid one; most of the animals that were provided as a food source for the wasp



- 1. A newly emerged eumenid wasp in a hatching tube**
- 2. A wasp nest in the lab with wasp larvae (white) and spiders as larval food**
- 3. A chrysidid wasp looking for an appropriate nesting tube to parasitize**
- 4. Observations on a trap nest near Cañas Gordas**

larvae are in fact not dead, but just paralyzed by the sting of the adult wasps. Hence they remain in the nest as a kind of zombie, waiting to be eaten by the growing wasp. Sometimes, we would even find what we call a hyperparasitism massacre. This phenomenon occurs when a parasitoid attacks and develops on another parasitoid. In our case,

some of the wasp larvae will never ever hatch, as they are eaten by other species such as ichneumon wasps. It's exactly this kind of relationship which will hopefully allow us to know more about the effects of tropical deforestation on trophic networks, i.e. who eats whom.

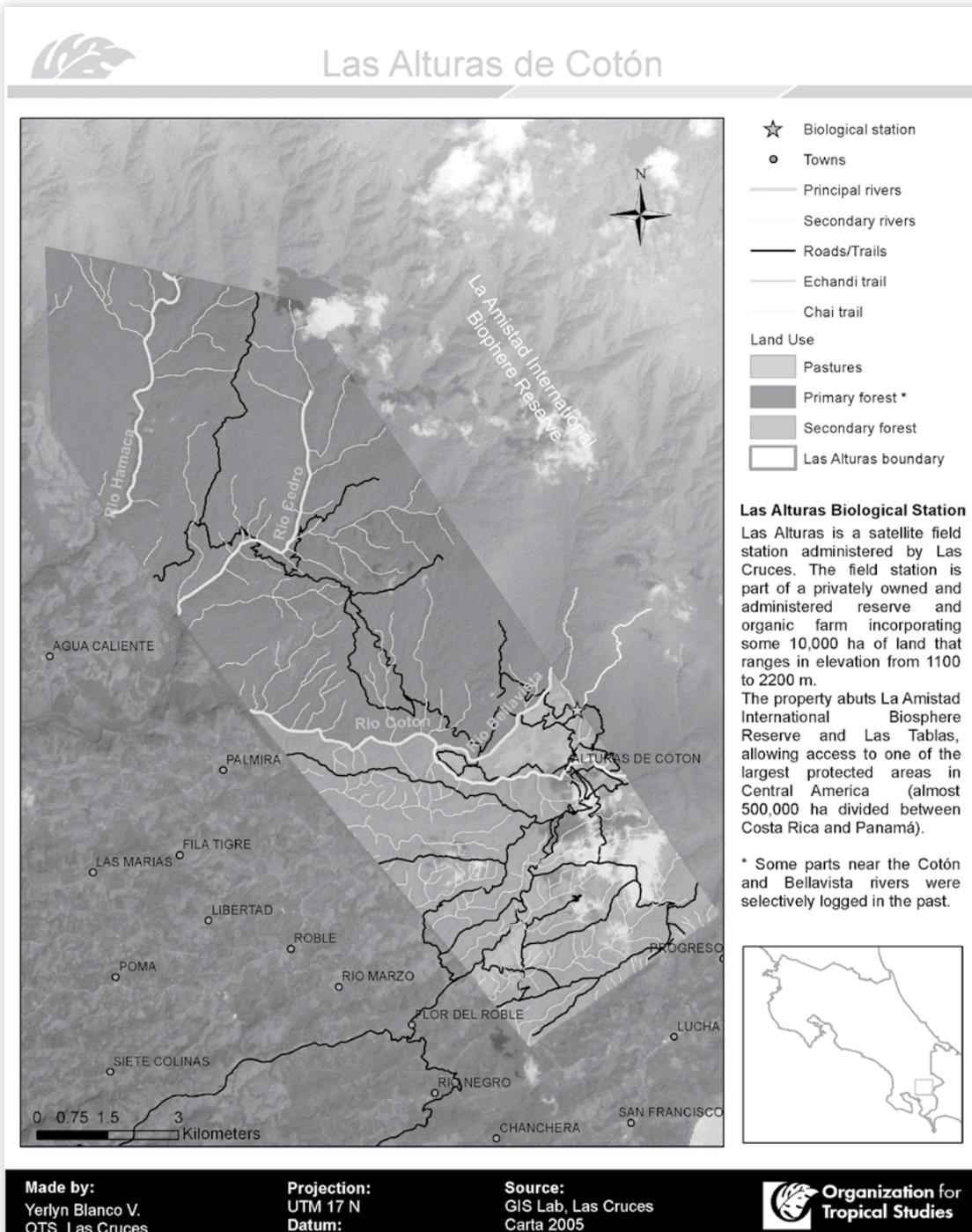
The field work for our study at Las Cruces will run until the end of November 2013, so maybe you will see some of the trap nests on your hike along the Rio Java. Or if you stop by the Las Cruces lab, just

ask for Hanna. Maybe you will be lucky and observe a little wasp just hatching there or I can show you some bee larvae in their nesting tubes!

Lastly, I want to emphasize that a lot of help for the project was provided by my great colleagues Urs Kormann and Manuel Larbig and of course also by the local people in Coto Brus, especially my field and lab assistants Jafet and Mauricio Paniagua and Dayan González. Thanks to all of you!

GIS Corner

Yerlyn Blanco / yerlyn.blanco@ots.ac.cr



The new Las Alturas map!

Las Cruces has a rich database of cartographic information that is used by researchers for many projects. The aerial photographs are an important part of this database and although the entire geographic area of Costa Rica is not represented in a comprehensive flyover, we have several important mosaics that cover most of the Coto Brus valley. In all, we have a total of 170 orthorectified aerial images.

To enrich this collection, we recently acquired an additional 60 images that include the years 1960, 1980, and 1998. All these images are within a 15 km radius of the station. Photographs will be orthorectified by a group of students at the University of Denver and a group of researchers are planning on using them for a distinct project of landuse change over time. Aerial photographs are not only useful to researchers, they are also important for people who live and work in the area as they can be applied for many projects outside of scientific research.

This year the Las Cruces GIS lab updated the Las Alturas trail and road map. This was done by taking a GPS device on each one of the roads and trails that needed to be mapped, and was done on foot, in a cuadracycle, and even on horseback! The Chai and Echandi trails were also retaken to incorporate recent extensions in both. In all there are now some 75 km of trails and roads that have been mapped in Las Alturas!

Flora and Fauna

The Great False Vampire Bat (*Vampyrum spectrum*) Near Las Cruces!

Hannah Frank / hkfrank@stanford.edu

I can only recall one time that while doing field-work I literally jumped for joy. ... This despite the small frugivorous bat that had attached itself rather vigorously to my finger. It was February 28, 2013 and we had just caught a Great False Vampire bat or *Vampyrum spectrum* (see back cover). As most are aware, Costa Rica is extremely biodiverse; the Coto Brus area alone is home to over 60 species of bats. My colleague, Chase Mendenhall, had been conducting a large population survey of the bats in this region for years and had trained me in identifying the 30 odd species that we commonly catch. There was one bat, however, that I was assured I would never see: the world's largest carnivorous bat and the largest bat in the Neotropics, *Vampyrum spectrum*. In fact, I had told someone the previous night that there were no *Vampyrum spectrum*, also known as the spectral bat, in the area. As it turns out I was wrong.

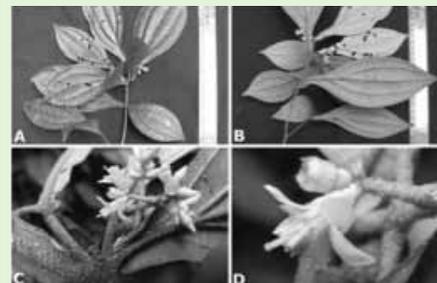
I was sitting at a small plastic table next to a coffee field, "processing" bats – removing their ectoparasites and taking non-invasive samples for genetic testing – for my PhD project where I am looking at how land use and ecology affect bats' evolution and exposure to disease.

My field assistant, Jeisson Figueroa, received a call from his brothers, Randy and Winston, who were checking the nets; they had caught a *Vampyrum spectrum*. I waited with nervous anticipation and crossed fingers and when they approached with the bat, my only thought was "Wow." (In retrospect, this is probably when the *Sturnira lilium* that I was holding at the time took advantage and latched onto my hand.) There was no mistaking it for any other bat in the region. A good deal larger than any other species we catch, it has huge canines that no doubt help it capture the large vertebrate prey it feeds on – including other bats and birds that weigh as much as it does. The individual we caught, a young male, may well have been catching prey to bring back to his mate and their young.

A *Vampyrum spectrum* is a true gem: a rare, beautiful, awe-inspiring creature that you always hope to catch but never expect. I feel incredibly lucky to have seen it and share the news. To my knowledge, there were no records of *Vampyrum spectrum* in the Coto Brus region before this and it is heartening to note that this top predator persists in this modified landscape, flying through coffee fields and forest alike.

A New Tree Species!

Zak Zahawi / zak.zahawi@ots.ac.cr



Close up series of images of *Miconia povedae*, a new species described for science and collected at Las Cruces. Photo Federico Oviedo-Brenes.

The incredible news to report is that we not only have a new plant species registered for Las Cruces (something that happens with relative frequency) but a new species for Costa Rica and science! The plant was initially collected by our station taxonomist Federico Oviedo-Brenes while hiking in the Las Cruces forest. But after he failed to key it out using many different plant guides, he sent some fresh samples to a Melastomataceae expert and the eventual determination was that it was a species new to science! At present it is only known from a few locations in the Las Cruces forest but there must be other individuals out there!! The species has been named *Miconia povedae* and it is a small tree up to 4 m in height with white flowers. It has not been collected bearing fruit as yet.

Busy Night Life at the Las Alturas Biological Station

Leslie Hay / hayleslie6@gmail.com

A brief sampling period of 2 nights demonstrated that the trails at Las Alturas can be busy. I visited Las Alturas with a group of Tropical Biology students from Malone University between June 7-9, 2013. Along with Miguel (an OTS employee from Las Cruces), the class set-up two trail cams in hopes of capturing any wildlife. However, with only two cameras and only two nights to set them out the expectations were focused on mesomammals or terrestrial birds, as the odds for camera trapping any large mammals were low. So the group was extremely surprised to find 3 jaguar photos nested amongst other mesomammals pictures! Indeed in a 1.5 hour time-span, the trail cams recorded a paca, a jaguar, and several photos of an opossum – all in the same location and on the same trail (a 10 minute hike from the station)! We hope to return in the near future with more cameras for survey work in the Las Alturas area.



Out of Place! Really?

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Great news to supplement our efforts to study and preserve biodiversity! The first reaction is to say, “These species are out of place!” What causes people to think something is out of place? The examples are of species that had not been seen or found in or around Las Cruces before. In any case, are they really out of place or are there hidden reasons that they have not been seen before? On thinking about this, here are a few reasons (not exhaustive, though) to explain new findings:

- Flying species that go astray and get “lost”.
- Species that are present for some time and later people do not see them any more.
- Species hidden in relicts of particular ecosystems that are understudied.
- Climate changes that are generating altitudinal movements of more mobile species, or that are causing changes in flower and fruit phenology of plants, causing associated animal species move to other sites in search of adequate food.
- Increase in the collecting and research efforts in areas where nobody had entered before, or sites that lacked access or were not of interest (the Southern Zone is the last frontier of development in Costa Rica and the access has always been difficult).
- More interested people making more observations than in the past.
- A lack of proper methodologies for adequate sampling of specific groups.

All these factors, in combination or

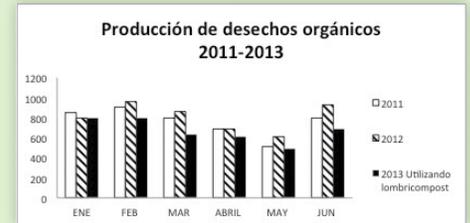
- ✓ A pair of Crested Caracara (*Caracara cheriway*) colonized a higher and colder area than their normal habitat, successfully nesting at the Wilson Botanical Garden and having two brooding seasons (Amigos 70, November 2008; Amigos 77, May 2012)
- ✓ Sighting of squirrel monkeys (*Saimiri oerstedii*) on the roadside near the Wilson Garden (Amigos 78, November 2012)
- ✓ Black-cheeked Ant-tanager captured by the San Vito Bird Club during a mist netting session, 75 km away and 1000 m higher than its common range of distribution (Zeledonia 16(2), November 2012)
- ✓ NAPIRE students finding a Panamanian species of water mouse in a minnow trap while studying freshwater crabs in small creeks in the Las Cruces forest in 2008.
- ✓ Federico Oviedo, station taxonomist, discovering species of plants near Las Cruces that previously were not collected above 600 m elevation or further south than Dominican, on the Pacific coast.
- ✓ In this edition of Amigos Federico also writes about a new species to science that was found at Las Cruces.

not, plus other possible reasons, could contribute to these discoveries, and make new additions to the flora and fauna of this diversity-rich area in the highlands or Southern Costa Rica. With the help of readers like you, we may make additional discoveries.

De la Comunidad



One of the Las Cruces earthworm composting beds. Photo Carolina Vindas.



Organic waste generated in 2011 and 2012, and then in 2013 when composting began.



Monthly organic waste consumed by earthworms as a fraction of the amount generated.

New Composting Practices at Las Cruces

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Over the past three years Las Cruces has been keeping a record of the production of organic and inorganic waste that we generate, which has allowed us to look for more environmentally friendly solutions. One of the most alarming figures is the enormous quantity of organic waste that is generated by the kitchen. In the past two years this has amounted to some 7,000 kg of waste which can represent the equivalent of greenhouse gas emissions of 8.5 tons of CO₂.

As a result Las Cruces decided to initiate an earthworm compost, which consists of 'beds' that are populated with California red earthworms that consume food waste such as fruit waste, vegetables, coffee grains, rice husks, and even paper and cardboard.

In the first half of this year, we have succeeded in reducing the quantity of organic waste significantly, as these hungry friends have consumed around 700 kg of waste. The compost they produce is then

used as a fertilizer in planter beds around the Wilson Botanical Garden which has improved soil conditions considerably through increased aeration and the addition of minerals.

The following graphs show the production of organic waste for the first six months of the past 3 years, and the notable difference in production in 2013, when earthworm composting was initiated. In the second graph there is a breakdown of organic waste produced monthly and the amount that was consumed by the earthworms. The amount increased over time as the population of earthworms grew in the beds, and in June accounted for consumption of 157 kg of organic waste.

Such methods could be applied in restaurants, hotels, other businesses and even in households, in order to practice more sustainable methods of waste processing that are environmentally friendly and low cost. These practices also generate direct benefits in the form of organic material that can be used in home gardens or farms. Earthworms can also

consume waste generated by pigs, cattle, horses, and even chicken excrement. They will also consume paper and cardboard and in general help to reduce our emissions of CO₂. However, the rate of processing of material and the quality of the compost does depend in part on what is put into the mix!

Our Donors

Donations Update

Alison Olivieri / sanvitobirdclub@gmail.com

On an organization-wide level, 2013 represents an historic milestone for OTS as we celebrate 50 years of international leadership in tropical biological research and education. Locally, here at Las Cruces, we are proud to be a field station provider of such excellence but we are almost equally busy celebrating cats.

Now you say, “Really, cats?” And we refer you to the “What’s New” and “Flora and Fauna” sections of this newsletter where you will read that while we have had ocelots, now we have a puma making an appearance in a researcher’s clandestine nighttime camera trap. Needless to say, this is causing great excitement around the Station.

About the ocelots, we learn from the Animal Diversity Web of the University of Michigan their diet consists of small rodents (65-66%), reptiles (12-18%), medium-sized mammals (6-10%), birds (4-11%) and crustaceans and fish (2-11%).

Wikipedia posits that male ocelots require territories of 3.5 to 46 square kilometers (1.4 to 18 sq mi) and females need smaller, non-overlapping territories of 0.8 to 15 square kilometers (0.31 to 5.8 sq mi).

As for pumas, nearly the size of jaguars, much larger territories are necessary. According to a report in Canadian Geographic magazine, males have territories of 150 to 1000 km² (58 to 386 sq mi) and females make do with half. In its northern range, this cat will eat any animal it can catch, from insects to large deer.

Standing alone, the Las Cruces forest might support one or more ocelot territories and we certainly have agoutis, opossums, birds and armadillos on the menu but our land mass cannot provide sufficient territory for diverse feline predators. However – and this is where you, our *Amigos*, come into the picture – we could support more diversity for this group at some future time by connecting

our forest to the Guaymí Indigenous Reserve via a 7 km biological corridor.

Since Director Zahawi initiated the Land Acquisition Campaign to create this corridor several years ago, he has successfully added three nearby properties to Las Cruces’ land holdings because of your generous support for his plan. With these new cats ‘in the picture’, the urgency of this project is ramping up so we ask you to please consider supporting the Land Campaign in addition to the general fund with your next contribution.

Thanking all of you for your gifts is easy. What is difficult is thinking of new and compelling ways to ask for donations. We hope it is enough for you to know that your support allows us to fulfill our now 50-year-old mission of providing leadership in education, research and the responsible use of natural resources in the tropics. Oh, and the cats: Land Acquisition Campaign contributions will help those cats too!

Géneros de Orquídeas



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A flowering *Elleanthus poiformis* (Orchidaceae). Photo Ellen Woods.



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