Amigos Newsletter

No. 66, November 2006

Wilson Botanical Garden

Las Cruces Biological Station

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

Organization for Tropical Studies

Who We Are

The Organization for Tropical Studies (OTS) acquired the Wilson Botanical Garden in 1973, as part of the Las Cruces Biological Station. It is one of three tropical field stations operated by OTS in Costa Rica. Located in the remote southwestern corner of the country, Las Cruces 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 lies 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 the Wilson Botanical Garden part of the Reserve due to its diverse plant collection and proximity to La Amistad.

The Wilson Botanical Garden, founded in the early 1960's 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, gingers, marantas, heliconias, and ferns. More than 3,000 exotic species of plants can be found in the 12-hectare (~ 30-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, or close to half the number of birds found in all of Costa Rica. There are also 43 species of bats, and a number of common mammals including agoutis, white-faced capuchin monkeys, kinkajous, olingos, and tayras. Reptiles and amphibians thrive in this moist, cloud-laden habitat and there is an impressive diversity of insects, particularly moths and butterflies.

Las Cruces owns a ~200 hectare primary forest fragment (home to over 2,000 native plant species) and smaller adjacent areas that are in various stages of forest recovery. 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.

At approximately 1,100 meters elevation (3,300 feet), the prevailing temperatures at Las Cruces are cooler than an inexperienced traveler 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 December – April, 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 pathways and trails. We can also provide internet access to overnight visitors who bring a portable laptop computer.

The nearest town to Las Cruces is San Vito which is 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 Wilson Botanical Garden.

For more information please visit the Las Cruces website at www.ots.ac.cr/en/lascruces/ 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) 773 4004.

Reservations can also be made by contacting the OTS office in San José by email: nat-hist@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.): 011 506 524 0628.

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 fields 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.

AMIGOS
NEWSLETTER
No. 66, Nov. 2006

Front Cover: A giant *Ceiba pentandra* near the town of Sabalito. We entered this tree into a contest sponsored by INBio (National Institute of Biodiversity) to find the largest *C. pentandra* individual in Costa Rica. We are still awaiting the outcome!
Back Cover: *Ptychohyla legleri* (Hylidae) at Las Cruces.
Editorial Committee: Tatiana Acón, Mariana Mora, Alison Olivieri, Rodolfo Quirós, Emilce Ramírez, Ariadna Sánchez, Zak Zahawi.

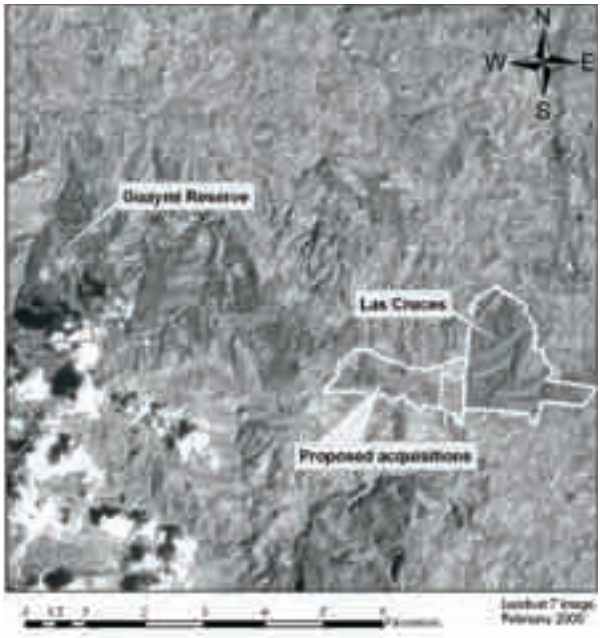
Director's Keys and Notes

Zak Zahawi / zahawi@ots.ac.cr

Almost a year has gone by since I started at Las Cruces and time really has flown. It has been an exciting and dynamic year as I ease into this now not so new position and a lot has been going on at Las Cruces and the Garden. I have written about a number of them in the next section. As I mentioned in the last *Amigos* newsletter, I would be asking for your help in promoting the research and conservation agenda for Las Cruces – and I will, but let me start out with a little background information.

Well for those of you who remember the long trek to Las Cruces from the large metal bridge over the General or Térraba River, you probably noticed that much of the surrounding landscape is heavily deforested and under pasture cultivation. In fact, Coto Brus is one of the most deforested counties in Costa Rica, and given the steepness of land and high annual rainfall, this has resulted in severe environmental problems including soil erosion, water contamination, and flooding. At Las Cruces we own one of the largest remaining forest fragments in the region. However, at a little over 250 hectares (ha), it is effectively an island embedded in a pastoral landscape, and most fauna (and even flora) are either trapped within its boundaries or are unable to reach it due to its isolation. Aside from continued environmental problems, this excessive forest fragmentation will lead to a steady loss of biodiversity in Coto Brus where at least 7 species of mammals are already known to have gone locally extinct. Accordingly, it is increasingly urgent to address this critical state of habitat protection in the region and pursue a more proactive conservation agenda at Las Cruces.

Although a number of smaller fragments still persist, most of this landscape is under pasture cultivation, and it is simply not an option to acquire forested land to increase the protected area around Las Cruces. Instead a restoration-oriented approach is needed and the pastures that surround the station need to be purchased and restored. In turn, such acquisitions will serve to attract restoration ecologists to conduct research on forest recovery and on the design and execution of biological corridors that link up isolated fragments. Some of the larger fragments that surround Las Cruces will be incorporated



2000 Landsat image showing the potential biological corridor linking Las Cruces with the much larger Guaymí reserve 7 km away. Note that a continuous forested strip is present from the NW corner of the proposed acquisition to the Guaymí reserve.

in these purchases and by reconnecting them, we can create a biological corridor that links Las Cruces with the much larger Guaymí indigenous reserve (7,500 ha), 7 km west of the station. Ultimately, this corridor will provide access to additional habitat (both by creating new habitat and by reconnecting forest fragments) and help stabilize isolated plant and animal populations in the Las Cruces fragment as well as in the smaller proposed acquisitions.

So with this issue, I am excited to announce the launching of a new land purchase campaign at Las Cruces. The great news is that we have gotten off to an incredible start with a donation of $50,000 by a longtime Las Cruces donor who wishes to remain anonymous! The goal is to purchase two adjacent properties on the western edge of Las Cruces (~150 ha total), which will consolidate several forest fragments in the immediate vicinity of the current property boundary, and protect over 50 additional ha of forested land. A beautiful 1.5 ha natural lagoon also falls within the proposed acquisition. This lagoon is of historical value and a neighboring lagoon was found to harbor the oldest known maize pollen record in southern Costa Rica. The rest of the land is in pasture and will need to be restored. So what is the tall order necessary to achieve this? Simply put, we need to raise an estimated $330,000 for these land purchases over the next few years!

So how can you help? Of course I am aware that most of you do not have $50,000 that you can donate readily to such a cause! But a number of you may know people or organizations that would be interested in donating to such a campaign, so what I ask of you is to help get the word out. If you are interested, please send me an email and I will send you more information - such as a copy of the corridor photograph and an electronic version of the land acquisition poster that I made for this campaign. Of course if you feel like making a donation you are welcome to do so and any amount is appreciated – but if you do, please remember that part of the operational budget for Las Cruces comes from your annual donations – so don't exchange one gift for another!

With a long history of habitat protection in Coto Brus, Las Cruces has a strong reputation behind its conservation achievements, both at the regional level and at the national and international stage. Accordingly, by embarking on an active land purchase and restoration program, Las Cruces can further position itself as a leader in a field of ever increasing global importance while simultaneously protecting threatened habitat. With your help, we can turn this concept into a reality.

I will stop here with a reminder that you not forget to come and visit us. As you can see in the "What's New" section of *Amigos*, there are many interesting developments at Las Cruces and we invite you to come and see them for yourselves.

With best regards,

Zak

What's New at Las Cruces?

Zak Zahawi / zahawi@ots.ac.cr

New Buildings

Well, after many years in the planning stages and several delays in starting, we have finally broken ground on the future reception building for Las Cruces. Once complete, this building will provide almost 280m^2 of enclosed space and will house the new reception, alongside which will be a larger and more amenable gift shop. The building will also house my office as well as that of station administrator (Emilce Ramírez), and administrative assistant (Andrea Hernández). Finally, the building will have an 80m^2 lecture hall with capacity for 60 - 80 participants.

The concept behind incorporating such a space within the overall design is multifold. First, it provides a central meeting area for incoming groups to get organized and/or receive an introductory talk on Las Cruces. Second, the space can be utilized by visiting courses as a lecture hall - of particular importance when the station receives two courses at the same time. And thirdly, this space can serve as an excellent auditorium for holding workshops, small conferences, or seminars and will be able to provide an additional source of income for the station. The anticipated completion date for this project is July 2007.

Forest Trails & New Brochures

A number of the forest trails at Las Cruces were closed a few years ago due to a decrease in the number of garden personnel at the station. Since January, however, we have slowly reopened these trails and created two new ones that were recently completed. We now have more than 9 km of trails that criss-cross the forest and creeks of Las Cruces, taking you through a variety of beautiful habitats. One of the new trails traverses Melissa's meadow, which has been under restoration since 2000. The trail will have interpretive signs explaining the different restoration treatments applied so that you can evaluate for yourself how each method worked. A forest brochure has also been designed with information on the length, difficulty, and habitat type that each trail has to offer. The garden brochure has also been updated with a new and more comprehensive map of the paths, as well as more detailed information on garden collections.

A new bridge over a creek on the Melissa Trail.

So the next time you come to Las Cruces, in addition to getting the updated garden brochure, make sure you get a forest brochure and spend a day or two in our beautiful forest!

Volunteer Time

Melissa Arce in the new Las Cruces herbarium.

Since the last issue of *Amigos* we have had a number of short-term volunteers helping us. One important volunteer is Melissa Arce, a young Costa Rican biologist who has been working periodically in the herbarium since it was officially inaugurated in June 2006. As of September, Melissa has organized and processed more than 200 specimens and, in doing so, has helped develop a much-needed database for many of the researchers who work at Las Cruces.

Of course I want to give special thanks to our local group of volunteers who help in so many ways: providing garden walks to visiting groups, helping with fundraising outreach, helping with the editing and distribution of *Amigos*, among many other tasks. So a big "thank you" to all but I would like to give particular thanks to Alison Olivieri, volunteer par extraordinaire and president of the San Vito Bird Club. For more information on the latter, please contact Alison directly at (maoawo@aol.com).

We always welcome volunteers. If you are interested in volunteering and learning more about what you can do to help at the Wilson Botanical Garden, please email us at (lcruces@ots.ac.cr).

Mediterranean Night At The Garden: Buon Appetito III

How many outstanding meals at Las Cruces are you all going to miss?! On May 18, we had our third international cuisine night fundraiser at the garden. This event was by far the most successful and we had close to 50 guests for a fantastic Mediterranean dinner. The chef for the evening was Patrick Desvanian. Patrick is actually French but stated he could cook whatever type of food we were interested in having, so we strayed from French this time around and by the end of the meal there was no doubt about Patrick's multi-talented chefing abilities. On the menu this time around: Proscuitto con melone accompanied by marinated red peppers, tomato and mozzarella, and olives; a salad of mixed greens and pears with a blue cheese-walnut vinaigrette; grilled red snapper on a bed of marinated baby vegetables with a side of gnocchi; and for dessert strawberries topped with Grand Marnier sabayon! The evening was capped off with music and several guests took to the floor to dance salsa. All in all it was another great dinner event at Las Cruces. In addition to thanking Patrick and his wife, Kate Allen, for all their hard work in the kitchen, I want to give a big thanks to the many hands (too many to mention by name) that helped put this event together both in the weeks before and during the dinner. Lastly, special thanks goes to all the Las Cruces employees who worked very hard to make this all run so smoothly. Next time we plan on starting earlier in the evening so as to leave more time for dancing!

Storm Of The Century?

On July 3, 2006 an incredible windstorm ripped through the Wilson Botanical Garden and caused an enormous amount of damage. Winds in excess of 50km/hour were recorded at the weather station and at least one tornado touched down along the edge of the garden grounds, later traversing the secondary forest that leads to the Rio Java. All told in the garden alone 17 trees were lost including seven palms. One of those was a *Pigafetta filaris*; the photogenic palms that line the lookout point and are a landmark of this station. A number of other trees were de-crowned and more than 30 major branches were felled. The forest did not fare any better and, in all, it took the garden workers almost a month

Xenia Barrantes, Yorleny Lara, and Guillermo Durán - Las Cruces employees who transformed themselves into waitstaff - take a breather in between serving guests.

Storm damage to the Wilson Botanical Garden on 3 July 2006.

to clear the debris in the garden and forest and return the station to some semblance of order. Perhaps the only stroke of luck was the fact that no one was hurt and no buildings were damaged - nothing short of a miracle given the scale of the damage to the garden. Here's hoping this was the storm of the century!!

Amigos now available electronically

For those who prefer to receive newsletters by email, we are now able to send you an electronic version of *Amigos* in PDF format (email: lcruces@ots.ac.cr).

You can read it on your computer screen or print it at home. You can also share your *Amigos* and forward it to friends and family who might be interested in receiving a copy.

Research at Las Cruces

Bee Communities and Pollination in a Southern Costa Rican Countryside

Berry Brosi / bbrosi@stanford.edu
Published in a similar form in the CCB Update, summer 2006

Bees aren't creatures that the average person thinks about very much, but these little insects are absolutely critical for the human enterprise in their role as pollinators. Agricultural scientists estimate that about 2/3 of crop varieties are insect-pollinated, representing 30% or more of the calories that we eat. But bees are in trouble, with marked declines in honeybees and other pollinators across the globe. Despite these declines, scientists don't understand well how habitat loss and other factors affect bees, particularly in the tropics.

To contribute toward conserving bees and the crucial pollination services they provide, I have been studying them in and around the Las Cruces Biological Station in southern Costa Rica over the last three years. When I started my work there, I was interested in how small fragments of remnant forest affect bees, because previous studies by other researchers at Stanford University have found that forests can affect the biodiversity and abundance of many other groups of plants and animals.

To test if bee communities are affected by distance to forest and forest fragment size, I sampled bees (using insect nets and also two forms of traps) in nearly 40 sites from 2003 to 2005. We recorded over 4,000 bee individuals made up of more than 200 species — including a species new to science, *Neocorynura tica*, a tiny metallic yellow-green bee that I have described with bee specialists from the University of Kansas; our account of *N. tica* was published in the journal *Zootaxa* earlier this year.

In analyzing the results of this multi-year study, we have had several interesting findings. First, bee diversity (number of species) and abundance are not statistically related to the size of forest fragments or distance from forest. The species composition of bees, however, changes dramatically with proximity to forest. The social stingless bees (meliponines), an important group of tropical bees, appear in large numbers within forests and immediately at their edges, but their numbers drop off considerably at distance from forest. In contrast, the non-native European honeybee *(Apis mellifera)* is rare within and near forests, but makes up a large component of the bee fauna in sites distant from forests.

Photographs of the new bee *Neocorynura tica,* discovered at Las Cruces. Female (a) and male (b) bees are shown. Photo credit: Allan Smith Pardo.

These forest-related shifts I found between non-native honeybees and native social stingless bees are of interest in part because these bees are closely related. Both are truly social bees with a queen and non-reproductive workers (surprisingly, most bee species are solitary) and both exhibit communication within their hives, meaning they can recruit their hive-mates to rich floral resources. They are thus important for pollinating the many fleeting flowers in the tropics that only open for a day or two.

But if stingless bees and honeybees fill similar ecological roles, does it matter if numbers of one group are higher in one place and lower in another? Previous work by Taylor Ricketts (formerly a graduate student and postdoctoral research fellow at Stanford University and now with WWF) found that honeybees and stingless bees are the primary pollinators of coffee in southern Costa Rica, the flowers of which are only open for two days at a time. Near forests, however, there are more stingless bees and more pollination because of them, thus larger coffee harvests near forests.

There are further important ecological ramifications of the bee community shifts I documented, based especially on one critical distinction between these groups: the honeybee is a single species, while social stingless bees are made up of many different species — around Las Cruces, about 15 different ones. This is important for at least two reasons. First, some bees are better than others at pollinating specific plants because they are different sizes and shapes and have different behaviors, so having several different species means that there is a better chance that all kinds of different plant species will get pollinated. Second, bee populations can fluctuate considerably from year to year, so having several different species of bees around can buffer the loss to pollination if one particular kind of bee is having a bad year.

This work on bees is contributing to our understanding of what factors are important for sustaining a diverse and abundant component of bees in tropical working landscapes. Further work will more explicitly link bee community dynamics to pollination, a critical and potentially endangered ecological interaction for both native plants and for people.

Mist Netting Bats in Las Cruces

Jason Beck / upinthenight@gmail.com

Heather York (University of Kansas) and I arrived at Las Cruces in a terrible hurry (as graduate students are prone to do). Rather than take my things to my room, I tossed them by the driveway and went to work. We had 30 minutes until sunset, so in a frantic rush we set up 3 mist nets in the garden while the sun lazily painted the clouds. As a bat biologist, evenings like this are so common that I often forget this is how many of my stories begin.

Las Cruces was supposed to be a pit stop of sorts for me, between La Selva and Corcovado, while it was Heather's last field site before returning home. After three nights, I changed my plans. Our capture rates and species diversity were high enough that I couldn't warrant two days of travel to catch the same bats I was already finding and, as an extra incentive to stay, the cool mountain air was much easier to work in than the muggy furnace I expected at Corcovado.

Within the context of my thesis work at Idaho State University, I am interested in the question of how, and with what compromises, have some bats retained the ability to crawl despite the tremendous evolutionary pressures that flight places on the locomotor system. The nature of my thesis requires me to study a diverse array of species, and in ten nights at Las Cruces we caught over 150 bats of 22 species: *Artibeus lituratus, A. intermedius, A. watsoni, A. jamaicensis, Vampyressa nymphaea, Platyrrhinus helleri, P. vittatus, Carollia perspicillata, C. sowelli, C. castanea, Uroderma billobatum, Desmodus rotundus, Sturnira ludovici, S. lilium, Myotis keaysi, M. riparius, Eptesicus chiriquinus, E. furnalis, Thyroptera tricolor, Pteronotus parnellii, Glossophaga soricina,* and *Loncophylla concava*.

Since I have yet to find a paper with a good synopsis on bat crawling ability to direct you to, here is my brief summary: Fruit and nectar bats, by and large, appear completely incapable of crawling. Regardless of how hard I try to design a situation where crawling is the only means of escape, they either lay motionless or simply flop around. Nectar bats are so small and adept at flying that there aren't many natural situations where they can't fly and thus the loss of crawling probably has only minor implication. Vampires, in stark contrast, are incredible crawlers, and use this ability to stealthily creep up on their prey and scamper around in tight spaces. They can easily shift to a gallop if they have room to run but not to fly. Insectivorous bats can crawl, but to wildly varying degrees. The smaller bats often roost in cracks and crevices to escape predation and retain a scamper that has probably evolved little in the past tens of millions of years. The larger species, like *Pteronotus*, that may be better able to fend off predators are the least capable crawlers in the group.

The bats at Las Cruces cover the basic trophic range of tropical bats and, since crawling ability also generally follows those trophic lines, the field station was a great place for my research. Insectivorous bats are among the most common, but the hardest to catch. In pastures, where I've seen hundreds of bats foraging, they easily detect and avoid lonely mist nets. The gardens, however, are open enough to facilitate foraging for insects, but the trees provide places of clutter to break up echolocation, making good net sites. Fruit and nectar bats also frequent the gardens and were often caught at the locations I selected for insectivores. The forest is a great place to focus on fruit bats. Short-tailed fruit bats *(Carollia)* often feed on low-growing piper fruits and can be caught either in fruiting areas or on trails of almost any size. The Rio Java trail is a great place to catch "commuting" bats of almost any kind. Large fruit bats drop down from the canopy to avoid aerial predators and use the trail as a flyway between fruiting trees and roosts. At a point approximately half way to the river the trail runs alongside a fence with a huge open gap to the world outside the forest. At midnight, vampire bats fly through this opening in droves as they travel from their roosts to their favorite cattle pastures.

By mentioning vampires I must, of course, follow with a disclaimer. No, I don't think there is any chance that the vampires at Las Cruces are feeding on or would feed on visitors. They aren't aggressive and never "attack", but rather creep up to a sleeping animal, make a small incision and lick the blood as it drips. They prefer to feed on the same animal night after night (so only the staff need worry) and quickly leave if the animal stirs. They aren't known for breaking in to buildings, preferring to feed out in the open (cattle and chickens). When I hold vampires they are generally more calm and patient than other bats, quietly waiting for my grip to loosen or shift enough to make a rapid escape. Other bats try to get as much of a mouthful of me as possible, while vampires prefer to nip at the edges and fingertips of my gloves, making tiny incisions.

A self-portrait of Jason releasing a great fruit bat, *Artibeus lituratus.*

Las Cruces, it turns out, is equally spectacular night and day. The natural world seems to calm for a few minutes at dusk, in a sort of relaxing gasp, before the life of night rushes awake into a bustling roar. The same is true at dawn, as the last bat finds its roost an overly eager lark starts to crow, offering only momentary reprieve. If this bat biologist can wake up at 4:30 to enjoy a song in the morning, surely other visitors could enjoy the sights and sounds of the night.

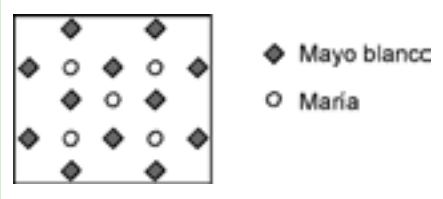
Tropical Pasture Restoration using Mayo blanco

Kristin Young / youngkc@uci.edu

As we are all now well aware, tropical deforestation has left a significant portion of our planet in a degraded state. As conservationists struggle to preserve remaining healthy ecosystems, economic pressures drive the further destruction of forests across the tropics. So, it is critical to develop methods of restoring productivity to already degraded lands while giving farmers alternate economic options. Given the severity of soil erosion and infertility in the tropics, rehabilitation of rainforest trees is certainly a challenge. For my dissertation research at the University of California-Irvine, I am testing methods of jump-starting the forest recovery process on degraded soils in Costa Rica.

Two of the most limiting factors to tree growth in disturbed areas in the tropics are thought to be soil infertility and aluminum (Al) toxicity. Soil infertility is characteristic of tropical soils, but is exacerbated by high levels of erosion following deforestation. The low pH of tropical soils results in high Al solubility and concomitant Al toxicity. Al toxicity inhibits plant root growth and causes Al to bind tightly with phosphorus (P), a process that renders P unavailable to plants.

In order to catalyze forest recovery, or natural succession, restoration ecologists design planting regimes that address specific limitations to plant growth. For example, when P is limiting, the addition of P should stimulate plant growth. Also, the removal of toxic forms of Al in the soil may create a more hospitable environment for plants not adapted to Al-toxicity. Planting native pioneer trees with characteristics that target these specific limitations to tree growth may jump-start succession.



Planting regime. Target trees (María) are planted in a matrix of nurse trees (Mayo blanco).

I am using a native pioneer species (*Vochysia guatemalensis;* known locally as Mayo blanco) as a nurse tree that may facilitate the growth of a neighboring later-successional tree *(Calophyllum brasiliense;* María). Mayo trees are Al-hyperaccumulators, that is to say they can store over 30,000 parts/million (ppm) Al in their leaf tissue – that's 3% of their leaf material! This is quite amazing, considering most non-accumulating plants have around 200 ppm Al in their leaf tissue (or 0.02%). Hyperaccumulated Al in Mayo is typically complexed with organic acids internally, making the Al non-toxic to the plant. Accordingly, if Mayo can accumulate sufficient Al to draw down the pool of Al in the soil, this would make the soil more hospitable for neighboring trees. Furthermore, when Mayo trees take up Al, P is freed from Al-P bonds and should be more available to neighboring plants.

Thus, planting Mayo trees may help address both soil infertility and Al toxicity. Planting mixed-species patches with fast- and slow-growing native trees gives farmers economic options. Mayo blanco is a fast-growing pioneer that can provide economic benefits in the short-term, and María is a threatened, slower-growing hardwood that will provide long-term economic value to the land.

I am looking into three ways by which Mayo trees may facilitate the growth of María: decreased toxic soil Al, increased soil P, and/or improved microclimate (i.e. increased shade). In order to differentiate between these potential mechanisms of facilitation, I designed six treatments: one manipulation and five separate controls. I set up this large-scale field experiment on my field site in Campo Dos y Medio, 14km south of Las Cruces. This site is a 25-hectare farm owned by my advisor, Dr. Lynn Carpenter. Between the 1950's and 1992, the farm was used for coffee production and cattle grazing, which caused severe erosion in several areas and moderate erosion overall. The soils on this farm are just about as bad as it gets. So, if our planting methods can be successful here, chances are they will have an even better success rate in less disturbed soils.

In August of 2005, I planted Mayo tree seedlings to test the efficacy of "site preparation". Site preparation allows the nurse trees to establish, grow, and impact the soil and microclimate for one year prior to planting target trees. María seedlings were grown in the nursery for one year and transplanted into the field in August 2006. Over the next few years, I will be monitoring growth of the Marías and comparing the growth among treatments. I will monitor changes in soil fertility and microclimate, including soil temperature and light intensity (amount of shade produced).

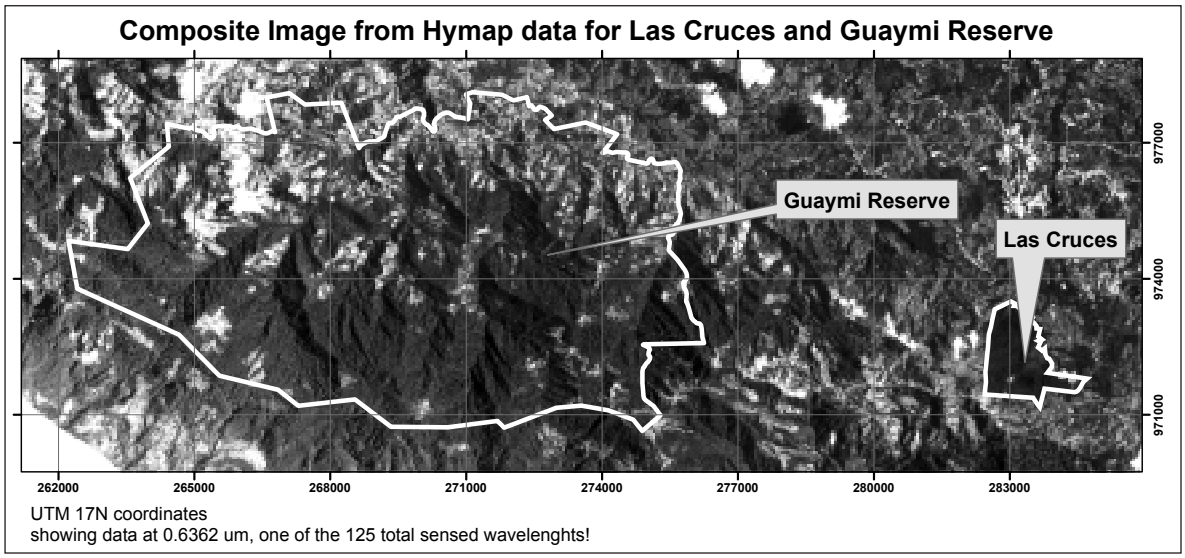
It will require a bit of patience, but I hope to provide local farmers with a method of restoring badly degraded soils in both a timely and economically valuable manner. Recommending successful methods of converting pastures into productive mixed-species patches would provide economically profitable and sustainable options for farmers in the tropics. It has been a joy working at Las Cruces for my third summer, and I can't wait to return next year!

Mayo trees after one year of growth. The fresh planting holes are the sites where María seedlings were planted in August 2006.

GIS Corner

Advances in GIS at Las Cruces

Guillermo Durán / gduran@ots.ac.cr



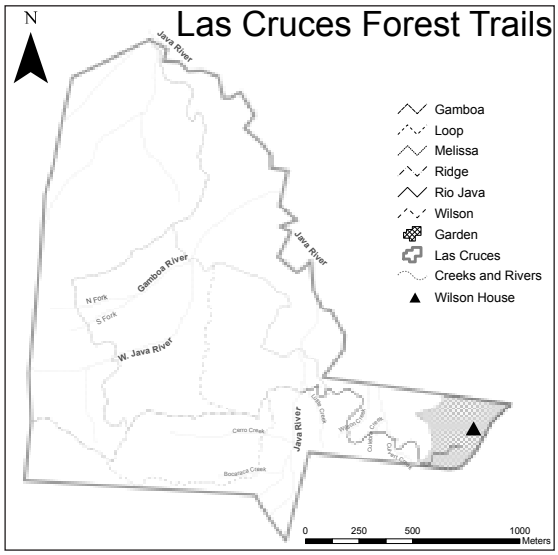
An example of the data gathered by the HyMap hyperspectral scanner. The image shows Las Cruces and the Guaymí reserve.

Over the past few months we started to work on our GIS webpage. As a first step we wanted to provide some information about the GIS lab, and a list of all the layers we have gathered with a small thumbnail of each. We hope that this geographic information will help researchers and other people who are working in this area. It is important to note that all the information is available for free to anyone who requests it. In the case of restricted data, it will be indicated on the website and there will be an email or URL link to the person or institution who owns it. At the moment requests have to be made to me by email, but in the near future it will be available online, and you will be able to download the data after filling out an online form.

Our URL is http://www.ots.ac.cr/en/lascruces/gis/

I hope at some point to also develop an internet map server. With this, it will be possible to make simple maps online (similar to using Google Earth). Our friends from the GIS Lab at the Palo Verde OTS Station already made their own; the GIS in La Selva will be working on its own too.

We were also working on the maps of the garden and forest trails for the new brochures. The forest trails brochure has all new and old trails and comes with a profile showing the steepness of each trail as a way to discern between hard and easy ones. The new garden brochure shows all the trails between planting beds, the buildings and has more recent information about the garden. All these maps will be available on the GIS website soon.



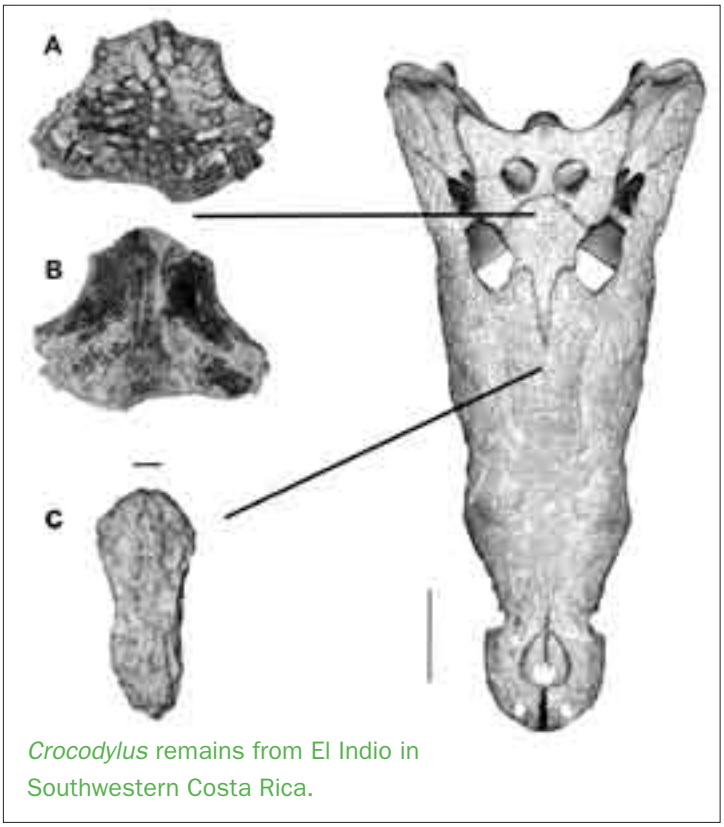
The new map showing the forest trails of Las Cruces.

Good news is that after some months of waiting, the Centro Nacional de Alta Tecnología in Costa Rica gave us the data gathered with the HyMap hyperspectral scanner. This remote sensor was flown by NASA in 2005 as part of the CARTA 2005 project; it is one of the best existing earth remote sensors. It has many applications for scientists working with natural resources such as mapping the different kinds of vegetation present in an area or minerals present in soil. It provides a lot of raw information that is ready to be analyzed, and is one of the most valuable pieces of information in our database.

Flora and Fauna

Crocodiles were in Costa Rica during the Pliocene, some two million years ago

Jim Mead (James.Mead@NAU.EDU) and
Luis Diego Gómez (gomozp@ots.ac.cr)



Crocodylus remains from El Indio in Southwestern Costa Rica.

"How do you know?" you might ask. Well, through the collaborative research efforts of a team of biologists and paleontologists at a fossil locality not far from the Las Cruces biological station in southwestern Costa Rica. What has been recovered is tremendous – a literal warehouse of the region's natural heritage. Vertebrate fossils are not rare in the lowland rainforests and premontane forests of Costa Rica, yet they have received preciously little comprehensive attention….that is until now.

Luis Diego Gómez (then director of the Las Cruces Biological Station) assembled a team of paleontologists to visit the fossil deposit known as El Indio. The team included the herpetologist and crocodile expert Rolando Cubero from Heredia; paleontologists César Laurito and Ana Lucía Valerio Zamora from the Museo Nacional de Costa Rica; and Sandra L. Swift and Jim I. Mead from the Laboratory of Quaternary Paleontology at Northern Arizona University. The team of six headed by Dr. Gómez visited the site to determine how to systematically recover the hundreds of bones found exposed in a cut bank along a side stream of the Río Limón. The Costa Rican team members had already recovered many skeletal elements found as a lag deposit in the bottom of the streambed. The purpose of the first trip was to develop a plan for future excavations of the primary deposit.

To date, the El Indio fauna contains numerous skeletal remains recovered along a 50 m stretch of the Río Limón tributary, which is approximately 85 km from the Pacific Ocean and now at 680 m elevation. The skeletal remains are eroding out of the Paso Real Formation of late Pliocene to earliest Pleistocene age (approximately two million years old). Crocodylian remains were common and recovered along with turtles and extinct mammalian forms of horse, camel, giant ground sloth *(Eremotherium)*, pampatheres (giant armadillos, *Holmesina* and *Pampatherium)*, gomphotheres (mammoth relatives) and others. Interestingly, many of the turtle shells and mammal bones exhibited conical marks that appear to be puncture depressions which are consistent with those produced by the pointed teeth of crocodylians. Although most of the fauna has yet to be described and published, a recent article (cited below) explains and illustrates the *Crocodylus* bones, now known to represent the oldest evidence of this ancient archosaur in Central America. These crocodiles inhabited a large embayment situated between the Cordillera de Talamanca and the coastal mountains.

Today there are two crocodylians inhabiting the coastal waters and larger rivers of Costa Rica: the spectacled caiman *(Caiman crocodilus)* and the American crocodile *(Crocodylus acutus)*. Additional species of *Crocodylus* live outside of the immediate region. During the two million years since the embayment, with its crocodiles, turtles, and mammals, the low-angle subducting Cocos Ridge west of Costa Rica has uplifted the region into a series of mountain ridges forming the present land bridge. When the entire fauna is published by Costa Rican paleontologists, it will explain just how important the El Indio locality is to fully understanding the development and literal rise of the Panamanian land bridge – that important corridor that connected South and North America.

For further information see:

Mead, J. I., R. Cubero, A. L. Valerio Zamora, S. L. Swift, C. Laurito, and L. D. Gómez. 2006. Plio-Pleistocene *Crocodylus* (Crocodylia) from Southwestern Costa Rica. Studies on Neotropical Fauna and Environment 41(1):1-7.

A New Species for Las Cruces: the Brown-chested Martin

Ariadna Sánchez / asanchez@ots.ac.cr

Photo: Ariadna Sánchez

Progne tapera is a 16-19cm bird classified in the Swallow family. Different from other martins, this species has opaque brown feathers above, dark gray under the wings and white below. It has a brown sprinkled band around the chest, which gives its common name.

In Costa Rica, this species is considered a rare southern migrant, and up to 3 birds have been noted on at least 6 occasions during different years between June and mid-September (Stiles & Skutch 1989). The species is classified by the Asociación Ornitológica de Costa Rica (AOCR) in the list of species "without voucher" since there is no official record such as a national museum specimen, song record, or even photos.

But the good news is that this species was seen and photographed on April 17th perched on an electrical wire, near the San Vito hospital. I saw this individual together with Federico Oviedo (one of the bird researchers that have worked at Las Cruces for several years) and some friends.

Now we not only have a new record for the official list of the Las Cruces & Wilson Botanical Garden (actualized in January 2006 by the ornithologist Jim Zook), but a new voucher record for the official bird list of Costa Rica. It means that now we have 410 birds species registered for the Las Cruces region and another good reason to continue working on the conservation of this area.

Natural History

Behavior: *Progne tapera* dwells in forest edges, meadows, open areas, bridges and buildings, and even in urban areas. It usually flies with other swallows. They build their nests in tree holes, gullies, or in buildings using feathers and straw, and sometimes they use abandoned nests of certain Furnariids (Ovenbirds). They lay 3 to 5 white eggs per year.

World distribution: The species breeds in Argentina and S Brazil and in northern Colombia, Guiana, SW Ecuador and W Peru. The southern breeding populations migrate north during the winter to Panama and occasionally to southern Costa Rica.

Other data: *Progne tapera* was formerly placed in the monotypic genus *Phaeoprogne* because it differed in some phenotypical characteristics such as coloration, degree of sexual dimorphism, a more slender bill and less forked tail, and more extensive tarsal feathering than the species included in the *Progne* genus (SACC 2006). But new genetic data indicate that both genera are considered sister genera and are included in the genus *Progne* (SACC 2006). However, additional taxonomic studies are needed to determine whether the actual or the former genus is more appropriate.

ORDER
Passeriformes

FAMILY
Hirundinidae

English name
Brown-chested Martin

Spanish name
Golondrina de Río, Golondrina Parda

Bibliography:

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Stiles, F.G. & F.A. Skutch. 1989. A Guide to the Birds of Costa Rica. Cornell University Press, New York.

Zook, J. 2006. Personal communication and photograph revision.

www.birdlife.org

www.zeledonia.org

De la Comunidad

Jóvenes Organizados para un Mejor Mañana

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Copal is a small town next to Las Cruces, the neighborhood where the Wilson Garden and Las Cruces Biological Station are located. From the friends I have made in town I learned that the local fiestas in Copal were among the best of the surrounding towns many years ago. My reaction was one of surprise: how is this possible? This town looks like it is dead!

At first glance, Copal does not even look like a town. There is no town square as in other places. The only visible icon is the elementary school in a corner of the crossroads. When you look around, you find out that the Catholic church was a small square building that fell to the ground after a heavy tremor in December 2004; the soccer field was overgrown with grasses and other weeds; and the community center was in ruins and some of the materials to build a new one found homes elsewhere, leaving only the metal frame and a roof. In general, the town was not as whole as it had been some years earlier. I understand the reason: young people of those times are now married and many have left Copal, thus, youthful energy has been missing from the town for a good number of years.

But no more! Mid-January was designated as the time to introduce newly-organized youth to the people of Copal. These young men and women, 15 to 25 years in age, decided to take action and organize the first town fiesta -- at least in the last seven years -- making this their debut as the newly-concerned people.

Fifteen young men and women met in October 2005 for the first time, to talk about the town's needs. As a result, they decided to get organized and fight, among other things, the inertia in the community. The name of the group is **Jóvenes Organizados para un Mejor Mañana –JOMMA** or **Organized Youth for a Better Tomorrow,** and at the moment it has grown to twenty members, most of them either students in high school and above or working locally.

To start raising money, they organized several Sunday afternoon movies for people of all ages, shown on a medium-sized television but with good sound equipment. The money arrived from selling cookies, popcorn, and sodas to the people bumping into each other in the one-room elementary school building.

The big idea was a town fiesta with a horse parade, a rodeo, soccer games, and big dances. When this was announced in early December, the whole town got excited, and generated a good amount of expectation. Preparations took more than a month. A good sign was the construction of the rodeo ring, in which most of the men and some women of the community participated. On January 10th, the metal frame of the community center was surrounded with a large

JOMMA pose for a photograph.

amount of black plastic sheeting, and the house for the dances and karaoke sessions was in place. The young people were organizing the whole thing, but their parents and relatives extended helping hands: January 14th was the date to start!

The result was amazing: not only were the three days of fiestas safe and packed with people, but also the happiness of the place came back -- you could see it in the faces of the people. Furthermore, the economic outcome was great. There were good reactions: the young people were very motivated for their own achievements through this activity and the older people got excited and motivated as well. The parents were very happy their sons and daughters have given such a jump-start to this dormant town.

One notable outcome was that after the whole activity there was no trash left behind. The recyclables were collected and money was obtained to buy big containers to serve as trash collectors in the main corner of the town and in front of the elementary school.

Maybe the next time you read about Copal, it will be a note about the start of the construction of a church, a children's playground, or community center led by these young people who have started to rebuild the town's happy atmosphere. We would like to see this happen in many other places.

George Henry Alcock, a Neighbor and a Friend

Alison Olivieri / maoawo@aol.com

Sadly, we must report the death of George Henry Alcock on May 30, 2006.

One of our very favorite "Amigos", George enjoyed the beauty and tranquility of Costa Rica for many years with his wife of 50 years, Veneva Sidwell Fredericks Alcock, their large family and innumerable friends.

Owners of the lovely and lively "finca-next-door", Pino Colina, the Alcocks were enthusiastic supporters of everything going on at Las Cruces from visiting student groups to individual research projects to our now-famous fundraising dinners!

All of us at the Wilson Botanical Garden, of which Pino Colina was once a part, will miss George more than we can possibly describe so we are going to make a permanent memorial for him near the old weather station, and next to a *Ceiba pentandra* tree recently donated by his son George Alexander Alcock. A hardwood bench will be furnished with a small plaque reading: George Henry Alcock, 1927-2006. It will be a place to sit and read a book, admire part of the Garden's collection of exotic trees, sneak a look at a passing agouti or watch birds and butterflies.

George is survived by Veneva; children Bill Fredericks, Steve Fredericks, Vicki Fredericks Murphy, Andrea Fox, Janet Farmer, Lisa Alcock Bricker, George Alexander Alcock; 15 grandchildren and 23 great-grandchildren.

If you would like to make a contribution in Memory of George Alcock, you can use the enclosed donation form. Please indicate your intention on the form and know that the entire Alcock family sends thanks.

George and Veneva at Pino Colina.

Our Donors

Donations Update

Alison Olivieri / maoawo@aol.com

Owen Puleston (age 6, left) and Theo Puleston (4) have a bake sale to raise funds for the Las Cruces land campaign.

Plunked in front of the keyboard, trying to write an article for the *Amigos* newsletter about fundraising, one feels a little like the auditors from Ernst & Young at the Academy Awards – excited to be here but representing a rather humdrum aspect of the show.

In this issue it will be even more difficult, following in the wonderful footprints left behind by Silvia Pérez, formerly the Costa Rican Fundraising Coordinator of OTS. Silvia has gone to California to study at the Monterey Institute of International Studies and, while we will miss her terribly, we wish her all the best the world has to offer. Especially important here at Las Cruces, Silvia revamped *Amigos*, updated our presentations on important printed material, and initiated the Campaign for Luis Diego Gómez.

We do, however, have an adorable (no other word does this justice) story about a recent donation to our new Land Acquisition Campaign! Zak recently received an email from a friend, Virginia Metzak, whose children (the oldest is in first grade) diligently raised $150 (!!) selling lemonade and toys they had outgrown. Clearly, these young people have careers ahead of them in futures trading and investment banking! We thank the Metzak family from the bottom of our hearts.

Now we need to address the Annual General Support goals for Las Cruces. This is the all-important Annual Fund that kicks off each year with this issue of the *Amigos* newsletter. Last year we received $33,536 in annual General Support while raising nearly $30,000 to add to the OTS Las Cruces Endowment Fund from the LDG Campaign. Thank you all for your generous donations. This year we have raised the stakes and need to collect $45,000 from our Annual Fund Drive for General Support. Please do NOT forget the Wilson Botanical Garden, as we need every dollar you can spare.

These dollars – your dollars -- make it possible for us to keep the trails cleared and the rooms clean for our visiting student groups; the research laboratory, library, and herbarium open and humming; the kitchen ladies chopping, scooping, and baking; and, in general, everything rolling along. We cannot do this without your support and, as Silvia would say, “to donate is to invest in the things you believe in”.

PLEASE take a moment to make a generous contribution, using the enclosed donation form and return envelope. We know you believe in the mission of OTS Las Cruces and the Wilson Botanical Garden. Thank you so much, muchísimas gracias, in advance!

Amigos, many thanks to all!!

(Donations through September 2006)

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