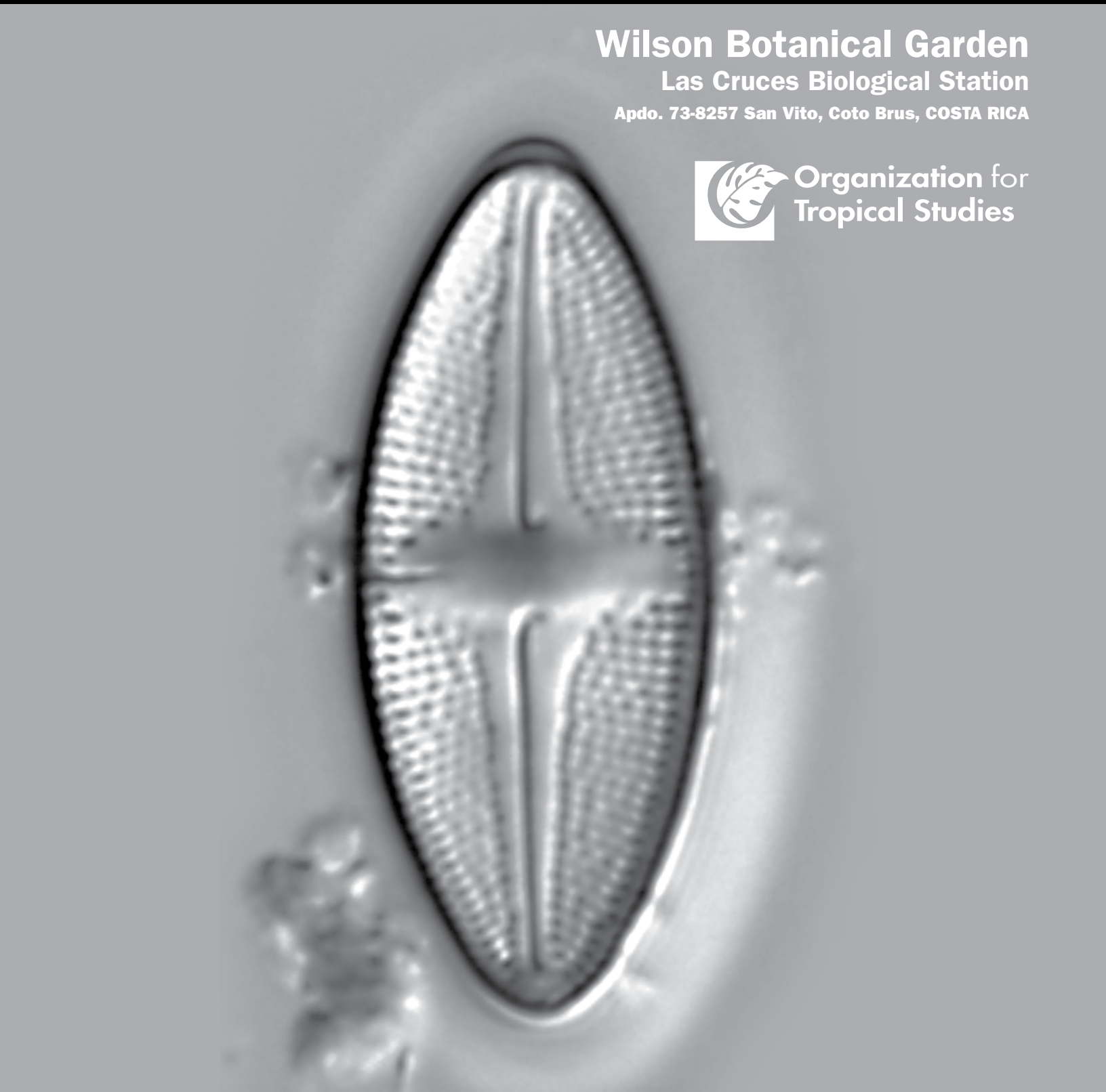
Amigos Newsletter

No. 84, November 2015

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 field stations owned and operated by the Organization for Tropical Studies (OTS) in Costa Rica. The station was acquired in 1973 and, along with the Wilson Botanical Garden, 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 International 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 Biosphere 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 that include palms, aroids, bromeliads, gingers, 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 that inhabit the Las Cruces reserve, and the forest fragments in the immediate surrounding area. 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 60 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 more than 200 hectares of primary forest (home to over 2,000 native plant species) and ~150 additional hectares that are in various stages of forest recovery. The reserve 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.

The nearest town is San Vito, the municipal capital of Coto Brus County. It was founded by Italian immigrants in the 1950's and to this day they have a strong presence in the community. There is even a Dante Alighieri Italian-Costa Rican Community Center provides Italian 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 Las Cruces website at http://www.ots.cr/lascruces or contact us directly by email: lcruces@ots.cr or telephone at: +506 2773-4004. Postal mail can be sent to: Estación Biológica Las Cruces/Jardín Botánico Wilson; Apdo. 73-8257; San Vito de Coto Brus, Puntarenas; Costa Rica.

Reservations can also be made by contacting the OTS office in San José by email threepaths.reservaciones@ots.cr or by telephone +506 2524-0607.

The North American OTS office is located at Duke University, telephone: +1 (919) 684-5774 or email: ots@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.

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Front Cover: The diatom (*Luticol* sp.), which was collected during a storm event at a Las Cruces forest site (for details see full article on Biogenic Silica). ***Photo Sarah Spaulding***

Back Cover: Part of the group of the Florida Bebidas company who participated in the volunteer activities at Las Cruces in July and August. ***Photo Rodolfo Quirós.***

Director's Keys and Notes

A drone taking off for a quick forest survey. Photo Jonathan Dandois.

Zak Zahawi / zak.zahawi@tropicalstudies.org

A few *Amigos* issues back (May 2013) we printed a fantastic aerial collage of the Las Cruces Biological Station as taken from an Unmanned Aerial Vehicle (UAV) or drone. The UAV was equipped with a simple point and shoot camera and programmed to continuously take photographs as it flew along a pre-programed route using its built-in GPS to guide it. The images were then stitched together to create a very nice collage of the station and the immediate surrounding area.

This image though was actually just part of a test flight. In reality what the University of Maryland researchers came to do was fly these drones over the long-term restoration plots that Karen Holl (University of California-Santa Cruz) and I established a decade ago in and around Las Cruces. The restoration project, also known as "Proyecto Islas", was established to evaluate the impact of different restoration strategies on forest recovery. It is now in its 11th year and has been largely funded by the National Science Foundation, with some support from other agencies and private donors. As with all large-scale and long-term projects, however, it is costly to keep running and manage not only the upkeep and access to sites, but also all data collection to evaluate how the project is doing. One major goal of the study is to evaluate the success of recovery under different restoration strategies. This assessment includes collecting data on tree structural metrics such as canopy height, canopy closure, above-ground biomass (an important proxy of how much Carbon each plot has fixed), among others. On the ground it is somewhat tedious and slow and skilled technicians are needed to collect the data. Accordingly, we decided to evaluate a novel monitoring strategy using drones which promised to potentially reduce the cost of monitoring considerably (both monetarily speaking as well as in terms of time investment).

The results of this collaborative project were quite striking. Using the images

collected from the drones, and open source software and algorithms to process them, we were able to create 3-D point clouds that represent the vegetation on the ground and interpret this information to derive remotely generated metrics for forest structure. However, there remained an additional step. This technique, or "Ecosynth" methodology, had to be tested against field-based measures to determine if the results generated were representative of what is found on the ground. The result? Ecosynth generated similarly accurate values for almost all measures! Although still in its infancy the methodology could, in the not so distant future, be much more widely applied. It would represent a significant reduction in the cost of monitoring and also permit much more frequent evaluations of forest metrics. Moreover subtle measures that are typically difficult to collect in the field, such as phenology (i.e., leaf flush, flowering) or canopy roughness (how bumpy the surface of the canopy is) could be monitored with this technology.

Needless to say, new technologies don't come without their challenges. For example, learning how to fly these drones is not that simple – and only a few in-flight accidents could rapidly ramp up your costs! Processing the imagery is also challenging and requires skills in use of the open-software programs to generate the data. Nonetheless the methodology is highly promising and the paper that we recently published in Biological Conservation and accessible here: (http://www.sciencedirect.com/science/article/pii/s0006320715001421) was just given the Atlas award – a prize given once a month to the most promising paper published under Elsevier – a publishing house with several hundred journals to its name! I am sure you won't be seeing the last of these little drones at Las Cruces!

All the best,

Zak

What's New at Las Cruces?

Rodolfo Quirós and Zak Zahawi / rodolfo.quiros@tropicalstudies.org; zak.zahawi@tropicalstudies.org

Corporate Volunteering at Las Cruces

Over a few days in July and August a total of 75 collaborators from the Ciudad Neily section of the Florida Bebidas Company, dedicated a combined 450 hours of their time to work in the Botanical Garden and in the forest. They cleaned up ditches and trails, removed leaf litter to be used as natural fertilizer in the garden, relocated fallen trees branches and big leaves, and removed some of the exotic plants from the forest that are growing along the Rio Java trail. This contribution adds up to around 56 days of work time for our ground's crew, accordingly it represents a big help in our efforts to keep the garden beautiful and safe.

Volunteers at the garden are a great help, and also provide an opportunity to share experiences. We are very thankful to those who choose to help us maintain our garden in good order.

Volunteers at work. Photo Rodolfo Quirós.

The Wailing Wall!

Soon after the previous *Amigos* newsletter went to press, we held the official inauguration of the first new wall to grace the botanical grounds in decades. This wall starts at the main entrance and runs along the main driveway into the grounds of the Wilson Botanical Garden, providing visitors with an immediate and striking visual impression upon entering. No cement was used in the construction, but a careful and methodical placement of stones. This was a major endeavor undertaken by the gardeners who dubbed it the 'wailing wall' when they were working on it as the project never seemed to end! The wall extends for about 150 m to a stone staircase that leads to the Wilson House. We may expand the wall to the main 3-way intersection sometime in the future… but only once the gardeners recover!

The new Las Cruces wall. Photo Zak Zahawi.

The OTS Plant Database

With the supplemental grant from the NSF Collections to Support Biological Research Program (CSBR) that was received in 2014, we incorporated the seed collections of La Selva and Las Cruces into the OTS plant database (www.ots.cr/plantdatabase). The database, which was developed with collaboration from the central office IT department, now houses more than 15,000 herbarium scans from all three OTS herbaria, thousands of live plant images, the seed collections, and other datasets in the near future will also be added (e.g., pollen). It was renamed the OTS Plant Database (replacing the Digital Herbaria) to reflect its greatly expanded role and future potential. This grant was concluded in May.

The Wilson house on the operating table. Photo Zak Zahawi.

Wilson House

In the previous *Amigos* newsletter I mentioned that the Wilson house was about to go a much needed overhaul. Given the wooden building's 53-year history, this was a considerable undertaking. The task was leased out to a local construction group and they spent the better part of April and May replacing damaged beams and structural supports throughout the building. It is hard to describe the volume of wood that was replaced but easily dozens of truckloads of damaged wood (mostly due to termite infestation) were removed. Although a second repair phase is set for this September-October, most of the major repairs have been completed and the building is now structurally sound. The overhaul was programmed in two phases so as not to interfere with the peak summer season at Las Cruces where the building sees a large amount of usage. We took advantage of the overhaul to improve the spatial distribution of rooms and storage space, and remove the last remaining bathroom in the building which had caused some water damage over the years due to leakage. It was no longer needed given the adjacent battery of bathrooms that was built a few years back with NSF funds alongside the Wilson house that serves each floor separately.

Research at Las Cruces

Biogenic Silica: What is It, and How Might It Be Useful in Showing Hydrological Connectivity?

Thomas C. Peterson, Ph.D. (hydrologist, retired; tcpete@frii.com)

Horsetails (*Equisetum*) are fascinating plants. They are called "living fossils" because they are the only living genus in Equisetaceae and have been around for over 100 million years. They are relatively common in many different environments. If you have handled them, you have noted the abrasive feel of the stem. The dried stems have been used to polish materials--sort of like #400 super-fine sandpaper. The rough feel is the result of silica bodies because *Equisetum* and many other plants (including algae) are biosilicifiers that concentrate and deposit amorphous hydrated silica.

Chemical weathering of parent material releases silicic acid (H_4SiO_4) to the aqueous phase. The dissolved silica (DSi) mimics water in biota. Thus, DSi moves with water throughout the vascular system in plants, and it is also incorporated into diatoms (a common phytoplankton). In plants, it is deposited in many locations as small silica bodies called phytoliths ("plant rocks"). In diatoms, the silica is deposited as the cell wall, and the silica bodies are called frustules. Additional information on the role of silica in plants can be found in Epstein, E., Proc. Natl. Acad. Sci. 91:11, 1994.

Horsetails are familiar to most people even if they are unaware of the presence of phytoliths. However, phytoliths are fairly common in a variety of plants. Plant families, with high phytolith production, present at Las Cruces Biological Station (LCBS) (based on a search of the Digital Flora of Las Cruces database) include: Annonaceae, Arecaceae, Asteraceae, Boraginaceae, Bromeliaceae, Chrysobalanaceae, Commelinaceae, Costaceae, Cucurbitaceae, Cyatheaceae, Cyperaceae, Heliconiaceae, Hymenophyllaceae, Marantaceae, Moraceae, Orchidaceae, Poaceae, Urticaceae, and Zingiberaceae. Not only do these plant families have high phytolith production, genus-specific phytolith morphology is common (http://wikipedia.org). Evidently, Equisetaceae has not been recorded at LCBS. This is not surprising since *Equisetum* prefers wet areas and is shade intolerant. It is also heavily grazed, which probably is not good for cattle teeth (Hauke, R.L., Rev. Biol. Trop. 15:269, 1969). *Equisetum x schaffneri* (a hybrid of *E. bogotense* and *E. giganteum*) has been collected a short distance west of San Vito, *E. giganteum* has also been collected northeast of Agua Buena. If you note the presence of phytoliths with a specific shape, you can reasonably assume that it came from a specific plant genus.

The same concept applies to diatom frustules. The morphology of the frustule is generally genus-specific and often species-specific. Most people associate diatoms with the ocean; however, they are present in most places that are wet, whether that is a fluvial, riparian, or an adjacent terrestrial environment. Some diatoms are aquatic and some are aerophilic. Diatomists generally focus on the aquatic phase; however, diatoms can be found in soils, herbaceous plants, mosses, and on tropical tree bark. They might also be present in bromeliad phytotelmata. Diatoms are often used as bioindicators of water quality in Europe.

Phytoliths and diatom frustules do not readily dissolve when the organism dies and decomposes. Owing to the genus-specific nature and longevity of these silica bodies, they have potential use as biological tracers. Archaeologists have used phytoliths as bioindicators of genus- and species-level plant life to gain insight into the past environment at excavations. Hydrologists (with the help of biologists skilled in phytolith and diatom microscopy) should be able to use both phytoliths and diatoms as biological tracers of both water source and hydrological connectivity during rainfall-runoff events. This is possible because many phytoliths and diatoms are species-specific to various zones, e.g. aquatic, riparian, and upland (terrestrial) zones. Note that both diatoms and phytoliths are small. Most range between 2 and 200 microns (one micron is equal to 10^{-6} meter).

A test-of-concept experiment was completed at LCBS. Two sampling sites were chosen: (1) an abandoned pasture site adjacent to the Rio Java in the southwest corner of LCBS near the terminus of the Ridge Trail, and (2) a primary forest site adjacent to Cerro Creek, just upstream of the Loop Trail. Soil and plant samples were collected to determine presence of phytoliths and diatoms associated with each site. Samples of overland flow during rainstorms were collected with specially constructed sample devices (OFDs) placed at various distances away from the streams at each site. Stream samples were also collected during storms.

A review of the experimental results indicates that phytoliths and diatoms have potential as biotracers. However, a big constraint to future studies would be finding biologists skilled in phytolith and/or diatom microscopy. Nonetheless, it was a fun and informative experiment. Some of the results are shown in the following figures.

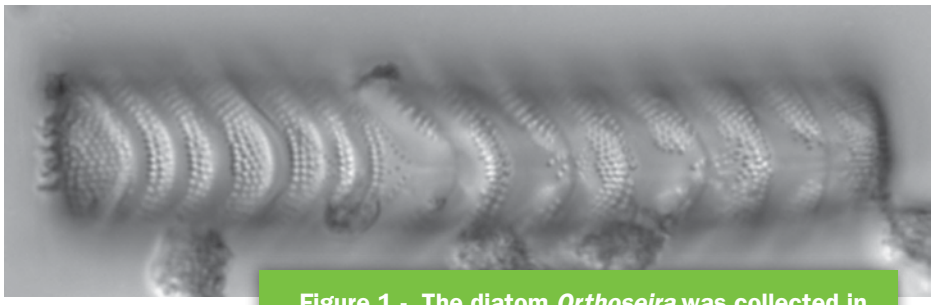


Figure 1 - The diatom *Orthoseira* was collected in an OFD in a riparian area at the forest site. It is commonly found in soil, moss, and on tropical tree bark.

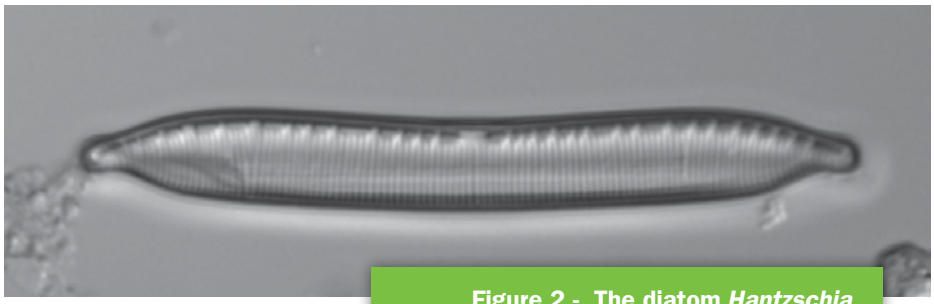


Figure 2 - The diatom *Hantzschia amphioxys* was collected in an OFD at the pasture site. It is typically found in soil in terrestrial areas.

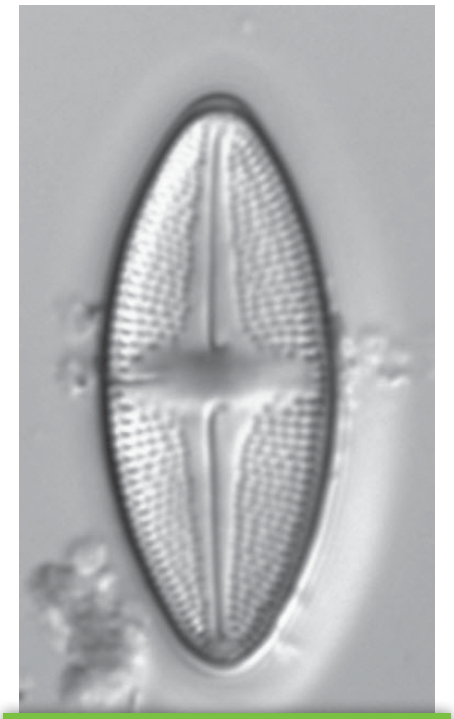


Figure 3 - The diatom *Luticol* was collected during a storm event at the forest site. It is aerophilic and is found in soil and moss.

Figure 4 - A phytolith from *Piper friedrichsthalli* was obtained from a plant found in the terrestrial area at the pasture site. The distinct elongate morphotype is shown at 400X magnification.

Figure 5 - A phytolith from *Axonopus scoparius* (also known as *Paspalum scoparium)* was collected in an OFD in the riparian area at the pasture site. The phytolith has the distinct bilobate or dumbbell morphotype of Poaceae. The common name for this plant is imperial grass. Magnification is 400X.

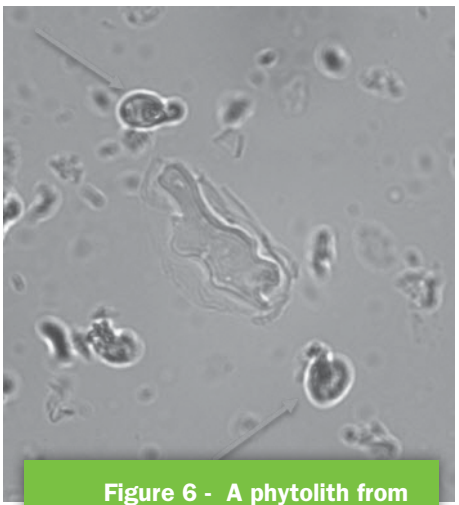


Figure 6 - A phytolith from *Calathea crotalifera* was collected from a plant in the terrestrial area at the forest site. The phytolith has a distinct spheroid morphology and is shown at 400X magnification. The plant is commonly called rattlesnake plant.

Butterfly Abundance and Species Richness in Regeneration Plots

Adrea Gonzalez-Karlsson and Jeromayln Santos/
adreasusan@gmail.com

Deforestation is an ongoing problem in Latin America and has decimated many types of plant and animal life. At Las Cruces there are a number of multiyear projects evaluating the efficacy of different types of forest restoration. The Islas Project is a multiyear experiment testing forest regeneration strategies under different planting schemes. Island plantings, where tree seedlings are planted in patches, is considered to be the least costly strategy whereas plantation planting is the more traditional strategy of planting tree seedlings in rows across an entire area.

But we want to see the forest through the trees as there are many animals and plants in the forest in addition to the trees. A forest without butterflies is one that can be considered to have lost an important long distance pollinator and so this summer we measured the abundance and diversity of butterflies in three sites of the Islas Project that were former pasture land at each of four treatments: an island plot, a plantation plot, a control plot where no seedlings were planted, and a reference forest. We hung traps baited with fermented pineapple and walked 40 meter transects to measure butterfly diversity to the species level and collect data on wing dimensions.

Collecting data on butterflies in the field. Photo Adrea Gonzalez-Karlsson

***Tigridia acesta*, a colorful species found in the island plots. Photo Adrea Gonzalez-Karlsson**

We recorded many nymphalid butterflies including five subfamilies, 18 genera, and 43 species. For each individual we trapped, we recorded the species, as well as their color and size. Plot types were different in composition across taxonomic levels. Island plots were the most diverse, followed by plantation, forest, and control. In addition to taxonomic diversity per se, butterfly size and coloration varied between sites, following similar patterns to taxonomic diversity. Higher diversity in the island plots may be the result of a more heterogenous habitat found there with some components of the plantation habitat but also some more open areas that are also found in the control treatment. Open areas are typically favored by butterflies although they like access to a mix of habitats.

The relationship between these measurements means that there is great potential for further studies of Lepidoptera across landscapes by students, and citizen scientists since recording color pattern and size by eye is easily done. This is important going forward since butterflies are an important part of the ecosystem and we are damaging iconic species. The blue morpho was found only in forests plots and so there is much work left to be done to regenerate tropical forests and protect these beautiful insects.

This work was part of the NAPIRE program, a research experience and cultural exchange program designed for Native American and Pacific Islander undergraduate students. This experience is supported by The Louis Stokes Alliances for Minority Participation Program (LSAMP, National Science Foundation).

Pouring pineapple juice onto a plate to attract butterflies. Photo Adrea Gonzalez-Karlsson

GIS Corner

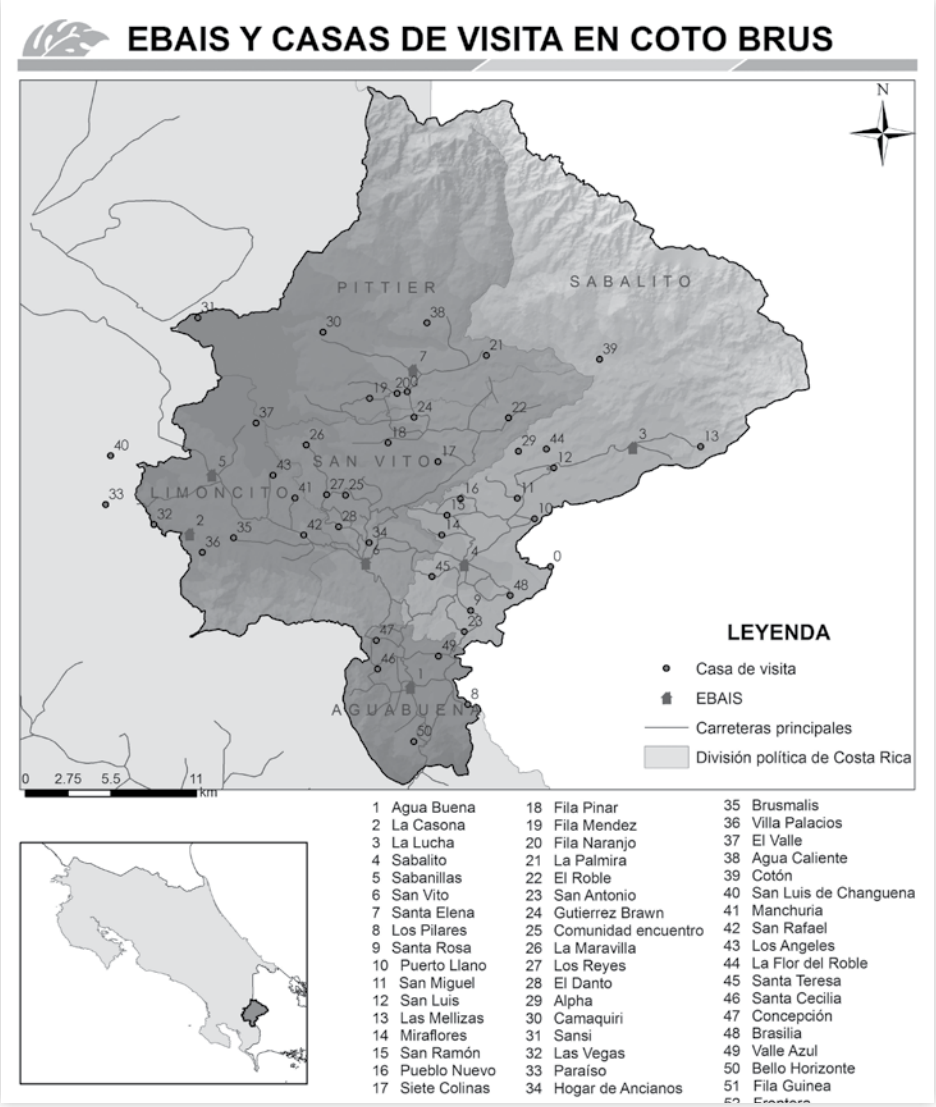
Yerlyn Blanco yerlyn.blanco@tropicalstudies.org

Hello Amigos! As I had mentioned in the previous *Amigos* newsletter, we have been working on a new map of all the health clinics in the county that should be very useful for the community at large but also for Las Cruces. Surprisingly, the county of Coto Brus did not have a map of the distribution of national health care clinics (known as EBAIS) and the so-called 'visiting houses', which are regularly frequented by health care specialists who oversee the medical issues of people in distinct communities, some of which are quite remote.

Given the need for such a map, we started fieldwork in January of this year to visit each one of the 52 health centers in the county and georeference them all. Of these centers, seven are health care centers and 45 are visiting houses. Once we have completed the fieldwork we will use the cartographic map of Costa Rica to generate the map and we are almost done with the project – a near complete version of this map is printed alongside this article.

This map will be handed over to the Costa Rican Social Security service of the region, but we will also keep a copy of the file at Las Cruces where it can be made available to researchers, OTS staff, and even students such as those that participate in the Global Health semester program. In fact Global Health students should find this particularly useful as they are frequently developing research projects with the health care clinics in our county. As always, I invite you to inquire about the information housed in our cartographic database; you can find all manner of information on Coto Brus county and Costa Rica in general.

This project aside, I am also participating actively as a member of the local committee for the Amistosa Biological Corridor. In this capacity, I have generated more than 10 maps that will be used in the technical profile document to be submitted at the end of the year in order to officialize the corridor. The maps contain baseline information on various characteristics of the corridor, including maps on the corridor's geomorphology, soils, hydrology, political regions, and other themes. We hope that the corridor will finally be officialized at the end of this year as it will be an important step in helping to promote the conservation of the region's biodiversity.



Flora and Fauna

Helping the Heliconias

David Janas; david.janas@tropicalstudies.org

One of the most iconic groups of ornamental plants in the tropics is the genus *Heliconia*. These herbaceous members of the Zingiberales are often standing tall, with brightly colored inflorescences, trying to flag down the attention of passing hummingbirds. While we may not be the intended target of their display, *Heliconia* have found themselves spread all across the world's tropics while offering humans little more than aesthetics. With around 220 species spread throughout Central and South America and a few Pacific Islands, there is considerable diversity within *Heliconia* though there are some basic themes that set them apart from other, similar plants. They are all stalked erect herbs, ranging from below the knees to patches larger than a house, with each stalk bearing a single inflorescence consisting of a variety of colorful bracts and contrasting flowers. The exact colors and proportions of these bracts and flowers separate the different species and traverse the entire color spectrum with the exception of the rarest color in plants: true blue, which *Heliconia* reserve for their fruit.

A *Heliconia mathiasiae* inflorescence. Photo David Janas

With showy colors and a propensity for rapid growth, *Heliconia* are common garden features throughout the world tropics and the Wilson Botanical Garden is no exception. Robert Wilson amassed a diverse collection of species – native and exotic, many of which are still living in the Garden today. One of the distinguishing features of a *Heliconia* is its "walking" rhizome. Some years after planting, a carefully-sited *Heliconia* may be several times the original size and also several meters away! This was one of the main problems facing the traditional *Heliconia* Garden here at JBW – after so many years in place, if there was an original design for the garden it was no longer in evidence! We were left with a field of randomly dispersed *Heliconia*, some beautiful and healthy and others stressed and languishing.

Along with the new design, which features an enclosing wall of those (mostly native) species that are particularly abundant in the Garden and two short loop trails that examine the rainbow palette of both the erect and pendant inflorescence types, we are introducing new cultural practices as well. Traditionally, the *Heliconia* collection has been maintained in a more formal way with grass and debris removed from the base of the plants so that everything has a very clean appearance. However, *Heliconia* require lots of nutrition to fuel their rapid growth and since we are working to eliminate our use of chemical fertilizers and pesticides, the planting beds will have to be heavily mulched in order to keep the collection (now over 100 species and varieties!) looking its best.

Next time you visit the Garden, be sure to stop into the Zingiberales Section and check out our collection of one of the most beautiful groups of plants in the world, the *Heliconia*. Which one is my favorite? There are many to choose from, but right now I think *Heliconia mathiasiae* is my favorite. It is about head-high in the sun (taller in the shade) with many closely-spaced, thin stems bearing horizontal leaves so it makes a useful screen in the landscape. It grows well here whether in sun or shade or loam or clay, and they rapidly form a tight clump without any deep-diving long-distance-runner rhizomes, which makes it easy to dig up and move around (and give away!). The inflorescence isn't overly gaudy but the bracts are clean, bright red with showy yellow flowers that the hummingbirds love to visit and are borne in abundance throughout most (all) of the year. As a bonus, it is native to Costa Rica. Even the name is fun to say once you get the hang of it: HEL-i-co-nia mah-thia-see-EYE!

Bird Songs

Zak Zahawi; zak.zahawi@tropicalstudies.org

A new entry in the species list database for Las Cruces has been added. Local recordings of 134 bird songs have been uploaded to the website and interested parties can view the listing and click on each link to hear the call of approximately one-third of the bird species found in our area. These recordings were done a number of years ago but were misplaced and only recently 'rediscovered'! Should others have calls they would like to add to this list, please feel free to contact us! All species lists, which include birds, trees, mammals, lichens, herpetofauna, dragonflies, and orchid genera, can be downloaded here: www.ots.cr/lc-species.

Roberto Burle Marx and The Wilson Botanical Garden

Holly Shimizu; hollys579@aol.com Las Cruces Advisory Committee Member

Roberto Burle Marx (1909-1994) was a colorful character, a passionate plantsman, and a world famous landscape architect, artist, musician, environmentalist, designer, and painter. Using plants as his medium, his designs had rhythm, color, surprises, and emotion, done with the intention of leaving the person feeling elevated. He wanted to harmonize the ecological medium and looked to local environments for sources of inspiration. Burle Marx believed that the beauty of nature can be transposed to compositions in landscapes. Often referred to as the father of modern landscape architecture his work continues to inspire people around the world.

Most of his life was lived in Rio de Janeiro, Brazil, although he traveled extensively to collect plants (which he propagated for his gardens and nursery) and for his commissions. He designed over 3,000 works in more than twenty countries during his 62 year career and considered plants to be his vocabulary. Burle Marx donated his home, Sítio Roberto Burle Marx, to the Brazilian government in 1985. The garden contains over 3,500 species of plants and people still come from all over the world to see his gardens and the incredible work of this amazing designer. As evidence of his active role with plants, there are sixteen plants that bear his name including: *Heliconia hirsuta* 'Burle Marx,' *Calathea burle-marxii*, and *Philodendron* `Burle Marx'. He believed that gardens should not only be beautiful but should provide the chance for people to feel one with nature. One of his goals was to get people to truly "see" the plants in front of them and thereby make connections to the place and its flora. During his life Burle Marx was a tireless advocate for the protection of South American rain forests. According to Luis Diego Gomez's article in Amigos Newsletter No. 41, September 1994, Burle Marx wrote a letter to Robert Wilson saying, "Why use native plants? Because destruction of the tropical flora is so rampant….governments prefer fast profit than to conserve. Why import English rosebushes when we have so many superior plants?"

The significance of Roberto Burle Marx's help in the design and layout of the Wilson Botanical Garden cannot be overstated. Roberto Burle Marx met Wilson in 1954 and they went on to become close friends due to their shared love for tropical plants. When Burle Marx visited Las Cruces in 1962 he influenced the design of the gardens and persuaded Wilson to have formal gardens that blended with the wildness of the existing site. When you consider the design of Bromeliad Hill with swaths of bromeliads surrounding the Wilson house, there is a certain formality to the design with the terraces, the shapes of planting areas, and the colors, textures and patterns of the bromeliads, and it all creates a beautiful rhythm and movement. Two of Burle Marx's signature plants are still thriving in the Bromeliad Hill Garden, they are the ruffled fan palm (*Licuala grandis)* which is planted next to the imperial bromeliad (*Vriesea imperialis*). From that central core the gardens decrease in formality as they span outward and closer to the forest.

Las Cruces has some records of plants collected by Burle Marx in July 1964 when he was in San José and visited the Lankaster Gardens in Cartago. In 1965, Burle Marx and Wilson went on an extensive plant collecting trip together in Bahia, Brazil and then, in 1977, Burle Marx came to Costa Rica to give a lecture and was able to visit the Wilsons. In 1988, the well-known botanist, Dr. Luiz Emygdio de Mello Filho (who collaborated with and influenced Burle Marx) visited the Wilsons at Las Cruces. Yet, there are still many details, gaps and pieces of information that need to be filled in and gathered. Since most of the Garden records were lost in the Las Cruces 1994 fire, there is a need to track down some of this information that was lost. Inevitably, gardens change over time, plants grow or die out and gardens must be refurbished. Nonetheless, Bromeliad Hill is being restored with the intention of having it represent the original design done by Burle Marx as closely as possible. How helpful it would be if we could track down a sketch or a design that Burle Marx prepared for the Garden, or his plant lists for the gardens and collections, or thoughts on design intent… our work will have to continue!

Bromeliad hill on a sunny day. In the left center of the image is the *Licuala grandis* and to the right of it are two *Vriesea imperialis* plants. Photo Zak Zahawi.

De la Comunidad

The Social Network, a Vital Component of Environmental Education

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Last June was cause to celebrate, reflect, and take stock of the global environmental situation. The Month of the Environment could not pass by without the Program for Outreach and Environmental Education at Las Cruces (PEEA-LC) putting together a celebration, which took place on 29 June. This event, called "Educating Ourselves Environmentally" was done in joint collaboration with the Environmental Education course that forms part of the Ecological Tourism degree at the University of Costa Rica (UCR), Golfito, and the San Vito Bird Club (SVBC). More than 90 people participated in the activity, among them boys and girls from the Federico Gutiérrez Brawn school, the Copal de Concepción school, and Comunidad Encuentro (a locally based drug rehabilitation center for youths from the city).

The activity lasted all morning and part of the afternoon and was held at the Wilson Botanical Garden. The intention was to create an interactive learning-teaching space that revolved around themes such as: biodiversity, energy, climate change, water, contamination, and other topics, all delivered through educational activities. The sessions were designed by the students from the UCR whereby each school group or participating high-school would engage in a workshop for around 30-40 minutes. For the University students, this event represented a chance to put into action what they had learned about environmental education by designing, planning, and executing an actual activity with participants from local schools and the community. For the SVBC, and the participating schools, the event served to complement other activities that have taken place in the area such as the "Detectivos de Pájaros" program run by the SVBC. Finally, for PEEA-LC this alliance helped strengthen the network between OTS, neighboring institutions, and local groups who actively participated in the organization of the event. Once again, environmental education underscores the need for us to work together as everything is interconnected. Accordingly, to better understand and conserve the ecosystems of our planet, we need social networks.

Pariticipants in the Educating Ourselves Environmentally event held at the Wilson Botanical Garden.

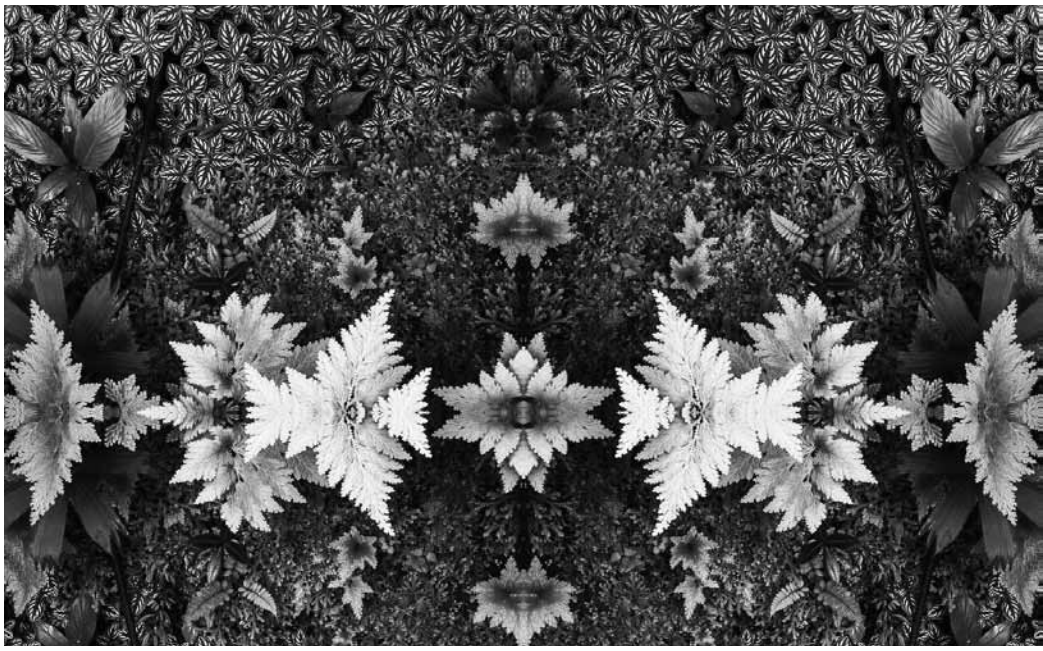
Students from the University of Costa Rica's Ecological Tourism program in Golfito.

Our Donors

Of Gail, Harry, and Blogs!

Alison Olivieri / sanvitobirdclub@gmail.com

Gail and Harry Hull in Cerro Punta, Chiriqui, Panama



Rio Java Trail Mandalagraph by Harry Hull III.

Many of you will fondly remember Gail Hull who breathed life into Robert Wilson's original "Amigos Letter" in 1989 with intriguing articles and graphics about the goings-on at the Wilson Garden. She worked here for many years and, as some of you know, she lives a mere 6-minute drive north of the Garden, at a beautiful private nature reserve called Finca Cantaros (fincacantaros.com), with her husband Harry. Gail's life here in Costa Rica is ineluctably bound up in Finca Cantaros, a property that had a lake, a small house and not much more when she bought it in 1994. It is now a glorious park, full of birds and other animals, forest paths, flower gardens, archeological artifacts and several ranchos where a visitor can meditate, read a book or draw, surrounded by nature. The lake is seasonally teeming with Blue-winged Teal and sometimes the elusive Masked Duck even shows up, creating a stir among local birders.

Now Gail has started a blog, called "Foto Diarist, Photography and Musings about Nature & People" where she weaves stories around her captivating photos. Recent topics have been caterpillars, Gray-headed Tanagers, the Coto Brus Regional Health Director Pablo Ortiz and, of course, her first love: plants. We think you, our *Amigos*, will delight in this blog. You can find it easily by entering fotodiarist.com into your browser and you can sign up to "follow" Foto Diarist by entering your email into the rectangular box in the lower right-hand corner of the home screen, thereby receiving each publication. Gail is judicious with her essays – your email account will not be overwhelmed.

Speaking of Gail, there's Harry! He has a blog of his own, albeit of a vastly different sort. Also a photographer, Harry sees shapes and images the rest of us don't -- he manipulates his photos to create something entirely different than the original picture. Often, his subject is the natural world but sometimes he is taken by the work of man. Recently he has added videos, starting and ending with a still photograph, and featuring interesting music. Harry's blog can be found at: mandalagraphs.com and, again, you can sign up to receive regular Mandalagraphs as described above.

Now that you have been properly introduced to Gail and Harry, neighbors and *Amigos*, why don't you write and tell us about YOU? Our mutual interest in the Las

***Aristolochia* from an article in the Foto Diarist blog. Photo by Gail Hull.**

Cruces Station and the Wilson Botanical Garden connects us as surely as if we lived next door. We would like to hear from you and about you: what creative ideas and activities keep you busy?

Las Cruces is a small place in the global scheme of things; those of us who live here count ourselves among the very lucky. We look forward to your visits and your continued support enabling us to welcome natural history visitors, college students, international researchers, photography clubs, birding groups, plant associations, and now cycling maniacs who zoom out the main entrance early in the morning with their bus behind them! Please use the enclosed donation form to make a contribution to our Annual Fund or to the Director's Land Acquisition Campaign. As ever, thanks to you from us.

As always a big THANK YOU to you all!

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