

Amigos

Newsletter

No. 89, May 2018



Organization for
Tropical Studies

Wilson Botanical Garden

Las Cruces Research Station

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

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 southeastern 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 bird list has registered 410 species; close to half the number of birds found in all of Costa Rica. There are also more than 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 some 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 the Las Cruces 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, excellent 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. For example, a Dante Alighieri Italian-Costa Rican Community Center provides Italian language instruction and Coto Brus is the only county in Costa Rica where Italian forms part of the elementary curriculum! But enough said here! We hope that you will be inspired to come and experience firsthand the splendid tropical diversity of the Las Cruces Biological Station and Wilson Botanical Garden!

Please visit the Las Cruces website at <http://www.tropicalstudies.org/lascruces> for more information or contact us directly by email at lcruces@tropicalstudies.org 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@tropicalstudies.org or by telephone +506 2524-0607.

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

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

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

Director's Keys and Notes

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It takes a Village



Deirdre Hyde is a British painter trained at Reading University. She first came to Costa Rica nearly 40 years ago as part of an expedition to Cocos Island and although she has produced paintings, illustrations, and designed museums in many other countries throughout Europe and the Americas from Norway to Brazil, Deirdre always returns to Costa Rica, which she considers home. Her work is included in collections such as that of the Duke of Edinburgh, the Smithsonian Institution, National Geographic Society, and Canning House, as well as private and public collections worldwide.

Spirit of Place

Rebecca Cole / rebecca.cole@tropicalstudies.org

Deirdre Hyde looks at the painting with the critical eye of a dissatisfied artist. “It has faded”, she said. “That yellow is quite fugitive”. And the tip of her paint brush flicks towards the fiery-billed aracari perched in lush vegetation that drapes over a winding stone pathway. After a few moments of precise work, her attention turns to a long spiral of heliconia flowers that should be bright orange-red but have aged to a rusty brown, and then to the delicate fronds of a tree fern caught in a shaft of sunlight. It is a painting of the Wilson Botanical Garden, rendered in the deep peaceful greens of many-layered vegetation and flashes of color so vivid that you can imagine the calls of toucans

and the swift dart of a violet sabrewing hummingbird.

Wilson Botanical Garden by Deirdre Hyde has an unusual history. It was commissioned at a pivotal moment in 1995 in the aftermath of a devastating fire that leveled most of the buildings on the station. The destruction was so complete that nearly everyone thought the station would close for good. Fortunately, a group of supporters rallied and funds were raised to bring the station back to life. The new painting was part of this effort and was auctioned to help raise funds to rebuild Las Cruces.

Like many of Deirdre's paintings, Wilson Botanical Garden captures the abundant diversity of this tropical forest

Front Cover: Sketch on paper of the Wilson Botanical Garden: Courtesy of Deirdre Hyde.

Back Cover: Bromeliad Hill in the Wilson Botanical Garden: Courtesy of Deirdre Hyde.

Editorial Committee: Rebecca Cole and Leslee Schmitt



and the complex interactions of a world alive in countless ways. *“When I first saw the rainforest, it was like a big green wall, and you need a way in to be able to see into it. My job is to try to say look at this look at this little thing, it is related to that, so that you can read the landscape better. There are so many stories here to be told!”* The buyer donated the painting back to Las Cruces and it has graced the wall of the high-roofed and airy dining hall it helped to fund since then. Over time, the tropical sunlight has faded the warmer colors, which in artists’ jargon are rather “fugitive”.

This spring, Deirdre Hyde returned to Las Cruces as our *Artist in Residence*, not only to bring new life back to her original painting, but also to design a spectacular set of panels for a new visitor area which we hope to open this June. The panels will combine information provided by scientists doing research at the station with art to capture concepts, tell the story of our region, and communicate efforts to conserve this special landscape. We hope that visitors from our local community and from abroad will soon enjoy these new additions to the station!

The rest of this newsletter contains a wonderful article on the history of Las Cruces and an insight into the life of Alexander Skutch, one of the world’s greatest ornithologists. You can also enjoy the journey of researchers as they unravel the complex world of hummingbirds and their unusual relationships with plants and microbes. Enjoy!

Sketch from a quiet corner of the garden.

What's New at Las Cruces?

A Space for Natural History

Rebecca Cole / rebecca.cole@tropicalstudies.org



Rosi (one of our forest rangers and former manager of a butterfly park) and Carla (head of environmental education and outreach) working on the new Natural History room.

It was a team effort. We wanted to make a space where visitors could learn more about the rich biodiversity of our region and find out about the cool research that scientists are doing at the station. We started by emptying out the large, well-lit Director's office next to the gift shop in the Reception building (I am now working from the Taxonomy office in the Library in case you want to find me). Then, the maintenance crew installed new outlets, a large TV panel, and made a set of shelves and cabinets for exhibits. Carla Azoifeifa, our Environmental Education and Sustainability Officer, put together visual and written information for children of all ages to enjoy. Rosibel Ortiz, our Forest Ranger and local butterfly expert, made a set of insect exhibits. Rodolfo Quiros (Education, Logistics, Librarian and Natural Historian) contributed a timeline of the station's history. The San Vito Bird Club donated a lovely painting by local artist Kathy Bauer that shows the range shift of birds moving northward from Panama into Costa Rica as well as a video of bird images and calls. Over the next few months, scientists at Las Cruces are going to help populate an exhibit showing the weird and wonderful outcomes of their research. Next time you visit Las Cruces, feel free to step into the new Natural History room and see what is new!



A new painting by local artist Cathy Bauer shows ten bird species that have shifted their ranges northwards from Panama into Costa Rica in the last decade. Whether it is habitat change, global warming, or some other factor, species once seen only south of the border are now common in Coto Brus county. The painting, along with background information and a video, was donated to Las Cruces by the San Vito Bird Club.

Research at Las Cruces

Would the Fresh Flowers in the Room Please Stand Up?

D. G. Gannon. Oregon State University / dustygannon93@gmail.com

I have recently been called the world's expert on heliconia sex. This title was given to me jokingly by a mentor and friend as we walked through the *Heliconia* garden at Las Cruces Research Station, peering into the soupy bracts of *Heliconia wagneriana* plants in search of fresh flowers. Despite the lack of any authoritative or public recognition of the title, I was proud. Just a year ago, I could not distinguish a mature flower. However, ignorance and inexperience can provide one with unique perspectives. Because I knew (and still know, despite my unofficial title) nothing of heliconias, I was looking close enough, studying the most mundane details, for discovery to jump out at me.

Heliconias, also commonly called lobster claws, are tropical understory herbs with broad, banana-like leaves and flashy inflorescences. The inflorescence is composed of thick, colorful vegetative structures called bracts, from which protrude rather inconspicuous flowers. The flowers are generally long and somewhat cylindrical, but often curved, creating striking matches to the bills of the hummingbirds who pollinate them. The cylinders are slit vertically, nearly the length of the flower. This narrow opening provides the only access to the nectar at the base and is covered by another flower whorl (petal-like structure) that peels back to provide access to pollinators and expose the reproductive organs (stamens, anthers, stigma, etc.) when the flower matures. Flowers develop and pass in a single day, resulting in tens to hundreds of flowers per inflorescence over the course of the flowering season.

My dissertation work is focused broadly on the evolution of the heliconia family (Heliconiaceae) and the influences of their hummingbird pollinators. Specifically, I

am working with Drs. Matt Betts, Andy Jones, Adam Hadley, and Urs Kormann at Oregon State University on 'pollinator recognition,' or the capacity to distinguish between and prefer visits from specific pollinator species. Plants of *Heliconia tortuosa*, a common understory plant in montane forests of Costa Rica, are not receptive to pollen when brought by a short-billed bird (or a person with pollen mounded up like a scoop of ice-cream on the end of a toothpick), but 'turn on' to receive pollen from long-billed birds. We expect that, because a long-billed bird can drain more nectar from a flower, the plants recognize the removal of the full nectar load as compared to a skim off the top and respond by allowing pollen tubes to begin growing. The pollen tubes are then able to grow down to and fertilize the ovary to create seeds. How? Why? Are there other species that do this? These are the basic questions underlying our investigations at Las Cruces.

The first step in testing for pollinator recognition in other species is to exclude the pollinators and then pollinate the plants by hand (i.e. no nectar is removed, but there is ample pollen present). If the plant can recognize its pollinator, we should find few pollen tubes in the styles we hand pollinate as compared to those open to bird visits. We exclude hummingbirds by covering inflorescences with white mesh bags. To some of these bagged flowers we apply pollen by hand, covering them again afterwards, and others we leave open to bird visits. We then collect the styles (female parts), preserve them, and stain them with a dye that binds to the pollen on its route from the stigma (the tip of the style where the pollen tubes germinate) through

the style to the ovary. After the staining process, pollen tubes appear neon yellow when viewed through an epi-fluorescence microscope. We performed this precursory test across five heliconia species in February and March, 2017; but one species, *H. wagneriana*, presented problems early in the season.

Each morning before breakfast I would walk around the heliconia garden to see how many flowers had developed overnight, the mesh bags hunched over, heavy with moisture and looming through the misty, grey light like ghosts. For nearly two weeks I thought that the *H. wagneriana* plants I bagged had not produced a single mature flower, whereas those without a bag produced many. On plants without bags, I would often see the narrow opening in the flower agape and the stamens poking out, coated in sticky conglomerates of fresh pollen waiting to lodge themselves in a hummingbird's feathers. Why hadn't I seen this on the plants I bagged? Were the bags detrimental to the flowers?

Because I cannot hand pollinate flowers that are not fully developed, I was getting no data from these plants. My hunger for data points and the realization that I really knew nothing of these plants prompted me to take a closer look. Some bagged flowers had a bright and glossy lower lip that was rolled back and splayed out, as if creating a landing pad for a hummingbird's bill. Others were instead dark green and folded up, though the narrow opening was sealed on all flowers. I attempted to remove a glossy flower with my forceps, but as soon as I touched it, the stamens shot out like a jack-in-the-box! A smile crept over my face. I tried another, and again

I took my first step towards the title of 'Heliconia Sex Expert' right then, since no one (to our knowledge) had previously reported such a behavior in Heliconia.



The flashy inflorescences of a *Heliconia wagneriana* in the Wilson Botanical Garden.

they popped out. It then dawned on me that the glossy flowers were fresh and that birds must have been triggering the stamens on the plants I had not covered with bags. I took my first step towards the title of ‘*Heliconia* Sex Expert’ right then, since no one (to our knowledge) had previously reported such a behavior in *Heliconia*. The next step came when I showed a video of the jack-in-the-box stamens to a fellow at lunch that day. A wry smile crept over his face as well, and he proceeded to tell others in the dining hall that I was making sex videos at the station! I followed behind him, red in the face and fumbling through explanations.

Aside from lunch time entertainment for some tourists, there may be some benefits to jack-in-the-box stamens that resulted in their evolution. We hypothesized in our article documenting this behavior that keeping stamens inside the floral tube may preserve and protect both pollen and sensitive flower parts until a hummingbird is present. Rather than leaving pollen out in the hot sun to dry up and degrade, it is kept in a dark, humid environment, and rather than exposing the reproductive organs to hungry critters, they are protected by flower whorls. Additionally, the upward extension of the stamens, which occurs because they coil up like springs inside the flower, likely smears more pollen along a bird’s bill and head as the bird moves downward to drink nectar. Interestingly, there are a number of plants that have evolved similar traits, including some *Catasetum* orchids and *Cornus canadensis* (Cornaceae), both of which launch their pollen using spring-loaded mechanisms.

We hope this project will continue to yield surprises over the next few years as we move into aviary experiments with hummingbirds (the true experts in *heliconia* sex). We plan to continue testing for pollinator recognition across *Heliconiaceae*, ultimately applying phylogenetic approaches to test ideas about its origin and evolution. With over 250 known species of *heliconia*, who knows what other kinds of discoveries could pop out at us?



Hummingbirds are allowed to feed from sterile sugar water to sample the microbes they carry on their bills and tongues.



A wide variety of floral nectar is sampled to identify the microbes found in flowers and shared with the hummingbird pollinators.

getting swept into the flower by a gust of wind.

There are two steps to determine the efficacy of microbes as a pollinator fingerprint. The first step is to characterize the microbial constituents found in nectar in forest patches with and without the experimental removal of *H. tortuosa* (the potential trigger for pollinator loss). The second step focuses on the denizens of the hummingbirds' bills and tongues – the microbes catching a ride – in these same forest patches. By sampling the microbial communities found in the flowers and on the hummingbirds, the researchers can identify the microbes shared between the plants and birds – which can serve as a floral visitor's calling card.

Microbial identification can be tricky – many microbes look similar and many more refuse to grow on agar plates. In collaboration with researchers at Stanford University, the group employs DNA sequencing to characterize the microbial communities harbored by the flowers and hummingbirds.

Thus far, the results from the first year of the study identified potential microbial signatures of hummingbird pollinators via the overlap between the microbes found on hummingbirds and those in floral nectar. Data collection and analyses are underway to determine how microbes may serve to track shifts in visitation of flowers by hummingbirds.

Pollination is one of the world's most important ecosystem services. And previous work has revealed that nectar microbes can facilitate plant-pollinator crosstalk with consequences for pollination. Incorporating nectar microbes into future studies on plant-pollinator interactions in the context of global change will likely provide insights into ecology and conservation both here in tropical forests and elsewhere in the world.

Detecting the Microbial Signatures of Hummingbirds

Marion Donald, Rice University / mld1@rice.edu

Found only in the Americas, hummingbirds delight with their jeweled presence and graceful acrobatics. Their characteristic hum, caused by wingbeats of around 80 beats per second, reveals their engine burning through the sweet fuel collected from nearby flowers. Due to the high metabolic rates of these birds, they rely on sugary (high energy) floral nectar for their fuel source.

When the hummingbirds dip their bills to refuel, they deposit microbes into the nectar. Some of these microorganisms are nectar specialists, meaning they are finely attuned to make the sugary pool their new home. These new residents may provide novel tracking of these flighty, pollinating gems in a way that no birdwatcher or video camera ever could.

Now what of this? Pollinators are declining worldwide, which is a major problem for maintaining healthy forests, meadows, and agricultural crops alike. Conventional methods for identifying pollinator loss and their consequences often rely on multi-year studies of the plant and pollinator

communities. This hinders researchers from rapidly identifying and ameliorating pollinator loss.

A recent collaboration between researchers at Rice University and Oregon State University turns the attention to the hummingbirds' microscopic partners introduced above. These nectar microbes may allow rapid tracking of plant-pollinator interactions and identification of pollinator loss.

Here in the surrounding forests of the Las Cruces Research Station, the researchers are testing the idea of a hummingbird's microbial signature by conducting a large scale experiment in which a common and important plant, *Heliconia tortuosa*, is effectively removed from the forest. It is thought that hummingbirds rely on the copious amounts of nectar these *Heliconia* produce to refuel as they traverse the forest during the Costa Rican dry season. Thus, its removal may trigger the loss of these hummingbird pollinators.

Just as the TRACOPA autobús delivers the researchers from San Jose to the nearby town of San Vito, some microbes may depend on hummingbirds as their mini-TRACOPAs. The microbes enter and exit floral nectar with each hummingbird visit – essentially hopping on and off the bus and grabbing a sugary meal in between trips. Other microbes may be more agile in their arrival methods – perhaps

De la Comunidad

A Short History of Las Cruces Research Station and the Robert and Catherine Wilson Botanical Garden

Gail Hewson Hull. Associate Director of Development and Visitor Services, Las Cruces (1989-1999)

THE EARLY DAYS. Imagine the remoteness of the property and its condition in 1960 when Robert Gardner Wilson and Catherine Archibald Bond Wilson first visited the land they would buy in the area known by a few inhabitants as Las Cruces, between Linda Vista and Copal in the *canton* of Coto Brus. There was a small community of thriving Ticos in Sabalito, about 15 km away; and Italian settlers had begun developing the even closer San Vito community, carved out of forest, in 1951, a mere nine years earlier. All the roads in the area then were gravel; there was a ferry, not a bridge, to cross the Rio Terraba at Paso Real.

The Wilsons were drawn to San Vito by an old friend¹ from Florida who lived in the Las Cruces neighborhood. They fell in love with the area and found land for sale that had been cleared of trees for pasture a few years before. The Wilsons saw the potential in the fine soils and the cool, mid-elevation setting and knew the forested hills to the west would provide native plants for nurseries and gardens. There were creeks running down to the Rio Java, and the night and morning fogs boded well for orchid and bromeliad diversity, the latter being Robert's specialty² as a horticulturist.

Robert Wilson had made his name as a landscape designer and plantsman *extraordinaire* with his legendary Fantastic Gardens nursery in Miami, Florida. Catherine was gifted in managing the finances and record-keeping of plant acquisitions as Robert traveled the world, bringing back to Florida—at a time

when it was still legal to do so—tropical plant species from Mexico, Brazil, Trinidad, Jamaica and the Bahamas. The high number of species available at the Wilsons' nursery attracted gardeners from all over the Southern United States.

The Wilsons bought the core of what they later named "Las Cruces Tropical Botanical Garden" [Las Cruces] on that first visit in 1960; and they acquired two more contiguous parcels between 1961 and 1967. Ten hectares were to be developed as gardens; pastures to the south and west beyond the gardens were allowed to grow into secondary forest; and beyond that was primary forest. By 1967 the Wilson's Las Cruces was 144.7 ha (361.75 acres).

The Wilsons' plan was to make the whole Las Cruces enterprise both an attractive garden for visitors as well as a commercial nursery to develop income. There was even a plan to grow Asian tea bushes and dry their tiny leaves for sale. Tea turned out to be a non-starter in coffee country (!), but the hedge along the Las Cruces entrance road remains the remnant of that experiment.

A long friendship with Roberto Burle-Marx—the world-renowned Brazilian landscape designer—brought Burle-Marx to visit the Wilsons at Las Cruces in 1961. Robert and Burle-Marx had met in Brazil in 1954 and went on collecting trips together in Bahia in 1965. Burle-Marx had been called "the Picasso of landscape design" by noted New York landscape architect Anthony Walmsley in the *Smithsonian*. Wilson had also made



Gail Hewson Hull, Director of Development at Las Cruces, 1989.

1. Jack Ozanne

2. Robert's expertise culminated in a book still used today by aficionados, *Bromeliads in Cultivation*, published in 1963. The records kept by the Wilson showed nearly 300 taxa of bromeliads over more than 25 years.

a name for himself in landscape design in Florida, so they had many common interests.

Burle-Marx's influence³ can be seen especially in the colorful parterres of liquescent bromeliad carpets, spilling down Las Cruces's Bromeliad Hill. Burle-Marx was a polymath artist who liked to use curving landscape elements as sculpture and to mix wildness with cultivation.

GROWTH OF LAS CRUCES TROPICAL BOTANICAL GARDENS. Despite signs of commercial problems, the garden reached its apogee in design and diversity in the early 1970s. Robert continued collecting plants on trips to Brazil (1965) and the South Pacific (1968). The latter trip was sponsored by the Australian horticulturist (plus mining and wool magnate) Stanley H. Smith⁴, and included Papua-New Guinea, Fiji, Australia, Indonesia, Singapore, Malaysia, Philippines, and Ceylon. Smith provided funding for Las Cruces' original laboratory, dormitory and dining facilities in 1967⁵, and supported other gardens around the tropical world that endeavored to follow the Kew Gardens model: protecting plants *ex situ* that might otherwise disappear from the wild.

THE WILSONS AND OTS. Eventually, the distance of Las Cruces from prospective customers and the poor road conditions of the time made a steady income very problematic, and the Wilsons looked for assistance in keeping their enterprise and horticultural dreams alive. The relatively young Organization for Tropical Studies [OTS], established in 1963, began using Las Cruces as a southern field site for students in 1965. Ten years later, in 1973, the Wilsons realized they could no longer keep their enterprise going, and an agreement was

reached that transferred ownership of Las Cruces to OTS. The Wilsons remained the managers of the property and were accorded the right to remain living in the home they had built on the grounds.

By 1975 the Wilsons came to believe that OTS was not funding Las Cruces or stewarding the garden to the degree they had hoped. Their dissatisfactions eventually escalated to talk of expropriation of Las Cruces by the government (a pet idea of Costa Rican President Daniel Oduber's wife, Majorie) or transfer of to the Universidad Estatal a Distancia (UNED). Neither of these ideas went very far, but as OTS grew as an organization it was able to gradually provide more reliable funding for Las Cruces, and the Wilsons became more reconciled to the situation.

LUIS DIEGO GÓMEZ TO THE RESCUE. In 1984, Catherine Wilson died; and by 1986, at age 75, Robert's health was deteriorating to a degree that affected his ability to adequately manage Las Cruces. He—and Las Cruces—needed help. Fortunately, the right person was available at that time to take over the leadership of Las Cruces. The botanist and former director of the National Museum of Costa Rica and its herbarium, Luis Diego Gómez Pignataro, was ready to escape from urban life in San Jose. He had been a friend of Robert's for years and had his complete confidence when OTS named him director of Las Cruces in 1986. Luis Diego provided the energy and exceptional managerial and botanical skills needed to inspire employees, renovate the greenhouses and grounds that had deteriorated, oversee rewiring and plumbing of buildings, and while doing so, helped Robert to become proud of his gardens once again. In 1988 OTS held a special ceremony, unveiling a

plaque in honor of Robert, designating the 10-hectare garden area of the Las Cruces property as the **Robert and Catherine Wilson Botanical Garden** (WBG).

In January 1989 Luis Diego married Gail Hewson, OTS' first development officer in North America. With Robert in attendance, Luis and Gail tied the knot in a garden ceremony which included all the LC staff and international guests. Gail—a former administrator and legal recruitment coordinator from San Francisco, CA—became associate director of development and visitor administration for LC and focused on “natural history visitor” services and development of guest amenities. Garden maps, specialized tours, interpretive signage, the opening of a crafts store, and editing of a new publication—the *Amigos Newsletter*—mailed to every overnight visitor, are all legacies of Gail's initiative.

Not long after, Robert Wilson's health failed rapidly and he died peacefully in April, 1989. The stone marking Robert and Catherine's graves on the grounds reads, “*He dreamt of a garden; she helped make it real.*”

LAS CRUCES REVITALIZED. With a national reputation as a naturalist and conservationist, Luis Diego had an expansive vision for the future of Las Cruces. He was an outstanding teacher and researcher (eventually publishing over 300 papers on fungi, ferns and other plant groups) and his international contacts were legion. Between OTS' fine institutional reputation for science and education, and Luis Diego's charismatic expertise, more researchers were drawn to Las Cruces. OTS graduate courses and, later, undergraduate courses, supported operations with annual visits. With the involvement of medical

3. In a proclamation in support of Robert Wilson's tropical garden, Roberto Burle-Marx wrote in Rio de Janeiro, March 24, 1977:

On visiting the Botanical Garden at Las Cruces, organized and maintained by the extraordinary Robert and Catherine Wilson, one can state that, due to persistence, understanding and altruistic dedication, this park has developed surprisingly and is a moving example of how love gives us the comprehension that plants are intimately related to our lives. In an epoch when minority interests eclipse collective interests, we see a process of deterioration in landscape, with the consequent extermination of flora and fauna. I am certain that we shall find many plants destined to extinction otherwise preserved at Las Cruces, and in conditions assuring their multiplication and perpetuation.

Any country which maintains such a Botanical Garden as this must be proud of its contribution to culture and education. There, botanists can carry out research on the behavior of living species; landscapists can visualize more clearly the beauty of the structure, colour combinations, and in short, the mystery and beauty of the lives of plants.

I believe it indispensable that the Wilsons should count upon human and financial resources, vital to those who undertake a work of such importance. Intense devotion, more important than money, they have demonstrated and continue to demonstrate.

doctors from Costa Rica and the U.S., Luis initiated a course in Tropical Medicine and inspired many students with his knowledge of ethno-botany. He fostered sister garden relationships, thus attracting intern support and garden volunteers. With increasing visitation, and with the advent of the *Amigos Newsletter* and significant donations from visitors, financial stability increased with each passing year.

Just as the future of Las Cruces seemed brightest, in 1994 a disastrous electrical fire demolished the just-remodeled Stanley Smith Building. This catastrophe might have been the end of OTS' southern station, but OTS' development team and a multitude of generous supporters were able to raise about \$1 million to rebuild the laboratory, office space and dining facilities. New cabins for natural history visitors also provided much enhanced hospitality services for birders and plant societies. That same year, Gail successfully sought funds—primarily from researchers, family foundations and visitors—to purchase the adjacent Gamboa property, doubling the size of Las Cruces' forest area. In 1998 thanks to a family gift in honor of their daughter, "Melissa's meadow" (pasture) was acquired, an area of 31 ha (75 acres) from the neighboring Rojas family. Reforestation and restoration began.

Luis Diego's influence in the development and history of Las Cruces cannot be overstated, and his biographical data is available elsewhere. He remained at the helm of what had by then become the Las Cruces Biological Station and Wilson Botanical Garden for 17 years until 2003, when he was asked to take over management of OTS' flagship site, La Selva Biological Station. After a long battle with leukemia, Luis Diego Gómez Pignataro died November 13, 2010.

THE ZAHAWI YEARS. After a period of about three years with an LC interim manager, Rakan ("Zak") Ammar Zahawi, Ph.D. (Forestry), was named director, and under his leadership, Las Cruces continued to thrive (2006-2016). Zak's interests and expertise led directly to important forestry research, as well as a 35% expansion of the Las Cruces territory, now standing at 365 hectares (902 acres). Individuals and family foundations were responsible for four land acquisitions during that period. He oversaw a doubling of researcher housing, the building of a Visitor's Center and gardeners' workshop, an expansion of laboratory facilities, and a complete renovation of the Wilson's 50-year old home for safe student dormitory space. Information technology was completely overhauled. A GIS [Geographic Information System] department was created, and the Environmental Education and Outreach Department revolutionized the extent of contact with local community interests and schools. Thanks to Zak's contacts and the local San Vito Bird Club's fundraising, a strong 15-meter canopy/ observation tower was erected overlooking the forest.

So many improvements to cite, but certainly resources available now to researchers are important to mention: Zak's oversight and persistence resulted in the establishment of an herbarium with over 4000 specimens that is now registered in the global inventory of herbaria, under the code HLDG. NSF funding allowed other OTS stations to include their specimens, so that now the OTS Plant Database contains live images and scans of more than 15,000 specimens. What results from resources like these? Research is double what it was in 2006 when Zak became director.

RECENT HISTORY. A new chapter in Las Cruces history began when Rebecca Cole, Ph.D. (Restoration Ecology), took the reins of directorship in October 2016. Rebecca brings a wealth of tropical forestry experience to Las Cruces, and even has roots here: her family settled in Coto Brus in the 1950s, around the same time as the San Vito Italian colony. As a child, Rebecca was invited by Robert and Catherine to plant "flowers" in their garden! Her father Darryl hosted OTS's agro-ecology course research at their farm in Loma Linda, so Rebecca's acquaintance with the lexicon of soil science and the workings of tropical ecosystems came early and intensely.

Rebecca's background will inform research in and around Las Cruces. Her graduate work focused on restoration of forest to degraded lands. She has worked in Hawaii on ecosystem recovery from feral animal damage and invasive plants, has studied forest succession in the Osa Peninsula, and has worked on high elevation pollution on glacial peaks in Peru. She looks forward to engaging with other researchers to test research ideas related to global change biology, natural and human system dynamics, restoration ecology for the area, and biogeochemistry.

The OTS community and the Coto Brus community wish Rebecca success as she brings students and researchers together to tackle some of humanity's most urgent environmental issues. The Robert and Catherine Wilson Garden continues to evolve as plant collections grow and change under the care of experienced gardeners and volunteer horticulturists. Visitors who are inspired by the garden's beauty and diversity are invited to become faithful *Amigos* of the Wilsons tenacious dream.

4. Smith died suddenly at the age of 61 in July, 1968 while Robert was traveling in the South Pacific under his auspices. Smith's wife May created the Stanley Smith Horticultural Trust soon afterward, based in England, that has provided crucial funding for many projects at Las Cruces over the years. A book celebrating the lives of Stanley and May was published by a team of historians in 2017: *No Substitute for Kindness - The Story of May and Stanley Smith*.

5. See large metal plaque in the wall below the Las Cruces laboratory: *This building was given by Stanley Smith for the benefit of science, particularly those sciences that relate to horticulture. From his worldwide observations and experiences he has concluded that some of the most important new horizons are in the tropics. He hopes that the scientists who use these facilities will, each in his own way leave a bit of newly wrought knowledge that someday will prove of benefit to mankind. 1967.*

Flora and Fauna

The Legacy of Alexander Skutch - Ecological Literacy in Southern Costa Rica

Alan Poole, Cornell Lab of Ornithology / afp7@cornell.edu

In the spring of 1941, a gentle, modest young North American naturalist bought 250 acres of farmland and forest not far from Las Cruces, just south and east of San Isidro in the district of Pérez Zeledón. Already a recognized botanist and ornithologist, Alexander Skutch was 37 years old at the time and looking for a home. He had been wandering the American tropics for over a decade, studying botany, collecting orchids for botanical gardens and wealthy individuals, and becoming increasingly interested in tropical birds. In southern Costa Rica he found what he had been looking for -- a benign climate, large tracts of relatively undisturbed forest, a dazzling array of birds and plants, and inexpensive land.

Over the next 60 years Skutch (who lived to be almost 100) rarely left “Los Cusingos” -- as he named his farm, for the small toucans, the Fiery-billed Aracaris that were so prevalent there. By settling in and focusing his attention on this piece of land, he was able to carve out an unprecedented body of work on Costa Rican natural history, especially birds, one that has been never been equaled since: over 200 scientific papers, and 20 books, as well as nearly 50 articles and 4 books on philosophy, all containing his vivid and graceful writing. Gary Stiles, author (along with Skutch) of the monumental *A Guide to the Birds of Costa Rica* (Cornell/Comstock; 1989), summed up how truly extraordinary this effort was: “The legacy of Alexander Skutch to Neotropical ornithology is, quite simply, the largest body of natural-history information ever collected by a single observer. We still remain ignorant about the basic biology of most species in the world’s richest avifauna, and the possibilities of

obtaining that knowledge are declining — not only because of the destruction of tropical habitats, but also through our changing ways of doing and publishing science — ever less pure observation, and more deductive reasoning and statistical hypothesis testing, a trend that Alexander deplored.”

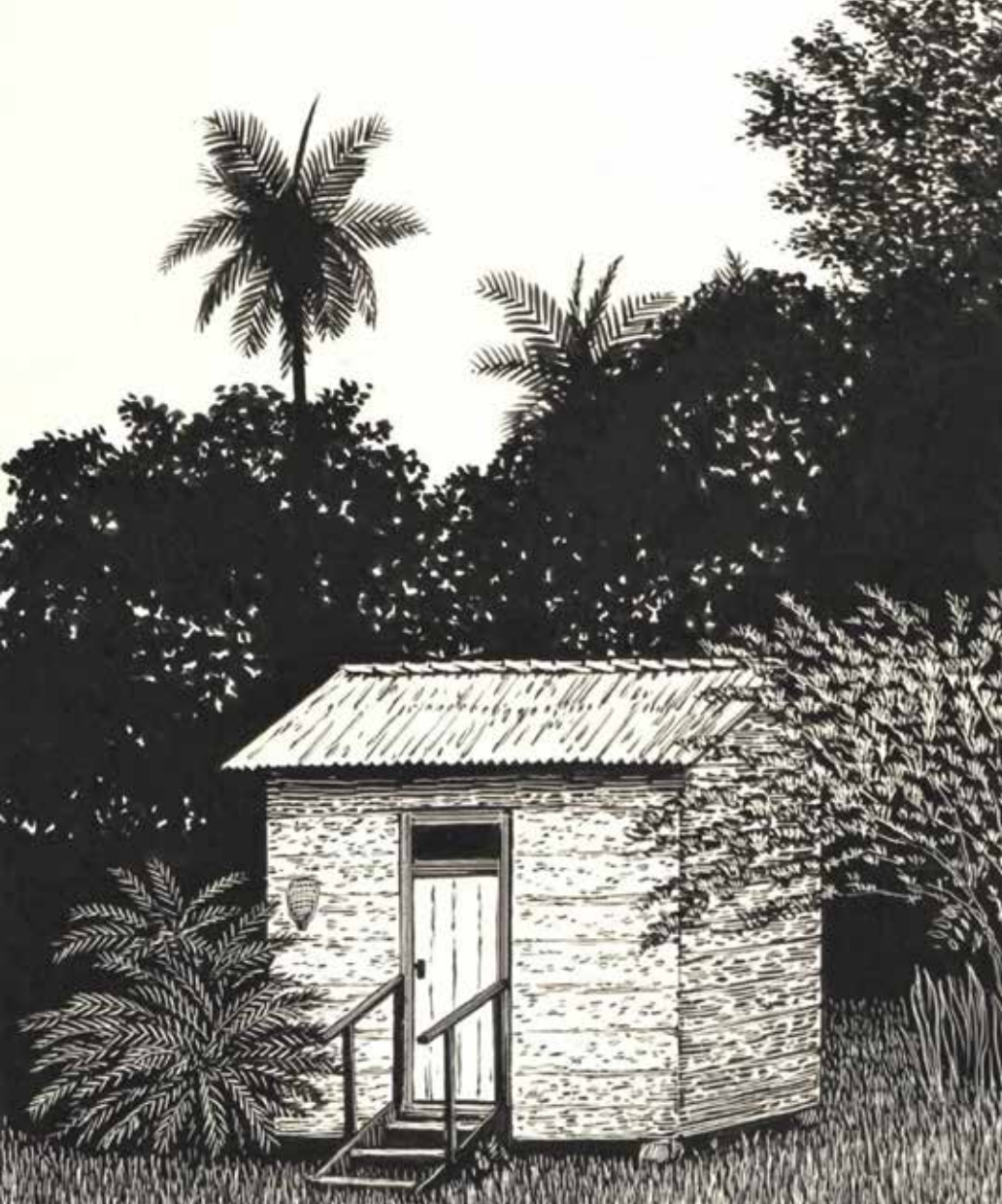
For those who have never picked up a book or an article by Skutch, a pleasure awaits you. The prose flows easily, the science is descriptive and accessible, and there are often telling, humorous anecdotes about how observations were made. The focus is almost entirely on behavior, especially of birds at the nest. Careful, patient observations were the hallmark of Skutch’s ornithology. He was, like Margaret Morse Nice before him, a “watcher at the nest” -- brilliant at finding nests and persistent at keeping tabs on them afterward. His only despair was when nests were lost to predation (mostly snakes); his work makes clear how prevalent such loss is in the tropics.

The three volumes of “Life histories of Central American birds” published in the *Pacific Coast Avifauna* series (which alone would make an impressive life’s work), along with his monumental *Parent Birds and their Young* (Univ. Texas Press; 1976), form the core of Skutch’s work on Costa Rican birds. In these we see how meticulous he was in his observations and how involved he became in the lives of individual birds -- watching day after day from blinds set up near nests. Take his study of hummingbirds, whose nests he often found under the leaves of banana plants on his farm. He describes, in one example, how Band-tailed Barbthroats build such nests:

“How does a bird attach a nest beneath

a slippery, ribbon-like leaf strip, without any projection to hold the materials nor any place to perch while she works? Probably only a hummingbird, whose ability to hover motionless in the air and to maneuver in a narrow space exceeds that of all other feathered creatures, could build in such a situation..... at first, the bird works wholly on the wing. She wraps strands of cobweb around the strip, or the tapering tip of a palm frond, while she hovers on rapidly beating wings and circles slowly around it, once or several times, keeping her bill pointed toward the leaf. She brings fragments of vegetable material and attaches them to the cobweb, then more cobweb to bind them firmly together. When she has accumulated enough material to form a little shelf on the underside of the leaf, she rests upon it, always facing inward toward the supporting strip, and often continuing to beat her wings into a haze, while she builds up the cup around herself. She uses her bill to tuck pieces in place and her feet to arrange those inside the cup. Sometimes a thin wiry strand persists in sticking up over the rim, and, with her long bill, she tries again and again to make it stay down. Like every other hummingbird that I have watched, barbthroats build their nests with no help from a mate.”

But Skutch was more than just a chronicler of bird behavior and life histories. With his background in botany he had an intimate grasp of habitats and landscapes. This was a man who thought ecologically, long before most ornithologists were doing so. He saw how avian breeding seasons were determined by the foods available to parents feeding young, and he had a keen eye for all the flowering plant on his acres that might yield fruit or nectar for animals that depended on those. Naturalists lucky enough to have walked with Skutch in his pastures and woodlands were in awe of his knowledge. This was a man who knew his own backyard intimately, and spent years



connected his house to water and electricity only in the last 10 years of his life. (His wife of 50 years -- devoted but long-suffering -- finally prevailed upon him to buy a refrigerator at age 89!). Overarching all this was Skutch's adherence to Hindu philosophy, especially the practice of *ahimsa* -- doing no harm and causing no discomfort to any sentient being. Here was a scientist who made an unprecedented contribution to 20th century ornithology without once trapping or handling a bird.

What do the writings of this man have to tell those of us lucky enough to be at Las Cruces today? For me, they are a reminder of the value of life history studies -- documenting the details of the day-to-day lives of birds and other animals, knowing what they depend on for rearing their young and keeping populations robust. Informed conservation depends on no less -- this is the baseline for all such work. In addition, I have been charmed by the look back in time that Skutch provides -- the highlands of southern Costa Rica in less developed days. We see travel by horseback along narrow woodland trails, small self-sufficient farms, and landscapes less dominated by cattle and more by wild forest. Lastly, Skutch sketched out ways to integrate farming with the preservation of wildlife habitat. Admittedly his priorities are not those of most landowners today, but, with writing like his to lead the way, we glimpse areas where compromises could be reached. His goal was always for a resurgence of new life, with the farm serving as a center of spreading biodiversity.

Readers visiting Los Cusingos today can glimpse the legacy of this extraordinary man. Now overseen by the Tropical Science Center, Skutch's house and garden have been well preserved, with trails through surrounding forest that invite walks. The bird feeders remain well-tended, so a visit is always a treat for the birder. There's no better place for the naturalist to find inspiration than here on the farm that Alexander Skutch left behind.

Sketch of Alexander Skutch's writing cabin. Courtesy of Dana Gardner.

taking notes on what was there, notes that informed his prolific writings on down the line.

For those of us with interests in the history of tropical biology, it is important to understand how different Skutch was from those who had come before him. Studies by 19th and early 20th century biologists in the Neotropics were confined largely to taxonomy, with a focus on collecting specimens for museums. Skutch never worked for a museum, university, or a government agency, and he never collected a bird. He was one of the first to take an observational approach to the birds of Central America, and the life histories that flowed from that were entirely new and of great value. Before Skutch almost nothing was known about how these wild

birds went about their lives and raised their young -- much less where they nested and what habitat they depended on. Chronicling that information helped lay the groundwork for bird conservation in Costa Rica, and elsewhere in the Neotropics.

Skutch's writings also provide a fascinating glimpse of life on a farm in rural southern Costa Rica in the mid- to late 20th century. We see how well he met his goal of finding self-sufficiency in his food (not 100%, but close). We are introduced to his farming neighbors, and get a feel for how his ideas of land use and conservation often clashed with theirs. And we can't help but admire Skutch's pursuit of a life of simplicity. This was a man who never owned a car, and who

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It Takes a Village

Rebecca Cole / rebecca.cole@tropicalstudies.org



Crew from the Wilson Botanical Garden taking the first steps toward a community park to protect the Ceiba tree.

sand, cement and the heavy equipment used to move the supplies on the roots of the tree. After members of the local community became concerned over the damage this would cause, the owner of the construction company began helping us to find better ways to protect this iconic tree. Through our Environmental Education program, Las Cruces is working to find ways to create a park around the tree that we hope will one day be a meeting place and a center of this community.

This effort, and many other conservation and education projects at Las Cruces, are made possible only with the help of supporters like you. This year, we received several very special gifts. Gretchen Daily, Paul and Anne Ehrlich and Charles and Roberta Katz, made a donation that has been critical to maintaining our Environmental Education program. The generosity of the San Vito Bird Club, Greg and BJ Nace, and Roger Schmitt have enabled us to create a new indoor and outdoor Visitor Center. Artist Deirdre Hyde has contributed her considerable talent to explain science through art at the station. A gift from the estate of James F. Dayton under the guidance of William Boggs will help keep the Wilson Botanical Garden vibrant and growing. The contributions of too many others to name here individually are helping us to keep the gates open and the station moving toward a more secure future.

It really does take a village to keep the station and all of our programs running. Thank you for your support, past, present and future.

In the village of Sabalito, in a remote corner of southern Costa Rica, not far from Las Cruces Research Station, stands a towering Ceiba tree. The *Ceiba pentandra* is not just any tree species. It holds a special place in many cultures across its tropical range. In the Maya culture, the local name means “sacred tree” and in their religion, it stands at the center of the earth. Tribes in the Amazon use the fine fiber, or kapok, to wrap their blowgun darts. In Costa Rica, it is said that indigenous people planted the trees as waypoints. Rainforest giants, these trees can reach up to 200 feet in height. Their spreading branches provide resources for a myriad of living things.

The Ceiba tree in Sabalito is special

for many reasons. Standing alone now in an open landscape, it was spared the rampant deforestation that felled much of the forest of this region. Its towering size and striking architecture has made it a symbol of conservation and connection with nature in this small community. In 2006, the Ceiba was officially honored as an *Árbol Excepcional* (Exceptional Tree) by the Costa Rican Institute of Biodiversity (INBio). This single tree is even the subject of a new book, *One Tree*, that carries a message of conservation and the connection between humans and nature to a global level.

But not one of these things has conferred any sort of protected status to this remnant giant. A few months ago, a construction company began storing rock,

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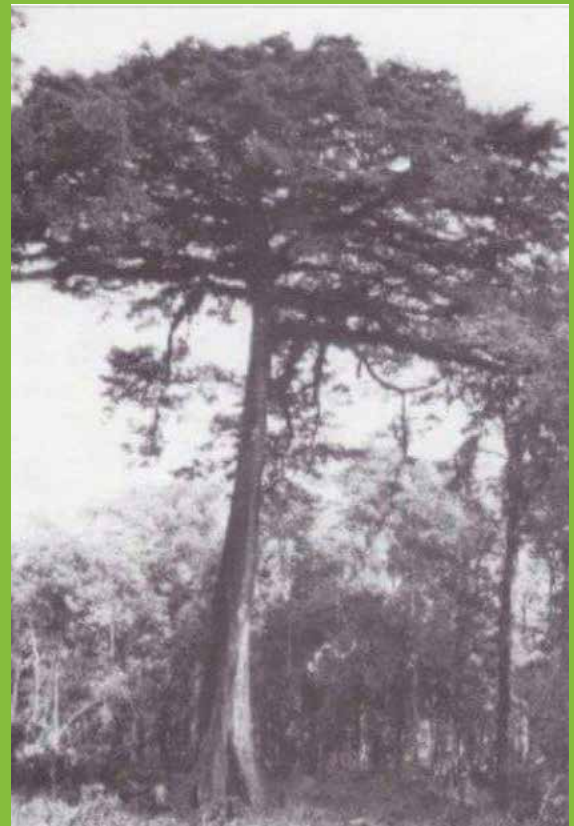
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Ceiba in Sabalito ~1970



Ceiba in Sabalito 2018. Photo courtesy of Meghan Howard.



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