

RAPHIA

Newsletter of Caño Palma Biological Station

El Cerro - Home of Turtle Mother (Page 8)



The Nymphalidae

Insects with
'4' Legs
(Pages 3 & 5)



AND



See Page 9



Canadian Organization
for Tropical Education &
Rainforest Conservation

In This Issue of Raphia

- 3 Feature story** • Butterflies - Life in the Forest
- 5 The Nymphalidae Butterflies** • Insects with '4' legs
- 6 Notes from the Station** • Views on the Cerro
- 7 Turtles Round the Cerro** • A bit about the history, culture and mythology of turtles in our area
- 9 Sign the Petition** • Do we really need a road through Tortuguero NP
- 10 Molly McCargar** • Young woman off to big city
- 11 The Acer Project** • Monitoring the health of the trees round Caño Palma
- 13 Dominica** • Prof Fulthorpe tells the story of Hurricane Maria and its impact on this tiny Caribbean island
- 16 Station Happenings** • A summary of Anna's research-coordinator reports
- 18 Update: Ocean Plastics** • Answers the question of where most ocean plastics originate from

COTERC's Annual General Meeting

4:30 - Saturday May 12th

At Toronto Zoo

(in Administration Building at 361 Old Finch)

All are welcome to attend

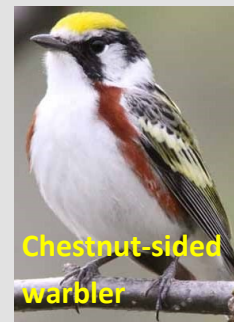
Migratory Bird Day

Why not come to the Zoo early and visit us at our display as COTERC joins in the Zoo's activities celebrating the return of some of the world's most beautiful warblers (like those below) as well as other migrants. You'll find us on the boardwalk near the Indo-Malaya pavilion. In the morning, experienced birders will be leading free tours through the adjoining Rouge National Park in search of the migratory birds. For more information, link up with the Zoo at

<http://www.torontozoo.com/Events/?pg=bird&dt=2018-05-12#evt>



Blackburnian warbler



Chestnut-sided warbler

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Butterflies -- Life in the Forest by Martijn Terpstra

Though Martijn attended Van Hall Larenstein and Wageningen Universities in the Netherlands, he has done his field work in the tropics. A stint on the Caribbean island of Saba studying red-billed tropicbirds was part of his bachelor's program in Animal (Wildlife) Management. For his master's thesis, he studied how the quality of semi-natural grasslands and field boundaries affects sunflower pollinators such as bees. He completed his master's by doing his internship at Caño Palma starting in February 2017, Now back in the Netherlands, degrees in hand, he became a field assistant at an ecological consultancy. Martijn is from a small village in the northern Dutch province of Groningen.

I'd always wanted to experience the Costa Rican rainforest so, when I saw I could do my master's internship at Caño Palma and its beautiful location, I jumped at the chance. But why choose butterflies and not the more popular turtles or mammals? Actually, I chose insects. They've amazed me since I was a kid. Trying to put yourself inside their heads for their world view is unimaginable, which makes them extra interesting. Despite this passion, I hadn't had the opportunity to work with insects that much. Aside from my master's thesis on bees, I'd mostly studied birds. When Caño Palma presented me with a plan to study butterflies, I was sold immediately!

Insects are often overlooked in research and nature conservation because of the challenges inherent in studying them. As well, it's often assumed that insects will somehow benefit from conservation measures aimed at higher taxa. This is a shame since insects represent around 50% of Earth's biodiversity, and provide valuable services to ecosystems as a food resource, pollinator and pest controller. Still, in temperate areas such as Europe, insect conservation is on the rise. The tropics lag behind given the extra challenges for researching them there, e.g. taxonomic knowledge of insects is limited, habitats are often inaccessible, monitoring can be difficult (because of differences between canopy and understory), and, though there's a broad range of species, insects occur in low densities. To deal with these challenges, butterflies are most



Brown Morpho

often selected for insect studies. Besides being attractive (most people like butterflies more than, let's say, mosquitos or ants), they're relatively easy to observe, catch and identify.

Since no butterfly studies had been done in the area of Caño Palma, we wanted to study differences in butterfly

Raphia

communities between microhabitats - specifically between forest and "urban areas" (urban at the station is what we call nature in the Netherlands). With input from Molly McCargar, research coordinator at the time, we chose to study fruit-feeding butterflies since they're most often used to assess butterfly communities in the tropics. They can be caught in fruit-baited traps (below) and released after identification. I was a bit spoiled because, before my arrival, the traps had already been made and tested - unfortunately with little success.

This got me a bit worried. And, when I finally arrived, I learned the butterfly pilot study was the least favorite among volunteers because nothing ever happened. Clearly something needed to change - it all seemed to work perfectly in the literature. Then we noticed the butterflies could exit the traps too easily. So we narrowed the opening and put the bait higher. This way the butterflies are less likely to see a way out. As well, we let the bait (banana) ferment so it gave off a stronger scent. Thanks to the slingshot talents of Manuel, we were able to change the locations of the traps to the original study design as seen in the picture below. This way the differences in butterfly species composition in different microhabitats (high and low, closed and open canopy cover) could be assessed. We extended (cont'd on next page)



Spring 2018

Butterflies (Cont'd)

our research into gardens at the station and in San Francisco. Every three days, we moved the traps from the forest to the gardens and back. This way we'd complete two studies.

Result: success. More butterflies and especially more species were caught! I was so happy because I had been imagining myself checking butterfly traps for four months without any results. Which wouldn't have been that bad since there's always something to discover in the rainforest: agoutis and tinamous running off, angry capuchin monkeys, or a juvenile caiman unexpectedly parked at your feet. In San Francisco, a giant Brazilian wandering spider found her new home in a trap.

After four months, we'd trapped 396 butterflies divided over 34 species, all from the family Nymphalidae. Significantly, we found different species in the forest and in the gardens. A typical shadow species like the brown morpho (*Antirrhoea philoctetes*) was only caught in the forest. Carolina satyrs (*Hermeuptychia sosybius*), a species in which the larvae feed on grass, was only caught in the gardens. This demonstrates that the presence of different butterfly species can tell you something about the environment. This was clearly shown in the differences in species composition between the different microhabitats in the

forest. The species composition in the canopy differed significantly from that of the understory, e.g. the split-banded owl (*Opsiphanes cassina*) was mainly caught in the canopy while the orgetorix owl (*Catoblepia orgetorix*) was mainly found in the understory.



Orgetorix owl

As demonstrated by the 34 species identified, there's a great diversity of fruit-feeding butterflies around Caño Palma. More species would almost certainly be detected by researching in different seasons and locations. Additionally, we might find more species once we've improved the traps as butterflies were still recorded escaping. Butterflies, and other insects, can reveal a lot about the environment they live in. And that's all the more reason to keep studying the insects in this area as those yet-uncovered species deserve some love too.

Finally, I want to send a huge thank-you out to all those staff and volunteers who helped make my project a success. I hope I can return to Caño Palma in the future!



1) Forest floor gap 2) Canopy 3) Forest floor, closed canopy 4) Canopy near gap

Insects with '4 Legs' -- the Nymphalidae Family

by Doug Durno

As insects, butterflies should have six legs – and the Nymphalidae are no exception. Except this family, which accounts for all butterflies trapped by Martijn, only shows four. It's just that the front pair, the forelegs, have become much reduced and are usually difficult to see as they're pressed up against the thorax with the feet tucked up under the head (see the front page). Thus the forelegs aren't fully functional since they're of no use for walking or perching. However, covered in long brushlike hairs, they're used as sense organs.

So, what role do the forelegs play? First of all males, with only one hairless tarsus, have shorter forelegs than females with their five tarsi. Bristles, called sensilla, on her tarsi function as sensory organs, able to distinguish a suitable host plant on which to lay her eggs. That plant has to provide food that the eggs' larvae will eat. So she has to be quite picky. Otherwise the larvae won't survive. An example we're all familiar with is the monarch butterfly and its association with milkweed.

What evolutionary advantage do much reduced forelegs provide? One theory claims that if these butterflies don't use their forelegs for walking and tuck them under the head, they're in a safe position to be a backup in case sense organs on the other legs become damaged. A second theory claims that the brush-like hairs on the reduced forelegs heighten the sense of smell, leading to improved signaling and communications between individuals. (This brush-like set of hairs has led the Nymphalidae to also be

Nymphalidae Info

- What's the easiest way to tell the sexes apart? Counting the tarsal segments on the forelegs, of course. The male has one segment while the female has five.
- You can usually identify a Nymphalidae by the 12 veins and the vein pattern on its forewings. However the only true way to identify a Nymphalidae is by the tricarinate



ridges on the underside of its antenna as shown by the blue arrows (carinate means keeled).

- Many Nymphalidae have brown camouflage patterns on the underside of their wings so that they look like a dead leaf when standing with wings held together
- Though most Nymphalidae drink nectar, many get some of their liquids from carrion, dung and rotten fruit.

called brush-footed butterflies.)

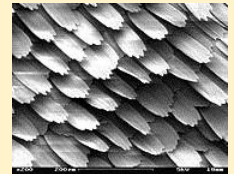
Another question: If the Nymphalidae only need four legs to walk and perch, why haven't other butterflies evolved in this direction too? It seems evolutionarily beneficial to not have to waste energy on maintaining longer, stronger legs in good working order. And it's not as if the Nymphalidae are small and don't need the extra support that six legs would provide. Most are of a medium or larger size.

As for the two pairs of rearward legs, the bristly sensilla can quickly recognize whether or not a plant is suitable for eating. But, to actually taste a leaf, it first has to be punctured. Nymphalidae have specialized tarsi sharply tipped with blades perfect for perforating a leaf's surface. The butterfly goes through a 'drumming' routine, releasing chemicals from within the leaf. The nearby sensilla can not only tell if the plant is edible, but can also recognize if the plant is unhealthy or old. Young, healthy plants provide better nutrition.



Butterfly Info

1. Of the approx. 18,500 butterfly species, Nymphalidae account for over 6,000.
2. Almost all butterflies feed only on liquids. They use their proboscis like a straw.
3. Butterfly wings are made of chitin and are covered by scales (at right) that are actually modified hairs.
4. The scales have various functions:
 - Reflection off them gives butterflies their coloring. Patterns that enable camouflage, mimicry and warnings to predators to stay away have evolved, bestowing protection.
 - Insulation to help maintain the high body temperature needed when flying.
 - Dark wings better absorb sunlight to warm the butterfly more rapidly.
 - When gliding, scales help keep the butterfly aloft by increasing the lift to drag ratio.
5. Some adult butterflies never excrete waste, using it all for energy.
6. We've all seen butterflies gathered at a mud puddle. That's a good source of salts and minerals.
7. After emerging from the chrysalis, the adult has to set its wings. First, it pumps haemolymph, a liquid similar to blood, into its wing veins to expand the wings. But, before it can fly, it has to wait while the wings harden.



Notes from the Station by Charlotte Foale

Cerro Tortuguero is a magical place, but recent history has caused locals to have mixed feelings on our region's highest point.

Not long after I arrived 11 years ago, the Cerro was closed to public access. Regular tours along the dirt trails were hazardous, and the forest suffered as groups cut their own routes to get around obstacles. Though officially closed, many groups continued to climb the hill to enjoy a unique view of the national park.

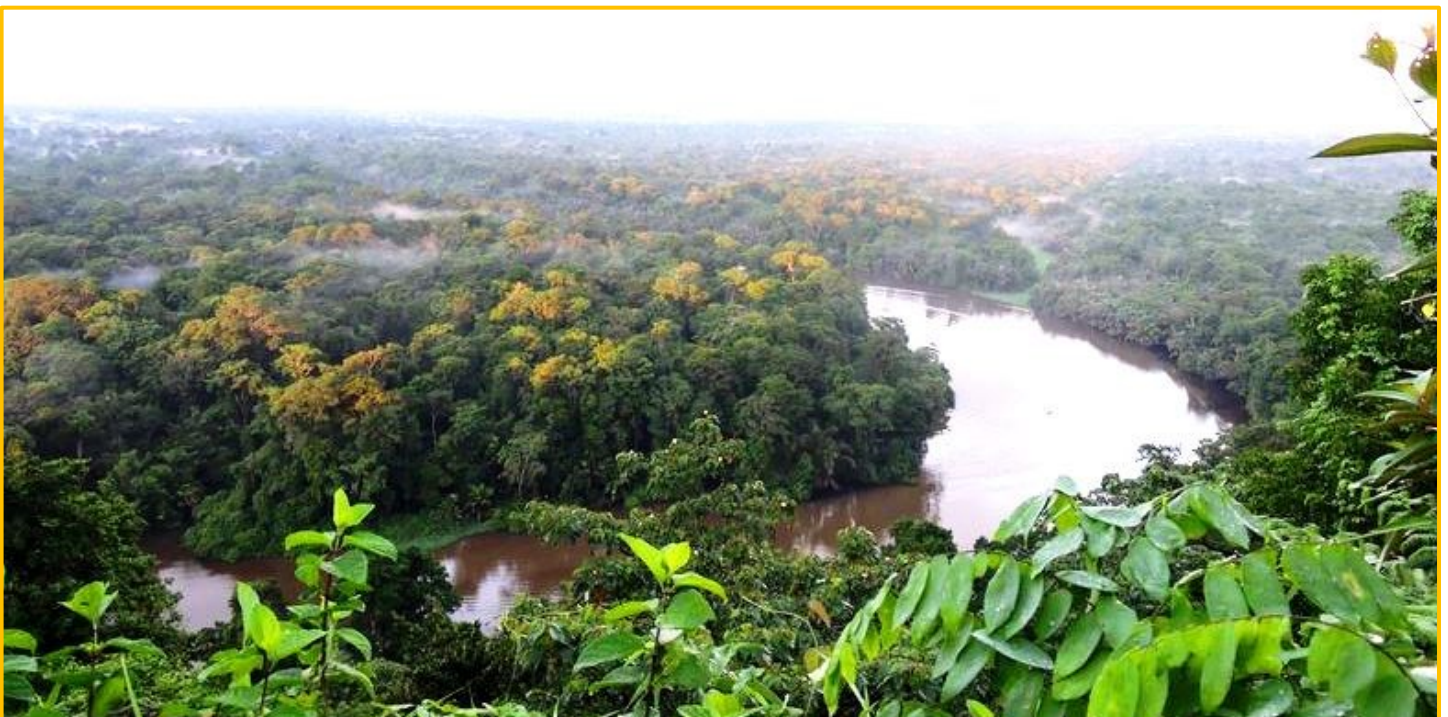
Several years ago, construction began on a modern concrete and steel trail to the top of this extinct volcano. The community of San Francisco awaited the opening with high hopes of finally attracting tourists to the village, and many planned small businesses, tours and cultural activities, anxiously anticipating independence from hotel work. Early 2017, amid controversy, the hill was reopened to the public under the management of the San Francisco Community Association (ADI), but within six months it was closed again. With Tortuguero's tour guides charging \$42 per person to climb the hill, there were very few people visiting the attraction, and the ADI couldn't afford the overheads and lost their contract to manage the facility. With no one to take over the management, the Cerro has remained closed since August, with a tree-fall damaging the trail, and making it unlikely that any group will take on the project. Locals are angry

and disappointed, and the development of small businesses has fallen to the wayside.

With the Cerro officially closed to the public, each weekend and holiday, it ironically hosts many Costa Rican tourists who climb it for free.

For Caño Palma, the Cerro has been one of most popular sites to survey. Despite hunters leaving it with the poorest density and diversity of mammals, volunteers love to go there. In addition to large-mammal monitoring, over the past 6 years we've used it to study tent-making bats, snakes, plant phenology and, with its unparalleled view of the forest canopy, the green macaw. It provides us with a contrast to other study sites, as it's more frequently accessed by humans and has housing around its base with the varied contaminants that they introduce. It provides us with the low point on our gradient of human disturbance.

Every week, we get to experience the serenity of sitting at the west-facing viewing point, the vultures and hawks circling above and below us, the monkeys eyeing us with suspicion as they feed alongside us in the canopy. For those few hours each week, we can put aside the politics and frustrations that have come to symbolize the Cerro, and truly enjoy the community of canopy-dwellers.



A Very Brief History of Turtling in the Caribbean

Articles by DD

In pursuit of their pelts for making felt hats, beavers were all but wiped out in Europe. Big Hat (a predecessor of Big Oil) turned to North America. There, as beavers were wiped out in the East, trappers and traders continually moved westward, helping to open up the continent. As well, they altered native culture, he says understatedly.

Turtles played a similar role in opening up the Caribbean. In 1513, Ponce de León sailed around the Florida Keys, reaching islands about 110 kilometers west. Here the crew gorged on turtle meat and they named these islands the Tortugas (now, though turtles are still getting wet, the islands are called the Dry Tortugas). As the 16th century proceeded, explorers and settlers opened up all areas of the Caribbean, dependent on turtles to ****pun alert**** meet much of their nutritional requirements. For longer voyages, living turtles could be brought along to provide fresh food throughout the journey. By the 18th century, the meat of green turtles was being exported to Europe and the

"The turtle trade facilitated the creation ... of a dynamic contact zone of ongoing transnational and cross-cultural encounters among indigenous, European and Afro-Caribbean inhabitants."

northeast states of the US. Though hawksbills aren't a great eating turtle, they were still pursued for their eggs and shells to make such things as jewelry and mirrors.

As turtlers settled the islands and the coast, turtle-gathering expeditions set out to all corners of the Caribbean. New communities were established. Knowledge, turtling techniques and tools were among the many things exchanged between different cultures. Indigenous people near the coast were a valuable resource for capturing turtles (see box below) as they often had a rich knowledge of the turtles' habits as well as techniques to capture them.

Cahuita in southern Costa Rica was settled as early as 1828 by turtlers. Did they find turtles in Cahuita? One turtler wrote: "My people from Nicaragua come here and strike them [turtles] every year, March right until September. They go home, boats loaded with green turtle meat, turtle oil, and hawksbill shell".

"The Miskitu Indians often go to sea with the rovers [buccaneers], and many spend three or four years away without visiting their homeland, so among them are men who can speak very good English and French – just as there are many buccaneers who speak the Indian language well. These Indians are a great asset to the rovers, as they are very good harpoonists, extremely skillful in spearing turtles ... In fact, an Indian is capable of keeping a whole ship's company of 100 men supplied with food." From the International Journal of History, Crawford & Márquez-Pérez, Vol 28 (1), 2016, Page 71.

Welcome to Turtle Bogue

In the 1820s, Tortuguero was visited by an Englishman by the name of Orlando Roberts who was a trader on the Caribbean coast of Central America from 1816 to 1823. In his book, he wrote about his travels, giving a detailed description of the migration, nesting, and exploitation of the green turtles he observed at Tortuguero or, as it was called then, Turtle Bogue (Turtle Bight). This is a brief excerpt from Roberts' book as taken from "Turtle Bogue: Afro-Caribbean Life and Culture in a Costa Rican Village" by Harry G. Lefever.

"In proceeding along the shore, we meet with the Boca de la Tortuga (mouth of the Tortuguero River) or Turtle Bight:--at this place hundreds of the finest turtles are killed annually, merely for the sake of their manteca or fat, which is melted into oil, and used by the Indians, and others on the Mosquito Shore, as a substitute for butter.

Most of the fishermen on their return from the south towards home, stop at this place for the purpose of procuring this oil, and turtle eggs, which later are dried in the sun to preserve them;--and in this way thousands of turtles are annually destroyed or prevented from coming to maturity.

During the months of April, May, June, and July, the green turtle comes from various kays, and places a great many leagues distant, to several parts of the Mosquito Shore, especially to the sandy beaches in the vicinity of Turtle Bogue, to deposit their eggs. At this season, the sea is covered with what the fishermen call thimbles – a small blubber fish, in shape not unlike a tailor's thimble; these, and a peculiar sort of grass growing at the bottom of the sea, is their principle food."

Turtle Mother

Once upon a time, close-by a beach on the Miskito Cays off northern Nicaragua, there was a rock shaped like a turtle. Each year when the turtles were heading towards the Cays to nest, the rock would turn, pointing towards land to let the locals know the turtles were coming. And lo, they called the rock Turtle Mother since they believed she was responsible for the arrival of the turtles. They revered her. She provided the turtle eggs and meat they feasted on. At season's end when the last hatchling had made it to the ocean, she would turn round to point out to sea.

But, in our all too human way, the locals were greedy. They tried to turn Turtle Mother back around. They thought the turtles would magically reappear if the rock was pointing towards land. Mom was none too happy. She abandoned them. And was found again on the beach near what became known as El Cerro Tortuguero. But people are the same everywhere. Eggs and turtle meat

were gluttonously devoured. People came from all over to capture turtles and take provisions back home. Annoyed, Turtle Mother removed herself up El Cerro. The turtle trade kept growing into the 1940s. Mom had had enough. She disappeared into a cave on El Cerro. When the villagers tried to find her, a mysterious landslide closed off the entrance and Turtle Mother was not seen again.

The year is 2050. Turtle Mother has been holed up inside El Cerro for 100 years. Maybe, she thought, the world has come to its senses. Maybe it's safe for me to reappear. Outside the cave, looking around, she saw turtles swarming the beaches. Their eggs were left untouched. Hatchlings had only the gulls to evade in order to make it to the ocean. The seas were remarkably plastic-free. Visitors soon afterward found a turtle-shaped rock near Playa Norte. And we all lived happily ever after.

The end.

Or is it? Can we stop the poachers and the plastic polluters, and appease Mom?

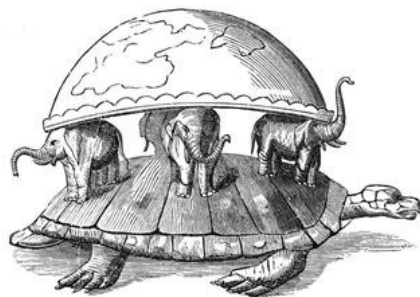
The Earthquake Makers

*See the TURTLE of enormous girth!
On his shell he holds the earth.
His thought is slow but always kind;
He holds us all within his mind.
On his back all vows are made;
He sees the truth but mayn't aid.
He loves the land and loves the sea,
And even loves a child like me.*

•Stephen King•

Many ancient cultures, without science to reveal the mysteries of the world, explained the Earth as resting on the back of a turtle. For example, according to the Iroquois, Sky Woman was pushed from the sky and landed on an Earth covered in water. Sea animals, wanting to help her, dove to the ocean's bottom to get dirt. When a muskrat (sometimes a toad) succeeded, the dirt was deposited on the back of a turtle where it grew and grew into what we call North America and the natives called Turtle Island.

(Today "Turtle Island" is used by many environmental and Indigenous-rights groups.) Additionally, Chinese mythology tells of the goddess Nuwa who was responsible for Earth's creation. To hold up the sky, she used Buzhou Mountain. When it was damaged by another god, Nuwa cut the legs off World Turtle and used them to prop up the sky.



Bygone tribes in India envisaged the Earth as supported by seven elephants standing on a turtle's back. The Hindu creation myth expanded on this belief. The shape of the turtle evolved into their vision of what the Earth looked like. Its bottom shell (plastron) represented the ground; its rounded top (carapace) the heavens; and the void between shells the earthly atmosphere. In a world that presented so many threats, peoples used mythology to make the world a more secure place, at least in their minds.

But why do so many cultures value the turtle? You could begin by looking at Aesop's fable "The Tortoise and the Hare". Tortoises represent determination and perseverance. As well, though peaceful creatures, they can defend themselves. They're long-lived, which led early peoples to regard them as wise, embodying knowledge. They're associated with water, earth, eternity and fertility, making them ideal candidates to play a role in mythologies about the Earth's creation.

Yeah, but what about those earthquakes? Well, we know earthquakes occur along plate boundaries near the Earth's surface. It wasn't a stretch for those ancient cultures that saw the Earth as resting on a turtle's back to believe that the shaking of one of the turtle's plates, the plastron or carapace, could cause the Earth to quake.

Say "No" to the opening of a public road through Tortuguero National Park

SIGN THE



PETITION

HERE 

<https://www.facebook.com/station.canopalma?fref=ts>

Building A Road to Tortuguero - From the *Tico Times* - 1996

This is a 22-year old article so the road-building issue isn't a new one. (Some editing)

"The unauthorized clearance of a 30-metre wide swath of rainforest for construction of a road to connect the isolated Caribbean town of Tortuguero to the rest of the world fanned heated controversy and anger this week.

Last Friday, a team from the Tortuguero Conservation Area discovered that a tractor, apparently hired by the municipality of Pococi, had cleared the way for a road passing through as much as 3 kilometres of Tortuguero National Park. The Conservation Area announced it will present a criminal complaint today.

"They don't have permits to enter the Park," an angered Conservation Area director Luis Rojas said. "We won't allow anyone to build a road". Rojas told the Pococi municipal executive months ago that the road, which follows the power lines from Palacios to Tortuguero, could not enter the Park.

Pococi municipality vice-president Johnny Vargas said, "We are using the pathway that all Costa Ricans have the right to use." He said the road's construction had the support of the majority in the area.

On Thursday, Park officials reportedly seized the keys of the tractor from the driver.

"We openly condemn this, both morally and legally," Minister of the Environment Rene Castro said, promising "strong punishment" for those responsible. "Pococi municipality made a mistake and it will have to assume full responsibility."

The road passes through land recently acquired by the Tortuguero National Park as part of the 'biological corridor' between the Park and Barra del Colorado Wildlife Reserve.

The municipality has permission and a budget to build the road as far as the Park entrance, about 4 K from Tortuguero village. Road proponents say it will allow greater access to Tortuguero, which can only be reached by plane or boat.

Rafael Morera, who lives beside the new road, defiantly

said, "For 20 years, this has been a road, but it has only been a park for 2 years, and you can't deny people a road." Although he admitted no cars have ever driven what till now has been a footpath, he bluntly stated: "A road is a road."

Rojas replied "It's a service path that's never been a road."

National Agrarian Party Deputy Victor Hugo Nuñez, who has earmarked 10 million colones for the project said "As long as there is not safe transportation in the zone, you can't deny the town transportation via road. People are exaggerating when they say the road goes against the area's ecology."

Road opponents fear it will eliminate the area's charm that draws tens of thousands of tourists annually, providing almost all the area's income.

Conservationists fear it will allow for greater destruction, both in the threatened lowlands and on the beach, the most important nesting place for the endangered green sea turtle.

Outspoken tourism operator Michael Kaye noted, "First and foremost, a road opens up the region to logging, monoculture plantations, agriculture and hunting. With access roads, any private or disputed property will be harvested on the fringes of the protected areas, leaving in their wake two separate forests where there once existed one. This will bring crime, drugs, overpopulation, deforestation, and interruption of animals' ranges. It's violating the integrity of the park system. My feeling is that if it keeps going this way, this might end tourism in Tortuguero as we know it. It'd convert Tortuguero into another Caribbean mass-tourism destination."

Enrique Obando, president of the Tortuguero Community Dev't Association (the closest thing to a local government) said he'd like to keep the road from being built. But, at a community meeting yesterday, he said the association would join with hotel owners in opposing the road only if the tourism industry agrees to help resolve the town's transportation problems by providing a boat and motor for public transportation as well as working with the community to resolve health care, refuse disposal and educational problems. The association is not going to put up any opposition to the road unless the tourism industry gives something to the town."

Molly McCargar

Start spreading the news
I'm leaving CP
I want to be a part of it
New York, New York

Yes, the sainted Molly McCargar has given up the sleepless nights of turtle survey in order to wake up in the city that never sleeps. And when awake, she'll be analyzing the genetic samples of turtle eggs she collected during her residence at Caño Palma. This will contribute to her PhD work at Fordham University.

Originally from San Francisco (the one with the bridge), Molly first came to Caño Palma as a Marine Turtle Intern in 2014 after completing her BSc in Marine Science at Boston University. With a passion for the work, and previous experience in 4 other turtle projects, Molly excelled at Caño Palma and her internship was extended from 3 to 6 months. She then migrated to Columbia University in NYC to complete her MSc in Conservation Biology. The focus for her Masters was Ichthyology.

With her exceptional work ethic and keen scientific mind, the station was always hoping to find a way to bring Molly home to Caño Palma. She came back at the end of 2015 to start collecting the above-mentioned genetic material. When the Research Coordinator position became available, she was a natural fit. In addition to conducting her research, Molly supervised undergraduates in their research, and ran our long-term monitoring projects. She is a woman equally at home in the field or in a lab.

Thanks from all of us Molly.



Raphia

Spring 2018

ACER -- Counting Trees

by Sarah De Vido

Sarah, from Montréal, Québec, is presently working on a bachelor's degree in Environmental Geography at Université de Montréal. She had previously earned a diploma as an Environmental and Wildlife Management technician at Vanier College in Montréal. On graduating, Sarah hopes to work in a field that addresses the effects of climate change. Sarah spent six weeks at Caño Palma in early 2017 engaged in the ACER project.

While at Caño Palma, our team would hightail it off into the forest quite early most mornings to work on the ACER project. Now, inquisitive person that you are, you probably want to know what an ACER project is.

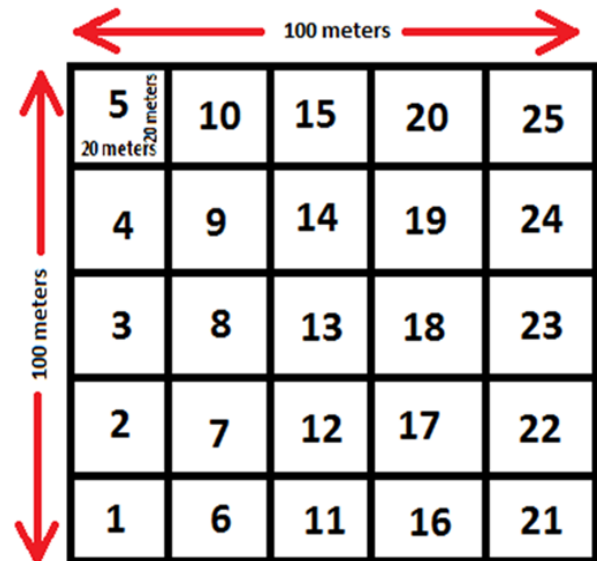
ACER stands for Association for Canadian Education Resources. A real snooze inducer, eh. For participants though, I can assure you that such projects are rather valuable. The purpose behind them is to get us students involved in experiences that engage deeply with some piece of real estate, be it urban or as remote as Caño Palma. If we're all committed to the project, we should grow into a small, inclusive learning community that is student-centered and student-driven. Hopefully, this will empower each of us with the independence to pursue our own learning, making this educational experience more meaningful and relevant to our individual lives.

After that brief commercial announcement, let's get back to what we were up to in the forest. Back in 2012, a Vanier College student doing an internship in the Environmental and Wildlife Management (EWM) program began the ACER project at Caño Palma. Ever since, it's been the responsibility of EWM students to keep it going. This year it was our turn – that would be Taylor Paterson, Christopher Pidgeon, Jessie Vallee and myself.

Now you're probably wanting to know what the project's purpose is. Well, we're monitoring the health of the forest around the station. Doing this for one year wouldn't help much. So, groups of students have been visiting the station annually, tracking changes in forest diversity over time. And, since it is a long-term project, our team won't have any conclusions to report. When we've finished counting trees in all the subplots, we hand over our data to the research coordinator who adds them to data from previous years. In the long run, we'll know such things as the abundance and mix of the various tree species. As well, we'll know the species richness – the more species there are, the better it is for the health of the forest.

What Is An ACER plot

Obviously, the entire forest around Caño Palma couldn't be measured so two plots were chosen: one beside the station and the other on El Cerro. As shown in the diagram, each plot is one hectare in size, subdivided into 25 subplots that are each 20m x 20m square. After each



subplot is measured out, an aluminium pole, marked with yellow paint to make it more visible in the thick vegetation, is installed at each corner. Within each subplot, all trees with a diameter at breast height (DBH) of more than 4 cm are tagged. This follows the guidelines as set out in the International Forest Research Protocol.

A day in the life of an ACER student

Since ACER projects are student-driven, you make your own schedule. You just have to ensure all subplots are inventoried by the time you leave. Each day you decide which plot to inventory or whether you'll stay at the station to input data on Excel. Of course, you also have non-ACER activities such as turtle survey, macaw survey or mammal tracking to take part in.

When doing inventory, you wake at 5, meet your team in the kitchen for breakfast, and choose what plot and subplots to work on that day. At 5:30, you're off, backpack loaded with all required equipment – and don't forget your compass in case you stray a little bit from the path!

This morning we walk over to the Caño Palma plot, which is relatively easy to work since students from past years had marked the corners of subplots (cont'd on next page)

ACER – Counting Trees (cont'd)

with aluminium poles. We just rope a subplot off and start looking for trees those previous groups had tagged. We measure each tree's current DBH and record it. Dead or fallen trees are also noted. After replacing any tags that are unreadable, we search out any untagged trees that look like they've reached a DBH of more than 4 cm. Any trees that measure up, we tag with the year, the plot and subplot, and assign it a number.

Around noon, we head back to the station to meet up with everyone else and have a bite to eat. If we're scheduled for ACER duty in the afternoon, we might kayak over to El Cerro, all the while hoping our subplot won't be infested with bullet ants or angry monkeys - the Cerro plot already presents enough obstacles. First of all, we can't leave anything permanent as El Cerro is not station property. So, we have to tag trees with biodegradable material. That means previous groups did the same, and we have to rewrite many of their tags. And, since alumi-

um poles are not allowed to mark boundaries, we have to remeasure plots and subplots. To complicate things further, the steep hills and fallen trees prevent us from using right-angles to set boundaries as was done on the flat terrain around the station. Up here, that method results in weirdly-shaped subplots. To solve the problem, we locate the protocol used by the students who had measured out El Cerro. It turns out they had gotten an expert botanist who used a different angling method. Now you can understand why El Cerro is taking a lot more time than the station plot. Of course, encountering a coral snake also slowed me down as I was being extra careful where I put my hands.

At day's end, supper is served in the kitchen. In the evening, you might be assigned to caiman or snake duty.

In a little less than 6 weeks, we were finished. Mission accomplished.



Sarah De Vido, Taylor Paterson, Christopher Pidgeon and Jessie Vallee on their final day working on the El Cerro plot

Dominica -- Nature's Island

by Roberta Fulthorpe

Dr Fulthorpe sits on COTERC's Board. She is a professor in the Environmental Sciences department at the U of Toronto. Roberta has done field research in Dominica.

The island of Dominica lies in the middle of the Caribbean island chain known as the Lesser Antilles. It is not the Dominican Republic, a common destination for sun seekers escaping winter. The Commonwealth of Dominica is a much smaller and much less travelled-to independent nation whose government has adopted for her the brand of the "Nature Island".

Christopher Columbus arrived at this Island on a November Sunday in 1493 and gave her the name Dominica - Latin for Sunday. But her real name is Waitikubuli - which means "Tall is Her Body". Twenty-million years ago, volcanic activity pushed molten rock high up above the sea, which settled into the nine peaks that form the core of the island to this day, some still threatening to re-erupt. The highest of these is Morne Diablotin at 1447 m. The immense height and steep sides mean that not very many beaches adorn the edges. When they do, they have dark sand formed from the volcanic rocks. This helps to keep tourists out. Her height and area (751 square kilometres) also means that over the millennia, many plants and animals have been captured from the winds and now make a home here. Correspondingly, Dominica is quite biologically



diverse. Many endemic species, those that exist only here, have evolved over time. One of these is the Imperial Amazon Parrot, or Sisserou, that sits proudly on the nations' flag.

This height and steepness of the terrain of Waitikubuli has also meant a great deal to the history of the humans who have lived on her. Populated by Arawaks from the Northern islands, and Caribs from South America, a unique culture grew up and transported in many plants and animals for the stew pot and the medicine chest. When the French and later the English tried to settle the island and profit from plantations, imported African "labourers"



frequently were able to escape confinement and find lives hidden in the lush hills. Today, the independent nation has influences from both those European cultures (left hand driving, narrow streets, roundabouts). But the people are largely of African descent, primarily Catholic, speaking English not too far removed from the Creole used by previous generations. They are a proud, hard-working, very fit, kind and patient people.

The "Nature Island" moniker is well deserved. Of its 751 sq km, 168 of them are national parks or forest reserves. Thick forests blanket Dominica's steep sides. More than 300 rivers and streams run with cold, pure water and most have at least a small waterfall. There are also drier coastal forests, high elfin montane forests, and a dry rocky "valley of desolation" that borders a lake of water that boils with volcanic heat. From the window of a plane, the view is truly stunning. The natural vegetation seamlessly merges with human gardens of interplanted riches – bananas, papayas, mangos, breadfruit, citrus, coconuts and a host of root and other vegetables. In commercial terms, Dominica is considered poor; but in reality, it produces an abundance of food for its inhabitants and still supports the most beautiful and extensive rainforest in the Lesser Antilles (the secret of this achievement lying in polyculture - the growing of multiple crops in the same space).



Dominica -- The Hurricane by Roberta Fulthorpe

In September 2017, Hurricane Maria spawned over the Atlantic Ocean. In that awful season, Dominica had escaped damage from two other closely passing hurricanes, Irma and Jose. However, on the evening of September 18th, what was predicted to be only a Category 2 storm smacked into the southeast coast of the island at Category 5 strength. After ripping off most roofs and toppling forests in the area, Maria turned as if she had purpose, went north straight up through the forests of the island's centre, and then turned west as if to maximize damage by howling into the north-western town of Portsmouth. Damage to homes and businesses was thorough. Some estimate 95% of roofs island-wide were torn off. No small number of people died from heart attacks and strokes as the winds bellowed, and the rains turned small rivers into massive tree- and debris-laden floods that swept right through entire villages. By morning, Waitikubuli's "green dress" was completely stripped. Her forests stood as empty sticks, making for vast landscapes of grey, broken and fallen trees, bleaker looking than North American forests waiting for snow.



It is now almost six months later. Recovery has been slow, difficult, uneven and painful, but is well underway. The capital Roseau has been almost completely restored, and cruise ships are visiting again. Buildings and roads and bridges have taken much of the labour and materials so, in outlying areas many lie unrepaired, especially on the east side of the island. International aid (from neighbouring islands, the UN, the UK, Samaritans Purse, and Red Cross to name a few) played a large part in the recovery. But, according to some, it was poorly organized and inequitable. People who were lucky enough to already have off-grid energy have fared the best. The majority did not have this - so solar panels, charge controllers and batteries were looted from newly installed road lighting out of desperation. Most of the country has been waiting patiently for the power lines to bring centralized fossil-fuel-generated power back to villages, although this strung-out system will fail again in the next major storm. With its abundant sun and 365 courses of falling water, Dominica has huge potential for renewable energy. It cries out for harnessing.

Still, as of March, the trees are coming back to life. The forest undergrowth and the food plantations have regrown in the sun and abundant rain of January and February, and Waitikubuli has put her green dress back on. The trees that did not fall, and many that did, are either releasing or resprouting new branches. On the west side, the forest appears to be have been conjured up by Dr. Seuss as the new growth lies close to the trunks and whatever main branches are left.



Raphia



Spring 2018

Dominica -- The Hurricane: Rebirth

In parts of the Centre and the East, there's much more tree fall and much less recovery for those trees that are still standing, but the undergrowth is green with new tree seedlings. The smallest creatures seem almost to have not noticed this major storm. If you are the sort that is calmed by frog calls, this is the place to visit. As soon as the sun drops, the loud frog chorus starts, interspersed with sounds of katydids and crickets. Small anolis (both the native Zandoli's and the introduced Puerto Rican Crested Anoli) are everywhere. Forest crabs, or the unhidden parts of them, can be spotted in many holes in the forest floor. Agoutis run amok.

Forest ecologists can point to data showing that, overall, the forests of hurricane-prone places are adapted to surviving even the worst of the storms. Just as our forests of Ontario will regrow after natural fire, the native trees of the Caribbean have ways of surviving devastating winds. Science places the rate of recovery of forests after hurricanes as much faster than recovery after non-natural disturbances, i.e. land conversion for tourism or commercial agriculture or mining. The reason lies not just in the fact that trees have evolved mechanisms for regrowth over hundreds or thousands of generations, but also because the life of the forest is kept safely entangled in the soil – the trees roots and their associated fungi and bacteria and seeds. As long as that remains intact, paradise will regrow.



Trees (in center) still bare



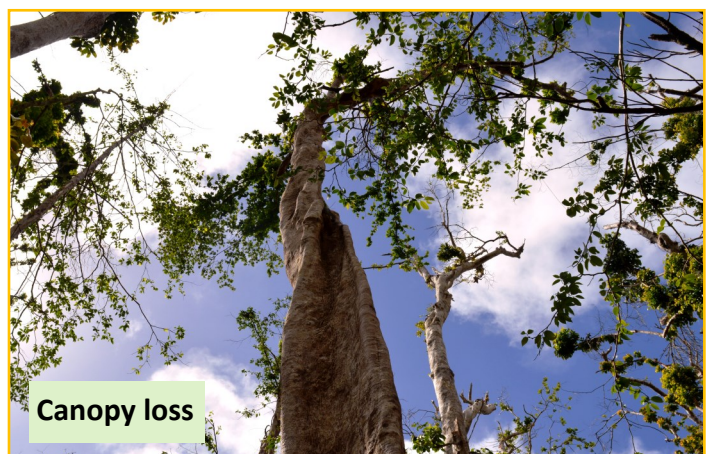
Papaya tree growing back with a vengeance



Crested Anoli



Roseau Valley regaining its lushness



Canopy loss

Photos by Roberta Fulthorpe & Elvis Stedman

Station Happenings

Taken from Research Coordinator Anna Harris's reports

January

Flooding - Floods were the main event to start off 2018. Water made it all the way up to the kitchen. The flooding meant that some surveys had their frequencies cut back while others were outright cancelled.

The mean canal depth for the month was 1.8 meters, which is a 12% increase from last year. (Mean canal depth is taken from a measuring tape attached to the side of the boat dock and is calibrated to represent the depth at the center of the canal. Daily measurements are averaged to get a monthly figure.)

Stairs - A combination of high winds and loose earth caused a tree to topple onto the stairs leading up the Cerro, severely damaging a section. We're having to walk around that section for the time being. (Photos on next page.) Macaw surveys on the Cerro were thus limited.

Caimans - A very high canal depth usually means that the number of caimans observed on surveys is fairly low. This is because the caimans can venture further into the forest and out of sight. Such was the case this month.

Marine-debris survey - On January 10, 2018, we conducted our final marine debris clean up! We collected 3,073 items. That included 1,430 plastic fragments, a 28.9% decrease from December (2,012). Although we will no longer be conducting marine debris as a survey, we will continue to remove garbage from the beach. Our plan is to have monthly beach cleans starting in the area where our marine debris transect was, focusing in the area of the river mouth. Rather than removing all items of debris, our efforts will be focused on larger items so that they will be removed from the beach before they turn into hundreds of smaller items. Below are some of the events we've since organized.

Activities below are featured on the Caño Palma Facebook page on dates indicated



March 20 - Shoesday: 660 shoes picked up in one hour in one mile by 8 people



March 11 - 43 Environmental Warriors from San Francisco picked up 2592 bottles



March 27 - 267 bottles picked up on turtle survey over 2 days



March 4 - This plastic bottle from Egypt marks the 23rd country from which trash has been found on the beach so far this year



March 18 - Home furnishing day: washing machine, freezer, crockery, cutlery and more gathered up

Raphia

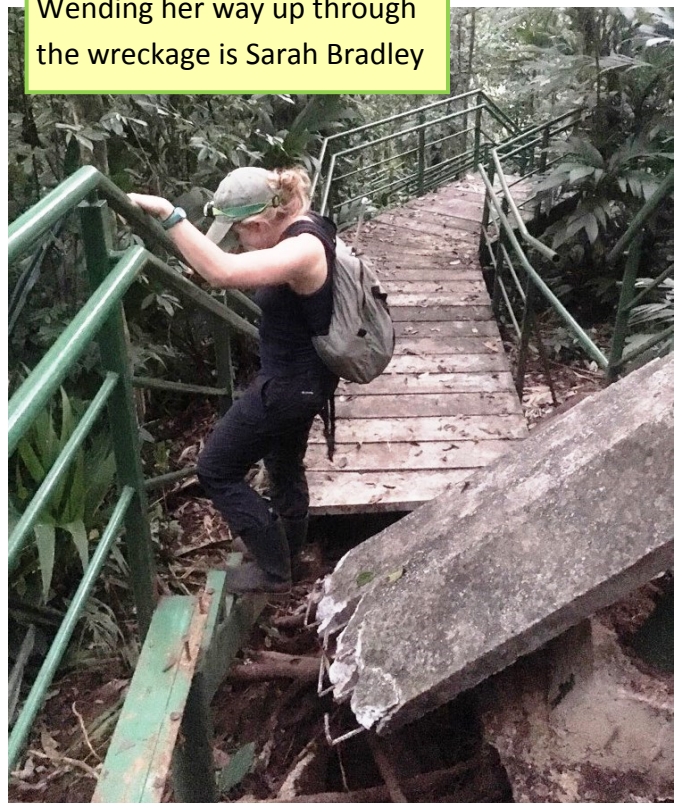
Spring 2018

If A Tree Falls on the Cerro

Damaged stairs with tree sawn and logs moved to the side



Wending her way up through the wreckage is Sarah Bradley



Photos by Anna Harris

In the last issue of Raphia (Winter), the appearance of a large garbage/plastics patch in the Caribbean was described. The Blue Planet Society (BPS), a volunteer pressure group dedicated to ending the overexploitation of our oceans, traced that garbage to a river in Guatemala. Recent research, as summarized below, points to rivers as the major source of this pollution of our oceans.

On a worldwide basis, according to a study published in the science journal *Nature*, 10 river systems account for 88% to 95% of plastics that end up in oceans. Which rivers, you ask, because maybe we can spark change if we have that information?

1. **Asian** rivers account for 86% of all plastics in the oceans.
2. **China** alone serves up about 66% of these plastics. Of the Top 10 polluting rivers in the world, six are in China, including the Yangtze at #1.
3. Of all garbage and plastics in the oceans, 98% originates from outside North America and Europe.

Why Asia? Perhaps the main problem is the lack of solid-waste collection. The UN says 2 billion people lack what we First-Worlders consider a basic service. Unfortunately, dumpsites in less-developed countries are often located close to waterways. It's just has to be a small portion of the garbage that makes its way into a river and it's a major problem.

One of the authors of this study, Dr. Christian Schmidt, says that the focus has to be on prevention rather than cleaning up what has already drained into the seas – which he believes would be an impossible task at this point. He says that if plastic input into the Top Ten rivers could be just cut in half, that would be considered a major success.

We in the West focus our attention on measures that address the issue within our own countries. That's understandable and of course essential. Yet somehow ways have to be found to pressure countries like China to clean up their act. The Ocean Conservancy estimates that it would cost China \$4.5 billion annually to set up disposal infrastructure. Would China spend that sort of money? Not likely. And that's just China. What about poorer countries in Asia that are even less well disposed to invest large amounts of money into garbage-disposal facilities?

Top 10 River Systems

1. Yangtze - China
2. Indus - India
3. Yellow - China
4. Hai - China
5. Nile - Egypt
6. Ganges/Brahmaputra - India
7. Pearl - China
8. Amur - China
9. Niger - Nigeria
10. Mekong - China, Laos, Vietnam

PLA-NTA-STIC Playa Norte

Check out our Facebook page for these **pla-nta-stic** activities that have been taking place recently to set an example for cleaning up our own spaces.

March 27 - 267 plastic bottles picked up in 2 days by our turtle teams

March 20 - Happy Shoesday - Update your wardrobe - 660 shoes gathered in 1 hour on 1 mile of beach

March 18 - Furnish your home from the beach

March 11- 2592 plastic bottles picked by the Environmental Warriors of San Francisco

March 4 - Today marked our 23rd country to contribute trash to our beach

Canadian Organization for Tropical Education & Rainforest Conservation

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We welcome any comments or suggestions from our members to ensure you feel involved. If you have an idea for an article, or better yet, would like to write one yourself - if you have a photo or two that you think we could use - if you have a suggestion for improving *Raphia*, please send it along to us at directoratlarge4@coterc.org

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Whether the amount is \$5 or whatever, your donation is greatly appreciated - and Canada Helps issues a tax receipt directly to you.



COTERC would like to thank the following individuals for their generous donations over the years. that will assist in furthering the research we do at Caño Palma.

| | |
|----------------------|------------------------|
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