This Trip Would Have Been So Boring Without Me:

Mike's Costa Rica Adventure

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AUTHORS NOTE:

This is a rough draft. Most of it was put together in the field, late at night, with little to no proofreading. I'm a poor editor, speller, writer, etc. on a good day, and I don't even have time to clean it up now! Also, I took about 4000 photos on this trip, so I was bound to get a few good ones!

2005

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Chapter One

(Beginning - 13 June 2005)

Travel is fatal to prejudice, bigotry, and narrow-mindedness.
-Mark Twain

IN THE BEGINNING...

Long ago and far away I was advised by my advisor to attempt acceptance and participation in the Organization of Tropical Studies Tropical Ecology course for the summer of 2005. Only 20 some odd participants are selected for each class which takes place in Costa Rica from mid June till early August.

ACCEPTANCE

Many papers were filled out, personal statements were written, I begged old professors to write letters of recommendation ("lie if necessary"), all was combined and FedExed (over night, no less) on the day before the due date. Very little of any worth is accomplished before the wee hours of the very end. Time passed and I received an email of congratulations, I had been accepted.

PREPARATION

More paperwork! Schedule a flight, get health insurance, begin another application process to obtain that most precious commodity, a permit to collect insects. Have to get shots, rabies (three scheduled shots) and Hep A and B (two shots). Have to start building my specialized traps. Have to get all the supplies needed for two months of work in a foreign land.

Featurette: Buying a backpack.

I need a good backpack to carry my collecting supplies for field work (two kill jars [different sizes], aspirator, collecting vials of various sizes, alcohol, nets [two to three kinds depending on the location], saw, water bottle, GPS, camera, pillow cases for litter samples, rope, flagging, tape, etc). Somewhere, perhaps in Thailand, I saw a backpack that was made so that it bowed away from your back, resting on your shoulders and hips only. This technology was far superior to all others which rest against your back and act as a turtle shell insulator on hot days. I must have one. Plan of attack: 1) Let us peruse the local establishments. The Backpacker, was, as close as I can tell, Baton Rouge's only outdoors establishment at the time. They did not have, nor had they heard of this style of backpack (these are the professionals, remember; the only store in a city of 270,000). 2) I decided then to visit the mall, perhaps a speciality shop or department store there would carry such a product. No such luck. After wading through a number of department stores, something I am not accustom to, I must report that the vast majority of their products seem to be women's underwear. I often had to cut across the store to find the luggage section and it seemed that as I swam through the sea of merchandise wave after wave of pastel panties crashed into me, pushing me back and forcing me to swim harder against the flow. Table clothes, panties, shirts, panties, refrigerators, panties, shoes, panties, one thousand patterns of tableware, panties, gardening supplies, panties, makeup, panties, lawnmowers, panties, home pneumatic tool kits complete with compressor and power wrench... panties. Online searches were cumbersome, Google "backpack that doesn't touch your back" and see what you get. 3)Finally I adopted the beating you head against a rock technique- sit down and read all the descriptions of all the backpacks in all the catalogs you can find. While

reading Campmor's catalog, I ran across the patented Air Comfort system by Deuter! I was saved.

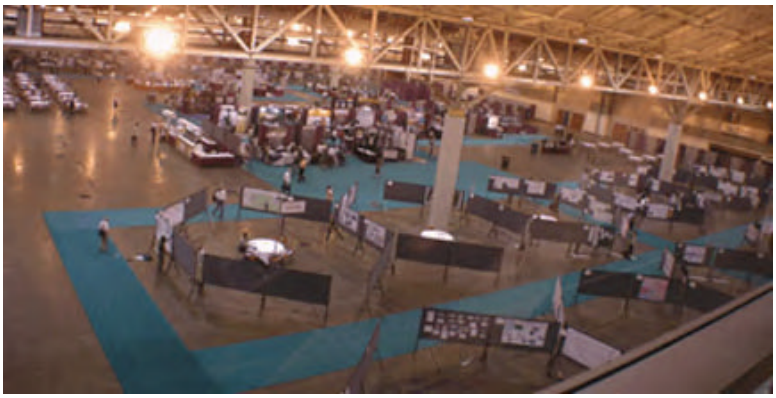
Massey's, an adventure store in New Orleans carries such a product. In fact, this is a well known company around the world (except Baton Rouge, of course).

Everything I wanted was like this. A new battery for a two year old computer that is no longer made, a waterproof case for a two year old camera that is no longer made, new parts for a SOG Powerplier that is no longer made, World Map for my GPS, etc. All were hurdles that took many weeks and tries to surmount.

PRE-TRIPS

It had been many months since we had last met, and would be many months before our next meeting. So a trip to see the family was wanted. Schedules were tight, and it arose that the best time to visit the family began with a message at 9pm Friday night. I left Baton Rouge two hours later (11pm) and made it to the Wal-Mart stoplight in Clinton at 9:50am Saturday. A much needed haircut later, an hour on the road and I found myself outside a locked and abandoned house in Olathe, Kansas. The family was there, but gone. Tired, hungry, and in need of a shower, I used a ladder from the back to climb in a window in the front. None of the neighbors complained. So began my trip to see family and friends. Many adventures were had.

Later I left for Columbia to spend a few days with friends, and to work on dragonflies I collected in Thailand. These particular specimens I had not been able to ID, but had been IDed for me. Leaving Columbia at 1pm with Ely, a college, following behind, we struck out for Baton Rouge.

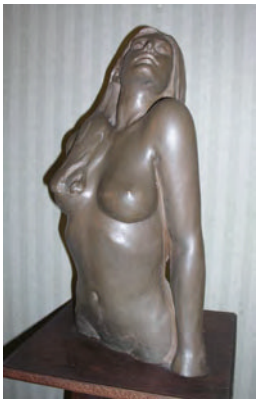


NABS Meeting

We spent the next week in New Orleans at a North American Benthological Society conference where I presented a poster of the work I did for my masters. Many adventures were had.

Our Hotel

Outside our Hotel



Inside our Hotel

Whales

Lunch

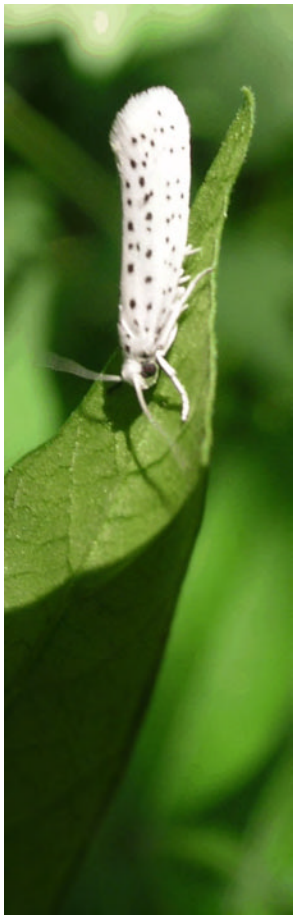
At the Aquarium

My advisor invited me to spend a week in the Great Smokey Mountains Nation Park while he and others collected beetles and gave numerous presentations to volunteers and the curious public about beetles and their role in the environment. Two days after New Orleans, a twelve hour drive from hot and humid to cool and humid. The Smokies are fantastic, combining floral elements that I consider to be distinctly northern and southern into an amalgam that somehow makes sense.

View of the Park from the Lab

I met nice people, including 73 year old Jan, who could almost out hike the Russians, had published two books on the beetles of South Carolina, just finished another, and was fishing for a fourth to start. One night a bear came to the house where we were staying. I got to see the synchronous fireflies at Elkmont: Blackness, a twinkle, a twinkle, then a burst of lights- different heights, depths, speeds, directions- five bursts, then complete darkness. Then it repeats. Magic.

Meeting with volunteers



Adult Caddisfly

Clingmans Dome, the highest point in the Smokies

Unknown flower

Fungus in leaf litter

View from the top. In the '70s an introduced beetle killed all of a particular pine species, their remains still remain.

The Smokies are accurately referred to as the salamander capital of the world.

Matt, Dr. Carlton's newest Ph.D. student, pets a blurry deer.

MAIN EVENT

Three days to go. Still need to prepare the apartment for abandonment. Still need to make and complete traps. Still need to pack. We are allowed 100lbs of checked luggage. I spent a day and a half, culling, preening. 100.5lbs on the day of reckoning.

Stephanie drives me to the airport. I have a meat pocket and a Mt. Dew for lunch, skipped breakfast. At the airport at 12:00. Check in, I had two carry on bags, each full to the brim. Begged, and was allowed to carry both on. Had to show ID and my ticket three times to make it all the way in. But they don't check ID when you get on the plane, so anyone could be on any flight, just switch tickets after the last security check point. Can't have a cigarette lighter with you! But you can take on camera flashes and batteries (you can make a stun gun with the capacitor in the camera flash). Oh well. Crew cut, pressed shirt, shined shoes, explained to a mother and father that they couldn't accompany their (10 year old?) daughter past the last checkpoint. The parents did not hold boarding passes and were not allowed beyond. The mother kindly explained that her daughter was a minor, and perhaps abandonment was not an option. But it was worked out before I was through the detectors. They were allowed to pass.

Somewhere

Short hop to somewhere. People got off, and others got on, then we were airborne again. Another short hop to San Salvador. Met a girl who was traveling with a small dog. Apparently its legal. I just wonder if they send it through the X-ray machine with the rest of the luggage?

View of San Jose from the Hotel

Another short hop to San Jose and I am in Costa Rica. I had informed the other participants of my arrival time, and a kind young lady (Ximena I think is the spelling, pronounced hE-man-a) offered to wait for my arrival so we could share a cab to the hotel. Five feet, 6 inches, dark caramel skin, black curly hair, not skinny, but without insulation. She was wearing an orange shirt with a black X on the front. A native of Peru, she is currently working in Puerto Rico on sea turtles. Has a backpack that she could fit it. A kind, affable person, who, best of all, is a native speaker of Spanish. We make it to the hotel (its 9pm local now) and after much discussion in Spanish jump into a cab and travel a break neck speeds to a very nice restaurant where I sample the local cuisine, and brush up on my horrible Spanish.

Back at the hotel we meet three other OTS students who had arrived after us. The security guard procures a bottle of "fine" whiskey and we head to the roof/balcony to get to know one another. A hotel guest, a spirited herpetologist from Virginia, joins us.

Another view of the City from the Hotel

Many tales are told, until 1:30am rolls around and I explore my room. Very nice, without air conditioner, but the weather is in the 60s so no need. Six minutes of vexation are relieved when I discover that warm water does exist, but not from the tap marked H. Check the bed for spiders, and am asleep.

14 JUNE 2005

Up at an evil hour. The birders have already been on the roof for an hour spotting specks that dart and parry to which they assign names. Toast with plenty of butter and jam, coffee with plenty of sugar. We load into our tour bus and head for the University, where the Costa Rican OTS headquarters reside. Introductions all around. "Hello, my name is..." "Hello, my name is...". I told them I was researching the mating habits of North American tigers, but since none had been found, I have plenty of time for my hobby; working on bugs. The building is new, very stylish, with a little garden in the middle and nice rooms all around. Pablo, a Teaching Assistant (TA) for the course, set up a wonderful display of many of the fruits from the country, complete with Latin names for each species.

OTS Headquarters

Flower pot at OTS headquarters

Many Fruits

The course is wide ranging and multifaceted, therefore much equipment is needed to accommodate all the projects we will attempt. The equipment has been broken into boxes, such as

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office supplies, books (3 of these), electrical equipment, computers, etc. Abbie and I have been assigned to box number 3- Chemicals. We are responsible for the contents of our box. Don't worry, its worse than it looks. Many, many small bottles of various chemicals including, but not limited to, distilled water, glucose, 2% hydrochloric acid, isopropyl alcohol, ethyl alcohol, methyl alcohol, 8 different "fragrances", and a bottle of wintergreen. I smelled it. Its wintergreen. The whole thing weighs a ton. A girl named Kia got the best "box": Miscellaneous equipment = everything that can't fit in a box! She's got stuff scattered everywhere, including a guitar!


Box #3, Chemicals


Flower placed on a fence post

After checking and stowing our boxes, we headed across campus to visit the biology section of the university. Pablo told us about his research in the bio-control of a Central American plant which has become established in Hawaii and threatens to overtake the forests. He is using caterpillars as the control agent and will be shipping some to Hawaii in the next few weeks.


Immature Bug

We were lucky enough to speak with one of the professors who shared with us three recent newspaper articles; the first stated that Eco-tourism brought more money to the country than all the major crops combined, the second that the rise in gas prices was

being offset by tourism, and the third that the national parks were severely underfunded. He told us of poaching of palm hearts from a rare (rarer everyday) species of palm in the parks. Income for people to feed their families. He cautioned that conservation of the forests was not just biology, but sociology as well. It seems we (US Americans) tend to forget about the people around the park.

A pioneer in snake antivenom research.

Quetzles

We were granted access to some of the natural history collections of insects, birds, mammals, reptiles, fish, etc. It is an amazing collection that is very important for present and future studies.

Line of Skulls

"Wet room" where specimens in alcohol are stored.

Preserved Snake

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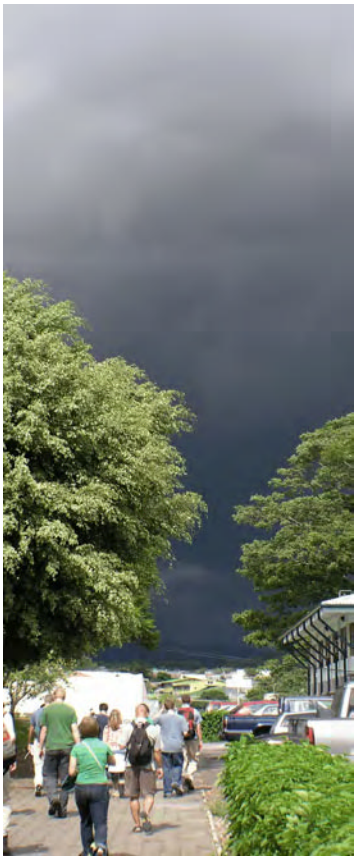
We faced a wall of rain on our hike back to headquarters. Luckily it didn't hit us until our gear was nearly fully loaded onto the bus. I needed boots, to exchange money, and wanted to visit a book store. The bus dropped us in downtown and, with Pablo leading the charge, we headed through the rain and crowds.

City in the Rain


Storm Clouds


Our hotel. Twists, turns, gardens, multiple levels and balconies are hidden by the plain facade.

Back at the hotel, we again loaded up and headed out for supper. A nice place with good food. After our meal a mariachi band appeared to sing happy birthday to another patron. They stayed for four more songs. It was blindingly loud. In the words of the guy setting across from me, "Those trumpets are a bitch". Three very healthy trumpets.

Tomorrow we rise at 7am, breakfast, and board the bus at 7:45. We are headed to Las Cruses Biological Station.

Chapter Two

(Las Cruses Biological Station, 15 - 22 June)

Cultivate the habit of early rising. It is unwise to keep the head long on a level with the feet.
- Henry David Thoreau

There is a light in the stair well. It is on all night long. It's worried about me. Must be, because it peers in through a window high on our ceiling and looks right at me all night long. About 5:30am I decided to antagonize it and turn around, so it could only see my feet. A grave insult to a Buddhist. But perhaps the light is Catholic.

Sculpture at Hotel Cacts

I am up, and I bolt my breakfast to give me time to check email, then pack, then lug things through the maze of the hotel to the bus. The day before we were assigned numbers so that we may count off and determine the presence of absence of any particular member of the group. I'm number 4. I really wanted three. You see, four is the first number about which nothing is really special. Its not the FIRST number, like one. Nor is it prime like 1,2,3,5,7,11, etc. Nor is it odd like 1,3,5,7,9 etc. Nor is it a triangular number like 3,6,10,15, etc. Three is odd, prime, and triangular. Oh well. Four it is.

Two lane highway through the mountains, no shoulder. Idiocy is universal.

Tree obscuring scenic view

The bus is vast. I procure a seat near the back and we launch. A hulking mass only rivaled by 18 wheelers (by weight, not volume)we spin and pirouette through traffic dominated by pedestrians, and passenger cars. Soon we are on our way.

Many people take photos of vast scenic views. But so few photograph trees obscuring these very views. I managed to take three such rare photos. I share one with you. The bus wound its way up and up through the mountains on a thin two lane ribbon, often cut deep through a hill, or perched on the mountain side. On our trip to campus yesterday, we learned that the bird diversity increases on both sides the further one gets away from the highway. Understandable. But the mystery lies in the observation that there are distinct species assemblages (communities) of birds on either side of the highway. What, and why, and how have not been answered.

Vast scenic view

Bang, Bang, swish, thud, thump. The little bathroom is located at the back of the bus. Really, its too big. There is plenty of room to fly all over the small space, which hampers aim. I had to strain to wedge myself with my knees, and shove my head into the ceiling to create some sort of tripod by which I could become one with the sway and buckle of the bus.

We travel up, up, up through ever shrinking forest and stop for refreshments at Restaurante de Georgina (founded in 1947, altitude 3100 meters). They put hummingbird feeders out to attract the tourists. I had some

Happy Hummers

Busy Bee

wonderful hot chocolate, and a not that great cheese tortilla. I got some pictures of happy bees, and a lizard with no tail.

Back on the bus we pass ruins populated by a single species of bromeliad, pineapple. We stopped for lunch and some of the kids do some bird watching. More winding and driving, we pass the Rio Grande de Terra along the way.

Pineapple fields

Bird watching

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Finally we come to Las Cruces. Travel time, just over 6 hours. Distance, just over 110 miles (as the crow flies). The bus, this gargantuan behemoth, backs into the

Rio Grande de Terra

Las Cruces

place, with less than one foot of clearance on either side. Which was great, because it got us about 100 yards closer to our destination. We disembark with

Us and our stuff

our gear. Unfortunately another course was already here, and they were in the dorm style, everyone shares a bathroom, no-great-stuff rooms. So we grudgingly took up residence in the brand new, private bathroom, every-room-with-a-balcony rooms. Right across from the cafeteria.

Chip and our room. Note the Balcony.

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Breakfast at 6:30am, lunch at noon, dinner at 6pm. Its grueling. Not bad food, almost always some sort of rice and beans, apart or together. Usually some sort of salad stuff, maybe a meat dish, fruit juice in the morning, otherwise water, fruit, not bad food.


Masked Tree Frog

I spot a big frog by our room. Costa Rica is the amphibian capital of Central America, and at least 3 or 4 people on the trip are serious Herpers (comes from Herpetologist, to study reptiles and amphibians). So my proclamation draws crowds, and many pictures are taken of the frog before its is released.

Rodo, the naturalist at Las Cruces, told us a little history of the gardens. Originally started when the Wilsons left Florida and purchased this land with the intention of starting a nursery about 50 years ago. The gardens are about 12 hectares (a hectare is 100 meters on each side), secondary forest is about 20 hectares, and 203 hectares of primary (virgin) forest. Surrounding Las Cruces is cleared pasture. It is an island. They recently purchased 31 hectares of pasture and have started experiments to see how the forest regenerates. The entire station is 675 acres in all. Most of the garden is less than 30 years old. There have been 390 species of birds seen at Las Cruces, 25 species of bats, and one Monkey, the white faced monkey (some us wonder if this is some sort of pun used by the natives, perhaps referring to the gringos which are often found here).

Our intrepid leader (lord knows she has to be strong to put up with me) gave us a talk on geology of Costa Rica. There are approximately 10,000 species of plants, 850 birds, 200 mammals, and 360 reptiles and amphibians known from the country. Costa Rica is approximately the size of West Virginia. There are 42 active volcanoes in Costa Rica. Long ago, glaciers carved lakes in the mountains. The isthmus connecting North and South America has occurred twice, once long ago, and recently about 3 million years ago. There are several pesky tectonic plates fighting in this area the result of which is that some of the mountains are of volcanic origin, while others are the result of uplifting. Anyway, climate does not appreciably differ on a north to south scale, but east to west. The Atlantic coast receives rain continually through out the year, while the Pacific side has to dry periods, one long and the other short.

Chestnut-mandibled Toucan

We break for supper and I wander up to the cafeteria to secure a beach head (very important thing to do). While waiting a spy two toucans calling in a tree far away. The picture isn't the best, far away, and in failing light, but the birders tell me they are

Big female walkingstick

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the Chestnut-mandibled Toucan. I also discover a VERY large walking stick, but some damned woman from Hawaii kept saying "we wanted to put together a collection to take back home", so I gave it up. Curses. (Rereading this passage I would like to add: Double curses!.)

I have to give a presentation some time about something. I really should finish that before it must be given.

16 June 2005

Another Moth

Moth

Damn its early. But they will ring the bell soon, and the stampede will begin. If you're not fast you loose out on breakfast.

I roll out of bed and grab the camera. We left the porch light on last night and I want to see what we've attracted. Two photogenic moths. I stumble up for breakfast. On the way back down Luke, the alpha herper, has found a salamander. The salamanders around here are all aboral, they live in trees. I believe they have

Salamander

Small part of the gardens

direct development, meaning they don't lay eggs. I'll get the name of this one later, but the species was only described 5 years ago! The gardens are magnificent. Over 1000 genera.

We split into two groups, mine hikes to the secondary forest. Andres, a Costa Rican scientist, tells us about what we are seeing. We visit the gingers, there is only one native ginger to Costa Rica, but here they have many varieties from all over the world. We pass through the mowed, sculpted garden, headed in a downward direction. Finally we meet a fence with two sticks baring the way. Instantly the garden disappears. Certainly no more grass, just a wide clay/mud trail through a dark forest, choked with undergrowth.

? Ginger

Shampoo Ginger

The ground is covered in leaves and rotting vegetation, vines abound and visibility into the bush is about 7 to 10 feet. The birders are on the ready, sighing small flits and shadows. Headed at a nice pace, on a slick rocky trail, I see newly emerged katydid on a tree trunk. Its not only the birders that see things that don't exist!

Katydid- just emerged

We pass the first creek. Our fearless leaders sit us down and ask, "Where would you find the most speces, at the base, mid-elevation, or peak of a mountain in the tropics?" It's a nice exercise to think about nature. The answer is in the middle. It is there that you find both highland and lowland species intermixed.

Group contemplation

Its ferns, lots of ferns, and figs, and a thousand different things I don't know, but what do we find in the middle of the trail? *Quercus*! An Oak. A beautiful oak in the middle of this alien land. We hike further and make it to the next bridge.

Acorns

We head back to switch with the other group. Now is our time to tour the garden proper. Rodo leads the tour. He tells us about the various types of plants which have been brought to the garden from all over the world. There is the ginger walk, the palm walk, bromeliad walk, etc. The garden gets from X to Y amount of rain and is from Z to A temperature, so any plant that lives in that range could, hypothetically, grow in the garden. Some plants take off, reproduce, and try to escape, like bananas and the shampoo ginger. Others have a harder time and grow poorly, or not at all.


Smallest Pineapple

There are many species of “Pineapple”. Here in the garden they have quite a few. We get to see the smallest and second smallest pineapples in the world. Rodo shows us some of the various reproductive strategies of the plants. The cycads, which are older than the dinosaurs, come as male or female plants, and some ferns have sexually dimorphic foliage, meaning that different leaves have male or female parts.


Female Cycad

We visited a huge fug tree, rife with thousands of apple sized figs. The tree is not native to Costa Rica, while it made it to the garden, the specific species of fig wasp which fertilizes the fruit did not. So try as it might, this tree will never reproduce.


Fern with male and female foliage

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The bromeliads collect water and make little pools that dot the ground and trees where they grow. These little pools attract a whole community of insects, spiders, frogs, etc. These are called phytotelmata, or aquatic container habits made from plants.

Bromeliad "tank"

Lunch comes and goes. Lots of rice, a veggie dish, other stuff. Not too bad. The rice is excellent. I think the put cilantro in it, but now that I think about it, I'm really not sure what cilantro is. Anyway, we start talks in the afternoon. Erin tells us about the Holdridge Life Zone Classification which is based on mean annual bio-temperature (temperate range where plants will grow), annual total precipitation, and potential evapo/transpiration ratio. It all comes together in a nice triangular graph.

Palm flower- see the bees!

Rodo comes and tells us about Melissa's Pasture. This is a triangle of pasture which was let go fallow, and was gifted to Las Cruces. The grass in the pastures here came from Africa. The cows keep it down. Without cows, however, it reaches a height of 7-9 feet. Its so thick you can

not physically push your way through. Very few studies have been done on forest regeneration so the pasture has been broken into quadrants to which different restoration techniques have been implemented. Some are left alone. Others were burned, mowed, or had small patches cleared and native trees planted. The secret is to get something above the grass. Once the grass is below a nice tree and shaded, its beat, but getting above the grass is hard to do. The pasture borders the forest on two sides. Every year they measure the distance in from the border to the nearest piece of grass. Every year it gets further. One can't help but think of the forest as a vast machine slowly spreading devouring and digesting, reclaiming. It's a nice thought. I like to think that its fighting back, slow and steady.

Two years of burning had sufficiently altered the plant community to get those quadrants on the right track for regeneration. After four years some of the trees they planted were over 4 meters (12 feet) high! The entire endeavor is horribly underfunded. No one alive today will live to see how the experiments turn out. The best estimates are that it will take at least 100 years to get primary forest from **moderately** impacted land.


Unknown Flower

Cato, another Costa Rican scientist (with an English accent), tells us of the history of his amazing country. Seven provinces, 4.2 million people, 75% literacy. The area was inhabited 12-8000 years ago with hunter/gathers. By the European invasion Cost Rica was comprised of chiefdoms. In 1821 Costa Rica and Mexico broke with Spain, the Republic of Costa Rica was proclaimed in 1848. Cost Rica was working on Democracy as early as 1889, and after a 40 day long civil war in 1948, abolished the army! The extra

funds were put toward education, public healthcare, and other social welfare systems. The national park system was stared in 1969. You can tell Cato is proud of his country, as he should be. Costa Rica is an island in the middle of militaristic stupidity.

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Chapter Two (b)

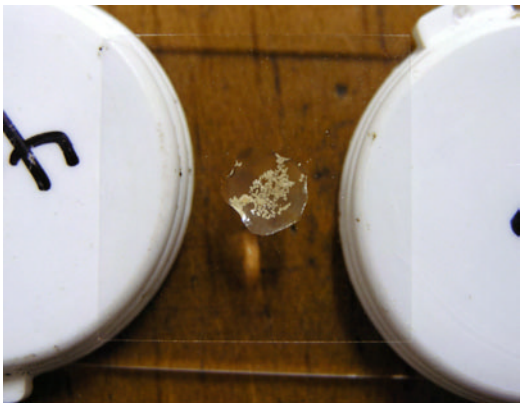
The truth is rarely pure and never simple.
- Oscar Wilde, The Importance of Being Earnest, 1895, Act I

17 June 2005
Workshops and Melissa's Pasture

Up for an early breakfast. Check the balcony before the house wrens get there to clean away the insects that accrued the night before. On the way to breakfast a flower had opened overnight and I got some pictures. Two days later it would wilt. We were to collect pollen this morning after breakfast. Dr. Steve Travers does work on pollination and pollination systems. I scraped some yellow suspect pollen off of a scarab beetle I found. If you can get the pollen to germinate you can sometimes tell what species of plant it came from. So we placed our pollen in a small drop of sugar water (I forget the specific concentration, but it matters) on a cover slip and suspended that upside down over a microscope slide. In about two hours, if all goes well, we will get pollen tubes to grow.


Porch Moth


New Flower


Pollen on cover slip

Hopper

In the meantime we head out to some flowers planted near the cabin. Steve had placed fine mesh bags over some of the inflorescences the night before to prevent bees and hummingbirds from drinking each flower's nectar. We used capillary tubes (exceedingly small glass straws) to draw the nectar from flowers. Then we used a refractometer to measure the sugar content of what we had collected, about 20%. The un-bagged flowers were all empty, birds and bees get up earlier than students!

Flower with florescent die

As an added bonus, we sprinkled a florescent dye on some of the flowers in the hopes that visiting pollinators would pick up the dye and deposit it on other flowers they visit. The dye glows under a blacklight and is a really good tool for many tracking studies. Unfortunately rain tends to wash it away, so our results that night were poor.

We learned about pollinator syndromes. The idea that certain characteristics of a flower indicate what type of organism pollinates it. For a butterfly the flower is usually bright red or yellow, with a moderate to sweet odor, and usually upright. For birds the flower is usually bright red with no odors, and upright. Bats get huge white or pale green colored flowers which open at night, have a strong fermented smell, and often hang downward.

Sorting plants

Back in the lab we checked out pollen. Mine didn't do well, but there was a chance it wasn't pollen at all, so no worries. One person got really good results and we all took a look at the tubes growing out of the pollen. The sizes are somewhat disproportional. Imagine a base ball bat (pollen tube) growing out of a base ball (pollen). People who study cells have a hard time understanding how this happens.

Countryside

After the pollen workshop we started a plant ID workshop. Erin and Cato had collected about 30 species of plants and presented us with a pile of foliage. Our task was to separate them in some meaningful way. The obvious separations were monocot vs dicot, opposite vs alternate, simple vs compound, etc. We did a fairly good job, but the plant diversity here is huge. You could spend an entire course just to learn some of the common families.

Passion vine flower

After lunch Rodo took us to Melissa's pasture to see what it looked like. A hike through the secondary forest (he

showed me a place to set up my traps), another pasture, and across a creek, we found a pasture not at all like what I was imagining. First of all its on about a 30° angle. Secondly the grass in the un-managed areas certainly deserves its name Elephant Grass. Kari is in a slight depression in the trail, but she stands six feet tall. Other areas of the pasture are more civilized. Some trees have grown to almost 30 feet tall in the last 5 years, but they will probably only live another two or three. They are early successional, fast growers, but short lived.


River at Las Cruces (Name Here)


Kari in Elephant Grass

When we get back to the lab Erin tells us about our project schedule for the rest of the trip. At each place we visit we will meet with guest lectures which will help us with Faculty Field Problems (FFP). Four to 5 students in a group, they (with the guidance of a guest lecturer) spend the night before figuring out what they want to do, collect data the next day, have another half day to collect more data, analyze the data, and make a swanky presentation at around 7pm


Five years growth

the second day. Lots of pictures, grueling statistical analysis, and as funny as possible. This is damn near impossible. After the presentation one student is designated as the secretary, who writes a paper about the project, another student, the editor, edits the paper, which is then revised by Erin or Cato. The paper is returned over and over until it is right.

We will only have one group project which will consist of 3-5 students (no faculty helpers) wherein we devise the entire project in much the same manner as the FFP above. This project will be performed here at Las Cruces in 2.5 days.

Each student has to do two independent projects, all by themselves. It again will take place over 2.5 days with a presentation at the end. These can be performed at Cuerici, La Selva, or Palo Verde.

Dr. Chris Peterson gives us a talk about various plots of pasture which border forest fragments that he has fenced to keep cows out. He studies the tree communities that recolonize the areas.

Then we met to plan our Faculty Field Problems (FFP). I'm in a team with Luke, Lucinda, Erin (student), Erin (fearless leader), Cathleen, and Andres (guest lecturer). There was a study not too long ago that looked at Anole (lizard) numbers in a pasture versus in the forest. That researcher got an average of 3 lizards per transect for the forest and found lizards in the pasture. But the research was performed in the dry season, and this is the wet, so we wanted to mimic the study and compare our findings with his. We planned transect lengths (100m into the field and 100m in the forest), sighting strategies, scheduled to be driven to a place near the site, etc. We would get

packed lunches to stay out all day, and leave at 7am.

After the talks its about 8 or 9pm but I have to set up my traps as soon as possible. One of my personal projects is using traps to collect insects in the forest. I want to compare the standard design with my own design. The problem is, these things need to be out for a while, many days to really be effective. The schedule is pretty thick, which means if I want to set them up I need to do it at night (after 9pm) or morning (before 6:30am). And the forest is thick, I'll need to chop out a place to put the traps, and a path to get to them. The forest at night is not a place to be alone, so I borrow Pablo's machete, and get Luke to come me, he's after herps. We head down the trail and finally find my study site. The vines, small trees, etc. are surprisingly easy to cut, like thick celery, but some have thorns, spines, prickles, etc. So I hack out a trail in the light rain, with only my headlamp in the very dark night. I tried to make a big loop that went out away from the trail and then fell back to the trail, but where I came out was at a place where the trail was about 8 feet below the forest, so with the help of Luke (who stayed on the trail), I was able to find my way back through the jungle and get back to the trail. I was covered in mud, and we trudged back to the cabins. Home by midnight.

Many persons have a wrong idea of what constitutes true happiness. It is not attained through self-gratification but through fidelity to a worthy purpose.

- Helen Keller

18 June 2005

Many Attempts

I set the alarm on my GPS for 4:30 am. These things are amazing, they do damn near everything! Its pitch black outside and I hurt. I waited, but was up and out of the door

Lucinda at 40 meters

by 5. Wearing the same pants as last night, they're heavy with mud and moisture. The birders waved as I hefted my pack (40 lbs) full of traps onto one shoulder and started heading to my site. The dull throbbing pain of sleep deprivation mitigated the dull throbbing pain of carrying the heavy bag. Its almost all down hill too, and that helped. Its about a half mile to the site, and I got three traps put up before I had to head back for breakfast. Then load up and get ready to leave for the FFP.

We were driven at break neck speeds along dirt roads that only go straight up, or straight down. Packed in the back of the vehicle trying not to accidently slam your head into the roof, or your neighbor. Finally we're dumped at a gate to a pasture. We hike through the field to our study site. The forest basically begins at the top of a crest and plunges down a very steep hillside. We stake out a 100 meter (little more than 330 feet) line into the pasture. In the picture Lucinda is down the hill and only 40 meters away. After the line was set, we walked about 20 feet to the left of the tape measure from the far end toward the forest and tried to scare up any lizards we could. Nothing. Well, a few grasshoppers.

Nurse log in the pasture

Now its time to go into the jungle. That it is too. Probably selectively cut long ago, the loss of heavy canopy cover has allowed a very thick undergrowth to grow. No machete this time. So it comes in handy that I'm large, portly, and thick skinned. Lucinda does an amazing job of not dying, too. We drop off at about a 40° angle and start measuring while we look for lizards. We have to go 100 meters, but our tape is only 40. And its hard to pull off the roll, so one end has to be tied. Thus some poor bastard has to go 40 meters, climb back up to untie it, then climb back down, then go another 40 meters, then climb back up to untie it, then climb back down, then go another 20 meters, then climb all the way back up. I'm dirty, tired, muddy, bleeding, and hot. We saw one lizard. Well, just the hind legs and tail, actually. We emerge into the sunlight and wait for the others to congregate. Ours was the only Anole seen. In fact only 5 reptiles/amphibians were seen by the whole group.


Measuring tape in the jungle

Average of 3 lizards per transect, my ass. What to do? Eat lunch. We had ours packed by the cook

Local megafauna

staff that morning. We passed a very nice pond bordered by forest on two sides on the hike in, perhaps a nice project looking at frogs could be performed there. We pack up and hike back towards whence we came, but veer to the right to see the other side of the pond. We through out ideas to look at frog species at night, and how they orient themselves around the pond, right at the water, within 5 meters, within 10, on the ground, in a tree up 1 meter, etc.

"Path of Death"

Suspended in a hollow log, a spider has constructed a shelter.

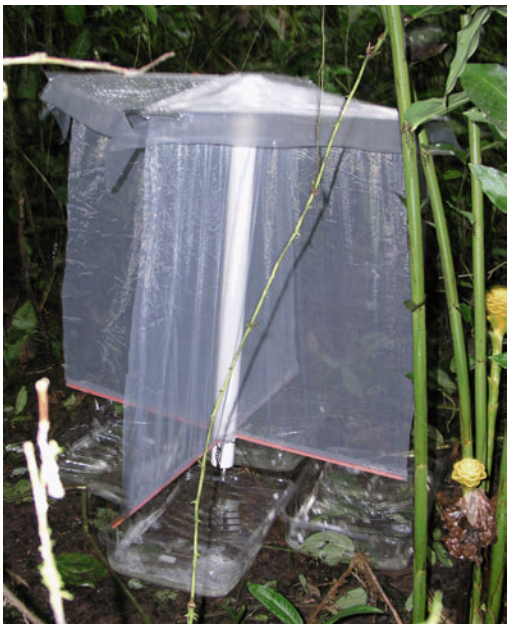
Pictured is the view we had. To get to our drop off point, we need to go from here to the pasture on the other side. Looks pretty close doesn't it. Does to me. There was a nice trail that led though the forest on the right hand side. Rather than back track, lets go along the trail and scope out our study site for later tonight. So we plunge it. An hour later the trial is gone, I'm clearing some of the path with brute force, Andres is tying an orange marker ribbon on a vine or small tree every 25 feet (breadcrumbs to help us

find our way home), and we're sending people in different directions to explore possible routes out. Little did we know, and little can you tell, but the pond has a huge dogleg to the right making our short easy walk a rather long hard one.

Walking back

Finally we break free and head to the pick up point. Just one problem. We can't raise the driver on the radio. So we start to walk home, and the clouds move in. Finally we are rescued! Another group had to walk all the way in! We make it back to Las Cruces around 2pm. I head straight to the forest to continue putting up traps. I take alone trays to put under the traps and a plastic water container. Along the way a Kowattie (sp?) pops out on the trail. We both instantly stopped and looked at one another. I got a picture and then he turned and went back in to the woods. I succeed in putting up 6 traps, three traditional, and three of my own design. I filled the water container (with no little effort) at a nearby stream and filled the trays with

Kowattie



My design


Hummingbird on nest

soapy water. The soap breaks the surface tension of the water so any insects that fall in immediately sink.

Its all uphill back to the station. I'm caked with mud, trudging slowly. I make it back by about 5:30. My group has decided on another project (this is the third one if you've been counting). This will entail looking at frog distribution around three small (bath tub sized) ponds in the garden. I shower, eat, there is a talk, then we set out to catch frogs, catalog where they were when we caught them around these ponds. I didn't find any by myself, but left the good areas to the people who know these things better than I. I did find a scorpion and a humming bird on its nest. Not bad for half awake.


Scorpion on tree trunk

19 June 2005

Finishing Up

Painfully early. We go back and measure how far from the water our frogs were, how high up they were, and the distance to their nearest neighbor. Then using a random number table to make random frogs we measure where they would be located, and distance to nearest neighbor. By doing this, we can test to see if the real frogs were

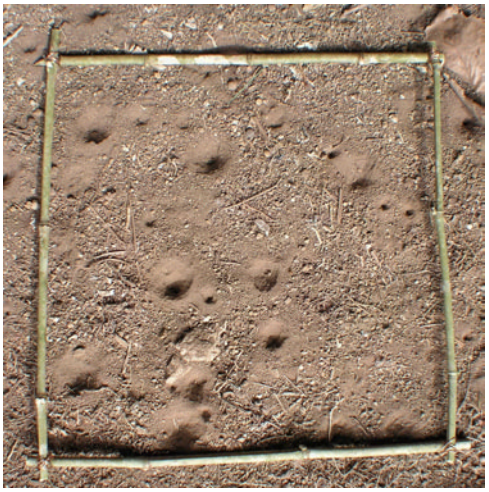
Team Frog: Back: me, Lucinda, Luke, Cathleen. Front: Erin (student), Erin (Fearless leader), Andres

randomly scattered around the water resource, or perhaps clumped together, or evenly spaced. Lots of measuring, lots of statistics. Finally we get our data together, put together a presentation, and all of the groups present on the research they did. Other studies included plant chemical defenses, regrowth forest composition, and pollen accumulation on hummingbirds. Ours was painfully low in sample size, but we found that the frogs were clumped around the water sources. (With this baseline you can now ask other questions like, do they have a territory, how do they defend it, what defines a good territory, how does ths affect ability to mate, etc.)

Tomorrow we start our group projects. Any ideas? Hell, yeah. I'm tired, worn out, and there happens to be a pile of antlion larvae under the balcony of my room. Sounds like a spectacular project. These are the guys that make pits in the sand and capture insects to eat. How are the pits spaced? Does pit size correlate to animal size? Etc. Sounds like a great idea. Luke (alpha herper), Nate (Statistics king), and Andrew (studies lemurs and can climb like one too) sign on. Tomorrow we wrangle some antlions.

20 June 2005

Starting Again



Antlion study site 1

Aerial Photo

I love technology. We want to measure the diameter of each pit, the distance it is from all other pits, and the size of the antlion in the pit. With this data we can do many wonderful things. So the first thing we did was backpack in drinks, chairs, and a radio to the study site (all of 50 feet around the building to the back). Then Luke made a ½ by ½ meter square out of bamboo. He took an aerial photo of the quadrant and assigned a number to every pit in the computer. He also assigned an X and Y coordinate to each pit center. I measured pit diameter with calipers, and then dug out each antlion (we only lost 4 out of about 200). Later we weighed each antlion. We did this for 5 quadrants. Now the computer knows the weight of antlion, size of pit, and relation of pit to every other pit in each quadrant. We got two quadrants done before supper and the talk. It took a while to get set up for the first one, but after that the second was done in a half hour.

Grueling conditions at the study site

Our talk tonight was a depressing one about massive frog and salamander die offs and extinctions which have swept down through Central America in the last few years. No one knows why.

(Sorry this just-a-few-lines-on-the-last-page-thing keeps happening, its is really annoying.)

Chapter Two (c)

21 June 2005

Up early for breakfast to finish the project. You can't skip breakfast. It might only be toast and some fruit, but once it was eggs (those fake dehydrated eggs that taste like heaven), and you can't take a chance on missing those.

Test subjects: Medium sized antlion larvae

We photographed, mapped, measured and wrangled our last three quadrants. Some of us started weighting each antlion, others kept collecting and sifting to get extra dirt. The second part of our experiment was manipulative. We set up 12 tubs each with one inch of sifted soil in the bottom (this took forever to get) and then varied the number (and therefore the density) of antlions in each tub. The density we found in nature was about 5 per tub area, so we set up treatments with 2, 5, 10, and 20 antlions in each (that's half through 4 times the normal density). All antlions were approximately the same size. Now we can see how they behave in situations of low to very high density.

Manipulative experiment

Bat

After that there was lots of analysis and preparation of the presentation to be presented tomorrow evening. This evening we had many talks from the students about research they had done in the past, or would be doing in the future. I got a picture of a wayward bat as I entered the laboratory.

22 June 2005

"Easy" day. We revisited our experimental plots, mapped, and measured each one, put all that in the computer, ran lots of statistics and finished up the presentation. This took the better part of the day. What did we find? First of all, we got three instars (growth stages) of very small, Medium, and Large. Also pit size was positively correlated with larva size, bigger bug, bigger pit. The real cool part was some mathematical wizardry that Nate did. People who have measured mammal predator home ranges have found that there is a relationship between animal size (say weight) and home rage size (say acres), and when graphed a certain way the slopes of the line for lots of different species are closely packed around (1) one. Someone, without experimental data, hypothesized, that sedentary predators (those that don't move around such as antlion larvae) should have a slope of (.75) three quarters. When Nate ran our numbers he got a slope of .80! So what we found was that real life damn near matched the predictions made by the hypothesis put forth in the other paper. This was very exciting, especially for Nate.

Base of a huge strangler fig on the way to the river

We all presented our findings, then had some more student talks. There was a party scheduled at Rodo's house, but I still had traps in the forest, and needed to collect specimens from the last two days of trapping. Have I mentioned that the traps together weigh 40+ lbs. Plus there are the trays underneath, which don't weigh much but are bulky and ill designed for transport. Nate and Luke headed down the trial with me, they were after lizards in the river at the border of the primary forest, so they went and I stayed to clean up my traps. An hour of two later I had everything packed up and in the trail. I hiked quite a ways to the river and took some photos, whooped a little to see if they were near, but the roar of the river pretty much drowned out everything. I walked back to my traps and started hauling, dragging, then along. I'd been going for about 45 minutes, ready to die, just past the gate and back into the mowed garden when Luke and Nate showed back up. So they helped me haul everything back up the hill. On the way we ran across

View across the river (its bigger than it looks). The white flowers are about 2.5 feet long, and bat pollinated.

Army Ants (note major solder with white head on left hand side).

some army ants. A column of ants about 6 inches wide, as far as our light could reach to the left and right of the trial. Most were kind of like regular ants, but about 10% were major solders. These have huge mandibles attached to white heads that were almost as much volume as the rest of the body, lots of muscle tissue in there. We watched spiders and other insects flee, and hide- the ants checked everywhere for anything that moved. It was pretty cool. I got some blurry photos. What would have though that night macro photography of fast moving subjects could be so hard!

Dead tired, shower, pack, clean stuff, pack the bugs special, so I can get up at 6 and be on the bus by 7.

Chapter Three

(Cuerici and the Mountain of Death: 23-30 June 2005)

We are all here for a spell; get all the good laughs you can.
- Will Rogers

23 June 2005

Erin (student) getting a quick nap.

Exhausted, we pack the bus and head to our next destination. The ride is much too short, only a few hours, and little sleep is to be had. We reach our destination, which is not exactly our destination, but just slightly to the left on a small scale map. The road into Cuerici (cut the WH off of WHERE and put a Q in its place, then add IS SEA) is too small for the travel bus, so we will load our equipment onto trucks and pack ourselves in about 7 kilometers (2.3 miles as the crow flies, but there are a lot of twists and turns). "Its all down hill," is a complete lie that was repeated over and over again by liars. Its cool, bordering on cold, we're at elevation, the GPS reads 9,100 feet. Remember that Denver is only 5,280 feet. The station is at 8,500 feet, a substantial drop over just a few miles, but there are humps of hill climbing, too. The air is rather thin. I'm almost last in line because I'm waiting to give my

Pablo and Phillip ride down with some of the stuff.

Passalidae, Bess Bug/Bessy Beetle

bugs to Pablo to take down in the truck. Finally I start down the mountain. At first there are people around, or at least visible in front of me, but I'm not too keen on walking really fast, especially when there is new territory to be seen, and I'm kicking logs over, etc. There is heavy cloud cover over head, a thin wispy grey, that actually are real clouds if you're above of below them, but fog if you're in them. I trod along slowly, but surely and get pictures of some of the flowers and some massive Psasslide beetles (Bess Bugs) that are wondering in the road.

Flower

Two roads diverge in the fog, I took the left.

The clouds started rolling in thicker and it was starting to sprinkle. It must have been an hour walk, most with no sign of other human beings on an ever worsening road. Finally, I found the buildings. We are the only group staying here, and they waited lunch about an hour for us. So plenty of

Estacion Biologica Cuerici

Home, sweet home. Sleeping above, dining below.

hot food (wow did they pile it on, too) at the end of my hike.

This area is basically located in a cloud rain forest. I don't think the temperature ever went above 75°F, most nights it was the 50s (maybe 40s). It was sunny almost everyday in the morning until just after lunch, then the clouds moved in and it rained steadily into the night.

There is electricity, more on that in a minute, no phones (actually one in the owners residence for emergencies), no TV, and certainly no internet. The kitchen is amazing, but no refrigeration, and no oven. Also, you want to be warm? There is a cast iron furnace beside the dining room, which is located under the sleeping areas upstairs, and another large fireplace in the laboratory, located behind the main house via a fly way. Fires are only built in the evenings. Most of the flooring is made of rough cut wooden planks between 6 and 20 inches across, all a full two inches thick. Communal bathroom, with three showers, three stalls, and three sinks. They used gas water heaters, which rarely worked, unless you knew the "special rules".

Mountain Raspberries

After lunch we were given a tour of the facilities. This is not a research station owned by Organization of Tropical Studies, the government, or any agencies. This farm belongs to Don Carlos and his family and is 200 hectares, with 150 hectares of primary forest (2.2 acres in a hectare, I think). Many of the fields and pastures have been converted to raspberry patches with stalks an inch thick at the base, ready to rip and tear you to shreds. Many families in the area have joined together and produce and sell the berries as a unit. Apparently very good money may be had if they can sell to the US or Canada. They have a cow and a calf which I assume they get milk from. Don Carlos is looking into cultivating worms in compost to supplement the diet of the trout he raises. We marched way down the hill (and I lost my pencil) and came to a small little shack by the stream. Ten years ago, he installed a hydroelectric generator at a cost of about $10,000. A four inch pipe collects water at

Don Carols

Generator hut and suspected path of pencil loss.

Generator

the top of the hill, runs it through a series of trout ponds, and then down the hill, the water is necked down to about a one inch pipe and fed through the generator at 80psi. This creates about 12 kilowatts, 1280 volts off of a small stream. He's careful not to pull all the water out of the stream because that will affect the plants on its edges, which would result in erosion.

Largest trout pond. Luke's pointing out a trout.

Back up the hill we visit the trout ponds, a series of deep cut elongate pools which are connected by ribbons of pipe. The more oxygenated water at the top flows into tanks where the fry are raised, and in the ponds at the bottom are the biggest fish. There is a side channel to the big pond where water is diverted in the rainy season. This stimulates the fish to swim upstream and mate, but they are captured, and fertilization is artificial, a delicate process, then the fry are transported back up to the tanks at the top of the hill. The only other group raising trout in Costa Rica is the government and they are awfully quite about how they operate. So Don Carlos had to learn through trial and error and hard work. However, unlike the government, he is proud that he does not

Trout


Rearing tanks

need to use any chemicals, fungicides mostly, in his production.

After our tour we had supper, again heaping amounts of rice, beans, and whatever the meatish dish of the day is. The best part of supper is the hot chocolate, made with whole milk, which comes to us via a giant kettle hot off the stove. Some of the students gave talks and Cathleen (a resource faculty person) talked to us about her research into plant diversity. Interesting little fact, ½ square kilometer of good amazon rainforest can have more species of tree than all the tree species in temperate forests in the world.

It gets colder than hell at night, and is sometimes raining, but the bugs still come to the lights!


Unknown moth

Chapter 3 (b)

24 June 2005

All I had room for was a very light sleeping bag. Fleece. They warned us it would get cold here, bring a heavy sleeping bag, a woollen cap, etc. I packed none of these. Everyone had three blankets on their bed, somehow I didn't get any. It was probably because my giant suitcase was up there (I was on top bunk). So I stole one of Pablo's blankets when he wasn't around. It helped, but I woke up at 5am a little cold. Breakfast! Piled high and deep, no skimping here. There is no hot water out of the faucets, in fact the water is quite cold, so I opted to wear a cap rather than comb my hair (for the entire stay!)

Stairs in a tree trunk on the trail

Spiral plant

Today is a day of hikes. My group will hike with Don Carlos up, Up, UP, to the primary forest and back down. The trail works its way up one side of a valley to an observation platform, and back down the valley's other side. We start in forest with lots of bamboo, this is secondary forest, logged in the last 40 some odd years. In our group today is another Carlos, a young Costa Rican student

Fern

Lots of mosses and other epiphytes

Shelf fungus on a log

Millipede

Not an orchid

who is an expert on Fungus. In fact, he worked with a guy I knew at CMSU. The forest is dominated mostly by oak, there are two species, *Quercus costaricensis*, and *Quercus copeyesis*.

THE TOP!

Quetzles, a spectacular green and red bird with tail feathers as long as the rest of its body, are known in the forest so we tread cautiously, hoping to see one. Well, the birders were really

View from the top, panorama

The Pacific Ocean is just behind the clouds at the top of the picture

Group in the Primary Forest

hoping to see one, and they did, and it was a male, but it didn't have any tail feathers! We traveled up, up, forever and a day, stopping on and off to look at a plant, seed, mushroom, or bird until we finally made it to the top, to a very nice overlook. On a clear day you can see all the way to the Pacific, over 20 miles.

Barbara pretending to be an oak tree

A big oak with bromeliades

We started heading down again, and all of a sudden, the path leveled out, the underbrush cleared and we were in a forest of HUGE oak trees.

Fungus

Fungus full of snot

Horse

Another Fungus

These get pretty darn big, 14-17 feet around, and are quite impressive. Huge bright red bromeliads dot their branches. This is a beautiful place. 65°F.

We keep walking, in a general downward direction down, down, down, until finally we found a small farm, with some cows, a garden, and a "horse". A short comparatively flat hike and we were back at the house for lunch.

Bromeliad on a tree trunk in the forest

Our next adventure started immediately after lunch. We piled into the vehicle and drove at breakneck speeds over very bumpy roads back up to the highway, a little ways more and then pulled off. We were to conquer the Cerro de la Muerte and meet Jayne and Andy.

Mountain of death, we're headed to the top and further.

(Pretty stark isn't it? Above the tree line, the top is a little over 11,000 feet- the tallest mountain in Colorado is just over 14,000 feet).

Indigenous peoples and our group

Jayne and Andy are indigenous, their parents came from America, but they were born and raised in the mountains not far from here. Apparently Mom and Dad come down for a short vacation 25 years ago and never left. Both Jayne and Andy are amateur naturalists of the highest caliper. They know their plants amazingly well, and have learned a large amount of information about many of the other things and happenings on the mountain.

Part of the downhill portion of the walk

Being a bit long in the waist, and after just hiking straight up and straight down all morning, I was delighted to hear that this walk would be all down hill. Apparently fit people are always traveling downhill, even if the slope of the particular ground they are walking on happens to disagree.

There are quite a lot of plants up here in the cold (down to -6°C), and all are adapted for it. We saw a little plant in the rose family with very hairy leaves, the hair acts to keep the frost off, similar to throwing a blanket over your plants in the spring/fall.

Furry rose

The area was burnt 13 years ago but has recovered nicely. There are

Pretty flower

Blueberry

clumps of stunted bamboo that dot the mountain side. The ground is covered with lichen covered rocks, and tufts of grass like sedge.

The tuft of tall plants to the left of Emma (in red) is bamboo.

Mesaspis monticola

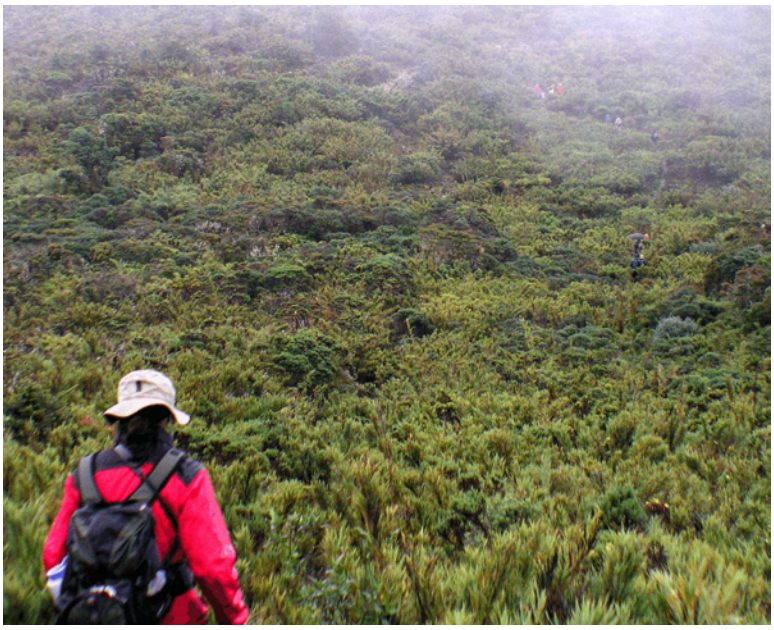
It started drizzling on us, its in the high 40s low 50s up here, and all I have is my light red jacket, and a spirited umbrella (with a Van Gogh print). Believe it or not, lizards live up here, albeit slow lizards. Pictured is *Mesaspis monticola* the dominate species (one of two) on the cerro. In a few days there will be an FFP on the lizards of the cerro, they will look at mite load and tail loss between males and females (which have different color patterns). They will find that mite load differs depending on the side of the mountain on which the lizard was collected. A finding that females have a greater incidence of tail loss will prompt Luke and Co. to stay up all night long fashioning nearly identical clay replicas of male and female lizards. These will then be placed on the cerro in the hopes that they will be attacked and that the marks left in the soft clay will tell of the attackers. Little do Luke and Co. know that all their

Ground dwelling bromeliad

Our extraction point is on the road in the distance.

future efforts are in vain, as no replicates will be attacked. A gallant effort non-the-less.

We hiked to a peak and then followed the backbone of the mountain as is undulated up and down. We came to a little artificial pond and I used my pocket net to seine around the edges. I came up with Aeschnidae dragonfly larvae, and some case bearing caddisflies (maybe Hydropsychidae or Phryganeidae). Pretty crazy to find stuff up this high.



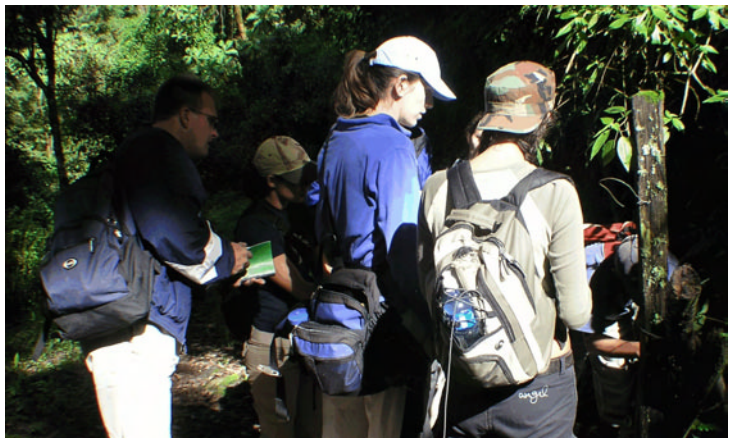
Kathleen is in red, do you see the rest of the group?

This is a beautiful place, very peaceful. After much hiking we made it to the road, but no car yet, so we wandered around. Kathleen broke off some of the red flowers below and turned it upside down. The oddest thing happened, some were full of little black flies, that boiled in the base of the flower and would not fly out, only when you turned the flower upside down (and they could fly down) did the flies get away. Very strange, nearly all insects, if given the option, will fly up.

Chapter 3 (c)

25 June 2005

Faculty Field Problems today. I'm with Carlos, the fungi expert. Today we are working with Myxomycetes. These are very strange organisms. During part of their life cycle they exist in an ameboid stage, a one celled organism that eats, breathes, and reproduces by division. Later, for entirely unknown reasons, these single cells come together to make a fruiting body, that sometimes looks like a very small mushroom, where sexual reproduction occurs and spores, which will later become a single celled ameboic stage, are produced and released. We wanted to see if there was some sort of pattern to where we found these fruiting bodies (such as height above the ground, relatively humidity, etc.). So wise Carlos decided that we should wander up the trail (not too far) and collect along the way.



The group attacking a myxomycete.

Cuerici blue snail.

Myxomycete fruiting body

Group looking for more specimens

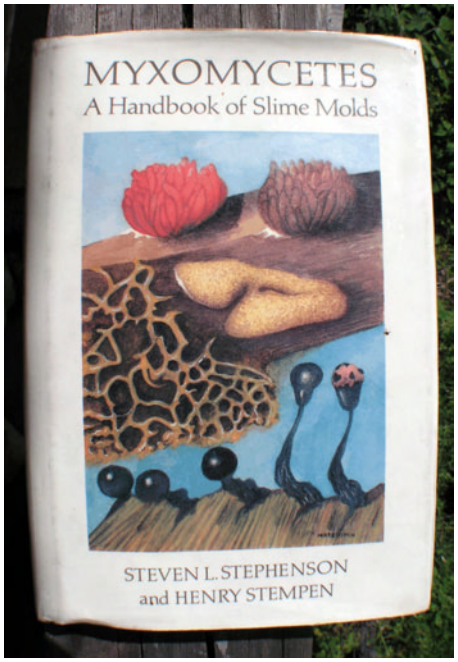
We were able to collect about 20 specimens before lunch and then the fun began. The course has two microscopes, one good, and the other gives the right eye an image about 5% bigger that the left. Just enough to make you nauseated. One of the things we wanted to know was the stalk length compared to head capsule of the fruiting body. These things are tiny, on the order of parts of a millimeter. Its not that hard to measure small things if you have a measuring device called a micrometer installed in the microscope. We don't. So I got to use the bad microscope and a caliper to measure these teenie tiny myxomycetes. Delicate work is an understatement. So many, many hours later, and Jeff was so nice to record the numbers I yelled out, we finally finished measuring (we averaged 5 stalks/heads for each species).

Through the scope

Moth at the window, Rebecca inside

26 June 2005

Still at it, I had more measurements to make and some of the group went out for more specimens, 35 in all. With our data set in hand we set down and Kari and Carlos started doing statistics to see if there was any correlation among



THE Book

any of the things we measured. I believe my quote when we gave the talk was, "If statistics were poo, this would be the most fertile valley in the land." We found basically nothing. None of the stuff we measured explained why we were finding these things, on a log 1.5 feet from the ground as opposed to 3 feet up, or at a relative humidity of 85% instead of 90%. Nor did we find that stalk length or head diameter correlated with each other, or with pH, height above ground, etc. What we did get, however, were 15 species, of which only one was known to have occurred in the area,


Jeff, using his birding skills to get the inside scoop on the stats.


Paradiacheopsis longipes - New record for CR and one of the species had never been reported from the country before!


Luke and Co. making models

Chapter 3 (d)

27 June 2005


Tall Oak

Another day, another project. This is an independent project (IP). Remember I did part of one at Las Cruces, while everyone else was sleeping, which I will finish up at La Selva, but I have to do another one in-between. I threw out the idea of looking at differences between invertebrates, including insects, in leaf litter and very rotted logs. Phil, an entomologist who works mostly on ants, thought that sounded like a good project, so we became partners.


Oak Forest, Pacific side

The best part of the whole deal was the study area: the primary oak forest on the top of the mountain. What we walked through on the first hike, and what we'll be headed to today is on the Pacific slope, so it receives on average less rainfall than the forest on the other side of the mountain, the Atlantic Slope.

Leaf Litter

Well rotted log

We took my machete as an all purpose digging tool, Phil found it quite entertaining for brush cutting, and we hiked up, Up, UP through the secondary forest and then started in the primary forest. We took 5- 1 quart samples of both leaf litter and of rotten logs which had decayed to nearly dirt like quality. The leaf litter had the consistency of sponge cake. It was riddled with fungus and fine roots throughout, and showed a wonderful gradient from whole newly fallen leaves on top, down to fine dirt just a few inches down. I'm sure people have looked at this, but it would be fun to see how long that process takes, probably not more than a year or two.

Another Big Oak

Younger oak with many red bromeliades

We collected our samples along the trail and almost at the top we ran into Ximena and Rebecca, who had joined up to do their IP on the oak Mycroryzae, which are fungi that tap into the roots of trees and provide nutrients to the tree in exchange for sugars. Carlos (the world expert on Costa Rican fungi) and his friend Maria Julia were also along to help.

Ximena eating her research :)

Do you see Phil at the bottom?

Another view looking toward the Pacific

Having come that far we decided to pop over the top and walk down the other side. But not before getting some pictures of the view, and later a stick throwing contest off the overlook.

Got back just in time for lunch! Then we started picking through samples for anything moving that was large enough to see. Just before the clouds rolled in some black vultures alighted

on the fence. Later they were obscured by the fog, which resulted in the course hit song "Vultures in the Fog", sung to the tune of "Strangers in the Night".


Vulture- not yet in the fog.

Cato gave us a talk on the National Park system in Costa Rica. The gist of the story is that right now 28% of the land in Costa Rica is legally protected. The reality is that poaching of plants and animals still occurs, there are lots of poorly protected parks. Another thing to keep in mind is that not all of this area is pristine and beautiful, in fact some of it is cattle pasture. Additionally, Costa Rica has a great diversity of life zones due to altitudinal and rainfall differences, and some of these life zones, like the dry forest, have been reduced to nearly nothing.

Lizard Races

Money is also a problem, the parks don't have enough. In some cases when parks were created, land was basically stolen from the owners who have not, even yet, been paid for it. Additionally parks are managed on a local scale, which is great, but all money matters go through an office in San Jose. So all the money a park makes, gets shipped to the central office, where it is pooled with other parks money, then redistributed. Money is like energy, every time it gets changed from one form to another a little is lost.

To catch up with Luke and Co. the fake lizards are safe in the open on the mountain, and he has procured a few live male and female lizards for an experiment.

Remember all females had lost their tails, while many males had not. Do, perhaps, male lizards of this species run faster than females? Only one way to find out, race them. So a stadium was made, complete with spotlight, lizards were warmed by the fire and raced. Turns out, neither sex is really interested in running at all!

28 June 2005

Now we are headed to the Atlantic side of the mountain, we consisting of Phil and I, plus the dream team Ximena, Rebecca, Carlos, and Maria Julia. Don Carlos gave us a ride to the gate of a protected area and we walked in from there. It was mostly down hill, and cool. So a pleasant walk. It certainly is wetter on this side, there was a thicker under story, lots more moss, and the ground was more like a very thick pudding, rather than sponge cake.


Atlantic side of the mountain


(Not yet a) Mighty Oak

We were able to get our samples fairly quickly, no one lost a finger. I found a acorn sprouting on a fallen oak tree. Perhaps in 300 or 500 years from now, another oak will begin its life on the remains of what was once this little guy. The odds are very much against it. In fact, if you have a population of oak trees that is not increasing, that is, the number growing to adulthood equals the number dying, then obviously the average number of offspring of

an oak tree which grow to adulthood is one. So of the thousands of acorns each tree makes year after year, if the population is not growing, only one will survive (on average).


The measured Oak

Anyway, one more bit of fun before we hike back to the station. I found a nice sized oak tree and hugged it. My arm span from finger tip to finger tip is 6 feet, and I got three full hugs around the tree, that's 18 feet circumference. But it had slight butresses, so lets reduce that to just 14 feet. I talked with Nate before and he found an equation that relates trunk diameter to amount of above ground dry mass, that is, how much from the base of the trunk up plus the major limbs would weigh if all the water was removed. The equation is Mass = 0.124 x $D^{2.53}$, where D is the diameter in centimeters. After all the conversions and math we find that the above ground portion of the tree, if it were all dried out, would weigh approximately 68,000 lbs, or 34 tons!


Base of the measured Oak


Little White Flower

Phil and I wandered back to the station. I found some recently cut logs and got some nifty bugs from under the bark. At 4pm we got a very good talk on Fungi by Carols. This is defiantly a group I will have to get to know better for my work.

Clouds rolling into the mountains

Two flat bugs (Aradidae) and a weevile

Chapter 3 (e)

29 June 2005


Pseudoscorpion

Today is a day of finishing up. All the samples had to be picked through, the bugs collected, and later IDed. Lots of work with the gimpy scope. In all we only collected 303 specimens, far fewer than we expected. And we found really no difference between the stuff we got out of leaf litter and the stuff we got from rotting logs. We found a greater difference between Atlantic and Pacific sites.

Everyone was rushing to finish with their projects and statistics and put together presentations. Towards evening Luke took me to a log where he had found lots of walking sticks. The locals call these *mula del diablo* which means literally "mule of the devil". I'm pretty sure they are in the family Pseudophasmatidae, we have a similar species in Missouri, and two species in Louisiana. The reason they got such a dim name is because they extrude a milky white substance from the back of their head when you molest them. Its highly acidic, tastes like hurting, and will burn the hair out of your nose if you take a big whiff. Some people have been blinded when sprayed in the eyes.


Mula del Diablo

30 June 2005

Morning Moth

Up so early it hurts. Andrew didn't get up but was discovered during a final room check by Jefe Erin, otherwise we would have just left him. I scampered about and took some final pictures of the place. If you visit you take lots of pictures, but if you live there you somehow neglect to do so. Some people elected to be driven back up to the bus (remember it was miles of downish walking to get here, so just as many miles of uppish walking to get out). I was first on the list. I do not doubt I could have made it to the top, I'm just not sure which day I would have achieved that feat. I would like to point out that only two times during this trip was Nate's facade of total ease and comfort broken, and the climbing of this hill was one of them.

Classroom/laboratory

View from the lab to the fish ponds

Dining Room

The kitchen, no refrigeration and no oven!

Last night Don Carlos, one of the owners of this station, gave us a talk. He only speaks Spanish, so Cato translated. About 40 years ago what most people around here made a living producing charcoal and railroad ties. Many problems arose from this when the government tried to reduce logging and make parks. When forming parks the gov would pay more for "improved land" so lots of people went out and cut down the forest to get more money. Finally people started growing blackberries (mora) and were no longer extracting a living from the forest. Then they took a great deal of interest in protecting what little forest was left. Don Carlos and some friends joined to make Cuerici to protect the forest and work toward sustainable living.

Main house where we lived, just inside the door is the dining room, sleeping upstairs.

View from the bus stop.

One more bit of interesting info, the loop trail up the mountain and back down took 4 people 5 months in make in 1990.

Chapter 4
La Selva

30 June 2005

So we left the cloud forest of Cuerici. We left behind daily afternoon rain, biting cold at night, and evening hot chocolate (the greatest stuff in the world when you're cold). We are now headed to La Selva, where all this (that is OTS) began. Located in the lowlands of the Atlantic side, La Selva gets more rain than any other site we will visit on the trip and is truly tropical rain forest. I forget how long this bus ride was, but I used the time to get many photos of people sleeping just incase they could be used for a presentation in the future.

Bienvenidos Estacion Biologica La Selva

In the old days they took a bus to a train then a boat and sometimes parachuted into the area, or something like that. Now of course you just get driven right to the door of your cabina. Its like stepping into a very wet oven. You could drink the air. We got our gear situated and hauled equipment over the bridge across the river way back to the Jaguar (pronounced Haguar) lab. There is an air conditioned room the size of a large closet where we set up our computers. And just around the corner is the library where its icy cold. I would often frequent these places, just for minutes at a time, to give me the strength to go on.


"Look, a tree!"


Puerto Viejo River

La Selva is known for its venomous snakes. Everyone who has been there has a snake story, mostly about others and their snake encounters, but a snake story non-the-less. My favorite apparently happened a little while back. A group was out wandering around and came across a hippy girl (they're everywhere) looking for something in the dark. When asked what she was doing it turns out she thought a snake had bitten her. She was in the woods without a flashlight wearing flip flops. So they looked around and sure enough a poor little hog nosed viper was mashed into the ground. She protested being sent to the hospital on the grounds that it didn't hurt that bad and the snake wasn't that big. I would have left her there, I mean, if not the snake, then something else surely...


Evil spider


Dragon on a leaf

La Selva gets about 4 meters (13 feet) of rain per year. It has 1853 vascular plant species, 118 mammal species (70 of which are bats), 423 bird species, about 80 reptiles (50 frog species), and a little more than 4000 species of moths accounted for. They have no idea how many species of other things there might be, but they're working on it.


Swallowtail similar to ours

We picked up a new person to help us with Faculty Field Projects, Dr. Scott Shaw. Scott works on parasitic wasps, these are some of the smallest and least known insects in the world. Some are so small that they parasitize dragonfly (and other insect) eggs. He works specifically with the Euphorini a group of wasps that, rather than attack soft poorly defended things like eggs or larvae (think of caterpillars), prefers to attack adults. This is odd, adults are heavily armored, can run and fly, and can fight back.

Spider

Tarpon... really

1 July 2005

I'm on top bunk again, there is a pile of ear plugs on the table from Jeff, but either I've gotten used to it, or his snoring is getting better. No worries. The ceiling fan (more like a propeller considering the humidity) above me is on full blast. One nice thing about this place is that because there are so many people (over 100) they make lots of food and keep breakfast stocked right up until 7:30. So you can roll out of bed at 7:15 and still fill your plate.

Emma, a soldier in the army of bird watching.

Our day began with a hike into the woods. The director of the station lead the walk and shared lots of interesting information about the various studies that had been done on the various plants. Crossing the bridge we

got a rare treat. Believe it or not, that little wiggle in the middle of the picture is about a 4 foot long tarpon swimming from the ocean up stream to spawn. Apparently a rare sighting.

Before entering the woods we stopped near the labs to look at some plants people had brought in. When a limb breaks or tree falls all of the other plants that were in it come down too, orchids, etc. These will die on the forest floor, so people bring them in, wire them to the side of a tree in the yard and then groups can come by and look at them. One of the more interesting things was an epiphytic cactus. This is a cactus that grows up in the trees, just like an orchid or bromeliad. I saw something similar to this when I was in the mangroves in Belize. They look like fat green snakes that wind around branches and trunks. It may seem odd to have a cactus growing in the rain forest, but the reality is, if you're not rooted to the ground, you get very little water, therefore the physiology of many of the plants in tropical forests are very similar to those of desert plants.


Epiphytic cactus


Shed scorpion exoskeleton


Moss on a palm frond

There are so many people working at La Selva, that to minimize erosion (remember, 13 feet of rain per year) they have made many of their trails concrete! The

Group on the trail

up shot of this is you can rent or bring your own bike and ride many of the trails for more than a mile from the main station. The down side of this is that it kind of takes away some of the wildness from the whole experience. However, they have had both jaguar and tapir sightings in the last month, so its still pretty jungly.

The picture to the right isn't that good. Its supposed to be of a liana (a generic term for a woody vine). The out of focus portion in the foreground is connected to the dark nearly horizontal portion in the background lower right. This liana was about 7 or 8 inches thick, but that doesn't mean anything. A long while ago, one guy tried to find the beginnings and ends of lianas and found that some where over a kilometer (0.6 mile) long. Some lianas have undergone no measurable increase in diameter between measurings that were more than 10 years apart. They don't get bigger around, they get longer. Usually when people look at forest dynamics they

Liana

Poison Dart Frog

measure rooted plant diameter at breast height and track changes over time. You can tell a lot from this, growth, birth, death, standing biomass, primary production, etc. But how do you account for something that starts here and grows a quarter mile to the left, doesn't get any bigger around, and is shading and competing with other plants thousands of feet away. Most people don't. A liana's affect on the tropical ecosystem is very poorly understood.


Leaf beetle


Ant fungus garden

We switched leaders, and I'm sorry I don't remember names here, but the walks continued back, back, back into the woods. The white thing on the leaf to the left is an ant fungus garden. The ants tend, feed, and eat the fungus, they also live in it.

To the right is a fuzzy photo of a Bulla Ant. Also known as a Bullet Ant, these are the largest ants at La Selva. As the story goes, if you're stung by one of these it feels like you're been shot, apparently the pain lasts for about 12 to 24 hours. The remedy offered by one person was to put the victim in bed, give then a bottle of whisky, and wish them well.


Bullet Ant

Leafcutter ant colonies can be huge, employing up to 4 million ants. The leafcutters collect foliage and feed it to huge fungus gardens that are protected in undergrown metropolises. When the colony dies the abandoned tunnels collapse, sometimes the resulting cavern is large enough to swallow a person and the horse they were riding! This hole was about 3.5 feet deep right next to the trail.

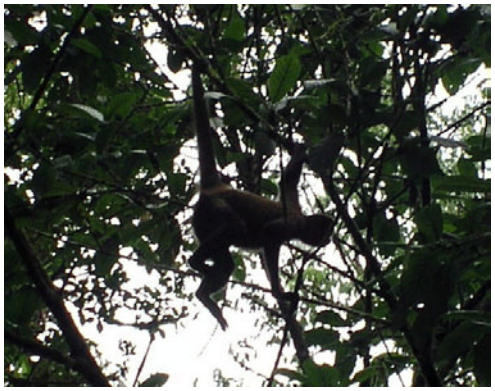

Abandoned leafcutter ant nest


Unknown fungus

We found ourselves in the arboretum, which has been largely cleared of underbrush.

Some monkeys come along so everyone tried to get pictures. Mine didn't come out too well, but you can tell it's a monkey.


Large tree growing out of or immediately next to a large rotting log.


Monkey


Cockroach

At the next site we will get to meet one of the experts on Costa Rican bats. He was one of the first people to study tent making bats based on a discovery he made on an OTS course in the 1970s. Above are some tent making bats we saw in the arboretum. The male cuts the veins of a large leaf (some bats are species specific) so the leaf sags and creates a shelter from the wind, rain, enemies, etc. Below are a few more things we found in the arboretum.

Stingless Bee Hive

The stingless bees lack stings, as their name suggest, however some are known to bite, and then turn around and spray acid in the wound. So it hurts all the same.

Weevil

Ant Mound

Grasshopper

In the forest there are 350 species of trees. Only 9 grow above the canopy. There are also 450 species of ants. Try to count to 450 and realize that each time you count that represents a species with: a name; not just one colony, but many scattered throughout the forest; predators; parasites; a specific place (ground, canopy, rotting logs, palm fronds, etc,) that it chiefly lives; a nest architecture; food preference; phermones for communication with members from own colony, members of own species from other colony, and members not from own species; and on *ad infinitum*. Awful lot of ants.


Soldier Beetle (?)


Brentid Beetle


Wasp nest by the trail

Difficulties of transportation is probably the only reason I didn't collect this wasp nest and all its inhabitants. It was about the size of a grapefruit and full of very angry wasps.

We made it out of the woods and headed back across the river. I got a picture of a very furry, very fast caterpillar on the hand railing.

And now its time for lunch!


Not a palatable caterpiller

Lunch was good. All the food we get on the trip is excellent. The base which usually crops up at about 90% of the meals is white rice and black beans. Separated thankfully. I'm not a big bean fan. I tried some in the beginning. That was enough. The rice, however, is something I kind of miss when its not there. There is a "salsa" made by the Lazorno company that is celebrated throughout the country which goes very well with rice, or just about anything. Some days, always for lunch, they'll make pork chops. Usually I'll get two initially, then eat other peoples or have other people get me more. Just about everyone in the group can out hike me, but no one can out eat me! We all have our own special talents.

Vine snake

Immature squawking bird

While we were eating our lunch this vine snake was trying to eat his. I have pictures of the snake and its meal apart because they were discovered by the person holding the bird. Had they been discovered by the person holding the snake, I would have pictures of them together (har, har).

Another hike after lunch and this one further than before. La Selva is at the base of a long protected area that starts at the top of a volcano and extends all the way down to the lowlands. The river we cross, the Puerto Viejo River, begins at the volcano and runs the entire length of the park, about 40 miles.

Mating Skippers

Standing on the bridge looking into the branches of a tree, I saw a leaf with an unusual dead spot in it, turns out it was two skipper butterflies mating.

I also got a photo of a type of assassin bug, known as a thread-legged bug. These have raptorial fore-legs like preying mantids.

Grasshopper

Thread-legged bug

We came across what looked like a very thick coconut, with a circular hole, not cut out of it, but just never grown in. Its called commonly a monkey pot. The seeds of the tree which produces it are bat and/or bird dispersed (I forget if both or just one). It

Agouti Erin and the Monkey Pot

Monkey Pot Tree

hangs facing downward and things fly up and eat the fruit out of the opening.

We found a tarantula hiding in its nest between the buttresses of a tree. There metallic green *Pepsis* wasps which cruse around looking for tarantulas to feed to their offspring.

Tarantula

Little mushrooms

Lets not forget the fungi, a very important part of the ecosystem. Nor should we forget about streams.

Stream in the jungle

Chapter 4

2 July 2005

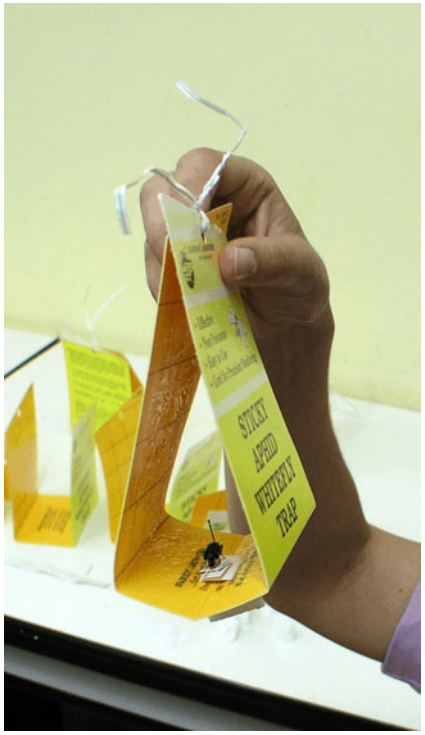
Wandering to the lab we came across a family of coatis. Two adults and three babies. The babies ran up a tree while the adults hesitantly scampered a short distance away on the ground. Being curious, and quite rude apes, we immediately ran under the tree to take pictures of the stranded babies. Only after our photographic desires were satiated did we back off and then, tentatively, the babies regained *terra firma* and shot like rockets to their awaiting parents.

Snake mimic? Butterfly Chrysalis

Mamma or Pappa

Today is another Faculty Field Problem. I'm in Scott's group. Remember he studies wasps, but we'll start with beetles and work our way over to them. Blister beetles produce a nasty chemical for defense called cantharidin. Cantharidin is very stable, that is, it doesn't break down and go away, even after the beetle has died. People who raise horses especially know that you don't feed hay with dead blister beetles

Arboreal babies



Baited trap

to your horse, it could die from eating as few as six. In nature, when a blister beetle dies, there are other beetles which will eat the body to get the cantharidin, this is then passed on to the eggs to offer protection from predators and parasites. But some rare parasitic wasps use the smell of cantharidin to find these beetles (not the blister beetles, but the things which eat the dead blister beetles). So perhaps you could trap for these wasps using cantharidin as a bait. And that is what we did. Scott brought yellow sticky traps, which are just that, thick cardboard coated with a vile substance called tangle foot. We placed a dead pinned blister beetle in half and left the other half empty. We put one of each, treatment and control, in ten trees in the arboretum and left them over night.

Traps in the field

Seems a bit simple doesn't it. To maximize trapping efficiency how high should we put them, in shade or sun, in old growth forest or new growth, how long do you leave them out, etc. No one knows because no one has ever done anything like this. There is a saying, "Standing on the shoulders of giants," which acknowledges that a lot of the research and discoveries of today are made possible by research and discoveries by others in the past. In this instance we're still mucking around in the dirt trying to get a toe hold. There is a lot of basic science and observation left to be done.

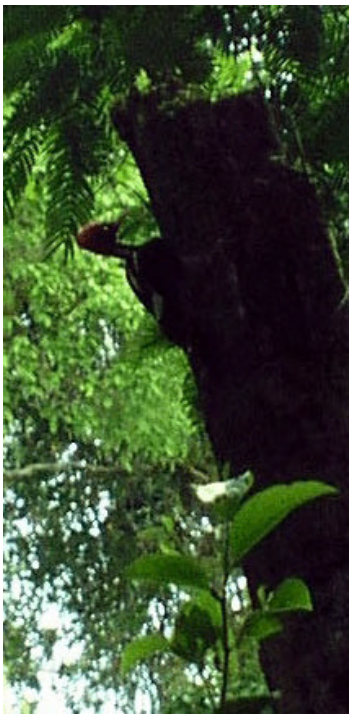
I got a few more pictures of some of the beasts around the place. The first I had seen before, but not gotten any good pictures of, the Peanut, or Lantern Headed Bug. Its

Peanut headed bug

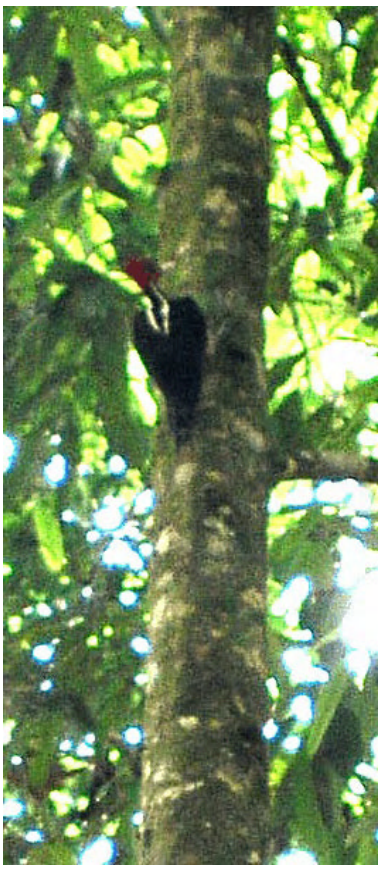
in the family Fulgoridae, related to plant and leaf hoppers. These are rather large, about 4 inches long and sit happily on the trunk of a particular tree. I had many chances to collect one, but there were only 5 when I first arrived, and this is a showcase insect, lots of tours come through here. So I was good. I did, however visit the site often just to make sure more didn't show up.

Another species of Fulgorid

Another pleasant surprise, and the best bird of the trip for my money, was the pale billed wood pecker. Long shots in poor lighting don't agree well with my camera, and I'm sure Erik got some spectacular photos, but here are mine, and there really isn't anyway a picture could do these birds justice. Amazingly there were quite a few, at least 4 individuals and I found what I'm pretty sure were at least two



PB Woodpecker



Pale Billed Woodpecker

Stilt-legged fly 1

nests, each built in the dead tree not much more than a foot in diameter. A bit more walking and we came across two wonderful flies in the family Mircopezidae. I like this family, and their young live in rotting wood.

Stilt-legged fly 2

Well we got done setting up traps by about noon, so I gathered all my equipment and headed back to the arboretum to set up my traps. About half way through a storm started rolling in. It was way off, and big. The clouds crept closer and closer, thunder and lightening in the distance while the wind started picking up. A rather large limb broke off in a tree about 100 yards away and made it half way down before getting caught in other branches. It was very similar to the large summer storms I remember from my youth. I finally got everything set up just as the drops started falling and headed in for supper and the nightly talk.

Limb over the trail. Note my assistants in the background.

After the talk it was 8pm. The sun is long gone and I still need to set my traps and bait them. Luckily the storm had dropped a freshly broken limb right over the trail to the arboretum, so I was able to get fresh limbs to bait my traps (I'm trying to see what insects are

attracted to tree falls, and fresh limbs make ideal bait). Also I needed to add water to the pans under the trays but had accidently left my collapsible water bottle at Las Cruces, so I had to substitute with a trash can instead. No handle of course, and sloshing was amplified by the can's design, so I had to try to carry it at arms length whenever I could. Not easy to do with 6 or 7 gallons of water. Plus the bulb in my headlamp burnt out so I had to switch to a very weak red light for the last few traps and the walk home, which kept getting longer every time I made it. The nice thing about having a very week headlamp is that you see some things that you wouldn't normally. So on this night, at 11pm, drenched in sweat, with a slight tick in my eye due to anger, annoyance, and frustration, I saw a line of mushrooms glowing in the dark.

Tailless Whip Scorpion on a tree buttress.

Chapter 4 (c)

3 July 2005

We ventured back out to the arboretum to collect our traps. I revisited the peanut headed bugs and got a nicer shot of three sitting shoulder to shoulder and a cryptic spider. Careful with the traps, don't want to crush the two sides back together or the insects in them will be torn asunder during the "repeeling".

Peanut Headed Bugs

See the Spider?

Back in the lab we scanned each trap and recorded which insect families each had collected. We set up an assembly line with a recorder and two checkers and made quick work of it.

Emma at the scope

Luckily, or unluckily, there weren't too many insects collected. We didn't get the wasps we were after, but did find a very high number of flies in the family Phoridae in the baited traps, and nearly none in the unbaited traps. Lots of statistics, of course, were done to make sure that there was a real difference (at least we are 95% confident) not just bias, and then we put together our presentation.

Wondering back to the cabin I saw my first basilisk lizard, also known as the Jesus lizard because they have a tendency to run across water to escape predators and excite tourists. Luke got a picture before it disappeared into the brush, and then resumed photographing a snake with the help of his lovely assistant Lucinda.

Striped Basilisk

Lucinda, Luke and Snake

You see, this is what Luke does, he captures semi-dangerous snakes, such as this rear-fanged vine snake, and then asks someone else to hold it while he stands at a comfortable distance and takes pictures. So of course I got some pictures too. Pretty isn't it.

Vine Snake

Peccary

Even though they look like it, Peccaries aren't pigs, they are in a whole different family. We have a small herd which shows up every night to patrol for fallen fruit. I finally got a picture of one after dinner.

4 July 2005

FFPs out of the way, we now have time to work on our Independent Projects, and I am hopelessly behind. Remember that I started one at Las Cruces, and I have one running now. In order to report my findings I need to count and ID the insects that I collected. So I resign myself to sit in the corner of a very hot lab and stare through a microscope for 8-10 hours a day, for the next few days. Happily on the way to the lab someone pointed out a crocodile in the river. Its nice to be in a place where such things still occur.

Crocodile

I sorted insects all morning and around noon I visited the Arboretum to collect what had been trapped over the last two days. I went back to sorting, but at three o'clock the group come together for a tour of the ALAS project. ALAS stands for Arthropods of LA Selva. It was started by two Costa Rican para-taxonomists in 1992. These people are basically experts, the only difference is they learned what they know in the field, while guys like me learn it from books and in the lab. An added advantage is that they don't get bogged down by little annoying details- collect as much as you can, preserve it in the proper manner

Traps in the arboretum

befitting the group, identify it to a base level (such as family or genus), and then ship it off to a willing expert to get a species name slapped on it. The hardest part of this is keeping everything organized and here every specimen is put into a database, and has its own bar code below the written label.


ALAS Project watching video of an undescribed ant species

We were taken to their collection, and shown the big showy butterflies and beetles, but the majority of drawers are full of minuscule insects by the thousands. Of the more than 4,000 species of moths that are known at La Selva, the majority have a wingspan of less than one inch.

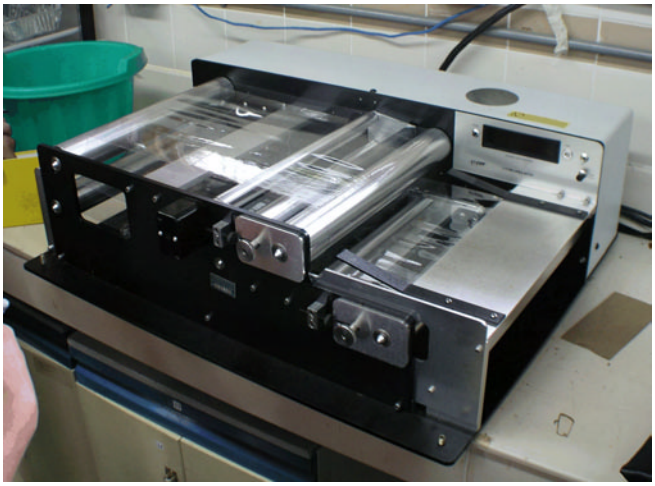

ALAS - Showy Butterflies

We were also shown some of the contraptions used to collect insects, such as the device they use to fog trees with insecticides and the funnels they use to collect the fallen insects.


Fogger


Funnel

After ALAS we were shown the other resources the station had to offer. There was a very nice chemistry lab, drying rooms, incubators, greenhouses (however, here they are covered in black mesh to reduce the light entering and create a more understory like atmosphere), rearing chambers, -80°C freezers, microscopes, etc. I got a picture of a keen little machine which calculates the area of a leaf, and can then calculate the amount of damaged area due, say, to insect feeding or falling limbs, etc.



This calculates leaf area. I don't know how, though.

We had a very interesting talk tonight. Background: Its interesting that as far back as the late 50's or early 60's Isaac Asimov talked about the possibility of Global Warming due to Carbon Dioxide emissions from burning fossil fuels. There are lots of people who, even yet, don't think its happening. The problem is there is no absolute concrete test which can show one way or the other. This really shouldn't come as a surprise, there is no single way any doctor could ever find out if you are healthy of not. Instead you are subjected to a battery of tests, and, if passing, are granted a full bill of health, even though, say, your left toe wasn't specifically checked for cancer. So over the past 10 or 15 years thousands of scientists have made tens of thousands of observations, and preformed still more tens of thousands of experiments, and finally there is such an overwhelming pile of evidence that few informed persons in the scientific community can doubt that global warming is occurring.

Some people respond with a firm hardy, "So what?" Some arguments go something like this: higher temperatures will result in greater evaporation, which will create more clouds and more clouds will reflect more sunlight, lowering temperatures.

Other arguments, and the one which concerns us tonight are: higher carbon dioxide will increase the worlds temperature, which will cause plants to grow faster thus using more carbon dioxide, which will counted Global Warming.

Here at La Selva they picked 6 different species of trees, over 3500 individuals, and have measured each individual each year since 1984. In 2000, after 16 years of recorded growth they put their findings together. They averaged the growth for all 16 years and then made a bar graph showing how much above or below average each tree species grew for each year. So lets assume species A grew 160 inches bigger around over the 16 years. That's an average growth of 10 inches per year. Some years it grew more than 10 inches around, that would be above average growth, and some years, it grew less than 10 inches around, below average growth. In the first 9 years (from 1984 to 1993) trees had above average growth 72% of the time. From 1993-2000 trees had above average growth only 21% of the time. And of course above average growth decreases and below average growth increases as we approach and surpass 1993. What was the climate doing over those 16 years? The average temperature of the forest had risen by 2°C. So this indicates that hotter temperatures mean less growth, less uptake of carbon dioxide, greater temperatures, less growth, etc, etc. Negative feedbacks, they call them.

5 July 2005

At the microscope. So much so that as people came and went throughout the day, many commented that it appeared that I had never left my chair. Never fear, I did go to lunch. However, today marks the day to took the least pictures, only 6. I did, however, identify 2,553 insects.

Owl Butterfly

Chapter 4 (d)

6 July 2005


Woody Mushroom

Back to the arboretum today to collect what specimens my traps have trapped. I use soapy water in trays to "catch" the insects. The soap breaks the surface tension so the insect falls through and into the water, otherwise insects usually aren't heavy enough to get caught in water. The down side to this is that you have to check the traps often, once a day would be best because water is not a preservative. In the states I would use low tox antifreeze which kills and preserves the insects and only has to be checked on a weekly or monthly basis.

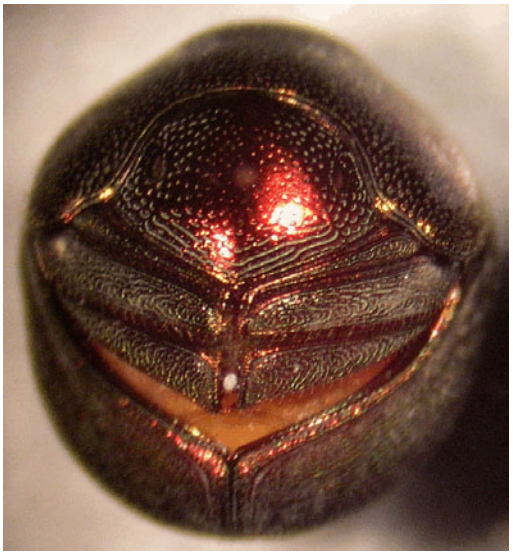

Different Fulgoroid

I got a picture of an old, wooden looking mushroom and then went to check on the peanut headed bugs. Seems there are less everyday, five on my first visit, now only three. I found another type of hopper with an elaborate head and beautiful red wings. I went to check out a rotting log and what should I find, but a nice lizard basking. Well, I've seen Luke catch these things quick as you can, and he's been bringing in some good insect specimens as well, so I decided to give it a try. I stowed my camera and extended my hands

Pre-caught Lizard

in the typical spread fingered I'm-gonna-get-you manner and pounced. Missed of course, but got it on the second try! But all of the snatching scared up another lizard, sufficiently different to warrant at least a half a grab, and I caught it, too! Well now I had a lizard in each hand and nothing to put them in expect a head mosquito net that I turned into a pocket insect net. On my first try I was able to throw both lizards in the net, whereupon they both immediately ran out, but one stopped on my arm and the other clung to the outside of the net. After some delicate ballet, and some choice curse words, I finally got both lizards in the net and headed back to the lab. Later these will prove to be not only different species, but ones Luke had not yet seen.

I sorted though more insects today. I got some really amazing stuff, and one of the neatest things was this beetle. Its curled itself into a ball, with the top of the head on top, kind of like a downward pointing triangle with the upper edge curved out and up. The legs are drawn in and meet in the middle, and the bottom are the hind edges of the elytra, hardened forewings.



Rolled beetle

Headed to supper I found a huge katydid. This was a female with an almost inch and a half long ovipositor that looked like two stout knife blades. She uses this to cut into soil or

Large Katydid

plants into which she lays her eggs. She certainly wanted to do me some damage!

Mantids

Later that night I went for a short wander down the trail and found a pair of mantids mating on a tree trunk.

7 July 2005

Another day of sorting and IDing insects. I didn't forget, it was the events of the past few days which slowed me down, but I finally made it back to the glowing mushrooms. I got some photos of them in the light of day.

Phosphorescent mushrooms in the daytime

Walking back to the lab I came across a coral snake... maybe. There is a complex of many species of snakes with red, yellow, and black bands stretching from the southern US down into South America. Some of these snakes are harmless, some have a mild venom, and others are deadly, to the point of almost certain death if a hospital can't be reached within a few hours. Better safe than sorry. I had my sweep net with me, an 18 inch hoop on the end of a three foot handle. So I took a quick picture, then, VERY CAREFULLY, slapped the

Coral Snake

net over the snake's head and made sure that the rest of the net bag fell so that the snake could slither into it, effectively catching itself. Well, this was a nasty one, well inclined to bite, and it really wanted out of the net, so I had to keep jiggling the net to keep it inside. Remember, this could be completely harmless, or damn-near-death.

I got it up to the lab, and we couldn't find anything good to put it in, so Phil helped me and I dumped it in a tub while he dropped another tub as a lid down on top. Pretty hairy business. I went back to sorting bugs and Phil went back to IDing ants. Two of the snake handler guys (their hair and dress reminded me of the people that ask for change at the Wal-Mart intersection in Columbia, MO) come by and removed the beast to proper quarters. Turns out it was a coral snake, very dangerous if bitten. Needless to say Luke was very excited about the haul and I think he even bought me a couple Poweraids over the deal (although he will more than return the favor a few nights hence). Possibly the most dangerous snake on the trip.

Lizard Lunch

After this I worked on bugs until lunch and headed that way. Just before I

Derbidae

started on the bridge the guard motioned me to look in the bushes and there was a vine snake with an unfortunate lizard in its mouth. I got some photos as people began to congregate and then headed on towards lunch. Luke had already set down to eat when I got there and when I said, "There's a vine snake eating a lizard on the other side of the bridge," he jumped up, ran across the cafeteria, slid though the door, jumped on his bike, and was off like a shot. Rumor has it he was airborne as he came off the far side of the bridge!

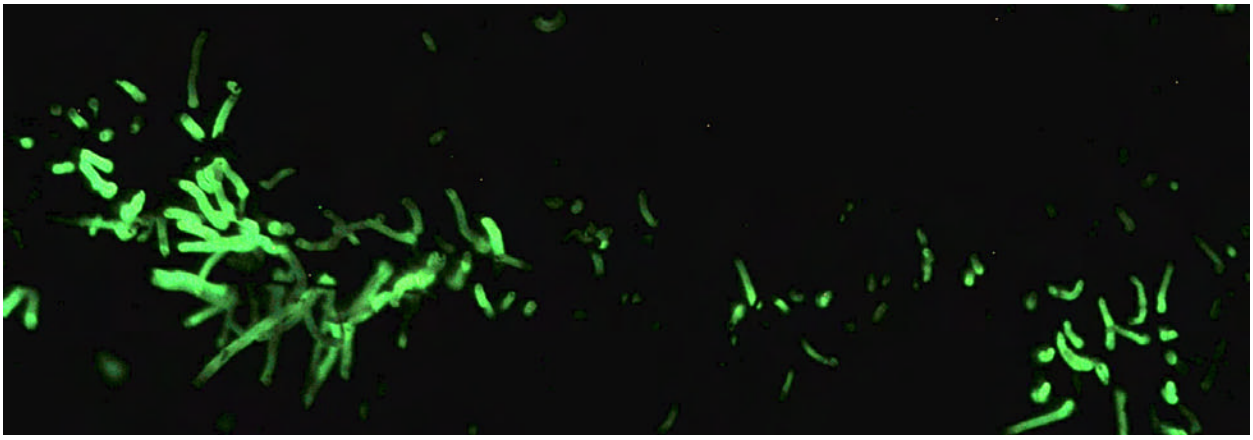
After lunch, sorting bugs *ad infinitum* and I needed a break, so I wandered into the woods and come across some very unusual insects. These are in the family Derbidae, and are related to plant hoppers and cicadas.

Coral on the Hook

Later that night we released the coral snake. It was quite a production though, there were four of us and we all had cameras, blazing away. Finally after the perfect shot had been gotten we let it be and it melted back into the forest.

A big toad for Luke after supper. Then I went in search of my glowing mushrooms. Something had eaten the tops off during the day! But, happily, the stalks still glowed, so after many failed attempts, I finally got a photograph of the glowing mushrooms (at least what was left of them).

Luke and Toad



Glowing mushrooms (stalks)

Chapter 4 (e)

8 July 2005


Our *cabina*, guys on the left, girls on the right.

Our last full day at La Selva. I spent most of it working on insects, and taking down my traps. Others were hurrying to finish their projects. I can't do them justice, but I'll briefly describe a few. First we have Phil's. That poor guy, decided to look at ant competition in light gaps, so he put out tuna (protein) or Pecan Sandy cookies (sugar) as bait and observed how ant species competed to get these. Light gaps in the tropics are Hell on Earth. They are usually created by fallen trees, and then thousands of shrubs, trees, and vines choke the area as they fight to grow above all the others. And then couple this matrix that is nearly impossible to get through with the hot blazing tropical sun while you run from place to place and observe ant fights for 5 minutes at a time. Also light gaps are a place where snakes like to hang out. The first day nearly killed him, the second day he got some helpers.

Lucinda looked at how Poison Dart Frogs set up territories and how they react to new comers in the cage. Apparently after she handled some a bit her hands started to tingle, so she put on gloves.

Kia built some spectacular bromeliad replicas out of plastic bottles and tried to see how tadpoles react to "predators". Kevin communed with the peccaries and Rebecca took a wonderful series of photos as he got closer, closer, and was finally accepted as one of the herd.

Andrew and Kari did just about the most bazaar study that was done on the trip. The idea behind the study is called the Acoustic Niche Hypothesis. Basically the idea is that if you are making a noise to get attention, either to attract a mate, or defend a territory, etc. then you want that noise to be at a distinct frequency that no one else is calling at so you can be heard clearly. Over time you get a stratification of sounds, with some animals calling at high, low, or middle frequencies. Now if humans were to make sounds, such as a truck rumbling by, this might push away some animals that use that frequency. So they trucked out in the forest at night with a laptop and a microphone and recorded the night sounds at greater and greater differences from a nearby road. Then they analyzed the recordings using some software that was free on the internet to see if there were differences between the sites.

Big Black Turkey-like Bird

Nate went out after Heliconia for a study. He was able to find some rare species, and even chopped some out of a guys front yard, if the rumors are true.

Vine snake

Luke surveyed for anole lizards in two different regrowth forests and then set out pit fall traps and home made sticky traps made with Tanglefoot, possibly the most vile substance on earth. He was coated by the time he was through, and I think a butter knife had to be thrown away to protect

Leafcutter ant trail

the innocent. The traps were to assess any differences in insect abundance at the two sites. I went through all the pitfalls, nasty stuff. His last day in the field he broke two bikes, and the second one went down almost a mile from the station. Needless to say, it was, for him, a long day.

Emma, singin' in the rain.

Throughout the forest, and even in the lawns, the leafcutter ants build highways to their nests. These are kept clear of debris, even grass is clipped. I got a picture of a trail in the arboretum.

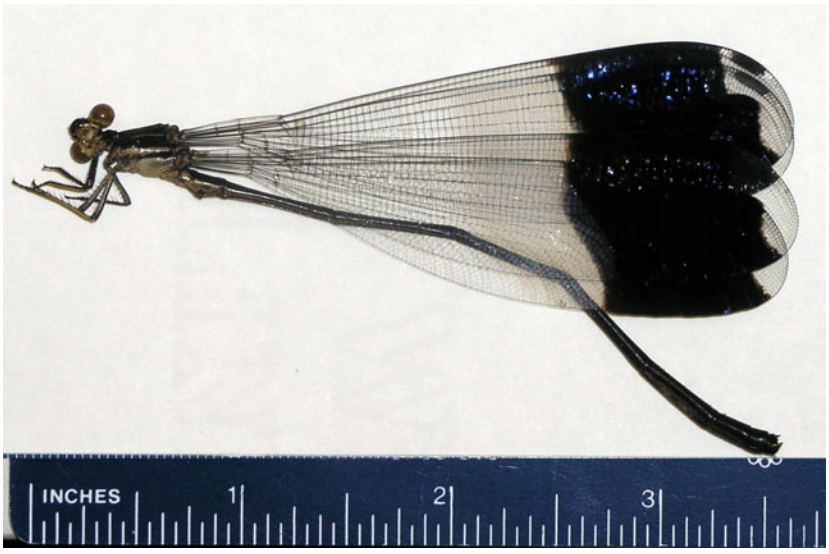
Mango Addict and Nice Piece of Bass

We had a huge down poor and had Emma run out so I could get her picture in the rain. She's a good sport. I also got a picture of the happy couple. Erin (fearless leader) and her beau.

This was the last night we would have Kathleen (resource person) with us on the trip. She was with us at Cuerici but is headed away from us on the morrow :(


Kathleen K

There was some sort of dancing class tonight, and some of us hid in fear, but later when it was safe to go out Luke and Nate went in search of snakes and frogs. What should they bring back, but one of the best specimens of the whole trip. This is a pseudostigmatid damselfly. Big spiders don't eat everything they catch, and some smaller spiders will eat the small flies and bugs that are ignored by the larger spider. These damselflies will hover in front of a spider web and pick off the smaller spiders to eat. Pretty cool. I've only seen one, and that was for an instant.



THANKS LUKE AND NATE!

9 July 2005

A day of transition. We are headed to San Jose, will spend the night and then head back out to a place called Palo Verde. Its hotter than ever, and lugging the bags took all the energy I had. I darted from one person's shadow to another, and finally just

got on the air conditioned bus for some deep breaths before loading all my luggage. If you haven't guessed I have quite a bit. One giant suitcase for the most of it, a long duffle bag like affair for my traps, backpack for my computer, another backpack for day excursions and collecting, plus my insects, pinned and alcoholic, which are kept separate and handled very gently. It's a pain, but most people are very nice about it. What I need to do for my research is different from what others needed to do for theirs.


Tell the kids its just sleeping

Someone found a dead bird, beautiful green, and it was entrusted to our newest Resource person, Bob Timm. He's from Kansas and will prepare the specimen and place it in their collection.

Whenever someone plows a road through an otherwise uninhabited area one of the consequences is urbanization and buildup all alone the road. Cost Rica was smart enough to realize this, and a few of their major highways are surrounded by parks on both sides. We convinced the driver to pullover and let us have a view of Parque Nacional Braulio


Ximena trying to get in the way of the view

Parque Nacional Braulio Carrillo

Carrillo on the way to San Jose.

This is a good time to rest, catch up, and try to get needed supplies for the weeks to come. After we hit the hotel, Luke slept the whole day, and I and others went out on the town. There is a coffee company called Britt here that makes the best candy. It's a roasted coffee bean ensconced in chocolate. It's a great crutch to keep you awake through boring talks and late into the night as you work on papers and presentations. On the way back from the store we passed a large outdoor television showing a soccer game. Somebody scored as we were waling by and the crowd went wild!

Watching the game.

Chapter 5
Palo Verde

10 July 2005

We began in the cool flat city San Jose, then went to the comfortable highlands of Las Cruces, later soaring to the frigid peaks of Cuerici and then plunging to the hot flat jungles of La Selva. Today we are headed to the Dry Forests of Palo Verde and it will rain every day.

Second place we stopped

Our first stop of the drive was at a great big restaurant where we got drinks and ice cream. They had a nice play set there and a couple of the smaller people had a go on the slide. I was all for lunch, but the powers that be said 10:30 was too early. No by me, but I am just the page, and the knights said heave to.

The second place we stopped was a small, very hot, cramped little restaurant, but if you traversed a long thin hallway to the left you were lead to a vast open air backroom, complete with tables, fans, and a big screen TV. After eating we had some time, some went to the grocery store, but Luke and I went for a walk. We wandered into a little general store and fell upon an important piece of equipment neither had, but both needed. A water gun. We split the purchase and headed back to the bus,


Tree in town, covered in figs

careful not to reveal our new toy.


Flat Grasslands

We drove for hours through flat Kansas grassland, always with the hint of low mountains to the north and south. This was a place for cowboys, burning heat, and dying thirst.


Canal from the mountains

I don't remember the story as I should, but here are the salient points. About 60 or 70 years ago a rather well to do American came down to Costa Rica, became friends with the president at the time and purchased a large parcel of land on which to raise cattle. The ranch grew to 100,000 hectares (more than 200,000 acres) over the years and was owned by only one family. About 10 or 15 years ago the government sued and pushed, and finally negotiated to buy some of the land back. Palo Verde is part of what was once this mighty ranch.

Between the mountains and the river there is a vast marsh, with crystal clear water 3 to 10 feet deep, choked with various lilies and grasses which thrive in the inundated environment. Now in the wintertime in North America it's the dry season in

Palo Verde and the marsh shrinks down to puddles the size of a small ponds. And when our ducks, geese, and other wetland birds migrate south some of them, thousands I should say, transfer their allegiance to Costa Rica and stay at the Palo Verde marsh for the winter. The marsh is internationally recognized as an important habitat for wetland birds.

Parque Nacional Palo Verde

We drove for an hour over a broken gravel road, stopped at the border of the park to get permission to enter, and drove another 20 minutes on the station. The dragonflies are thick. They billow around like dust caught in a whirl wind, green, with clear wings, they look like the Eastern Pondhawk found in Missouri,


Lawn to the Marsh

only bigger, and are almost certainly the same genus. As we rolled up I saw a low slung building sitting at the back of a slowly rising lawn. At first, and from far


Dining Hall


Office, Gift Shop, Lab, and Quarters

away, it looked like the front half of a giant lizard was sticking out of the grass watching us drive in. The air was hot and dry, or maybe it was humid, but the look of the place made the over whelming statement, "Beware, it is dry here."


Great fun to chase

It was a giant lizard, brown and iguana like. The more you looked the more there were. Ctenasaures (pronounced Teen-a-suars) they were. We chased them around and stowed our things. The rooms were on the back of the lab, which was on the back of the gift shop which was on the side of the office. Behind out rooms were the showers (no hot water, but it didn't matter, the heat was ever present) and up the hill was the library (blessed air conditioning and internet), and some smaller labs.


The marsh stretches to the River

A few hours till dark and just as many till dinner. There is a trail at the back that leads up the mountain behind the station. At the top is a look out point, a gift, a sanctuary. To reach the top you must climb through the forest, sharp rocks underfoot, and battle the dragon that comes in a million pieces, ripping you apart and sapping your strength with every bite- Mosquitos. Three, four, five on each arm, your neck, your ears, your

forehead, your lips, through the fabric- your legs, back, and shoulders. They were slow, for every 10 you tried to kill only 2 or 3 got away, but they were endless.


Laboratory, soccer field, and cattle at the edge of the marsh.

Five of us started out, at a fast pace, and soon I was all alone. It was hot, I was a fountain and each step became deliberate, soon I started to ignore the mosquitos and concentrate on just going up. After what seemed like an eternity, I found the top, having elevated by body 500 feet in the process. They were waiting on the rocky out crop that over looked the marsh to the river and the mountains beyond. The wind was cool, and not a single mosquito bothered. It was heaven, a majestic view and comfortable atmosphere. But all too soon it was time to go. Back through the fog of death, the forest that eats you alive. The howler monkeys across the valley were booming, and I boomed back as I raced down.


The Forest in the hills

We have a chef! At least he wears the hat of one, and meals are presented in vast silver tubs for us to scoop from as we pass through the line. Alas, ice is scarce, but the

Luke and Emma with Boa

dining room stays open all night, and when some can be found, an ice coffee (with plenty of sugar) can be the most refreshing drink on a late hot night.

This night Luke found a Boa. He measures and photographs all the reptiles he finds, and needed a bit of help with this one. The skin was smoother than silk.

Chapter 5 (b)

11 July 2005


Morning Moth

The first full day at a new site. This is a day for a tour. I got up and around and checked the windows for insects. A nice moth was waiting. The group was broken into two and I went to Bob Timm on a hike back up the road we had driven in on yesterday. Bob was on an OTS course back in the '70s and has been working on bats and small mammals in Cost Rica, on and off, ever since. As we wandered up the road he told us the history of the region, starting with the first peoples to make it down to what was to become Costa Rica thousands of years ago. Apparently the area had been well farmed way back when, and the Spanish continued that when they took over. Additionally the forests have been cut for precious wood, such as mahogany, for hundreds of years. More recent happenings involved those mentioned previously, culminating with the creation of the park just a dozen or so years ago.


Group on the Road

The forest floor has the look of something that has been baked to a crisp, then squirted with water. Kind of the way a flower pot or terrarium looks when its cracked dry and you add water. I saw an agouti, a cat sized rodent that is a very loud eater.

The Dry Forest in the Wet Season

Cactus

Bob would point out things, stop to talk about something, then say, "Now, we were at..." and pick back up with the history lesson, which lasted the whole walk. Very informative, very entertaining, and very in dept (we even learned that the Herford cattle were replaced with Indian cattle because this breed was better adapted to the monsoon like climate; bone dry for 6 months then flooded, muddy fields for the other).

Cactus "annual rings" and leaves from a vine.

Darkling Beetle

We entered the forest and walked back to a rocky outcrop, about 25 feet high and 60 feet around. Huge cacti, some nearly 20 feet tall grew there. The white waxy markings on the trunks represented one

year's growth. Another unusual plant was a tree sometimes called the "Tourist tree" because its "pink and pealing." The green under the pealing bark is photosynthetic like a leaf. The forest trees drop their leaves every year during the dry season, but this tree can keep making a little food even without its leaves.


Tourist Tree


Not for hugging

Some trees are amazingly well protected, with dense spines over the entire trunk. Its thought by some that these adaptations are remnants of a time when large mammals, such as ground sloths, toxodons, and even mammoths were around. Perhaps the thorns kept the trees from being trampled, rubbed, or eaten.


About 3.5 - 4 feet thick at the base.

We reemerged and continued up the road, only to fall back into the forest again. This time we were headed to a natural spring. It had a soft sandy bottom and you could see the water bubbling out of the sand below. The spring had been known since time immemorial and was the drinking water of the inhabitants and cattle for ages. It is the only source of water

Spring pool

during the dry season, baring the low muddy river some miles away.

Someone had poured a long concrete aqueduct that lead to two large low concrete tanks. In the dry season the tanks provided additional water for cattle, but since the cattle were pulled off, the local wildlife benefits. This is apparently a very good place to catch bats, as they flock to the water to get drinks. The aqueduct was choked with dead leaves and dirt, so we kicked and dug until finally, mostly due to Pablo, the water started flowing again. So we had to watch the first tank fill (19 minutes by my watch), then wait for water to start flowing into the second

Filling the tank

Group at the spring

Almost full

tank. We found a turtle, one of the first turtles of the trip, and got lots of photos before we wandered on.

Paper wasp nest

Mud turtle

Now we were at... Yes. I told you about the ranch being broken up, and the prized marsh hosting thousands of birds every winter. Well, after the park was created the cattle were taken out of the marsh, and the dikes against the river were closed (the previous owner had allowed saltwater from the Pacific to flow into the marsh to provide salt for the cattle). Almost immediately the marsh began to be over taken with cattails. At first they weren't too bad, but within a few years they had engulfed the entire marsh, and driven out nearly all the birds. They tried burning, they tried crushing the cattails with tractors to drown them, putting cattle back on the land, opening up the dikes, and a dozen other things, but always the cattails came back. Trees had started to grow in some of the shallow areas too. No one could figure out what was going wrong.

Big caterpillar

They have not completely solved the problem yet, but they think they have an answer. When the field station was built a road was put in from the river to the station, and a stream from the mountains to the marsh, rather than be bridged, was rerouted

"Moon" flower

directly into the river. This starved the marsh for water, lowering the average depth which allowed the cattails to get a foot hold and later take over. Plus, areas which were previously too deep for trees to grow were now shallow enough to allow a tree to survive the wet season.

Even after raising the water level, the cattails that are left won't give up easily. If you look at the picture of the marsh I took yesterday from the mountain top you'll see a square of cattails, dark green. These have been left to study the effect the deeper water has on them.

We made it back for lunch and I got a shot of a green iguana that had come down from the trees. Our next walk was into the forest proper behind the station and would begin with a hearty walk back up the mountain that had nearly killed me yesterday. So up we went, forever and a day.

Something I just realized, these are ceramic roof tiles, while the ones used on the buildings were aluminum!

Net Winged beetle

(Boss Lady) Erin led the walk and we talked about the plants and we hurried by as we tried to out walk the mosquitos. When we gained the top we talked about the marsh, and the river. Andrew, ever a climber, took to a tree.


Andrew of the Monkeys

We made our way back down and got onto another trail I hadn't yet taken to continue our tour. We stopped at a tree which drops its leaves in the wet season and grows new leaves in the dry. Its not a very big tree, but gets plenty of sunlight after all the other trees are bare. We also saw another tree with a great green bloated trunk, a Panama tree. The wood is apparently very soft and full of water. It thumped like a drum when you hit it. Hard to believe something so big could stand.


Forest across the valley

We made it back to the station, had our dinner, and a talk (either one on parasitic wasps by Scott, or one on bats by Bob, I don't remember). After the talks we broke up into groups for the FFPs. Long ago and far away I got rabies shots so I could work with the bats when this day came. However, we also have a faculty field person

who has studied Cost Rican streams and rivers and she is going to lead a study to look at aquatic insects in rice fields and the streams which flow into and out of them. Well... I had to go with my calling.

Panama Tree

Chapter 5 (c)

One hundred people planting rice by hand are as miserable as 25 doing the same.
Daniel Janzen 1986

12 July 2005

Still slightly sore from all the hikes yesterday, but slept wonderfully considering that daren't move much through the night. Mosquito netting does not represent an absolute barrier, there is still the length of a mosquito's proboscis with which to contend. A part of the body pressing against the netting may as well be outside it.


Outflow

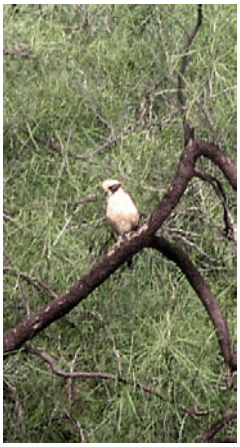
Breakfast, the cook was way too chipper. My group gathered supplies, and, barring the possibility that the days activities would eclipse lunch time, picked up the packed lunches we ordered the night before. We hopped in the car and bounced our way toward the rice fields. Rice requires flowing water so rice fields are little mazes of dams, levees, and ditches. For these fields the main body of water comes from one large stream, which is routed in and through many, many fields and later collected again on the other side to exit as one stream again. We wanted to compare the insects that live in the water among 1) the major inflow stream, 2) the inflow to a single field, 3) the


Tractor with wheels used to "plow"

Bird Buffet

outflow from that some field, and 4) the major outflow stream. Plus we wanted to visit an undisturbed stream in the area so we could compare it with all the above.

Amazingly, there were no mosquitos! Out first site was the outflow stream, there was a ribbon of a walkway across it for access to the other side. We collected everything we could find for 15 minutes, then took data on stream width, depth, flow rate (you toss an orange peel in and time how long it takes to move a certain distance), and turbidity (how muddy it is), and chemical stuff, like pH, nitrogen and phosphorus. We collected almost nothing but snails.



Laughing falcon

Kia (dry) and Chip (wet) at the inflow

On the way to the main in flow we passed a field which had been newly plowed, which is accomplished merely by driving a tractor through the field, the special iron wheels do all the work. The birds flocked to the freshly turned earth.

We sampled main inflow, and inflow and outflow of a single field the same as

Freshwater shrimp

Chip testing the water in a rice field

above. I was wearing my knee high rubber boots and escaped swamping throughout the day until I had to cross the last stream. Using two nets I vaulted myself across in fine shape, but the return trip was to no avail.

Kia (not Chinese) crossing the stream that swamped me.

We decided to sample the undisturbed stream tomorrow. So back in the car at breakneck speeds, don't dodge the pot hole, hit it square on (perhaps there is some unknown wisdom to the way they drive here- straight through and fast-as-you-like, or perhaps they just haven't ever thought of any other way). Luckily we made it back for lunch! I ate my cookies and kept my pear nectar for later (even stole someone else's) and enjoyed a nice hot lunch before getting to work. Collecting the specimens is the easiest part of the job, identifying them takes all the time. Chip and I retired to the lab on the hill and began identifying what we had caught. Another talk tonight after supper.

The backs of most of the "Rice and Streams All-Stars"

13 July 2005

Up and at 'em. We loaded our supplies and headed out again in search of a semi-natural stream. Where we ended up, after much bumping, was an outpost way far away with another series of tanks full of clear cool water. We disembarked from the truck and saw some howler monkeys in the trees above. I got a few

Howler Monkey

Group at the natural stream

pictures then loaded up and we hiked about 50 yards into the forest to get to the stream. It was small and cool, and choked with organic debris- bark, limbs, and leaves. Not exactly like the inflow stream we would be comparing it too, but the best we could come up with, nevertheless.

With that done, we headed back to the station to continue IDing bugs and working on the presentation. Kathleen made a wonderful graphic illustrating the relative positions of where we collected. Kia and others did statistical wonders with the data Chip and I cranked out. We collected a distinct genus of Mayfly I had never seen before, *Traverella*. IDing and presentation

Acacia thorns, note the ant hole.

Wasp provisioning her nest

making were the main tasks of the day. I did just enough wandering to get a close up of those famed acacia thorns. The tree has large hollow thorns, and special places that extrude nectar. Certain ants colonize the trees, drink the nectar and defend the tree against any attack by insect of plant. I also got a picture of a small wasp entering her hole. It rained hard in the evening, harder that it has been lately. The sky afterward was beautiful. Also, an owlfly visited the blacklight.

Downpour

Owlfly

Chapter 5 (d)

14 July 2005

My first day off. How so, you might ask. Well, you see... I guess it really wasn't, but it was a time I could goof off, if I was willing to put in some extra work later. I still had a few more specimens to sort and ID, and I also needed to make a presentation about my Independent research (the stuff I did at the very beginning at Las Cruces, and later in La Selva).

Careful, racing albino pigs.

It was a beautiful sunny day. Hot, but not too bad. If you follow the road that runs in front of the station for a couple miles you'll come to the river. One year the turtles were so thick on the road that one of the students did a study on them. Ximena, our turtle biologist, has yet to see a single turtle on this entire trip. So she took a walk down to the river. I came with dressed as usual, Ximena was wrapped up like a Tuscan Raider against the sun and mosquitos. The dragonflies are thick around here and she wants use them for an Independent Study. But to do a study on dragonflies you have to catch them first and she wanted some pointers, so we both took nets.


Re-rerouted stream

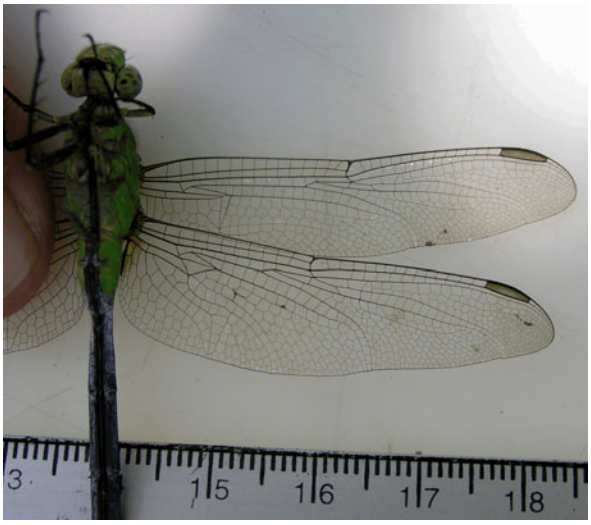
Dragon hunter, Ximena

We crossed the stream that had been rerouted back to the marsh. It was big, clear, and cool. I hung my feet in it for a respite. We finally came to the river. There is a little dock, and a little hut. Three men on horseback were there. Cowboys. Real ones, somewhat different from the people wearing costumes I tend meet at school and in cities. They left and we watched the river, looking for crocodiles. I took some pictures, and only when I got back realized that I could make a panoramic view, crude nonetheless.

We headed back, it took us a little more than an hour to get here, and lunch would just be being served when we got back. Ximena, armed with her long handled, big hooped net took a few swipes at dragonflies as we wandered back. Not even close.

Rio Tempisque

And its not like there are only one or two, we had about 30 around us all the time, swooping all over the place. Following us down the road to pick off mosquitos drawn to our carbon dioxide. I showed her you have to sweep hard, like you're hitting a baseball. She got that, but for some reason wasn't connecting, they would just flit, and be gone. I pulled out my somewhat smaller net, rather lazily caught a few one after

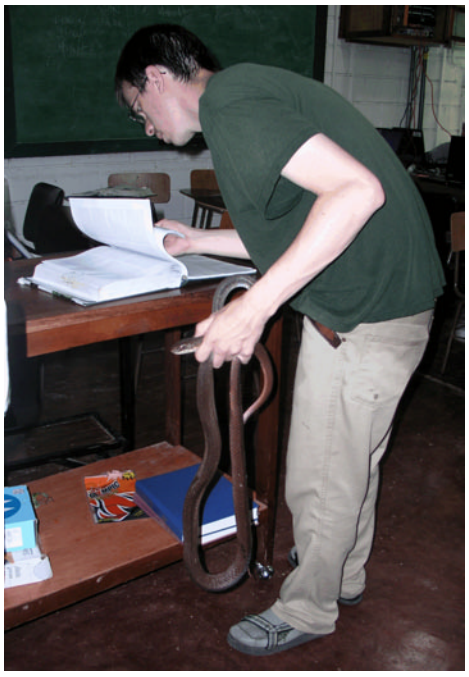


Dragon wings

another, and she cussed me. I told her, "To catch a dragonfly you must become one with the universe." And with this bit of wisdom (oh yes, wisdom), and a little more practice she was catching dragonflies right and left.

The study she wanted to do was pretty cool. Some studies have looked at the veins in insects wings and found if you look at the distance from this vein to that vein, or the length or width of the wing you find predictable differences between groups like males and females, or migratory and nonmigratory, etc. There are programs free on the web that, if you import a pictures of wings, will allow you to compare them allometricaly.

We were talking about something as we wandered back and just as we came to the station I looked up and saw a huge snake in the road! The road cuts through a low rise in front and to the right of the station so we were blocked from view of those above. I grabbed my camera and took two shots while Ximena took lots with hers. I got her net (with the longer handle) and stated after the snake. Now you need to keep in mind, all tropical snakes are suspect (deadly) unless you know them really well, and some can be aggressive. Well this one certainly wasn't, it was kind of poky, but that doesn't mean anything. I started yelling my head off for Luke, and made contact with a


Luke consulting Savage

few other people, but they just kind of dawdled off. It started up the embankment and when its head was sufficiently out from under some acacia limbs, I pounced and it shot full into the net.

Well I started up the hill and Luke came out of the kitchen and shot running down the hill. We met in the parking lot and he surveyed the situation. Not exactly sure what it was, he was sure it wasn't venomous. So with mongoose like skill he got it by the back of the head and headed to the lab to ID it. Turns out it was some sort of racer!

Well that was the best part of the day. Lunch, then back to IDing bugs. I did get an immature membracid leafhopper, very cool looking. Dr. Beth had a B-Day today, so the cook made a special cake. We knew something was up when there wasn't any dessert out.


Membracid immature


Kathleen and Prey

Erik had a cool IP that involved spotlighting birds (a type of whip-poor-will like bird), capturing them, measuring, marking, collecting poo, and finally releasing them. So here is a picture of Kathleen with one of the unfortunate captives.

15 July 2005

Ximena borrowed the camera to take pictures of dragonflies. Just as well. I was in the lab all day. It is rapidly becoming apparent that the results from the experiment at La Selva mean nothing. Oh well. Got some cool bugs, though.

I was in the uphill (air conditioned) computer lab working on pictures for my presentation when Erik came bursting in saying there was a snake (possibly coral) right outside. I grabbed my camera and took a few photos and then ran to get a net while others watched to make sure it didn't get away.

Again, Luke was summoned and the snake was captured. Turns out it was a harmless snail eating (I called it French) snake.

French snake

Chapter 5 (e)

16 July 2005

This morning I spent working on bugs, and my presentation. One of the more interesting looking specimens I collected was an immature owlfly. The adults look somewhat similar to dragonflies, but the immatures are like nothing else. The jaws open to an angle at or greater than 180 degrees, and spring shut in an instant on any prey that wanders by.

Owlfly larva

There was a waterfall at La Selva that people would disappear to when they got some time off, and two trips have gone to a local waterfall here (about an hour drive away, but reportedly very fun). I swim like a rock and would just spend the time looking for bugs anyway, so I haven't been. But today (Boss Lady) Erin arranged for us to go on a tour of the river.

Lubber Grasshopper

Those of us that could go all packed into the car and bumped our way down to the river. Big lubber grasshoppers were on the grass near the river bank. After a few minutes a nice sized boat,

Tour Boat

Group of the Boat

named Acutus after the American Crocodile (*Crocodylus acutus*), came down river and picked us up.

The trip started with a hard decision. Down river we would see more birds, and up river we would see more crocodiles. I dare say I'd seen enough birds on the trip to get me through till Christmas, so I voted crocodiles, and that's the way most of the passengers went, too. So up the river we chugged. The captain was very good at this, and he got us up close to some nice birds, and we nosed into the bank and he got some of the big grasshoppers to show us their colorful wings.

Heron

We chugged down river a little ways and then slowly pulled in against the bank. He said his pet crocodile was here and he'd call her. So he gave a call, and sure enough a few minutes later a big croc came paddling through.

Dragonfly, probably *Erythemis*

I'd let my camera go into sleep mode to conserve power, and when I tried to wake it up to take a picture of the beast, the camera chose that

time to tell me I had low, actually, no power left. So I quick switched out batteries (no little cursing now)

Crocodile

Kari ("On the Catwalk")

and was finally able to get some pictures as it slowly floated away toward the shore.

They probably occasionally toss them a chicken when there aren't any tourists on board and the croc learns to come by when it hears the engine.

Different Heron

9 Bats

We had an enjoyable time enjoying the breeze, and the chocolate milk colored water as we headed up stream. Some large trees

over hang the water and under some were bats. We got very close to a line of striped bats under such a tree. Everyone ran to the back of the boat to get pictures. Ctenosaurs would lounge on branches over the water, too. And where was no end to the birds. The banks were lined with good trees and thick vegetation, but in places you could see that less than 100 yards of riparian area remained, and it was nothing but fields after that. The boat turned up a side channel and the river narrowed, and narrowed. The captain had been here many times, knowing where the bats would be, pointing out flowers, etc. We had one

Ctenosaur

The far bank

Agouti Erin, Emma, and Phil

Second Big Crocodile

more crocodile but it dove while we were still a little ways off.

All in all it was a wonderful way to spend a few hours, I think it cost $10. We were deposited back at the dock. There wasn't enough room in the return vehicles, so some of us walked. I was breaking in a new pair of shoes (for mucking around in) and they started wearing a hole in the back of my foot about half way back. But a truck came and picked us up not too long after, so all was well.

Taking Flight

Green Spider

Just before supper I ventured out again. There is a walkway built a little way into the marsh and I hadn't had time to venture out to it yet. About half way there I saw my first Central American White Tailed Deer. Same species as the one we have here in the states, but smaller.

Yellow Mushroom

Apparently the cougars that eat them are smaller here too!

The marsh really is beautiful. Clear water, covered in a mat of plants. They have two kayaks here, and some people have been out tooling around these last few days. The report is that there are no mosquitos out here. So maybe tomorrow I'll take a tour of the marsh.

White tailed deer

(Short) Boardwalk

Not quite thick enough to walk on.

Chapter 5 (f)

17 July 2005


Road kill owlfly

Our last full day at Palo Verde. This afternoon we're scheduled to give presentations over our Independent Projects. We're given ten minutes. But I made sure I was up last, as mine will go a bit longer. Introduction, procedure, and results won't take too much time, but the big bang at the end will take a while. In the mean time I haven't been to the marsh, and I hear the kayak calling.

The stage: new crushed gravel in a slurry of dull orange clay was deposited from the bank out to meet the new boardwalk. The rock hasn't settled yet or even been properly compressed. It doesn't glide into the water either, the flat area of the walkway plunges at about a 70 degree angle into the water, about one foot of rock above, three feet below. To keep the cows in they put up a rickety barbed wire fence right against the marsh and stretched it to the boardwalk. I slid the kayak under the fence and into the water. It couldn't float far because of all the plants on the water's surface. I snaked my own way through the fence, and, using my toes like talons, held on the rock/clay that kept eroding into the marsh- at an alarming rate. I put my backpack, net, and camera on dry land near the edge. With the kayak squared up against the unstable bank I cautiously stepped one foot in and put a little weight on it. Instantly the kayak shot away about a foot and a half, flipped over, completely filled with water, and sunk.

Damn.

So I pulled myself back onto the bank and started hauling the kayak back up to land. Its full of water, and to snake it under the fence meant pushing the front end down (thus raising the back end out of the water) and sliding it forward. Again remember every time I put my foot down the rock erodes into the marsh, lessening what little area I have on which to work. Erik came over and helped with the tugging. I climbed back across the fence. Kayaks are not built to get water out of. Luckily they engineered a little hole, about the size of a quarter, in the top front. So I hefted the back of the kayak up and drained all the water.

Well, empty and slid back into the water, I gingerly tried my luck again. This time I got all the way into the little plastic tub of death. Wow was it squirrely. So I tootled around just a little bit to get my bearings. A shifting of weight, a slapping of ones arm, a turning of the head was enough to give you a sensation that your entire being was about to be flung to one side and slapped into the water. It's the type of sensation that makes you clench for fear of making a puddle. And this happened about

Forward view

8 times in the first 5 minutes. I finally plucked up enough courage to get my camera.

With my camera in my lap I struck out for opener water. Slowly, mostly because you had to paddle through so much vegetation, I made my way towards a long open patch further out. I must say, I was exceedingly frightened. Two reasons. First, the water is clearly over my head in many places, and a dismount from the skiff of doom would not be graceful, so try as I might, I couldn't envision keeping the camera above water if I were to suddenly slap over on my side.

Looking to Land

Secondly, if I were to flip over, its quite obvious that this little lucky launch will fill to the brim and there's no bailing it out. So, try as I might, I couldn't envision any practical way of getting back to shore with the half drowned boat even if the camera was safe and sound. I really don't take that many risks, but when I do I like to have an easy exit strategy, preferably one that doesn't require dog paddling through a weed choked swamp tugging a kayak along the way.

Oh, there are also crocodiles in the marsh.

Well needless to say, if one looks past the crippling fear of flipping over and the

ridged tension all my muscles were under, alert to spring into action at the slightest hint of loss of balance, it was a pleasant and enjoyable experience. I spent about thirty minutes out tooling around and by the end was pretty good at it. It was beautiful, no mosquitos, pretty birds flying all over the place, the water was cool and clear. Given a few more days I probably would have become much more at ease and certainly would have struck out for the river.


Tall croc's eye view.

I'm squeezed in pretty tight and my lower half is tingling. Time to head back. I took a different way back and the weeds were so think I was basically dragging myself forward with the paddle. Disembarking was no picnic. I secured the camera on shore, then tipped over towards bank, clutched the loose gravel, fingers wide, and pulled/hauled/drug myself out of the kayak and onto the little spit of land available.

I got everything squared away and then headed to my next horror. There is an old iron observation tower half way back to the station. Its been there so long a tree a foot and a half thick has grown up the middle. The ladder is made of rebar and secured only at the top. I don't like heights. Scare the crap out of me. But others have been to the

top, and even if they hadn't there was no reason I shouldn't go up and have a look around. If you let irrational fears hold you back some rational ones might creep in, and then where would you be.


Lookout Tower

So I started up. It was now that a tour group come by. The leader was showing the tower, and the trees, but no one would be climbing it, there was a solid foot of mud all around the tower courtesy of the cattle. I started up slowly. My sneakers were slick with mud and I held on as tight as I could as I climbed, one step, then the other. Remember its just rebar, not much to hold on to. Slowly I worked my way up, came to the top and, with my backpack on, just barely fit between the ladder and the railing. I had made it to the top.

Looking up and looking down are two different things. Consider that when you look up your eyes are about (in my case) 6 feet above the ground. And you look at the base of the platform. So when you're on top, looking down with your eyes 6 feet above the base of the platform your brain things you're about 12 feet higher than you should be. Here my brain told me I was about 20 or 30 feet higher that I should be and I stayed low so as to not be flung from the heights by a small gust of wind, which I was sure could happen any minute. The view was wonderful, the marsh stretched nearly to the horizon with birds dancing around,

Palo Verde Marsh. Stretches to the river which borders the mountains. See the pale spot near the center against the mountains, it's a huge abandoned resort.

dragonflies shooting hither and thither, and a large group of tourists extolling the differences between the palo verde tree in California and this one here. I took some pictures, looked around, wondrous sights, etc. but now I have to get down.

Luckily the tourists went away. I dropped my net, no need to carry that down, but kept my backpack, impact would have buried it in mud. Now if you look at that tower carefully you'll notice a very small space between the ladder and the side on the right. So to get down you can't scoot out, secure a foot hold and then swing out and start down (if you're my size). You have to start standing. Well, crouched really, because of the railing, which further reduces mobility upon ejection. I rejected this notion for about 10 full minutes. Considered it, then rejected it again. Finally, very

carefully (and I don't really remember how) I extracted myself from the tower (it was a tight fit with me and the backpack) and started down. Again, I think it's the lack of an exit strategy that causes so much worry- if I fall I will be crushed and broken and options to stop this from happening will be somewhat limited on the trip down.

But I made it back, safe and alive. I put some finishing touches on my presentation and it was time for lunch.

People gave very good presentations. Agouti Erin was in charge of introducing speakers and keeping people on time. Finally mine: at Las Cruces I didn't see any difference among the number of insects caught by my trap design and the old trap design (this is what I was looking for), but my experiment at La Selva showed no difference between the baited and unbaited traps. Oh well. Agouti Erin signaled that I had two minutes left and I said that's nice but I wasn't going to be paying her any attention.


Megan's elephant ride

To explain my results I said I was going to make a model, we had a few ecological models presented to us on the course and lets just say some were... I'm trying to think of a nice way to put it, pitiful, shortsighted, an example of something that leaves you stupider than you were before you heard it. Any one of those. Anyway, I went through all my photos (more than 3000 at this point) and pulled out the cute and embarrassing ones of people, even made a few fake ones, and based my model on these. For each picture I had a good line and included pictures of people sleeping, looking

funny, a photo of Emma's bikini bottoms on the line with Pablo's name written on the tag, Luke looking stoned (his version of a smile), Nate laid out like a playboy playmate on the mountain of death (luckily fully clothed), Emma threatening to eat a caterpillar, Ximena pretending to eat a mushroom, even Megan riding an elephant. I got some good laughs. It's a good thing I'm such a nice likeable guy or they would have probably killed me.

Good day, and it ended even better. The cook set up the barbeque and made pork chops and chicken breasts. Emma got me the Tropical Te Frios I had ordered (ice tea you can damn near chew- the sugar's so thick) so I ate to my hearts content. Back to the mosquito net for the last time. Good thing too, the smell in our room could knock you over. Five guys sweating all day long and someone who shall remain nameless (Nate) hasn't sent his laundry off to be washed since La Selva. To be fair the girl's room next door smells pretty bad too, but they won't admit it.

An Artist!

Chapter 6
Mangroves

...oh the lovely mud, it hath not its like for delightfulness in all the world!
-Mark Twain

18 July 2005


Kari on the bus: One Long Lady

We packed the bus full. Today we are headed to Monte Verde, by way of the mangroves. Goodby mosquitos, goodby mosquito net, goodby marsh and *Ctenosaurs*, we are away. Some of us made the most of the time to relax and enjoy the air conditioning.

One of the foremost researchers on mangrove ecology was to lead our tour. (Sorry, forgot his name). We bumped our way out of Palo Verde, onto the Pan-American Highway, drove a bit, and then bumped our way back onto ever decreasing sized roads until we were on a one lane dirt road slightly narrower than the bus. We changed into our rubber boots and met our tour guide.


The coast

He lead the way across a cow pasture covered in some sort of grass that sent out runners up to 10 feet long, which were nearly unbreakable. So tripping and cursing in

Group and the Bus

Mangroves are basically shallow saltwater flats. The high salt content (which decreases the further you go inland) pushes out most plants. Well, that's an understatement. Basically, once we entered the forest we saw three species of plants, and one was an orchid. The tree species called mangroves aren't related either, they come from different plant families.

the bright sun we headed to the sanctity of the shade.


Through the pasture


Mangroves

This first patch of mangroves was odd, to say the least. The ground was a few inches of mud, covered with a few inches of water. The adult trees sent up soft 4-5 inch high roots which bend when you walk of them. This

gives an added bonus of them springing back up and flipping muddy water on you, which is not nearly as fun as it sounds if you're wearing shorts.


Crab

Mangroves don't have seeds. Instead they are considered to be viviparus (just like humans and not like penguins), which means they "give birth" to live young. The seed sprouts while still attached to the parent, grows some leaves, and then drops off. The whole thing is long and pointy, so when it falls it literally plants itself!

The trees almost never die. Disease and age don't get them, lightning does. The trees have widely interconnected roots and are sitting in saltwater. Lightening will hit an adult tree, kill it and all the adult trees around it in a circle. The young ones, which may have been waiting 20 years with only three leaves, will rapidly grow to fill the gap. There was also a lot of cutting of mangroves for the cattle industry because they are high in tannin, but this has been stopped.


Nate

We slogged on through sameness (literally the Sahara desert has more plant species than this forest) with little crabs scuttling out of the way. You can tell by the look on his face that Nate, who works on forest dynamics, was loving this :)

We were warned that the change from one species to another would be abrupt, and that it was. We stumbled along through our straight treed, carpet of small roots


Standing Tall

forest and then we came to the elevated trees. Literally in the space of 20 feet the forest changed from 100% species A to 100% species B. Amazing.

These were great trees on beautifully arching stilts which pulled the tree from the ground and pushed it up into the sky. The water was deeper here, 2-3 feet in places. Some climbing was in order. So we set to and, with our fearless leaders in the lead, we entered the tall trees. I had my back pack on, an insect net, and rubber boots, not the best equipment for such a hike. Slowly we climbed up and over, out, under and through the maze of roots.

Finally when we had gone maybe 100 yards in about 40 minutes our leaders called a stop and we ate lunch and talked about the forest. Mangroves are (or aren't, depending on where you are) land builders. They slow erosion, capture sediment, and are credited with generally making lots of land on the coasts


The coolest jungle gym in the world!

Orchids

of islands and continents. Also they are the nursery grounds for many species of fish. The water's not too deep and there is plenty of cover to protect you from predators. Many fisheries managers have realized that conservation of mangroves is a very good thing.

Snail

We finished our lunch and toddled back toward the bus, for once I wasn't last. Megan didn't take to this environment too well, and Ximena was cripple (had pulled something in her leg). So we made the slow march back. I spied a dragonfly on a limb, and Kari found a scorpion in a cracked open coconut-like shell.

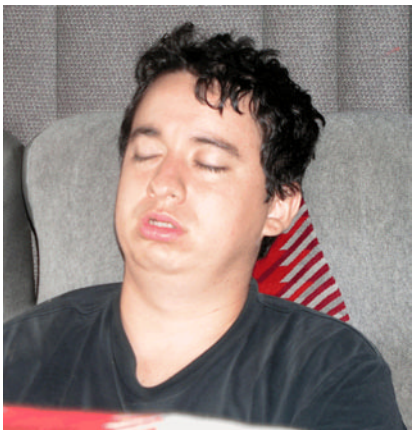
After Lunch

Back through the pasture, grass damn near tripped me again. Someone was nice enough to bring me some clean pants and my boots and I changed into these on the designated Changing Side of the bus. Which didn't make any sense at all, as anyone was allowed to change, there are

windows all around, and this was the side the door was on (with people going in and out).


Quite Dragon

Back onto the bus and back into the mountains. Its interesting when you're in a closed environment like a car or bus, you see some of the environmental change that occurs around you as you travel, such as the scenery, and maybe the pressure if you're headed up or down in elevation, but you miss other changes like noise, temperature, and humidity. Once I visited the White Sands National Monument in New Mexico, and with the AC on full blast had a hard time convincing myself it wasn't snow. Until I got out, that is. So I can't tell you when we emerged from the hot humid air of the coast to the cool humid air of the mountains.


Sleeping Beauty

Some us caught up on sleep. The road was not much better than gravel, with huge potholes, narrow, and slow going. Tour buses were thick, and we followed quite a few through the mountains. The locals have lobbied for years to not allow road improvement. If it takes a day to get to Monte Verde, you have to spend the night at


Pacific Forest

Monte Verde. If it takes two hours to get to Monte Verde, you can leave your costal resort on a shuttle and be back by the beach for supper.


Sloth

Just as in Cuerici, Atlantic and Pacific slope forests are very different. Pictured is the largest contiguous patch of primary Pacific forest left in the Monte Verde region. We finally made it to the station. Not all the way there actually, the bus could only get us to within a half mile, so we had to hike in from there. Uphill, of course. There was a sloth in the tree at the bottom of the hill. Kia had a very beautiful butterfly land on her half way up.


Blue Butterfly

The station we're staying at is one large building, with sleeping rooms in the back, a kitchen and dining hall in the front, very large, nice labs upstairs, and a third floor office of the owner. We moved our stuff into the laboratory, set up the computers. I checked out the library, very well stocked, and Pablo showed me a cute board game aimed at teaching kids about biodiversity. The eating arrangements were wonderful and best of all it was 65 degrees and no mosquitos- there weren't even screens over the windows!

Dipterozzzum

The lab

But the best part of all...

HARRY POTTER!!!!

The newest book (number 6) came out on the 16th of July, and none of us had the opportunity to dress up and stand in line to get it. But Dan, glorious Dan, our newest Faculty person brought two copies! One for Erin (fearless leader) and the other for Pablo. That night at 9 o'clock we retired to room number 3 to listen to the first two chapters of Harry Potter and the Half Blood Prince.

Green Lacewing

Ximena reading to the children.

Chapter 7
(Monte Verde)

19 July 2005

Today is our day to tour the grounds and forest. You enter the forest and cross a metal bridge over a deep creek. We walked as a whole

Bridge

Thick Forest

for a ways, then split, one group went up while the other went down. I was on the down group. Actually, you just went down a little ways, then it was back up, forever. Our guide was a plant guy, so he showed us orchids, cacti, trees, and vines. Occasionally he would point out little plants with thin white stalks what split half way up to make two branches, each with white

Blurry Clear Winged Butterfly

Vine and Stem

bell shaped flowers hanging at intervals. These were small parasitic plants which lacked chlorophyll and stole nutrients from other plants roots.

The forest was wet and cool and alive, and we went up, up, up occasionally stopping to look at seeds or trees or smell piper leaves. Finally we came to the edge of the forest and exited onto an access road cut up the side of the mountain to the radio and television towers at the top. It was red clay, mostly firm, but at an obscene angle up. We trudged onward. I collected some metallic blue tiger beetles and a couple fuzzy white, red, and black female velvet ants (really wingless wasps). Up, up, up. I was bringing up the rear when I wandered into a swarm of very large black bumble bees. I didn't have my net with me, so I waited for one to land and then caught it in my killing jar. Then I ran for a bit, hoping the other bees wouldn't attack.

Big Tree

Flower along the road

I finally made it to the top, the other group

was there too. The view was magnificent, you could see the town miles below. But the other side of the mountain was even better. You looked over a huge valley that was carpeted in unbroken forest, except for the occasional land slide on the far slope. It was breathtaking.

We headed back down the way the other group come up, Cato was our leaver on this voyage. At the top of these mountains there are elfin forests, smaller stunted trees that live on the windswept peaks. We traveled down through secondary elfin (they had cleared a lot for the towers).

Towards Town- note the deforestation in the background.

The other side of the mountain

Spiky leaf

We came across a wickedly spiked plant. A type of tomato, it made thistles look tame. There were even spines sticking up from the middle of the leaf. A membracid tree hopper with three spines, one up, two out, was resting on a limb. Also, two chrysalises were hanging from under the leaves, and a newly emerged butterfly was drying its wings.

Chrysalis

Butterfly drying

We went down, down, down. Some of the parts of the path were so steep that ropes were tied to trees above and hung down the mountain side for

Weevil

Membracid

Forest on the way down

assistance. In other places you had to go under trees that had fallen over the trail. Finally, we emerged at the bottom and had lunch.

After lunch we headed to the Monte Verde Preserve. This was a short drive from the station. Its famous as a place to watch birds, and was founded quite a while back. However, in the 1970s, '80s, and '90 while massive deforestation was taking place in Costa Rica those that were in charge of the preserve were not interested in expanding it. Today there is a nice gift shop, a short loop trail, and a longer set of trails that lead all over the place.

Tourists, after traveling hundreds, or thousands of miles, to one of the most beautiful natural places on Earth, doing what they do best.

Fuzzy Caterpillar

Again we broke into two groups, and I, Luke, Nate, Kari, and Andrew went with Bob Timm for the first part of the tour. He told us the history of the region and how it came to be.

During World War II Americans went off to fight, and Quakers were drug along too. After the second War to End All Wars we started fighting in Korea. Well, some Quakers decided enough was enough and started looking for someplace else to live. Cost Rica disbanded their army in 1948, so a few Quakers came down to scope the place out. They were interested in raising cattle and first traveled to the Las Cruces area. But this was in the rainy season and they didn't know about the rainy and dry seasons so they said, "This place is horrible, lets keep looking." When they visited Monte Verde it was the dry season, wonderful weather for raising cattle, so they founded the town. In retrospect, Las Cruces is better for cattle, but all worked out well in the end.

Different Membracid

Andrew on the Continental Divide

Solitary Bee Nest Holes

The new residents of Monte Verde did quite well. They preserved quite a bit of forest around the town to protect the water sheds, and implemented many sustainable farming practices (remember the dust bowl wasn't too long ago). Cattle give meat, leather, and milk, but the town is know for its cheese. The first cheese in Monte Verde was made using a US government pamphlet on home

cheese production.

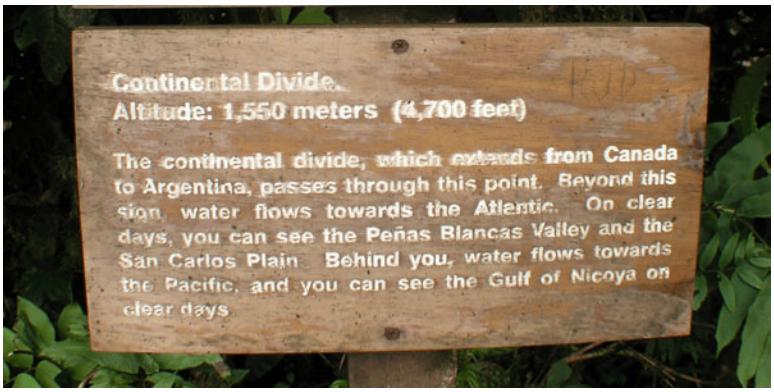
We met 75 year old Wilford, married in 1950, he was on the original Quaker expedition to Costa Rica. He used to be a ranger at the preserve and still walks the trails most everyday. Bob took us to the continental divide. We took a side trail and looked at some holes made by solitary bees that solitarily build holes as a group, and keep using them year after year. Some of the holes are 3 or 4 feet deep and may be used over and over again for 25 or more years. We followed the trail past the place where the recently extinct Golden Toad used to mate in masses during the wet season. I got a picture of two dung beetles rolling a ball of dung.

Wilford (left) Bob Timm (Right)

Parents

Luke where the Golden Toads used to be.

We hiked up and came to the continental divide. To the Atlantic side there is a huge expanse of unbroken forest. Its not part of this preserve, but another called the Children's Eternal Rainforest. In the 1980s and '90s there was a world wide campaign to



Sign at the top

save this area from deforestation. This was when land was on the order of $20 an acre and school children could donate enough to preserve a sizeable chunk of forest. Land is now about $500-1000 an acre.

Children's Eternal Rainforest

The dream team go their picture taken at the top and then we traded off to go back another way with Mark Wainwright. He came to Costa Rica as an artist and became a naturalist. He wrote and illustrated Natural History of Costa Rican Mammals and is working on a CD of Costa Rican frog calls.

Dream Team

This side wasn't the gentle

Observation platform where the preceding picture was taken.

sloped, wide path we walked up but a narrow cut through the forest, zig zagging

Back Down

back and forth, up and down. Mark shared lots with us, we saw a quetzal fly by, and caught and IDed a clear wing butterfly. We were running out of time so the last bit of the hike was more of a jog, but finally made it back to the visitor center. The other group was watching the humming birds at the feeders so we went too. They're pretty tame, but as we were leaving I had to see if I was fast enough to touch one. OH YEAH! The little guy never knew what hit him.

(Soon to be) Frightened Hummingbird

Chapter 7 (b)

20 July 2005

Nate's clothes were so bad he actually rinsed them out before he put them in line to be washed. One of the out buildings has a washing machine and they have a tented area with clothes lines for drying. I got my dirty clothes (basically all I had except for two pair of slacks and one or two shirts) in line early and they were some of the first washed. One of the perks here is that clothes washing is free.

Futility: Luke and Kari watch a stalk of fake flowers which will never be visited by hummingbirds.

We broke into groups last night and talked about the project we would do while here. I'm in Bob's group and here at Monte Verde he wants to do some small mammal trapping. There are a couple mice species that have special beetles that live on them. They burrow around through the hair and run around the nests. Long while back someone dissected one of these beetles and found that it had blood in it, concluding that the beetles were parasitic of the mice. However, in the lab Bob noticed that the mice didn't pay any heed to the beetles, letting them walk right over their noses if they so wished. Plus the incidence of beetles on mice increases with increasing elevation, and mice with more beetles tend to have fewer (or no) fleas. It turns out that rather than parasitizing the mice, these beetles are actually eating the fleas (that parasitize the mice).

So our project, apart from collecting mice to see what's here, will be to collect

these beetles and any fleas from the mice we catch. Bob collected the beetles in alcohol to take back and do genetic research on them.

Mundo de los Insectos

Our plan was very simple, but long on walking (always up). We would start at the bottom of the trail and put a trap every 10m (about 30 feet, or 5 of my paces) for a total of 50 traps up the trail in the primary forest at the bottom of the mountain. Then we would hike up to the secondary forest and continue up the trail for another 50 traps.


Habitats for the Insectos

Most of these mice are active at night, so no need to put the traps out early in the morning. We washed all of them, dried them, and then headed into town about 9am. I visited some gift shops and then the Mundo de Los Insects (world of the insects). It was OK, the kid who led me around knew quite a bit for an amateur but just a tiny bit of formal training would have really sparked the place up. Also the majority of the insects they have came from the wild, some captive breeding would have been better.

Britney Spears

I was running low on cash and tried to get money from an ATM but it wouldn't work. Funny, the card from my other bank always worked in Thailand. Oh well. I got through early and stopped at a local bakery. Brittany Spears was there advertising Pepsi.

We made it back by lunch and readied ourselves for the hike up. I carried a little more than half

Agouti Erin demonstrating the subtle nuances of the Sherman Live Trap. Rebecca, Bob, Ximena, and Lucinda

Laying the traps

the traps and started ahead tossing a trap every 5 paces (I was taught to count paces by starting with the left and every time the right foot comes down you count one, some people count every step).

Each trap was placed, flagged, baited and set. The whole hike bordered on a mile up. That being done we headed down for showers (they have hot water here!!!) and supper.

Clothes got washed!!! I hung them up, hopefully they'll be dry soon.

Tonight, chapters 5 and 6 of Harry Potter!!!!

21 July 2005

Up, a hearty breakfast, and out on the trail. Bob is a slave driver. I'm the beetle wrangler (and get fleas when I can). If the door is still open all is well. However if the trap's door is closed then you *might* have a mouse. We put a little bit of while fluff in each trap to help keep any mice we catch warm in the night, and this obscures any view you have of the beast if its in there. So you have to be careful opening the trap to see if you really did get one.

Peromyscus nudipes eating a seed as we measure it!

Heteromys sp. A pocket mouse with a seed in one of its pockets.

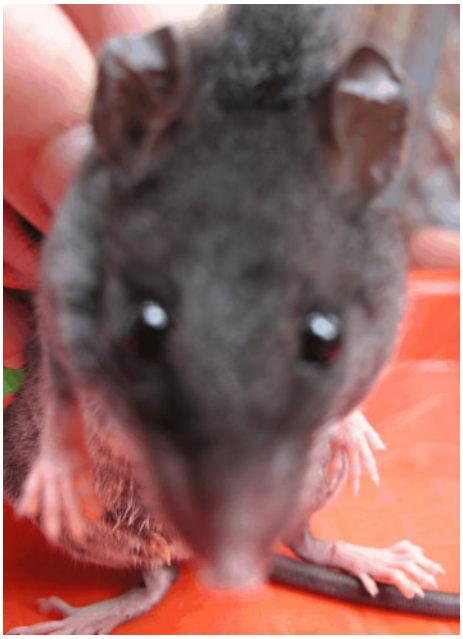
Lucinda and Mouse

Weighing the mouse

Mice are extracted by shaking them into a plastic bag. You let the mouse stick its nose in the corner and then grab it by the scruff of the neck and pull it

Identifying the Beast

out. Species, weight, length, sex, reproductive status, trap number, and for some species the number of beetles or fleas are all recorded for each mouse. Then you



Boo!

Oryzomys albigularis: Its just sleeping.

Fern Frond?

Gandolf

let them go, re-bait, and set the trap and move on.

Today we caught 14 individuals representing 4 species. One had its tail clipped off by the trap door and another got a little too excited and keeled over, probably from

a heat attack. Never fear, Bob prepared the specimen and is taking it back to Kansas with him.

Big Beetle

When we made it back to the station someone (not from my group unfortunately) had brought in a big male Dynastine scarab beetle. They took it back after we had all gotten photos. Alas, not for my collection.

After supper, Mark led a night hike where we listened to frog calls and looked at glow worms. Very informative, the forest is alive with sounds at night, even when its in the mid 50s.

Clothes aren't dry yet, maybe tomorrow.

On the night walk.

Chapter 7 (c)

22 July 2005

Scotinomys teguina - new species for the day

Our last full day at Monte Verde. As the water content of my clothes has not changed over the past few days, I'm beginning to think that perhaps they won't be dry by tomorrow. Oh well. I finally broke down and put on a "clean" shirt although it is a bit musty.

Up early to check traps. We have to check traps, pick them all up, take them apart and clean each one, analyze our data, and make a presentation by three o'clock this afternoon. Hiked forever and a day up the mountain. Yesterday we got 7 mice in the primary forest, 7 in the secondary forest. Today we got 15 mice in the primary forest, 15 in the secondary forest. Crazy.

Almost at the very top Lucinda saw a long brown snake coiled in a bush. I was able to get one picture before it shot away. The head was in shadow but Luke was able to identify it!

Brown Snake

Bob went back after we got half way up, he picked up the lower 50 traps and started cleaning them. Once we hit the top the girls started back down

ahead of me and piled traps while I came along and picked them up. I only got 49! Oh no! Now we ask ourselves, is one lost, or did we only have 49 all along. Agouti Erin went back up (bless her) and checked. Twas not to be found. Apparently we only ran 49 traps in the top half. Oh well.


Fresh Veggies

The presentation went well. Ximena made the first parts in Spanish and the last bit in English. So while everyone translated the Spanish to English for their part of the presentation, I translated the English to Spanish. Some people say I just added "O" to the end of everything, but I think I did pretty well.

My birthday came and went somewhere around here and I got a nice card that everyone signed, and the cooks made a huge cake. It was nice. Way back at Palo Verde Emma started making a pinata out of newspaper and sludge. It was specifically designed to look like an inflated trash bag, and it did just that. Since it was for me, Emma cut out pictures of girls in bikinis and glued them all over it (everyday every newspaper has on its front cover a picture of someone who died in a horrible accident and a picture of a girl in a bikini).


Thank you Emma!

Tonight was a huge party, I gathered my still wet clothes, and packed.

Chapter 8
(Cabo Blanco)

23 July 2005


Monte Verde "Field Station"

Up early. I finally got a picture of the place we are staying. Not a bad design, I certainly liked the hard wood floors. We loaded the truck, strapped our bags to our backs and headed the half mile or more back down hill to the bus. Moving is a pain for me. I have a big backpack that carries what I might need for the day, a sweep net, a couple of tupperware-like containers with alcoholic specimens, and four boxes of pinned specimens. Earlier I would also carry another backpack with my computer in it, but I've thrown caution to the wind and now pack that in my big suitcase which usually is moved in the truck as it's way too heavy to lift.


Lucinda and Emma, Clothes Twins

Finally made it to the bus and we loaded and waited to get our newest faculty advisor. Bob Timm is leaving us here and we're picking up JB (or JD, I forget). One of the land routes to Cabo Blanco from here is reportedly so muddy that the bus may not be able to traverse it, so a convoluted route must be

blazed. Our caravan consists of two vehicles, the bus laden with people, luggage and some equipment, and the white land- roverish vehicle I've gotten some pictures of before which also carries equipment. The route taken by the bus today will involve a ferry. Tickets cannot be purchased in advance, however, tour buses have priority, so as long as we are there before the ferry leaves we're almost certainly guaranteed a place. However, the truck would have to get in line, and almost certainly wouldn't make it across until much later in the day. So it will be going the overland route (shift it into low and hope she can make it through the mud).

Wharf

We go to the ferry early and wandered about a bit. I got a picture of an interesting daycare center and finally wound up in a restaurant on the second floor of a building near the ferry. JB (or JD) was there with Pablo and Dan. I ordered a Coke and Garlic Shrimp (it was nearing lunch time). I don't like Coca-Cola, its horrible. But something about going a week without a carbonated beverage in a tropical country makes me actually want one. Crazy.

"Children's Garden" but is the fence keeping you out, or them in?

A bunch of the gang showed up and ordered stuff. I got my dish and it was wonderful, much better than the packed lunch they gave us (don't get me wrong, though, I ate that too). There was a lady setting with someone else against the seaward wall. She had a little rat dog on a chain. It took a shit under the chair behind her. I know, strong language, but lets face it, a rat dog expelling feces in a restaurant- not pooping, not making bears, not even craping- its takin' a shit.

Nate and Luke making the best of it on the ferry.

Oh its hot. We stood in line, in the sun to wait our turn to get on the ferry. Kari let me duck under her umbrella. You're not allowed to be in the vehicle on the ferry, not a good place if it decides to sink, so they have three decks. The bottom one is open, but shaded, the middle is air conditioned, and the top is open to the world. When all was settled we set off at a bracing 8 miles an hour. I went up to the top in the heat and sun and watched the view. The view doesn't change much at 8 miles an hour.


The other side

We finally made it to the other side, met up with the other vehicle and started on our way. Just before we got there Erin (Jefe) stood up and explained that the main living quarters are a bit further down the trail than the

rest of the station and to fit everyone in three people would have to stay in a room in the first building. I instantly yelled, "Called it!" which, as we all know, is an unbreakable, irrefutable contract of ownership. Luke and Nate we designed as my roomies.

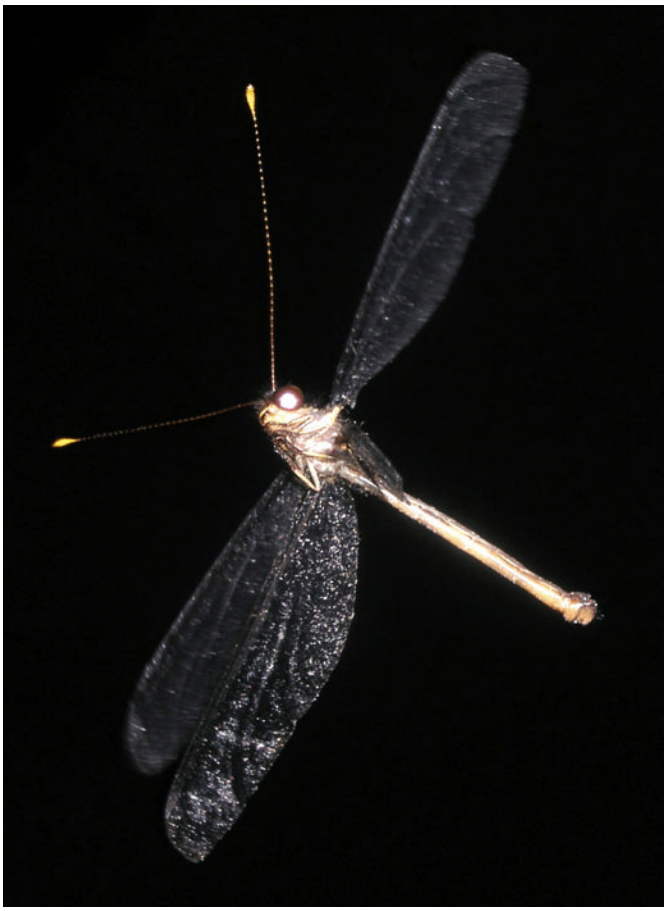
Cabo Blanco is another place that is not accessible by bus, or even car. The bus dropped us with the beach to our left and a gravel road to the right. We loaded up what we could in the truck and walked about a mile. After this the road necks down and is only accessible to four wheelers. The truck stopped here and we headed on to get rid of this load before we came back for another one. I am so glad I yelled "Called it". We (that is Luke, Nate, and I) are staying about 20 feet from the kitchen, 25 feet from the showers, 50 yards from the spot on the beach where you head out to go snorkeling, and the rest of the living quarters are another 300 yards further down the trail!

Action photo of Rebecca

Cabo Blanco Forest - many aerial roots

I dumped my stuff and headed back

to the truck to grab more luggage. One of the guards at the park had a four wheeler and was transporting heavy luggage and equipment. The forest here is similar to Palo Verde, but not so extreme. Sandy soil, low tree diversity with lots of vines, but not many compared to the jungle, and the ground is crawling with crabs, scuttling sideways.



Owlfly: Long clubbed antennae, big golden eye, forewings out of focus due to movement, left hind wing pointing directly at camera.

I loaded up some equipment that needed to be taken to the lab and headed down the trail past where the others were staying. The sun was setting but on my way back I saw something flying in a clearing over the path. Much to my surprise it was an owlfly! These are related to antlions and lacewings and are rather hard to come by, and to see one flying is bordering on amazing. I've read an account of owlflies flying low and fast at dusk in the desert southwest, but this was altogether different. It was a rather large specimen with a wingspan of about 4 inches. It was hovering about 6 to 8 feet above the ground, slowly patrolling what looked to be a territory or lek. Insects that entered the clearing were actively pursued and chased away. A couple of times I actually saw it chase a dragonfly! The really strange thing was, it wasn't flying with all four wings, the hind wings were held down at a dihedral angle and kept still, while all powered flight was done with the forewings. It was nice enough to let me take some pictures, and even

a movie! It was a really amazing sight.

Just as amazing as my owlfly (maybe even more) was what Megan found on the ground. Take a look at it there and see if you can figure it out. It's an adult sphinx moth that either died and was covered in, or was killed by and covered in fungus. Amazing.

The Moth at Cabo Blanco (facing left)

Tonight JB (or JD) gave a wonderful talk on fishes. They lead amazingly complicated lives, with juveniles looking completely different from adults, and many of them will actually change sex over their lives, so the younger ones start out female and turn male later on looking different at each step. It took a while for early ichthyologists to figure it all out.

No mosquito netting here, but there are vampire bats. People used to sleep out side on the porch and would occasionally get feasted on in the night! Made sure the room was extra secure before retiring to bed.

Chapter 8 (b)

24 July 2005


Pablo of the Morning

As with all the places we've visited thus far, today is a day for exploration. But, unlike all the other places we've visited thus far, today we are going to sea! Earlier in this narrative I mentioned the trouble associated with obtaining certain items necessary for the trip and today one will make its appearance. I purchased my camera (popular model of a well known brand) not more than two years ago, which of course means that the waterproof housing made specifically for it is not only no longer made, but cannot be purchased, excepting the last one in the known world, available from Australia. I was lucky enough to get it delivered just before I left.


Group getting ready for the first swim

So, after hundreds of miles and nearly two months of lugging it around, I pulled the 10 inch by 10 inch, four pound cardboard cube from my suitcase and wrapped my camera in crystal clear plexiglass joy. My first test picture was of Pablo, not quite awake. After breakfast JB (not JD) broke us into three groups, great snorkelers, good snorkelers, and shark bait. I put myself into the great snorkelers category which raised some eyebrows, but let me tell you, if there's an activity that takes less effort than sitting, I'm good at it.

The tide is about 3 feet, so at high tide there is a narrow spit of sand at best, but mostly the surf reaches the shore. However, at low tide the beach increases enormously, natural barriers block the surf, and a giant tide pool opens in front of the station. Generally there is about two hours when the water is low enough that you can swim in the pool.


Milton getting ready. Low tide.

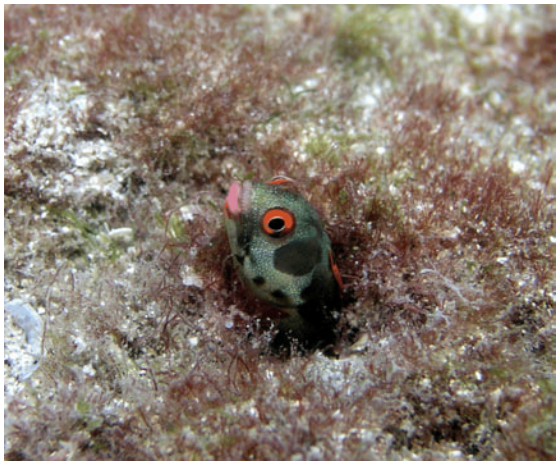

Grunts

The great snorkelers left with JB and headed out to the barriers. He showed us encrusting coral so we would look out and not damage it, and we toured the two inflow/outflow areas so we could be familiar with where they were. Then we switched with another group and headed to the shallows. I was taking as many pictures as I could. The camera was holding up wonderfully, but I got some fog over the lense. I had put only one desiccant bag in the housing, and as the camera was hot from being on, and the water was cool, condensation was occurring. Still, I got some good shots.

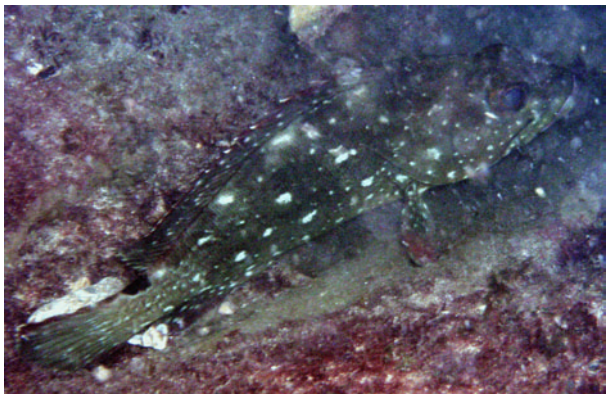
Looking back past Andrew

Encrusting Coral

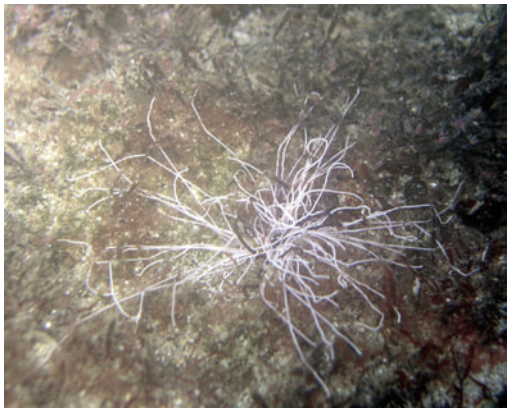
Grey Bar Grunt



Hancock's Blenne



Flag Cabrilla



Spaghetti Worm

In the shallows we met Milton. He told us some stuff about something which was generally annoying as it had little to do with snorkeling and could have been said earlier or later on land.

Ximena was in my group and all of a sudden she said, "There's a sea turtle!" (insert a Peruvian accent). Milton wasn't sure, but advised her not to chase it, as it could out swim her. They both left to look for it, and we pooped around until it was time to get out. Turns out it was a turtle and Ximena got right over it before it took off!

Out of the water, but still low tide, we met with Diana, Milton's wife. She showed us around some of the smaller tide pools. I saw sipunculids, peanut worms, for the first time. That's a new phylum for me! We collected brittle stars and dropped them to see the different methods they use to fall. Some actively swim down, others bunch up and cannonball down, while others put their legs straight up and fall like a missile.

Small Tide Pools

Dropping Brittle Stars

The other group (dots: background, center)

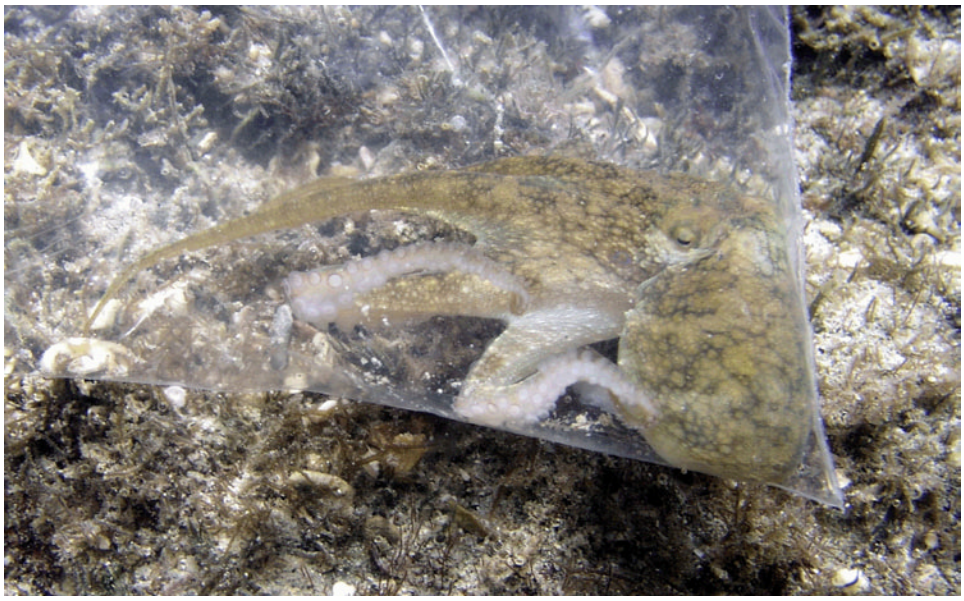
We collected what we could and took it up to tubs by the station so we could look at all the different things we caught.

Peanut Worm

Crab

Sea Slug

Green Spotted Puffer



Our first Octopus!! Just a little one we caught in a bag.

Finally we all went back to the station for lunch and got ready for our introduction to the forests of Cabo Blanco.

Luke all tuckered out.

Chapter 8 (c)

24 July 2005 (cont.)

After a hearty lunch Erin (Jefe) lead a walk into the forest. In her younger days she did research on seed dispersal by land crabs here at Cabo Blanco. Jefferson (pronounced Yefferson), a child of one of the cook's came by and threatened us with a squirt. Luke had donated the gun to a worthy cause, although Yefferson's Mother didn't think so.

Erin by a giant tree

Yefferson: Bantio

We headed up into the forest. This forest is wetter than the forest at Palo Verde, and almost gets as much rain as La Selva each year, but the distribution of rain defines the plant life. Here, there's quite a long dry period. Up, up, up we hiked, forever and a day. I'm a bit agitated, with all the hiking we've done I don't think I'm a damn bit better

Stream at the top of our climb

off than I was before I started. Then again, one of the nice things about this place is that they have a cooler full of soda and all you have to do is put a check by your name when you get one. So I guess it's a two way street. I like to say that my body is immensely strong at resisting change!

As I said, Erin did research here, she was looking at the plant assemblages and how they change as one moves inland. One of the biggest changes you get are the density and size of land crabs, with bigger ones further inland. These are omnivore/scavengers and scuttle around looking for stuff to eat, especially seeds which they take back with them to their burrows.

Blue Shrimp

Finally we came to the end of our walk where a beautiful clear stream crossed the path. We caught a metallic blue freshwater shrimp. Also a very unusual root, shaped like a gecko foot, was sticking out over the water.

We made our way back down and then headed down the beach side path past the cabins and laboratory and met with Diana. On the way

Gecko Foot Root

Palm base close up

Hanging in there

I saw a huge palm that had been beaten and rotted away at the base more than half way through, but still going strong. Palms are technically not trees, even though they grow as tall as them. This is an example of the enormous differences in anatomy between palms and deciduous and coniferous trees.

Diana had cut huge palm fronds for us to sit on. We talked about the tropics. One reoccurring question you run into is "why are there so many species in the tropics?" But this is a bit biased, as the European explorers who first asked this question 150 years ago all came from countries with exceedingly depauperate floras and faunas. If a Mayan explorer had landed in Europe he would ask "Why are there so few species out

Palm Flower

side of the tropics?" Which makes a bit more sense. We talked about some of the differences between this forest and others we had seen around Costa Rica.

After our round table with Diana Luke, Nate, and I had a spear throwing contest. We concluded that the tribe would quickly die of hunger if we were the chief hunters, no lingering starvation. Then we headed down to the end of the trail where it runs into the beach. Beautiful sight, pounding waves, etc. Nate did a wonderful impression of a Greek Emperor.

We made our way back to the station and I secured a hammock. Hammocks, and snorkeling, two of the greatest pleasures known. I took pictures in a semicircle from beach to beach to show the station. Then supper.

Emperor Nate

When the tide is out there is a vast beach that runs skirts the shore and you can easily walk to the peninsula.

We don't have any research projects here. We have to write papers for each of our independent projects, one of the Faculty Field Problems, and (as a group) the group project. We've been doing that throughout the trip, but now is the time to finish up.

Additionally all of the papers need to be converted to .pdf format, proofed, and placed on the main computer before we leave. Those that are done can goof off, those that have work to do are also goofing off, but will have to cram in the end.

I would love to report that my damp, now molding clothing has been put through the wash and dried, but the washing machine has broken. Maybe tomorrow.

The Harry Potter Club dissolved. Pablo finished the book yesterday and as he's my roommate I've been reading in secret every chance I get. If the girls find out they'll kill me!

The Cabo Blanco Field Station. Left to Right: Living quarters for the full time researchers, bathrooms, the main house with more living quarters and kitchen, a little over from that and behind trees is the laundry room, and to the extreme right is the trail to the other cabins. Behind is the beach.

Chapter 8 (d)

25 July 2005

Rolled out of bed and picked up where I left off in Harry Potter. I got in a few paragraphs read, hiding behind the partially open door, before breakfast. Washer and Dryer still not working but luckily most of my time will be in the ocean, so no worries. An early tide today, so it was off to the beach about 9am. This is a day for snorkeling. Following are some of the sites (sorry, no sounds) of the sea.

Cortez Damselfish

Traffic

Juvenile Cortez Damselfish

Cortez Rainbow Wrasse

Ex-Mollusk

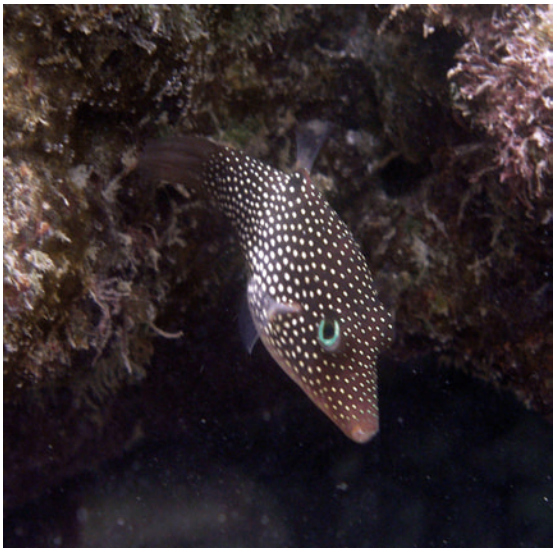
Panamic Fanged Blenny

Glossy Blenny

Red Tipped Dorid

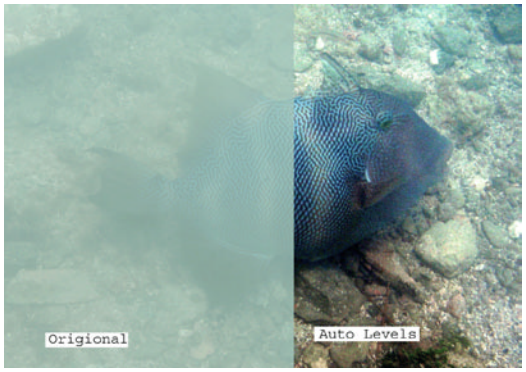
Jewel Moray Eel

Yellow-finned Snapper and Big-eyed Jack



Spotted Sharp-nosed Pufferfish

Blunthead Triggerfish



Before and after Auto Levels

Of course the above images have been run though Photoshop (specifically the Auto Levels function) to clear away some of the interference of the water.

As much as I didn't want to, I finally hauled myself out of the water and went for lunch. We do have one assignment as a group while we are here. It is a mock land development proposal to a mock counsel. Mock land is available for mock "development", so three teams are created to propose their own idea of how to use the land- cattle farming, eco-tourism, and logging. There is also a mock counsel of a local farmer, conservationist, etc. that will hear the arguments and decide which mock group to allow to mock develop the mock land.

I was on the eco-tourism team, so I drew a wonderful artists rendition of how the headquarters would look.

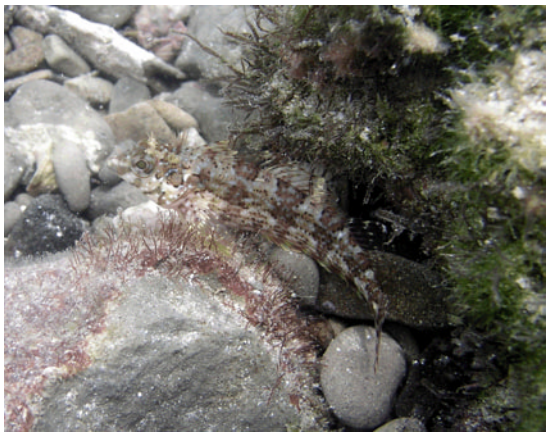
Headquarters

No clean dry clothes in sight, so I microwaved my shirt. One minute on high, then another minute. Warm and toasty! I decided to try this on a pair of boxers (for two minutes) and succeed in burning/meting holes in them. Live and learn.

Chapter 8 (e)

26 July 2005

Tide leaves about 11am today, so time to finish Harry Potter. Last night Lucinda found out I had been reading on the side and got very upset with me. Hell hath no furry like a short vegan woman scorned. So I begged Erin (Jefe) for her copy. Have I mentioned how much I like hammocks? Spectacular innovations in leisure technology. Now able to read in public, I secured a hammock and dug in. I was about two hours from finishing when the sea beckoned.



Glossy Blenny

Pale Nosed Moray Eel

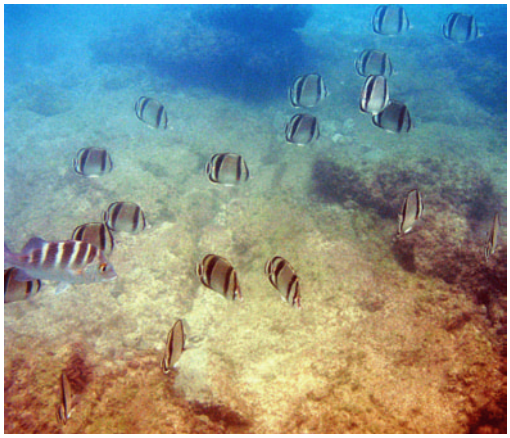
Fantail Pipefish

Aquatic Kari

Spotted Sharp-nosed Puffer Fish

Barnacle Bill Blenny

We got near the back wall and JB motioned us over and said, "I've got something to show you, I'll take you in one at a time." Tucked back under a ledge about two feet down was a little Fantail Pipefish. Only about 6 inches long. Chip held a flashlight while I lined up the shot. A little blurry, but you still get a sense of the beast. The Barnacle Bill Blenny had never been seen here by JB before. I got a few pictures of the beast, which put JB on the hunt.



Banded Butterfly Fish

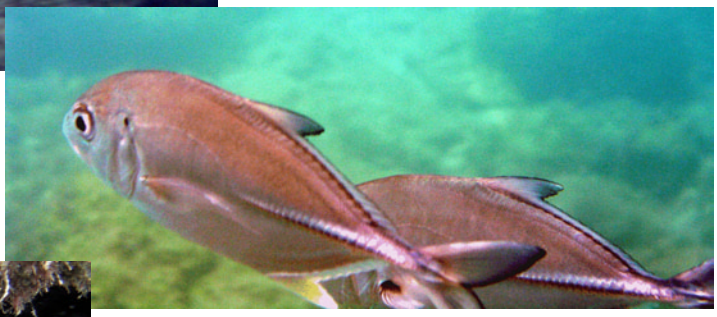
Tridachiella diomede

Mohara Grunts

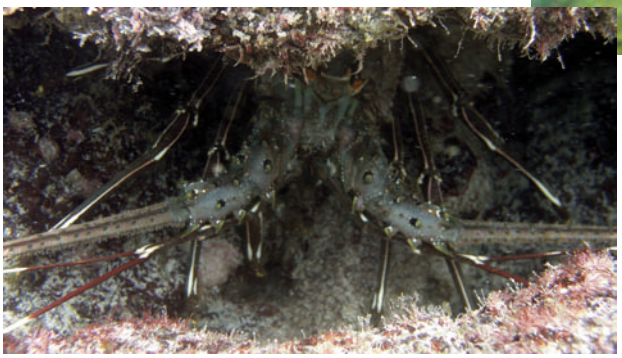
Barnacle Bill and Hancock Blenny

Cortez Rainbow Wrasse

Mexican Hogfish



Big-eyed Jacks



Spiny Lobster

Chapter 8 (f)

27 July 2005

Last night we had a great talk from Dan. Its been very well shown that birds that live in the tropics year round have smaller clutch sizes than migratory birds that raise young in the temperate zones. The question is, why? You would think that a bird which lives in a area with more or less constant resources, climate, territory, etc. would be more comfortable with raising more chicks. Well, Dan has worked on this with swallows over the past many years and the majority of his talk was a review of the other work that had been done concerning this question. Very little in science is accomplished with one study or in one paper, because, at the very least, you need someone else to verify what you found with an independent study, at the very most, some things are very complicated and can only be figured out after copious amounts of work in all sorts of directions. Dan went through study after study, each ask a question, such as "Is there more predation of chicks in the temperate zone?" and gave an answer "Yes", then offered a conclusion: "Temperate migrants produce more young because there is more predation in temperate areas". Each study asked a question, got an answer, and gave a conclusion as to why temperate migrants have larger clutch sizes than stay at home tropical birds. But no study was definitive, some complimented, while others contradicted. This is the nature of some types of science, all the studies were good, and all were correct, but all gave only an ingredient in the recipe.

Land crab on a tree trunk at night.

Today was a good long day. The tide wouldn't be out till about 1:30, so Erin (Jefe) and a long time caretaker decided to take the willing on a walk to the primary forest. The forest around the camp is secondary, having been cut 80(?) years ago.

Morning Beach Walk

However, there were still a few patches of primary forest on the interior of the preserve. We took the trail along the beach until we came to the southeastern beach which we walked until we came to a trail back into the forest and up, up, up the mountain. We were more than a mile as the crow flies and over 800 feet higher when we came to the end of the trail.

Group at the Blue Pipe

The forest was thick with lots of hanging vines and aerial roots (not to mention true roots) hanging and winding over the ground. Cabo Blanco is an "absolute preserve". For more than 20 years it was closed to everyone but a few guards. No one, not even researchers, were allowed in. Even today, a limited number of public are allowed in the public side and heavily regulated. We were only allowed in the research side because Erin is good friends with the people who run the joint, but we were not allowed to do any experiments, collect anything, cut a blade of grass, etc. This is why I was so bewildered/angered by the blue pipe we had to step over a quarter the way up

the trail. What is this? Oh, it's a pipe to channel water from a stream in the preserve to the village nearby. ABSOLUTE PRESERVE! ABSOLUTE PRESERVE! I really wanted to shout like a child discovering a cheater in the middle of a board game. Oh yes, absolute preserve, can't collect a dead fly, but can de-water an entire stream which has major implications for the entire system, aquatic and terrestrial, at and below the pipe. Oh well.


Natural Boggy Clearing

We came to a natural boggy clearing with a nice stream running into it. We had been promised turtles (there are few species in Costa Rica, and Ximena is a turtle biologist so any sightings are appreciated) and we were not disappointed! The guard was friends with the people who started the forest preserves in Costa Rica and saved Cabo Blanco so while we stopped to look at the turtles he told us their story.


Ximena with Turtle

It was a husband and wife team from Europe. They were looking for a place to live and the wife had a dream that they would end up in a place that was a narrow place of land between two bodies of water. The original place they purchased in Costa Rica wasn't right, too many mosquitos, etc, but finally they settled near Cabo Blanco. The area was nearly all forest, but after a couple of years people began clearing the land at an amazing rate. The couple decided to do what they could and started a huge effort which

resulted in the first National Parks in Costa Rica. The husband was later murdered by a guide while he was evaluating land that a gas company wanted to develop. Luckily the government was smart enough to realize that if the land was worth killing over it was worth protecting. The wife died fairly young, too. Rumor has it she began to follow the monkeys and only ate what they ate.

Twisty Vine

Primary Forest as seen from across the valley

We hiked deeper into the forest, crested a hill and started down the other side, only to find that a tree had fallen (longways) over the trail which led up the next slope and into the primary forest. So I got to see it, across the way, but not walk in it. Oh well, so is life.

We encountered a bee nest on the way back and I received my only sting of the trip. Not bad at all. We reemerged onto the beach at a lower tide, and headed back to camp, the ocean calls...

Chip contemplating the newly dehiscent beach

Chapter 8 (g)

27 July 2005

> What a unique device, the human tush. An architectural wonder, one of a kind...actually two of a kind. Designed to support our weight for a lifetime of sitting it also has the subtlety to do the samba. And when attached to certain members of the female species at a time when light summer dresses are worn can cause some of us to drive our cars straight up a lamppost. - Hawkeye Pierce, M*A*S*H

It was an eventful day under the waves. I set out for the barrier at the back of the pool. At low tide its about three feet above the water, with pounding waves on the ocean side, and calm shallow waters inland. I spied a freckled porcupine fish and another mystery borer. I was careful getting out of the water and slowly worked my way up onto the rocks. Not only are the rocks sharp, but there is always a remote possibility that one might step on a scorpionfish, which are very well camouflaged.

Mystery Beast

Freckled porcupinefish

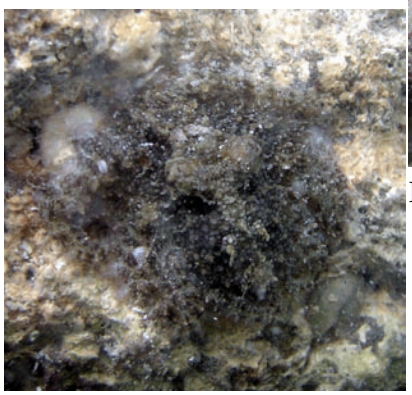
The seaward side

The calm tide pool

Back in the water I was fortunate enough to come across a spinster wrasse, pale-nosed moray eel, porcupinefish, and another little octopus! I ran into Ximena, Kari, and Barbara


Spinster wrasse


Pale-nosed Moray Eel


Octopus in a circle

who needed a submarine photograph taken. Then Ximena said "I haven't see an eel yet, find one for me." Ask and yea shall receive, so we went to the shallows and found one! I acted like I knew what I was doing, but it was really pure luck.


Ladies of the Lake


To catch a turtle...

But this is where the story turns crazy. Ximena is a sea turtle biologist and has seen one every day we've been here. I have yet to see a sea turtle, so I said, "Show me a sea turtle." Ximena stood up out of the water, raised her hands, palms outward, to her temples and began to rotate like a radar scanner. Kari took it upon herself to censure my documentation of this extraordinary turtle sensing procedure. But low and behold Ximena says, "There one is! (insert Peruvian accent)" and jumps in swimming like crazy to the center

of the pool. So I follow along as fast and hard as I can, the water is about 15 feet deep, deep blue, and murky. I think I might be making out something in front of and below me, just a hint maybe, when out of nowhere Ximena dives down, grabs this 100 pound turtle and hauls it up to the surface! I snapped pictures as fast as the camera would allow and then she let it go. Amazing!! Better than crocodile hunter!


Hawksbill Sea Turtle!!!


Too good to put down!

Well after that kind of craziness it was time to go in. We all got lined up for the final group picture. Arietta brought the Harry Potter book with her and got caught reading it! Another great day on the beach. Tomorrow is our last, then back to San Jose.


The whole group!

Chapter 8(h)

28 July 2005

One Quarter Collection

Our last day at the beach. I photographed some of my specimens to show off what a great hunter-collector I am, but this is nothing compared to the bounty of miniscule beasts safely wrapped in alcohol I collected earlier.

Also our last chance to go snorkeling. I've been out every day so far! Very proud of that.

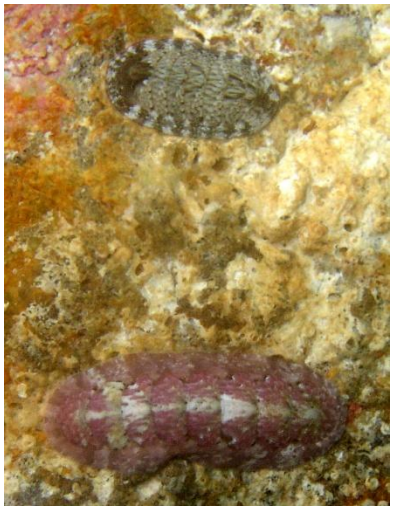
Bumphead Parrotfish

Before I got to go out, thought, we had a mock meeting where different "interest groups" pitched their ideas about what to do with hypothetical "land" to a panel of "impartial judges". I openly bribed all the judges with cookies before the hearings. Basically we were given the characteristics of a parcel of land in Costa Rica and three groups were to pitch their ideas about what to do with it. One group was to promote ecotourism, another cattle raising, and a third some sort of hippy living off the land thing, I forget. Sadly, the group who wanted to run cattle on the land won.

Mantis shrimp?

Tailspot Cardinalfish

So just to recap, a bunch of tree huggers got together in Costa Rica, played a hypothetical game about what would be best for some hypothetical land, and hypothetically concluded that conservation was a crock and the answer is MORE CATTLE! Gotta love it!



Chitins

Out in the water, I saw my first chitins of the trip, lots of fish, and a couple more eels.

Stary Moray

See the Crab?

I swam up to a group by the shore, and turned around for one last go around. When I did I picked up three juvenile Golden Jacks. Not more than a few inches long, these little guys had apparently been swimming with some of the others, and finding them missing, adopted me. They stayed about 6 inches to a foot in front of me and could keep up, or pass me no matter how fast I swam! I was able to snap one of my favorite photos of the trip.

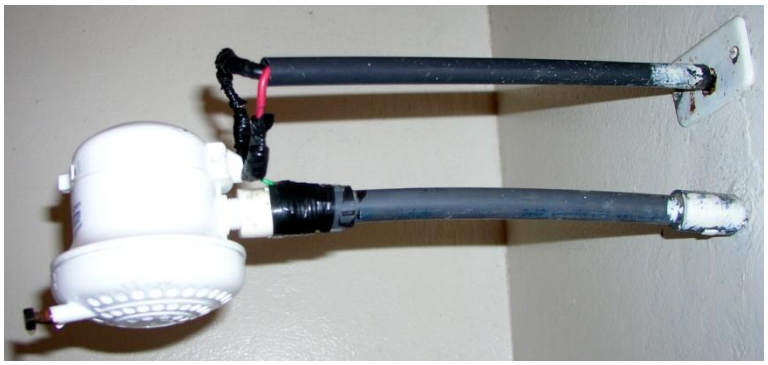
My Buddies

Just to make the experience extra special, a band of monkeys came down to the beach a played for a while as everyone was packing up to leave.

Monkey on the beach!

Chapter 9

29 July 2005



Showerhead of Doom

Packed packages and lugged luggage yonder down the road's path to the caravan bus. Back on the bus, across the ferry and back to the big city. We got our old room again at the Hotel Cacts. I neglected to tell you a tale of heroism and dread when first I stayed in this room, but I shall recant it now. Search the page for the picture of the shower head. You'll notice that there appears to be a lower pipe for delivering water, and an upper pipe for delivering electrons at 60 cycles per second. I've encountered similar devices before when traveling afar, but none quite like this one.

In Principle: The water comes through the pipe and enters the shower head at a brisk -20 degrees Fahrenheit and, ideally, is heated to an appropriate temperature just inches before it is ejected onto the naked body. You remain safe and comfortable.

In Fact: The water comes through the pipe and enters the shower head at a brisk -20 degrees Fahrenheit and is totally ignorant of any device installed to warm it. The patron is now naked, cold, wet, and curious. There are two knobs on the device, perhaps one must be molested in just the right manner to produce the warming effect. The first knob doesn't do anything, but the second knob delivers a violent burst of electricity to the now, naked, cold, wet, and damn scared lone shower inhabitant.

30 July 2005

Those of us that are headed on to Panama have the day off. The others are headed home. Luke, Nate, and I decided to venture to

Noble Workers

the (loosely translated) Natural History Museum. Along the way, we passed not very happy statues and rainbow eucalyptus trees in a park. We finally made it to the museum, paid and entered. A big *T. rex* skeleton begged to be photographed, and I was immediately set upon by an employee and told pictures were NOT allowed!

***T. rex* and others**

Most of the museum consisted of dioramas of the 50s style. And these looked like

they were from the 50s. The snakes had lost their color, and many had been spray painted, along with whatever they were affixed to. A cassowary had a whole plastic banana in its open beak, and an eagle was forever carrying off a very surprised sloth. Every so often there was a double headed calf, or

Two head are better than one

two pigs with a single head added to the displays. Some wilted dolphins populated an enchanted underwater scene.

There was a very impressive display of sea shells, and butterflies in one room. It was mostly *Morpho* butterflies, the metallic blue ones, but there are many species.

The Polite Squirrel

Later that night it was our turn to leave the hotel. We're headed to Panama. We were greeted by a motorcade of red taxies. I got in the last one in line, which was apparently not the right company, so had to leave (after paying the guy a couple hundred colones) and get in the last cab that was of the right company.

We were last in line, and there was really no reason to not be last in line, but it was very important for our driver to be first. He drove like a maniac, passing, cutting off, speeding down the wrong side of the street, etc.

Red Cabs

It was at this point that I experienced once of those lessons you take with you for the rest of your life. When there is nothing you can do to stop the madness, encourage it. "Mas rrrapido!" I yelled over and over. We almost took out a pedestrian, but he swerved just in time.

Someday we might have this kind of technology in America. Someday...

By the time we made it to the station, we were first in line. Turns out the cab runs on gas. Real gas! In the hustle and bustle of getting ourselves and our stuff out of the cab I lost the cover off of my GPS. Damn.

We got our tickets and established ourselves on the bus. It was ensconced in purple velvet and looked like a mock up of a Turkish brothel. Our driver went into great detail about how we were to NEVER EVER , UNDER ANY CIRCUMSTANCES, EVER, use the bathroom in the back for more than urination. The smell, we were warned, would waft up through the bus and we would have to live with it.

Thirty minutes after disembarking someone with, what I can only suspect was a case of severe diarrhea, shared it with the bus. Ever been in a heavily air-conditioned pit latrine that sways back and forth? I hope this is the closest I ever get. I should also add that the air-conditioning system was so good that water would condense on the vent above me and fat frigid drops rained down at a rate of about 1 about every 30 seconds. We made it to the border by 4 am.

At 6 we wandered out of the bus, passports in hand, got a stamp from Costa Rica, wandered to Panama, got another stamp and paid some money, wandered back to the Cost Rica, did something else, and then back to Panama for something else. Our bags were checked, then we got back on the bus and were on our way. I should like to point out that at no time did anyone really know what the hell was going on. Nor, as I

was wandering down streets and back alleys, was there any real way to keep me from just walking on into Panama until I was stopped by the canal.

The trail to Panama's immigration services shack

We got to watch some movies on the bus. I am ashamed to say I watched most of Torque, which was of less merit than one would imagine. We were also treated to BATS (spelt upside down), which was of great delight to use who had just come from working with real bats in Palo Verde. But the bus redeemed itself with Shawshank Redemption, one of the greatest non-comedic movies ever.

Boat to the island!

At the bus station we got onto a smaller bus that later took us to a boat. A one hour cruse down the Panama Canal and we finally docked safe and sound at Barrow Colorado Island. This island, created by the flooding of the Panama Canal, has been used as a research station by the Smithsonian Institute for about 100 years.

They are not all that big on air conditioning here. So it's sticky. But it's been a long day and after supper and a shower, I'm dead to the world.

Good jungle!

Research Station in the fading light of dusk

At certain periods it becomes the dearest ambition of a man to keep a faithful record of his performances in a book; and he dashes at this work with an enthusiasm that imposes on him the notion that keeping a journal is the veriest pastime in the world, and the pleasantest. But if he only lives twenty-one days, he will find out that only those rare natures that are made up of pluck, endurance, devotion to duty for duty's sake, and invincible determination may hope to venture upon so tremendous an enterprise as the keeping of a journal and not sustain a shameful defeat.

-Mark Twain, *The Innocents Abroad*

It's less than a week before the dawn of January, 2010, nearly half a decade since this travel log was begun. Let's pick up where we left off and see what we can find.

-Mike

[This is a rare treat. I didn't know I had already told these stories, so wrote them again 5 years after the fact. It'll be a bit redundant, but let's see how good my memory is!]

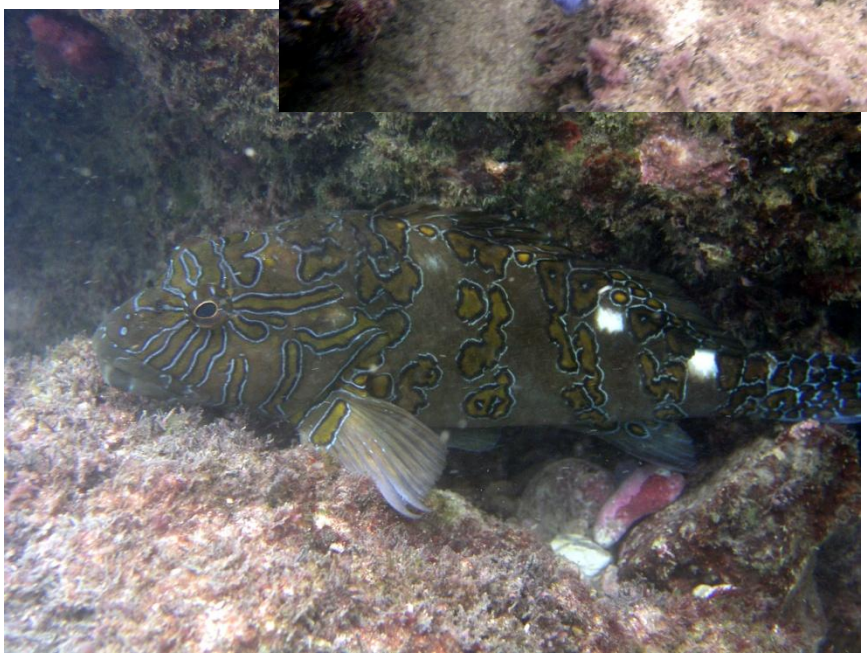
Chapter 8 (h)

28 July 2005

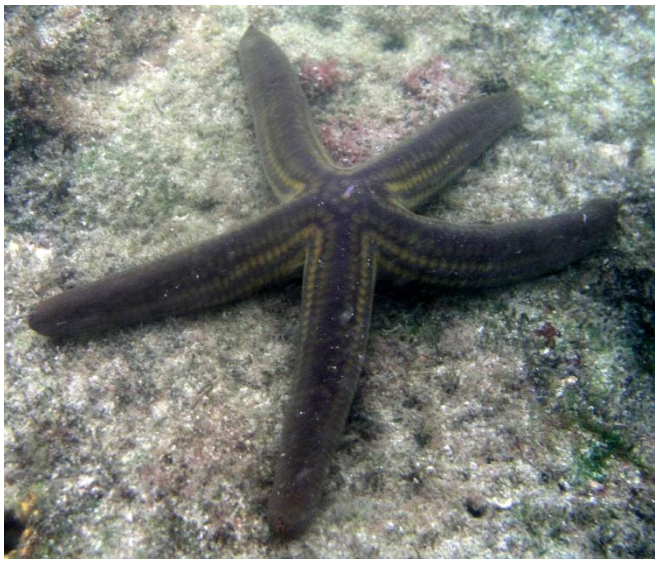
They shot all the big stuff, sanctified the birds, flora provide sad trophies to those not botanically inclined, and all the gold and diamonds are spoken for. The last of the great treasure and plunder, trophies and game lies in the insects. I have by now four boxes of jewels.

We hit the ocean one last time about 12:30 am.

Bumphead Parrotfish

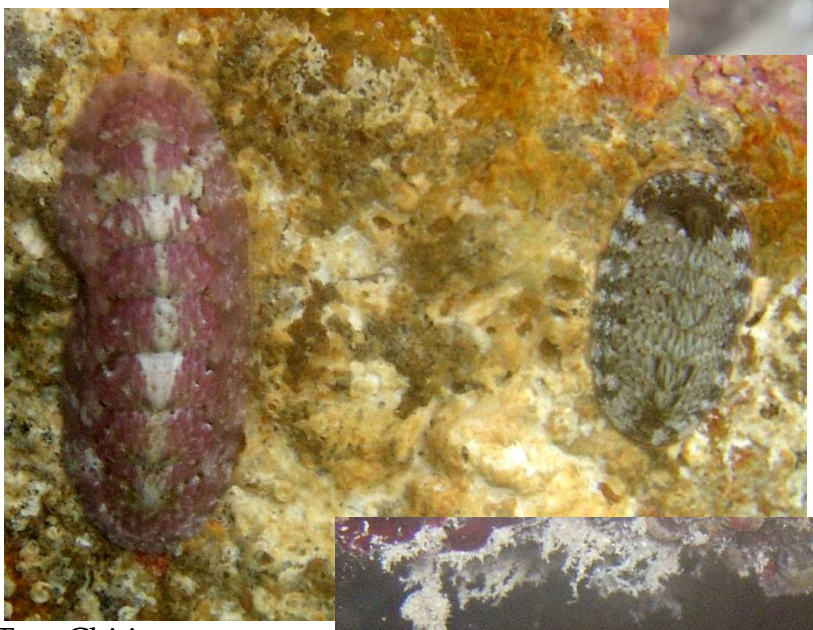


Giant Hawkfish



Linkia starfish

Crab in a hole



Two Chitins

Tailspot Cardinalfish

Starry Moray

Unknown Crab

The Tail of the Juvenile Golden Jacks:

At about 2 pm it was time to think about heading in. I swam over to the others who were getting out, but for some reason someone wanted one last go around, so I acquiesced and headed back (my last snorkel for 5+ years it would turn out). Well, the little guys pictured above, each about 2 inches long, decided to give me an escort. They swam like the dickens and tried to stay about 1.5 feet just to the left and in front of my head. When I sped up, they sped up, when I turned sharp, the turned sharp, when I dove, they dove. Amazing little swimmers. I don't know if they thought I was a shark, or mamma, but they were wonderfully loyal. They provided a nice good-bye to the sea, and one of my favorite photos from the trip.

Out of the sea and onto the beach. The monkeys came and played. We packed up and got ready for the journey back to San Jose.

Chapter 9

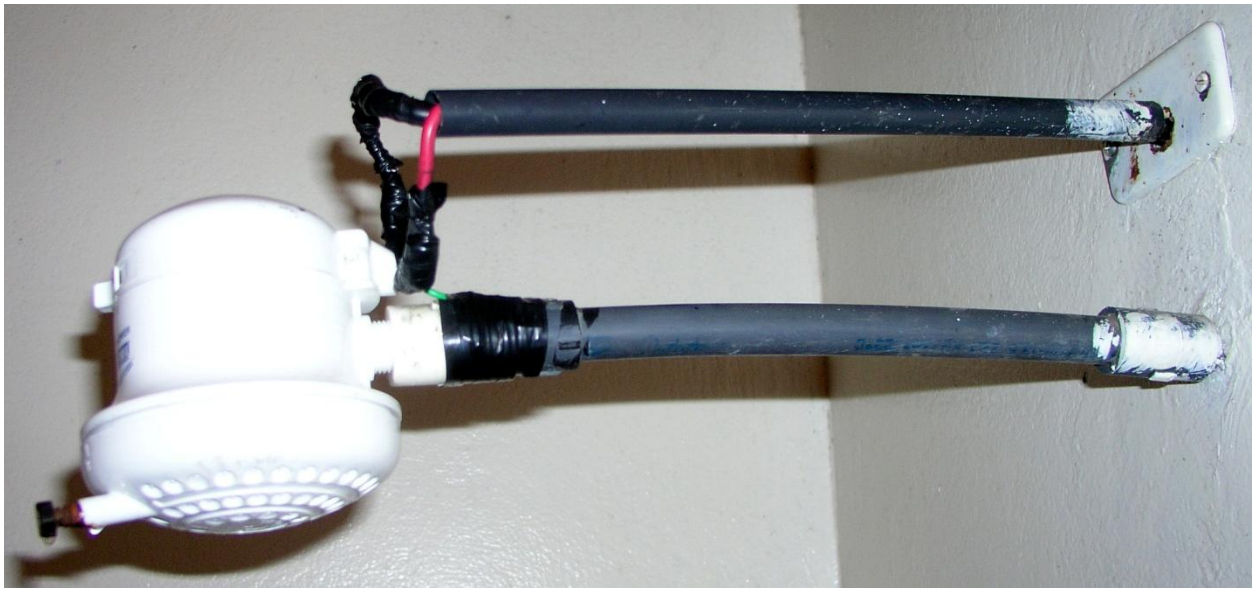
29 July 2005

Today is a day for travel. Pack up the luggage, pick up the traps, don't tipover the bugs in alcohol, and keep the sacred pinned specimens on top and in sight. Hike what you can down the way, over the "bridge," keep out of the way of the 4-wheeler, and try to make it to the truck that will carry it the rest of the way to the bus. On the bus, settle in and catch the ferry. Go slow on the water, go slow. Back on the bus, and hit the once traveled road back to the beginning.

Ximena waiting for the ferry

Not too fast!

One of the few (accidental) stereo photos from the trip.



Hot water heaters work by keeping a vast cauldron of water percolating during all hours of the day, and, upon request, send their steamy volumes out, out into the world. It may be convenient, but it's not all that economical. First you have a giant vat of hot water bubbling along 24 hours a day. Second you need two sets of pipes everywhere, one for hot water and one for cold. And, if there's three "pipe gallons" of water between you and the heater, you have to run that out before you get your first sprinkle of hot water, and upon completion, leave another three gallons of hot water in the pipes behind the fixture, their warmth wasted to the void.

Enter the well meaning apparatus pictured above. We're back in the hotel we stayed in in Costa Rica and its shower time. Here, ideally, hot water is generated on the spot, no lag time, no waste, no running out. But there's a catch. You're standing in water, the shower head is full of and dripping water, and (nearly) bare electrical wires are plumed directly into the beast. There are an unlabeled switch and a button on the side. Which do you use, how do you use them, and do you take the chance? I took the chance! Turns out the switch didn't do anything, but firmly pressing the button resulted in a mild electrical shock. So I tried the switch again. Cold Shower.

Chapter 10

30 July 2005

Free day in San Jose! All the city you can walk!

Luke, Nate, and I headed out to see the sites. First we went by this sculpture of what looks like nice, hard working people that got screwed over by someone in the past. I guess you could plop these sorts of statues just about anywhere on Earth and they would be appropriate.

Then we wandered through a park full of what appear to be non-native rainbow eucalyptus, of which we should take *Precaucion*!

And we finally made it to our intended destination (after asking a bunch of people, all of which pointed in a different direction). It's the Museum of Natural Sciences and they're open every day. They have a *T. rex* and others!

The first thing I did, after paying my entrance fee, was whip out my camera and take a photo of the aforementioned *T. rex*. Then the little man yelled at me and made gestures indicating that pictures weren't allowed. So here is the first not allowed picture from the museum.

They had several rooms (within sight of the manager) full of butterflies, mostly blue morphos, and one room full of sea shells. After insects, the most specious of the animals are the mollusks. I don't think I have the metal to work on mollusks, but I'll give them this, they make damn beautiful specimens.

The rest of the museum was mostly 1950s style (and age) dioramas of the various flora and fauna of Costa Rica and beyond. It was… well intentioned.

Local chickens, etc.

Inexplicable banana

Harpy Eagle with very surprised sloth.

Almost as good as the ocean itself, and you don't even have to get wet!

What museum isn't complete without its two headed farm animals and Begging Squirrel?

Tonight the party breaks. Some are headed to home far away, and some are headed to Panama for a couple days at Barrow Colorado Island (BCI), the research station owned by the Smithsonian on an island in the Panama Canal. Lots of packing and weeping.

To get to Panama: Get in a red taxi at 9 o'clock at night. I got in the last one, and he drove like a maniac. All I could remember to yell was "Arriba, arriba, ondalay, ondalay," in the fashion of that racist mouse. We were the first taxi to get

to the station. This ride taught me that when things are terribly unsafe, and you have no way of rectifying the situation, not only is there on point in worrying, but let's face it; encouragement might be your safest option.

We have tickets and the luggage is shoved under the bus. The entire inside of the bus is covered in purple velvet. We drive through the night, on two lane highways though the mountains at break neck speeds. We'll hit the border with Panama at about 2 or 3 am. They show movies on the bus. Sadly, I have to admit I watched the motorcycle movie with Ice Tea, I think it was *Torque*. There was a scene where two girls fought one another with their motorcycles. But they also showed *Shawshank Redemption*, so I can't complain too much.

Right when we got on the bus the driver made it very clear, in English and Spanish, that the bathroom was only to be used for "number one," "Nota the poopie!" GO NOW, or forever hold your piece. Ten minutes into the trip someone with Taco Bell Bowel went to the bathroom. The back of the bus (where I was blessed to be) smelled exactly like a pit latrine for the entire trip.

The bus is, in a word, cold. The AC, powered by a very vociferous diesel, is on full blast and unrelenting. Two days ago in Cabo Blanco I was sweating in my bed, and here I'm shivering. To add a happy element of surprise, the thin metal strip on the ceiling that runs the length of the bus drips ice cold condensate in heavy fat drops right down the left side of my face.

31 July 2005

We've been sitting in the bus, still running, for more than an hour, and at about 4:30 am the border opens. I don't remember the dance, but then again I don't think I ever really understood it in the first place. I remember you checked out of Costa Rica, Paid an exit fee to Cost Rica, checked in with Panama, got papers, then magic happened and you were back in Costa Rica for something and finally you were back over in Panama (same building/line as before) and you got your papers finalized.

One of the lines

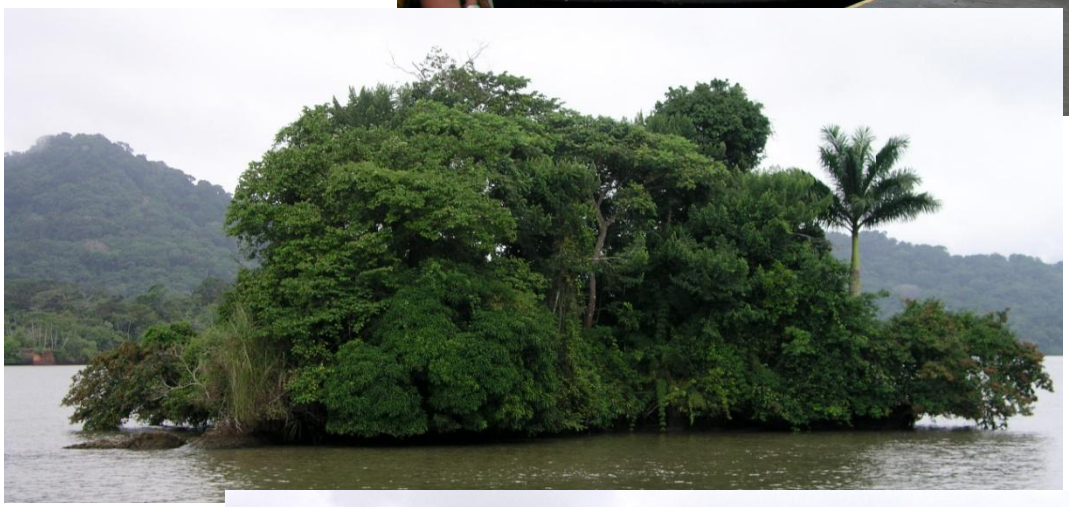
The Panama line. The "tall" building in the center of the photo is the official "stamp your papers, etc." office. Somehow you went through this line twice.

We finished with the border about 6 am. Back on the bus. We stopped for breakfast around 11 am. I don't know when we got off the bus, but we didn't gain the above (little) bus until 3 pm. Then it was on to the boat.

Chip, demonstrating the Chip Phone.

Weird tower at the bus station

(Below) Our boat to the Island



An island (above) and the shoreline (right) of the Panama Canal

Dredger

Village in the jungle

The face of the research station at Barro Colorado Island

Chapter 11

1-6 August 2005

There are few places on this Earth that are as well studied as BCI. There are plots, acres in size, where every plant greater than 2 inches thick has been IDed, mapped, tagged and is measured every year.

Measuring tree growth in real time (above), introductory hike (right), Agouti! (below).

It seems every monkey on the island has been probed at least 5 times and had its poop analyzed at least twice. BCI is legendary.


Ximena showing off her wounds from the Battle of the Turtle.

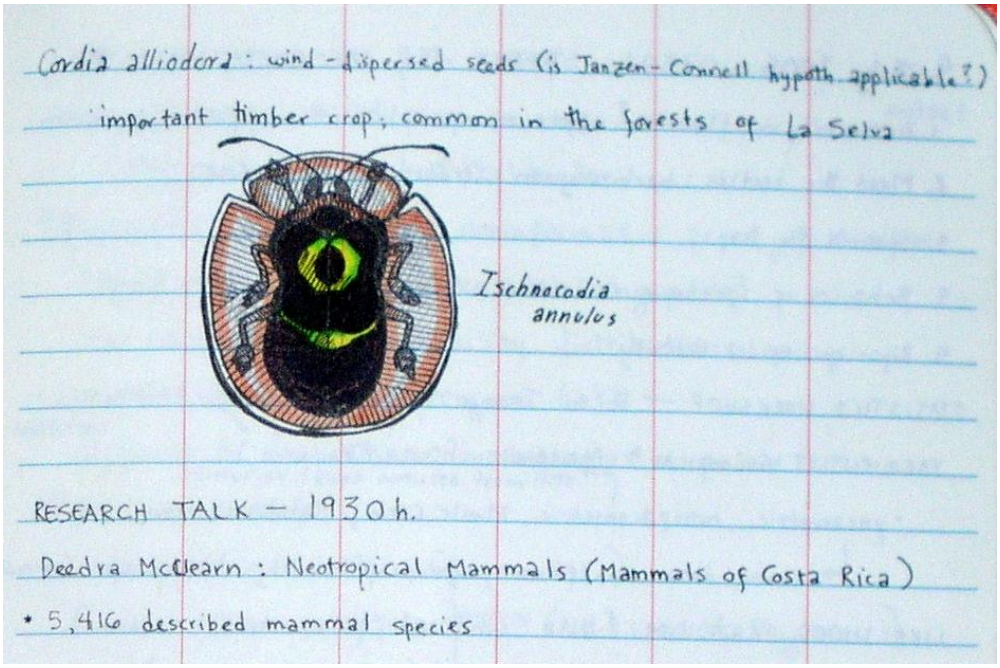

Barbra demonstrating a fat tree. (If you thumped it, it sounded like a ripe watermelon.)

2 August 2005

We visited Smithsonian's headquarters in Panama. It was a series of buildings built around a central courtyard. Here is a mosaic on the side of one building.

Panama City

That night we went out to eat, but for some reason we had to wait in the van for what seemed like an hour. Like typical children before the hour was over we were climbing all over the van, begging for food, etc.



This is an excerpt from Erin's (Agouti) notebook. It kind of makes my whole travel log look like crap. Thanks Erin! ;)

(Above) A warning sign. You would think that after the picture of the crocodile the rest of the information would be redundant. (Right) It took all my willpower to NOT smuggle this little guy back to the US.

Many adventures were had on our tour of BCI. I collected a few good bugs, ran into Nhu and Dr. Meredith Blackwell, both from LSU (Nhu had been in an entomology class I helped with the semester earlier, and Dr. Blackwell is now on my committee), they were studying the gut fauna of beetles, specifically the yeasts and other fungi, and I hid from the monkey people.

Luke and his luggage

Back at the bus station (above). The local busses (below) had very extravagant exteriors.

Back to Costa Rica. Hike your luggage down to the boat, boat to small bus, small bus to big bus, big bus to border. They put us in a cage for a while and had dogs sniff our luggage. Then back on the big bus back to San Jose. We got there about three in the morning, taxi to the hotel and finally a good sleep. The next day I wandered about and found Machu Pichu, the restaurant we went to when the trip began. I ordered (I forget what it's called) a thing where the shrimp are smothered in butter and garlic and baked on a shell. Also for desert I had a cup of some gelatinized caramel substance with the top glazed over and probably a shot of rum in it. Amazing!

Erin (Leader) showed up with my export permit! So now I'm legal to exit the country with bugs. There are some geocaches in San Jose. I started walking, but ran into a creek with no bridge, so got a cab to take me over to where it should be. The GPS took me to a pile of rocks, but no cache to be found.

I said good bye to Erin (Agouti) but would run into her again in a year or so in Florida (at an Entomological Society of America meeting).

You are supposed to book your flights through the school's travel people. It's a policy. Either I hadn't paid close enough attention to my itinerary (possible), or somehow I had been given the impression that this was basically the only schedule possible (also possible), either way it turns out Mikey had a 12 hour layover in Honduras. They kick me off the plane and give me all my luggage, two BIG bags, a 20 gallon chest cooler (full of my specimens), and my backpack and camera. I already paid $100 for the extra bag when I left Costa Rica. After going through security, I tried to give my luggage back, but as my flight wasn't leaving until the next morning, they wouldn't take it. I have, in cash, 100 Costa Rica "colones" (sp?) worth about $3, and would have to draw from credit/debit cards for any more money, so a hotel, with a taxi ride, etc.

was out unless I visited an ATM. Also, my flight was at about 6am, so I would have to leave a hotel at 4am to get to the airport on time. I asked the nice person at the service desk if the airport was open all night long and if I could just stay there. She assured me it was, and I would be fine.

They close the airport around 11pm. Lock the doors, dim the lights, etc. The guard came by, nice fellow. Spoke no English. I know about 30 words of Spanish. We spoke for a good half hour- forty five minutes. He told me about how new the airport was, and how big it was. He pointed out the vending machines several times. I commented on how new the airport was, and how big it was. I think he showed me a coin, or something, so I showed him my money clip, with a single 100 C note, folded over 3 times to keep it from falling out. I used the only Spanish I really know, "esso es toto" which means "That is all." I know this because in four years of Spanish class the instructor would end class with "esso es toto." Four years, three words. My security guard looked at it long and hard, turned it over and over, pointed out different aspects of the pictures on both sides, explained in lavish detail about how I could stay there and I would be safe, no one would steal my stuff, etc., and finally left with a wave. I have nothing but good thoughts about that night. At Chicago's Midway airport they turn you out to the street at closing time.

I slept fitfully, arranged so that a part of my body was entwined within or at least touching each piece of luggage.

6 August 2005

In the morning they wanted to charge me another $100 for the extra bag, but I said to the girl, "This is a layover, I slept over there, I never left the airport!" She got it figured out.

Now, yesterday, I went through security as I left Cost Rica. Then I went through security as I entered Honduras, and now I get to go through security as I leave Honduras. I'll also get to go through security as I enter the US (but never mind that).

Here there were three guards. One spoke very good English and they were bored and curious. “What’s in the cooler?” “Escarbajos (sp?) del Costa Rica” (beetles from Costa Rica). “Do you have a permit to take them from Costa Rica?” “Why yes I do!” And they studied my permit, how would they or anyone know if it was real or not, it just has to look official. I opened up one of my boxes for them to see. They thought the bugs were pretty cool. Thankfully they didn’t dig to the bottom where I had specimens in alcohol or there would have been lots more questions.

So I checked my bags, walked up the stairs to the second floor and went to the exit tax station. Most countries charge a fee (tax) to foreigners when they exit the country (most let you enter for free). They needed about 30 dollars cash. I have no cash. There is an ATM down stairs, so down I go. I have two cards, a VISA debit card (but it has the special stuff, Star, etc.) and I have been using it to get cash, and a real credit card. The machine doesn’t recognize my VISA debit card, but thankfully it does recognize my MasterCard credit card. Good thing I had both, or I might still be there today!

I paid my fee and boarded the plane. Flight to Florida, customs, on to New Orleans. Stephanie had sent her friend Ignacio to pick me up, and she had packed a welcome home gift basket: a little cooler with an ice pack and two bottles of Mountain Dew!

FIN

APPENDIX I

* * *

An Agouti Tail

There once was a little agouti that lived in the rainforest. Her name was Erin, but everyone called her Erin Agouti, because she loved to sing the Agouti Song:

Little busy tail
Little wiggly nose
I'm a cutey Agouti
From my head to my toes

In the forest all day
Hide lots of seeds away
I'm a cutey Agouti
From my head to my toes

Erin Agouti loved to walk around the forest and gather many seeds for her collections. One night while Erin Agouti was sleeping in her agouti nest of leaves she was awakened by a loud pounding sound. Strange monsters were walking all around her agouti nest and putting poles up and stringing a net between them. Little did Erin Agouti know that these people were Birders. Birders wake up in the middle of the night and tromp around their rooms, then they go out and catch birds and molest them. Erin Agouti ran away from the commotion and fell asleep in a bush.

Many hours later, about 6am, Erin Agouti was awakened by the sad song of Miss Kathleen Purple Throated Mountain Gem. "Hello, Miss Kathleen Purple Throated Mountain Gem how are you today?" asked Erin Agouti.

"Not too good Erin Agouti, I was flying to my favorite Costas plant when I was captured by monsters of the night. They violated me in strange and unusual ways and then put this horrible chain around my leg which will be with me until I die," said Miss Kathleen Purple Throated Mountain Gem.

"Oh no, that's horrible," said Erin Agouti. "I better get away from here". So Erin Agouti ran away. Later that day Erin Agouti was eyeing some juicy seeds when along came Luke Ctenosaur. "Hello Luke Ctenosaur, how are you today?"

"Not too good Erin Agouti, I was minding my own business when along came a monster and grabbed me by the tail. It surely wanted to eat me. Luckily my tail broke off and I escaped, but now I feel like half a lizard without my manly tail."

Little did Luke Ctenosaur known that he had been attacked by a Herpetologist, a breed of people not quite right. Herpetologists like to collect very dangerous snakes and then have friends hold the snake while they themselves stand far away and take pictures.

"Oh no, that's horrible," said Erin Agouti. "I better get away from here". So Erin Agouti ran away. All of a sudden Erin Agouti ran in to her friend Mrs. Barbara Agouti. "Hello Mrs. Barbara Agouti, how are you today?" asked Erin Agouti.

"Not too good Erin Agouti, my ten agouti children are hungry and need to eat, but when I went to my favorite seed gathering place someone had taken all the

seeds. And on my way home the only seeds I did find were ruined with a hole and a long string tied through them. My youngest ate one and has only passed half the string, now the school children have nicknamed him 'Kite'."

Little did Mrs. Barbara Agouti know that a Mammologist had stolen and later ruined all her seeds. Mammologists are scientists what often look like the mammal they study.

"Oh no, that's horrible," said Erin Agouti. "I better get away from here". So Erin Agouti ran away. Later Erin Agouti found a flowering bush and Kari Bee flying all around it. "Hello, Kari Bee how are you today?" asked Erin Agouti.

"Not too good Erin Agouti, some monster put a bag over all the flowers on this bush, now I'll have to look for more sources of nectar thus increasing the chances I'll be preyed upon, increase my exposure to parasites, the colony will be generally harmed as a whole because of this, and I can't pollinate my favorite bush," said Kari Bee.

Little did Kari Bee know that all her misery was caused by a Plant/Insect Interaction person. These people aren't satisfied with ruining the lives of organisms from only one kingdom, so they attack two.

"Oh no, that's horrible," said Erin Agouti. "I better get away from here". So Erin Agouti ran away. Then Erin Agouti heard someone crying. It was Nate Heliconia. "Hello, Nate Heliconia how are you today?" asked Erin Agouti.

"Not too good Erin Agouti, some monster came and cut off all my genitalia. Plus is slashed some of my leaves," said Nate Heliconia.

Little did Nate Heliconia know that the person who had done this was a Botanist. Botanists are evil people who amputate, mangle, kill, molest, maul, murder, mutilate, disfigure, obliterate, harass, hassle, and plague plants the world over. Plus they are strange.

"Oh no, that's horrible," said Erin Agouti. "I better get away from here". So Erin Agouti ran away. Later Erin Agouti was so tired from all the running that she set down on some moss and met Megan Snail. "Hello Megan Snail, how are you today?" asked Erin Agouti.

"Not too good, Erin Agouti. I was sliming along this morning and a monster came and planted a giant flag near where I was, then went away," said Megan Snail.

Little did Megan Snail know that the monster was really a Gastropodologist. There are only three of these people in the world and they are actually pretty cool. Generally they are not runners.

"Oh no... wait a minute... that doesn't sound all that bad," said Erin Agouti. And it wasn't. So Erin Agouti decided to visit her friend Mike Beetle. But she never found him because Mike beetle was dead in a box with a metal pin shoved through his body.

Then Erin Agouti went down to the beach and ran into Ximena Turtle. "Hello, Ximena Turtle how are you today?" asked Erin Agouti.

"Not too good Erin Agouti, I was swimming along peacefully when all of a sudden a monster dove down and attacked, thrashing me back and forth," said Ximena Turtle.

Little did Ximena Turtle know that she had been attacked by a Peruvian. These people grow up riding llamas in the mountains and then venture to the sea to catch sea turtles.

"Oh no, that's horrible," said Erin Agouti. "I better get away from here". So Erin Agouti ran away. When she came to the forest

she smelled something awful and saw Andrew Howler Monkey in a tree. “Hello Andrew Howler Monkey, how are you today?” asked Erin Agouti.

“Not too good Erin Agouti. I was collecting fruits from this tree when some monsters came along and threatened me, they showed their teeth and looked right at me. So I peed all over them, but now I can’t pee on anyone else for at least an hour,” said Andrew Howler Monkey.

“Oh no, that’s horrible,” said Erin Agouti. “I better get away from here”. It was getting late, and Erin Agouti wanted to go home, but when she got to her forest home it was gone, replaced by a giant field. Erin Agouti saw a sign, she couldn’t read it but it said, “Organic Soybeans”.

So Erin Agouti ran into the preserve where she met Erik Harpy Eagle. “Hello Erik Harpy Eagle, how are you today?” asked Erin Agouti.

“Well Erin Agouti I was really sad, some monster cut down my forest and replaced it with organic soybeans and I had no place to hunt for food for my children. But now that I’ve met you I’m very happy,” said Erik Harpy Eagle. And he grabbed Erin Agouti and flew away to his nest.

The End

APPENDIX II

* * *

Remember the very first bit of research we did at our first stop (ca. pages 37-40)? Well, Nate and Luke (mostly) and Andrew and I (leastly) wrote it up really well, submitted it to Biotropica and were immediately rejected. But we were rejected with a smile, so we (Nate and Luke, mostly) made some changes and resubmitted. This time it was accepted and finally published. Our paper follows.

Looking back, if we had been given a little more time, and a few fewer projects, we might have been able to get a few more cute little papers like this published.

BIOTROPICA 39(6): 774–777 2007 10.1111/j.1744-7429.2007.00301.x

The Energetic Determination, Spatial Dispersion and Density Dependence of *Myrmeleon* Ant Lion Pits in Las Cruces, Costa Rica

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ABSTRACT

The amount of space used by an organism is energetically determined. We utilized a population of ant lion larvae in Costa Rica to test allometric theories concerning the use of space by organisms and how different densities of individuals affect the use of space. The area of ant lion trapping pits scaled with mass to the three-quarters power, supporting allometric theory for sessile organisms. Our analyses also show that larger ant lion larvae show spatial repulsion and facultative density dependent pit-building strategies.

Abstract in Spanish is available at http://www.blackwell-synergy.com/loi/btp.

Key words: allometry; competition; home range; overdispersion; scaling; tropical moist forest.

ANT LIONS ARE IMMATURE INSECTS IN THE FAMILY MYRMELEONTIDAE (NEUROPTERA), and species in the subfamily Myrmeleontinae have particular interest because they build conical pits in fine sandy substrate to capture passing arthropods (Triplehorn & Johnson 2005). Pit-making ant lions are generally sit-and-wait predators that minimize movement unless stressed (Matsura & Takano 1989, Linton *et al.* 1991, Crowley & Linton 1999). The individual, positioned at the bottom of its constructed pit, subdues fallen prey (largely ants) with its long jaws, feeds on the hemolymph and extra-orally digested organs, and discards the carcass (Triplehorn & Johnson 2005). As abundant, sessile, terrestrial predators, ant lions have frequently been the subject of ecological investigation, especially in studies of optimal foraging and spatial arrangement (*e.g.*, Wilson 1974, McClure 1976, Griffiths 1980, Heinrich & Heinrich 1984, Gotelli 1997, Crowley & Linton 1999, Day & Zalucki 2000, Arnett & Gotelli 2001).

Ant lions pose an interesting allometric problem: as they are sessile, sit-and-wait predators, they may still compete with neighbors during pit territory establishment and pit maintenance. Ant lions construct trapping pits during the first larval stage, and exhibit strong site fidelity, as pit relocation is energetically costly (Lucas 1985, Crowley & Linton 1999). Ant lions acquire all of their resources within the trapping pit, which leads to the hypothesis that overall pit size should be proportional to the size of the ant lion occupant (Wilson 1974, Kitching 1984, Day & Zalucki 2000). Ant lions can interact with conspecific neighbors in two ways that may influence pit size. First, during pit maintenance, ant lions use their mandibles to toss sand from their pit (McClure 1976, Day & Zalucki 2000). Ant lions may therefore expel sand into the pits of neighbors, exacting an energetic maintenance cost (Simberloff *et al.* 1978, Day & Zalucki 2000). Second, ant lions may compete spatially for passing prey, as the pit of one ant lion may block prey flow to a neighboring ant lion pit (Wilson 1974, McClure 1976, Linton *et al.* 1991, Griffiths 1993, Gotelli 1997). Other factors being equal, an ant lion whose pit is surrounded by neighboring pits may trap fewer prey than an ant lion whose pit is placed in the open. The role of neighbor competition in driving the spatial arrangement of ant lion pits has been previously explored (Wilson 1974; McClure 1976; Simberloff *et al.* 1978; Griffiths 1991, 1993; Linton *et al.* 1991; Day & Zalucki 2000), yet none of these studies have tested predictions made by allometric theory.

Classical allometric theory (McNab 1963, Calder 1984, Mace & Harvey 1983) has posited that the space required by an organism to capture resources, home range size, should scale as:

$$H \propto M^{3/4}$$

Where, H is home range size and M is mass. The framework for this argument is simple in that the amount of prey captured (P)

Received 20 February 2006; revision accepted 29 September 2006.
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should be directly proportional to space utilized by the organism (*i.e.*, home range) and should scale isometrically with the metabolic rate of the organism (R), which scales to the 3/4 power with mass:

$$H \propto P \propto R \propto M^{3/4}.$$

Simplified, home range scales with mass to the 3/4 power. Yet, despite McNab's original findings (McNab 1963), empirical evidence from nonsessile vertebrate organisms generally does not support a three-quarters scaling relationship between home range size and mass. Rather, a scaling exponent of one or greater is observed for vertebrates (Schoener 1968, Turner *et al.* 1969, Harestad & Bunnell 1979, Mace & Harvey 1983, Peters 1983), and invertebrates such as *Solenopsis* ants (although the value of this exponent varies seasonally; Tschinkel *et al.* 1995). Recently Jetz *et al.* (2004) have incorporated species interactions in space into allometric theory as a solution to this incongruence of theory and observation. Specifically, if one incorporates the amount of home range space that overlaps with a conspecific individual and the amount of energy required to maintain home range boundaries through interactions with other individuals, the total amount of space required to fulfill an individual's metabolic requirements increases. This increase in home range size due to competitive interactions predicts an allometric relationship in which home range scales with body mass with an exponent of one.

Although ant lions have been shown to competitively interact during pit establishment (Day & Zalucki 2000), the competitive mechanism proposed in the Jetz *et al.* (2004) model may not apply to them. Their model predicts a scaling exponent of one due to territory overlap or persistent competition involved in maintaining territory boundaries. Once they have constructed pits, ant lions reside in exclusive territories, and do not compete within their territory boundaries for resources; as such, a scaling exponent of three-quarters may be expected in ant lions.

This prediction is consistent with studies of space use for resource acquisition in other sessile organisms, including plants (Niklas & Enquist 2001, 2002; Enquist & Niklas 2002) and purse-web spiders (Anderson 1987). For vascular plants, Niklas and Enquist (2001, 2002; Enquist & Niklas 2002) have predicted a three-quarters power relationship relating resource acquisition area (whole plant leaf area) to body mass. Because carbon resource acquisition rate (C) should scale with whole plant mass (M) as:

$$C \propto M^{3/4},$$

and because whole plant mass scales with whole plant leaf mass (M_L) to the 3/4 power, and whole plant leaf mass is expected to scale isometrically with whole plant leaf area (L), we get the following by substitution:

$$M^{3/4} \propto M_L \propto L.$$

This prediction has been supported with empirical evidence from plants with body sizes covering 20 orders of magnitude (Niklas & Enquist 2001, Enquist & Niklas 2002). The area a plant requires for resource capture scales differently than the resource capturing area (*i.e.*, a home range) for a nonsessile organism. As mentioned above this prediction is upheld for plant data, but may also prove to be a general principle for sessile animals as well. In particular, the resource capturing device of spiders, their web, has been shown to scale with an exponent of 0.65 rather than 1 (Anderson 1987). Using the analogy that the resource capturing area for ant lions is pit area, rather than leaf area in plants or web area in spiders, gives the alternative hypothesis to the Jetz *et al.* (2004) model that pit area should scale with body mass to the 3/4 power in ant lions.

A large population of ant lions (immature *Myrmeleon* sp.) located at 8°47′9′ N 82°57′51′ W in Las Cruces Biological Station, Costa Rica was utilized for the present research. Five sample quadrats 0.25 m^2 in size were randomly placed in the population of *Myrmeleon*. After the sample quadrat was in place, a photograph was taken directly overhead of each quadrat. Each photograph was then manipulated using imagery software in order to assign coordinates and individual numbers to each pit in each quadrat. Thus relative distances between all pits could be obtained.

The diameter of each ant lion pit was measured to a resolution of 0.1 cm using a caliper. The diameter was then used to estimate the area of each pit assuming that they were circular. After the diameter of each pit was measured, the resident ant lion was extracted and placed into a container. The mass of each individual ant lion was later recorded.

Three distinct ant lion size classes were identified from field observations. Classes were determined by plotting the distribution of the body masses of all individuals collected from the observational study. When plotted, there were three distinct groupings of body mass indicating three larval instars, which is consistent with other *Myrmeleon* populations observed in Costa Rica (Wilson 1974).

To understand the effects of larval density on pit size and number, a manipulative experiment was conducted where medium-sized ant lions were placed into plastic arenas (300 cm^2) at densities of 2, 5, 10, and 20 (ant lions were placed in the center of the arena and allowed to spatially segregate on their own, following McClure [1976]). Earlier field observations showed that approximately five ant lions resided in areas the size of the plastic arenas. Thus, we chose to use experimental densities that were higher and lower than those generally observed in nature to adequately determine whether density dependence could occur in ant lion populations under certain conditions. Each treatment was replicated three times and placed on a covered outdoor porch near our observational study site. After 12 h the number of pits and the diameter of pits were recorded.

Ant lion mass and pit area were tightly correlated. When pit size was regressed onto mass from natural populations, the slope of the regression was indistinguishable from 0.75, yet it was distinguishable from 1 using a 95% CI around the slope (Fig. 1A). Next, a Mantel test was performed on body size and spatial distance dissimilarity matrices to assess the level of correlation in each quadrat. Specifically, the two dissimilarity matrices were characterized as the pairwise difference in mass between all individuals in a quadrat and the pairwise Euclidean distance between all individuals in a quadrat. There was no correlation between these two variables for any of the five quadrats as a whole. To understand the spatial relationship between cohorts of ant lions through time the quadrat data were parsed into the three size classes (instars). The mean Euclidean distance between pits of all similarly sized individuals in a quadrat was

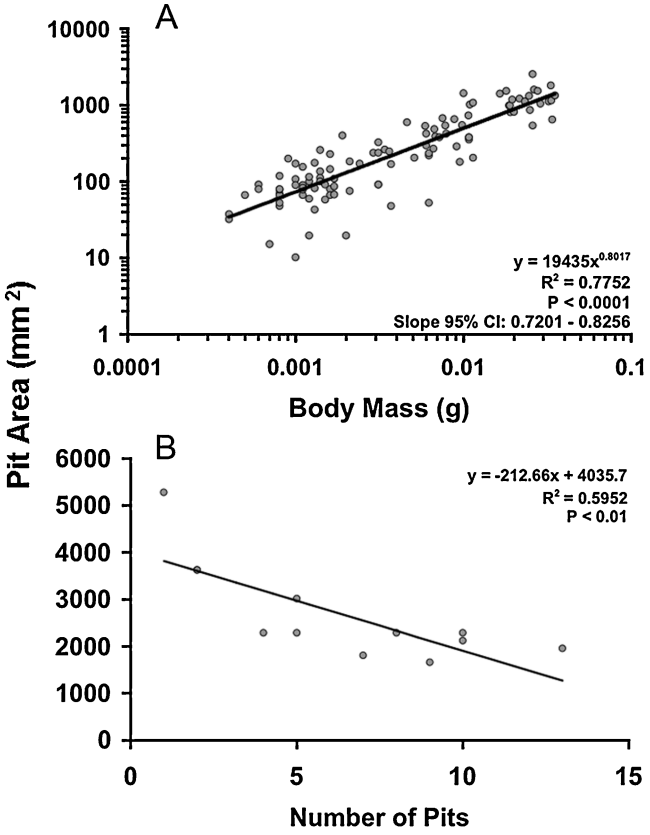

FIGURE 1. (A) Log-log plot of pit area versus body mass from natural populations. (B) The area of ant lion pits as a function of the number of pits formed during the experiment.

measured and then compared to 1000 randomly generated communities. Each random community had individual numbers that were constrained to match the observed data and coordinates that could not extend outside the quadrat. The random placement of ant lion pits was done using circular two-dimensional areas using the same distribution of areas as those observed. Thus zero-dimensional point representations of ant lion pits were not used. This was done to protect against unrealistically overlapping ant lion pits in the null populations (Simberloff *et al.* 1978, Simberloff 1979). The spatial distribution of the smallest size class for each quadrat was random (Quantiles > 25 and < 975). Two of the five quadrats had medium size class individuals that were evenly dispersed in space (Quantiles $= 981$ and 978). The spatial distribution of the largest individuals in each of the five quadrats was even (Quantiles > 983).

An ANOVA followed by Tukey Tests was used to quantify which density treatments differed from one another in the experimental manipulations of population density. The ANOVA result showed that there was a noticeable difference between two of the treatments ($F_{3,8} = 10.26$, $P < 0.05$). The number of pits formed per number of individuals was not different between the two, five, and ten density treatments. The 20-individual treatment tended to have fewer pits formed than the five and 10-individual treatments yet this trend was not significant ($Q_t = 3.99$, $P = 0.09$; $Q_t = 3.86$, $P = 0.10$). The number of pits in each treatment was negatively correlated with the size of the pits in that treatment (Fig. 1B).

The ant lion population studied in Las Cruces exhibits pit areas that scale with mass with a scaling exponent indistinguishable from 3/4. Therefore allometrically, and energetically, ant lions conform to patterns expected for sessile organisms. The results do not support the allometric home range model of Jetz *et al.* (2004), which predicts a scaling exponent of one to accommodate competitive interactions during resource acquisition. Energetic expenditure due to overlapping home ranges and defense of boundaries are explicit parameters in the Jetz *et al.* (2004) model and both are common in mobile organisms in nature, but signatures of such expenditure were not evident in our study of ant lions. While ant lions may indeed interact with neighbors during pit establishment, these interactions are not compensated by a proportional increase in pit area after establishment and may have negligible energetic consequences on ant lion life history.

Ant lion populations that span multiple size classes (instars) are not spatially structured as a whole, yet larger-sized individuals are spaced more evenly than expected by chance. Although there are likely interactions between larvae from different body size classes, this result suggests that surviving individual ant lions from a cohort become more evenly spaced. These results are in accord with the finding of Gotelli (1997) that ant lion larvae suffered density dependent mortality in the second and third instars, but not in the first.

An experimental quadrupling of natural ant lion densities significantly reduced the size of pits formed as well as inducing a slight trend toward fewer pits constructed. This suggests that just prior to, and during, pit establishment ant lions experience moderate density dependent interactions in space. A decrease in pit size was observed as a response to crowding across all treatment densities, but abandonment of pit construction became somewhat evident at extreme densities. We infer that the latter behavioral shift is unfavorable and perhaps utilized as a last resort under extreme competition for space and that the former may be the result of ant lions repeatedly being displaced by other individuals, thereby reducing the amount of undisturbed time necessary to construct larger pits.

Our experimental results describe a small role for competition in ant lion pit establishment. At the same time the allometric results based solely on first principles metabolic theory suggest that the most parsimonious conclusion is that ant lion pits sizes are energetically determined, and that it is not immediately necessary to invoke competition to explain the vast majority of the variance in pit sizes found in natural populations. This finding is consistent with the scaling relationship between resource capturing area and body mass, predicted and observed in plants, and observed in other sessile invertebrates such as spiders (Anderson 1987, Niklas & Enquist 2001, Enquist & Niklas 2002). Plausible alternatives to this energetic conclusion are that smaller pits constructed by smaller individuals are merely the result of constant displacement by other individuals in the population, as observed in artificially manipulated high densities, or that competitive processes occur during different portions of ant lion life history that were not examined in the present study. Future experimentation that uses natural densities

and longer time periods for observation will be required to test these less parsimonious possibilities.

Ultimately our evidence corroborates the above studies, suggesting that sessile organisms do indeed exhibit a different scaling relationship for resource capture and body size than mobile organisms (Schoener 1968, Turner *et al.* 1969, Harestad & Bunnell 1979, Peters 1983, Tschinkel *et al.* 1995). Future research concerning the use of space to capture resources across multiple taxa of sessile organisms is necessary to more fully understand the generality of these scaling relationships. Further, experiments that alter the frequency and intensity of resource availability are needed to more explicitly test the mechanism proposed by Jetz *et al*. (2004).

ACKNOWLEDGMENTS

We would especially like to thank Ximena Velez-Zuazo for her comments on this manuscript and for her assistance in translating the Abstract. We would also like to thank Mike Weiser, Edgardo "Cato" Arévalo, and Erin Lindquist for comments on an earlier version of the manuscript. M. F. would like to thank Barbara Martinez for stimulating discussions, which helped shape this project. Finally we would like to thank the staff and research personnel at Las Cruces Biological Station, in particular Rodolpho Quiros, for access to field sites and for use of laboratory space and equipment. N. G. S. is supported by the United States Geological Survey Geographic Analysis and Monitoring Program and D. L. M. is supported by a Graduate Research Fellowship from the National Science Foundation.

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