



Nectandra Institute

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Living With the Clouds and Biodiversity

— *Evelyne T. Lennette*

I live in a rented house in La Balsa, population of about 100 and 1.5 km from the Nectandra Garden. La Balsa is only 85 kilometers from the Costa Rican capital, San José, a metropolis of 2.0 million. The lone public building in La Balsa is a one room schoolhouse, with a current student body of 6 primary grade students. One year, the class size swelled to 14 due to an influx of migrant field workers in the nearby plantations. The lone commercial place, a combination bar/restaurant, closed and was torn down last month. In losing the bar, the community lost its community center, its rest stop for the tourists heading for Arenal Volcano recreational area and the refreshment stand for the local soccer games. Surrounded by pastures, dairies and ornamental plantations, life is very peaceful, even bucolic in La Balsa. A short distance away San Jose is choking in traffic and tight housing. It is therefore quite comforting to realize the exodus of suburban home buyers from the capital has not reached us yet. Nor are they coming if they can afford housing elsewhere. For that, I can thank the clouds.

The Caribbean trade winds drive the warm moist oceanic air mass overland and up the Cordillera Tilarán's volcanic slope, where we are located. As the warm air expands on its way up, it cools and condenses. Depending on the temperature and relative atmospheric humidity, we get cloud formation, mist, or rain, or a combination of the three, with or without fierce winds ten months a year. At 1000 m, La Balsa is in the premontane wet forest biozone (Holdridge life zone), with an estimated average annual precipitation between 2.0 -2.5 meters, 20-30% of which is from effects of clouds. However, the science of measuring cloud precipitation is inexact, as standard rain gauges are designed to detect vertically falling drops but not those that defy gravity — captured by vegetation. Moisture contribution from the clouds is a complex interplay of numerous variables such as geography, wind, solar angle, radiation, evap-oration, the shape, height and vegetation of the forest canopy etc.

The tropical quotidian weather has a narrow range of day lengths between 11.2 - 12.6 hrs and temperature 15 to 22 C , with almost no seasonal variation. The daily precipitation pattern is also quite predictable. Except for two and half months (February to mid April) when the sun shows for hours instead of minutes, La Balsa is shrouded in mist and rain most of the day. The clouds blow into La Balsa from an northeasterly direction; they settle in for the night, condensing on every and any surface, saturating every plant and animal on its way to the continental divide only a short distance away. I fall asleep almost every night with the soothing drip drip of the clouds and rain, accompanied by the ting ting of the tree frogs. At sunrise, the clouds may dissipate, the rain may stop. But by mid-day, the whole cycle starts once again.

Life in the clouds of La Balsa has been a personal eye-opener, unfamiliar, stimulating, inspiring and full of daily challenges. I grew up in the tropics and should be used to the high humidity and abundant rain, but it is the *absence* of drying that is the key difference. The presence of the clouds changes everything. With reduced sunlight and solar radiation, coupled to 100% relative humidity, everything tends to remain saturated and cool, for days or even weeks.

It is an irony of Nature that cloud forests are the most attractive places to live on Earth – except for humans. Per square meter, cloud forests support the densest and the highest number of life forms. Half of the estimated total remaining species on our planet chose to live in 11.5 million km² tropical forests, of which only 2.5% are cloud forests. Cloud forests have the highest biodiversity on earth. Yet, humans are rare among cloud forest denizens. After five years in La Balsa, I have some of the explanations for this dichotomy.

The following is a short, random and incomplete list of the clouds direct influence on life around the house: Aluminum window frames become conduits for condensation, producing rivulets of water running down the walls and floor. I mopped up a full 5 gallon bucket from every northern window (the windward side) around the house last December in a single night. Aluminum picture framing has the same effect, except that the matting and the artwork are the wicks. Refrigerators weep, ceramic floors become water-skating rinks, everything iron or steel rusts (cheap tools, expensive tools, microscope parts, cameras, computer and office equipment, appliances, locks, plumbing, sewing needles, nails, screws, staples, etc.), paper and wood products become saturated (matches, toilet paper, hand towels, printer paper, note books, photographs, storage cartons, can labels etc.), books curl, ink runs, glue

separates, tape unsticks, hair frizzes and remains wet, sugar becomes syrup, salt turns into brine, flour and spices lump, cereals turn mushy, pillows into sponges, plywood into corrugated wood layers, cabinet drawers into keyless locked boxes. The list of the clouds' indirect influences is just as long. Algal growth on interior surfaces (metal, wood, glass windows and frames, walls, sink areas, floors), not to mention blue, yellow, red and green molds, lichens, moss and fungal growth everywhere they can get established undisturbed for a few days, including microscope slides, inside electronic equipment and compound lenses. To make matters worse, much modern equipment manufactured as "weatherproof" is fit only for weather not in the tropics. A good example of this is our expensive weather station. Of its five components (solar, wind, rain, temperature and barometric pressure monitors) none functioned perfectly after the first six months. The last time the weather station was cleaned, I counted 16 species of mosses and 3 of lichens on the outside *and* inside of its weatherproof case, plus one ant nest and one wasp nest each in the "sealed" chamber, and thick algal bloom in the rain gauge.

Yet, for all the inconveniences, I love the clouds. Without the misty clouds, there would not be the enormous diversity of flora and fauna that brought me here.

The clouds themselves are beautiful to behold, especially at sunrise and sunset. The shimmering mist in the mornings, the silhouette of the jagged forest canopy on the mountain ridge, the expansive carpet of dewy spider tents on the grass—all a perfect backdrop for my mug of steaming, rich, local coffee, grown not more than 6 kilometers from La Balsa, and my pair of binoculars to spy on the birds. At sunset, sometimes just after a rain, one, two and even three, intense rainbows may appear in the horizon.

Each day, I wake up with almost certainty that the thick clouds enveloping my house will lift at 6:00. The leaf cutter ants will stir from their nests at about the same time, and march single file across my porch and front door toward the forest. By sunset, the returning single file (no doubt with many in-between trips) of loaded ants will have their harvest between their pincers, all heading toward home. If the wind is not whipping, the no-see-ums (a biting fly of about 1.5 mm in length) will start going for my blood with lightning speed at about 6:30 AM. Their tiny bite injects a droplet of anticoagulant and venom, causing local hemorrhage and nasty welts. I noticed, however, several years and hundred of injections later, my body learned to manage the bites. The size of hemorrhaging spot is still the same, but no more swelling and a lot less itching – proof of my immune system making peace with this insect's venom. Each day, a new lesson on the strategies of life awaits me.

Unlike *homo sapiens*, represented by only one species on the entire planet, the biodiversity in LaBalsa is mind-numbing. Even if I were to live to 100 years old, there would be insufficient time to catalogue and learn the flora and fauna just within the confine of my rental house. For example ants, I may not know their latin names but I can now differentiate their bites. The tiniest is almost invisible, but their bites leave golf ball-size welts. The largest ants are over a centimeter long, black, fierce looking with pincers that lock onto one's flesh when provoked. The ant can be forcefully removed, but not its pincers. I recall one unhappy experience while driving on the narrow, windy road to our office in San Ramon. Unbeknownst to me, I must have crossed the path of a moving colony of arm ants while opening the gate. After driving for about two kilometers, the soldier ants made their way up my pants legs and encountered flesh. Pain shot up and down over my entire legs and higher, but I fought to keep my hands on the steering wheel, for fear of going off the cliff. Finally, after enduring dozens of agonizing bites, the road widened just enough for me to stop and defend myself. My legs were sad sights for days, not to mention the lingering pain afterward



Domestic cockroaches, I have learned to recognize a half dozen species (all invaders from the Old World). Numerous species of flies, moths, bees, wasps, anoles, all have use of my house *gratis*. Sharing the same room with certain species of crickets during mating season can be ear shattering. It is difficult to believe how friction from two tiny legs can generate such piercing sirens, sustained for so many hours. Then there are the parade of beetles and other insects. During peak season, the combination of crashing beetles (dung beetles, scarabs of all kinds) against doors and windows, coupled with the flashing lights from giant fireflies made for unusual special effects inside my bedroom. Also, I learned soon after moving into the house not to apply certain hair conditioner after dark, else my head became dive bombing target for certain beetles that seem to be attracted to the scent. Neither do I paint outdoors with acrylic (and only acrylic) paint, or else have whole colony of frantic wasps descend on the fresh painted surface, probably a potent mimic of their pheromone. Nor do I leave my glass of beer uncovered, or else have my drink blackened by happy fruit flies, moths and less appetizing swimmers.



Let's not forget the larger animals. Antics from the big-eyed but tiny bodied pygmy rats have kept me chasing around the bedroom for many dark nights. I can't decide which is worse, having the photogenic pygmy rats sniffing around my bed or having them chew up the washing machine's rubber hoses or the garden hose in multiple pieces. My punctual friend the armadillo has been circling the house on time almost every night at two AM for the past year and a half, leaving craters where he feasted on earth worms all around the yard. Mr. Opossum, on the other hand, is much a more forceful intruder, chewing a hole in the porch screen to clamber in. We scared the heck out of each other one evening when I went out to investigate the racket he caused while "dropping in" for a visit.

The most lasting impression, after living with the clouds and biodiversity for a few years now, is the realization that this immense biodiversity is the culmination of millions of years of coexistence. Every evolving species had equal potential to survive or become extinct, each according to its ability to live with its fellow creatures. We are the lone species that is able to claim the self-granted "right to the pursuit of happiness", but without a hoot of consideration for the rights of our fellow non-human neighbors. The future of mankind as we know it is not bright. Mother Nature does not take sides.

"It matters not whether which one of you are right or wrong", my parents admonished me as a child after trying to defend myself against my younger siblings' aggression." You know better. Since they do not, only you could change the situation. Accept the responsibility to do better, for all concerned and not just for yourself." I pondered over the unfairness of that approach all my life. It took the clouds and my less intelligent housemates for me to see the light and to acknowledge my parents' wise approach to life.

The call I finally made, 43 years late

— Alvaro Ugalde

During the 35 years of my career in conservation, for dozens of times I have been asked, who or what inspired my mission? And without hesitation, I have always responded: "there is one person that is present in my mind as my first source of inspiration of my love and respect for all manifestations of life ... *Nidia Abarca*, my biology professor in high school" .

Her face is deeply imprinted in my brain, her strong features and the solidity of her personality. Her voice deep, loud and clear, with a certainty unique to those who prepare for every task of their life. She was a formidable teacher and I simply adored her. And, after one year with her as my biology mentor I had no doubts as to what career I wanted to pursue.

She dedicated her life and personality to her students, whether she was in school or in her home. And, she must have ignited the biology spark within me, because we spent hours discussing biology issues, while I helped in preparing the materials for her biology class. She was a solid science professor and at the same time a sweet person. A great example of a rare kind of human, one with a balanced mixture of great intelligence and lots of wisdom.

And, up until last December, I always added: "I have to go and find her, to tell her about my mission and the big role she played in it." Finally, after a talk during which I repeated my unfulfilled intentions, last month I grabbed the phone book, and dialled what I thought might be her number.

"Is this the home of *Nidia Abarca*, the biology teacher?" "Yes, it is, I am her daughter"...the voice answered... In few words, I said who I was and how much I appreciated her mother's inspiration. I also gave her my telephone number, since *doña Nidia* was not feeling well and was resting.

In the meantime, I went on with my life in Osa, Christmas and New year, and I even mentioned her a couple times in conversations with my donors and friends. I also wondered a lot as to whether she remembered me and even if she cared about my call.

And then, about 10 days ago, when I checked my phone messages while on vacation, I found the following words: "Dear Alvaro, I am *Mauriel Soto*, the husband of *Profesora Nidia Abarca*. My wife just passed away. I want to meet you to thank you for your phone call and acknowledgement". It was a shock for me...very unexpected, but at the same time, kind of suspected...

Today, I sat to write this story, after I had a very nice and interesting conversation with don Mauriel. I said, "I'm so glad I called on time; did she remember me?" "Yes by all means, she was very happy to hear from you and learning a little about how you feel about her role in your career."

"what a coincidence"...I said. "Not coincidence, don Alvaro.. there were several indications, including your call, that her role on this earth was fully fulfilled and that she could now depart. Her colleagues testified as to her legacy during the funeral."

While don Mauriel and I will soon get together in my renewed encounter with my biology teacher, I am determined to find more about what and who else were impacted and touched by this guardian angel. I might tell you more about her in the future.

But, my mind keeps asking from time to time: who called whom? Did I look her up? Or did I just simply answer her call? She might still have things in store for me to do!

Preserve Highlights for 2004

February - The start of construction of Staff Building represents the last phase of our construction for a while. With its completion in April 2005, our staff will finally have a comfortable, very attractive building in which to have lunch and relax during breaks. It houses a one-room laboratory, and small quarters for our caretaker and our park ranger, one room for a visiting scientist and a large workshop/tool storage area (bodega). The laboratory facility will allow us to do microscopic identification of bryophytes and insects, as well as plant tissue culture work.

March - As a continuation of our herbarium plant collection, a more detailed survey and collection of ferns was initiated. We now have about 120 species of fern recorded, photographed live, and with dried samples accessioned in our herbarium and database. Gerardo Rivera, our parataxonomist, arranged to have their identification reviewed and confirmed by Dr. Alejandro Rojas, a fern specialist formerly of INBIO. We plan to eventually have the information in a illustrated guidebook.

April - The reforestation project, started in 2002, has expanded to 5 experimental areas and 2 control plots. The five experimental plots were monitored for three variables—growth, turnover, and of procedure for weed

control which differed among the plots. Transplanted seedlings and volunteer pioneer plants were tagged. Mapping of the plants in relation to the terrain and exposure were done for 3 of experimental areas. Unfortunately, the work was interrupted by change in personnel.

August - Work of two watercolor painters inaugurated our Galeria. Mr Manabu Saito, a watercolor artist of botanical subjects, has been a regular visiting artist at our Nectandra Garden for the past three years. With his Japanese influence, Mr Saito brings to life plants and flowers with amazing details, vibrance and clarity. Mr. Nain Solis, a Costa Rican current living in Hollywood, captures the spiritual side of Mother Nature. Work of the two artists provide intriguing counterpoints to each other's approach. Other art work in our Galeria currently include ceramics done in the style (and with same source clay and earth-tone slips) of pre-Columbian Chorotega ceramics, and ceramics by modern local ceramicists with fauna and flora of the neotropics as subjects.

September - The kitchen for the Café was readied for business. Nectandra Garden is 8-9 km from the nearest food service. An average visit to the garden usually take 3-4 hours, depending on the visitors' interest, hence the necessity to provide meals. The house cuisine is best described as eclectic, using the best of locally produced Costa Rican ingredients using cooking techniques from several continents. The emphasis is on natural flavors, or unusual fruits and vegetables not often used or available in the US. Because of the distance to commercial suppliers, baked goods are made on site and custom-baked to coincide with the schedules of the visitors.

Costa Rica Expeditions held their Annual Naturalist-Guide Training session at the Garden. The naturalist-guides are the linchpins for our education efforts. They are the front line and the ones who will change attitudes of our visitors. Costa Rica Expeditions recognizes the important roles of these messengers for conservation. It provides a three-day annual workshop for their guides, both at senior and junior levels, with invited speakers on various topics related to ecology and conservation. This year, the field practice was split between Nectandra Garden and Monteverde Lodge, both located in cloud forests. The 40-plus attendees was a good test for our facilities, as it represented the maximum number of people allowed in the garden at any one time.

October - Sergio León started working, formally as our Outreach Education Coordinator. Sergio only recently retired from the National Park Service. His career with the Park Service took him to most of the major parks in Costa Rica, including the popular Manuel Antonio National Park, the most visited in the country. Sergio will help us launch our outreach environmental education program, starting with the small one room school nearest the Garden, in La Balsa. As the school curriculum is well regulated by the school board, we hope to be able to come up with extracurricular activities that appeal to the children and their parents.

December - Manuel Solis, our park ranger, has completed a series of positive plaster casting of the animal prints (fore and hind limbs) he found on his patrol. The prints are pretty comprehensive. They are displayed in relation to their pecking order on the food chain. The highest position is occupied, of course, by *homo sapiens* in the form of Manuel's hand and footprint. Included are Baird's tapir, puma, coyote, jaguarundi, collared peccary, nine-banded armadillo, red brocket deer, paca, agouti, margay, ocella, spotted skunk, common opossum, northern raccoon, rabbit, and rat.