Refuge ecologist visits Costa Rica

by Ed Berg

A visit to the tropics is as close as ecologists ever get to heaven during their mortal lifetimes. Only in the tropics can you see the full splendor of plant and animal life—the brilliant birds, the flowers, the little frogs and lizards, and amazing bugs of all sizes. And of course only in the tropics can you find yourself hosting the greatest variety of microorganisms that you would just as soon leave inside the medical textbooks.

I recently returned from a 12-day tropical ecology fieldtrip in Costa Rica, where I journeyed with three professors and their students from Binghamton University in New York. We traveled in three vans and stayed at various biological field stations and modest hotels, like pilgrims to a biological Holy Land. We covered a wide variety of forest types, from beaches and mangrove forests on the Pacific coast, to mountain cloud forests at Monteverde, and the dwarf alpine (paramo) forests of the Sierra de la Muerte at 11,000 feet elevation.

I have traveled quite a bit in Central America, but never with a group of such expert birders. The professors have been making this trip for 13 years, and have a remarkable command of the birds, by both sight and sound. We got up at dawn every day, when the bird singing shifts into high gear for an hour or so. Sometimes we would hear the rumble of howler monkeys bouncing from one heavily forested mountain slope to another. Once the sun was up, the bird vocalizations subsided and we retreated to breakfast in preparation for the day's activities. By the end of the trip we had seen and identified 282 species of birds, out of the roughly 850 species known for Costa Rica.

One of my favorite activities in the tropics is watching the long lines of leaf cutter ants. These ants cut half-inch pieces of leaves, which can weigh as much as 12 times their body weight. They carry the leaf fragments over their heads along well-trodden paths to underground borrows, where they have a labyrinth of chambers occupying several cubic yards of soil. They deposit the leaf fragments in these chambers and inoculate them with a fungus, which they subsequently eat. The ants are thus actually farming fungus gardens and are not eating the leaves.

A colony of leaf cutters is founded by a single queen, who mates with four to 10 males on her nuptial flight. The queen can lay millions of eggs over a period of 10-20 years, using the original sperm stored from this single flight. The worker ants of the colony are all sterile sisters or half-sisters from this queen. The queen also produces a few fertile females for future queens as well as some fertile males.

We all agreed that the outstanding bird sighting of the trip was the mating of three-wattled bellbirds. The male bellbird had a white head with three black wattles (strips of skin) hanging down from the base of his beak; the wattles are about three inches long and perhaps an eighth-inch wide. The male was perched on a high treetop, displaying himself by opening his large mouth (which is all black inside) and swinging his wattles. Presently a rather drab-looking female landed on a branch near him. The male hopped on top of her, made a quick thrusting motion, while uttering a single loud "Bonk!," after which the female flew away. Soon, however, she flew back, and the ceremony was repeated. The humor of the male's victorious "Bonk!" could not escape us, and our howls of laughter made it hard for us focus our binoculars, as we watched this cycle repeated fully eleven times.

The bellbird mating of course generated a discussion about the mechanics of birds mating, of which we were all a bit unclear. Visiting the Internet upon returning home, I learned that most birds do not have a penis and there is no penetration involved in mating. Birds have a cloaca under the tail feathers, which doubles as both an anus for excretion and a reproductive port. The male's sperm duct ejaculates into the cloaca near the opening, so that during mating the cloaca is moist with sperm. When the male mounts the female he must twist his tail under the female's tail so that his cloaca presses against her cloaca, and sperm is transferred. The female's vagina is connected near her cloacal opening, and the sperm must travel into the cloaca and up the vagina to the uterus to reach the egg for fertilization. When the egg is ready to be laid, it must pass down the vagina and out of the cloaca.

In our travels around Costa Rica we observed that much of the land has been deforested for cow pasture. Costa Rican cows must be pretty athletic, to

judge from the steep treeless slopes that have been cleared for them. The hillsides were frequently contoured with more-or-less horizontal paths created by cows trying to avoid going up or down these declivities. Patches of wild forest still cover the steepest areas, ridge tops, and ravines, and other areas considered uncow-worthy. These wild patches are small refuges for biodiversity, especially for birds that move from patch to patch.

We visited an interesting experiment in reforesting steep pastureland near Dominical, in southwestern Costa Rica. In the early 1990s a small group of Northamerican conservationists purchased 350 acres of mostly steep pastureland that had been grazed for about 20 years. They wanted to see if this barren land could be restored to forest, in an economically practical manner, and called the project "The Tropical Forestry Initiative." One of the founders was Carl Leopold, son of Aldo Leopold whose "A Sand County Almanac" is a well-known bible of conservationist philosophy. They have planted a variety of local trees, some with good forestry potential, and some for wildlife habitat.

The soils in this area are relatively young volcanic soils and are fairly rich, by tropical standards, despite the typical red clay appearance with little organic content. In less than ten years many of the new trees have grown to more than 50 feet in height and diameters of six to eight inches; the canopy is closing and a new, secondary forest is well underway. Further up the steep ridge there is uncut primary forest with huge buttressed trees with thick vines, and a many-layered canopy structure. The difference between the original primary forest and the new secondary forest was of course striking, but even more striking was the rate at which the new forest was catching up with the old forest.

This experiment at least shows that steep deforested slopes can be reforested fairly quickly with fast growing tree species, and much of the forest value for wildlife can be restored, perhaps within a few decades. For forestry purposes, however, the trees would probably have to be skidded out with horses to avoid destroying the new growth and gullying the slopes. Industrial foresters would probably never be convinced by this example, but it does represent a promising possibility for sustainable small-scale local forestry.

Sustainability is a big issue in the tropics. We saw extensive plantations of teak and oil palms, planted in neat rows with very little growing between them. The teak is cut on a short rotation of 20-30 years, and the oil palms must be killed off with herbicides and replanted every few decades to keep up productivity of the oil-rich fruits. After a few cycles the soil will be depleted, and it will be necessary to add expensive petroleum-based fertilizers, which is only practical in a world with cheap oil.

Our last night was spent at Hacienda Baru National Wildlife Refuge, which is another remarkable conservation experiment. In 1972 this area along the Pacific coast was a cattle ranch with 150 cows on 800 acres, managed by a young American named Jack Ewing for some Tennessee investors. The ranch hired three people full-time, and maybe another dozen during the rice harvest.

Jack told us how one of his cowboys had killed a beautiful ocelot, and Jack—an experienced hunter—for some reason felt bad about this killing. He started putting up "No Hunting" signs and hired guards to keep out poachers, which did not contribute to his popularity with the locals. The wildlife populations increased substantially, however, which did not go unnoticed.

In 1986 the road was paved and truckers with guns began shooting animals along the road. A local group was formed to stop this practice, and a particularly flagrant poacher was jailed. Other towns joined the anti-hunting group, and worked to set up a string of mostly private wildlife refuges called "The Path of the Tapir," which now protects a corridor of 15,000 acres. In the 1980s Hacienda Baru abandoned cattle ranching and the land was allowed to return to forest, and was subsequently reorganized as a wildlife refuge. Today Hacienda Baru is funded solely by ecotourism (15,400 visitors last year) and employs 33 people housing, feeding, and guiding visitors through the lush forests. The beautiful beach with vigorous surf is a further drawing card, as are the canopy tours with ropes and aerial platforms.

The Costa Rican government has taken some very good steps to prevent further deforestation and has recognized ecotourism as a major economic force. Over 20% of the country is in some kind of protected status, and this is drawing ever more tourist dollars into the national economy. Legislation has been passed recently to pay forest landowners for the ecosystem services of their forests, such as watershed protection. Water users downstream from uncut forests, such as hydroelectric utilities, are being asked to pay a water tax that will go to the forest landown-

ers. When the forests are removed, the quality of watershed ecosystem service is severely degraded: rainfall tends to decrease (when the water transpired from the trees is lost), and the streams discharge quickly in floods of muddy water.

The Costa Rican government also recognizes that forests remove carbon from the atmosphere, so there is a gas tax which is used to finance the planting of new trees to offset the CO_2 emissions from burning gasoline. These are impressive, ecologically aware steps for a small under-developed country, and it would be nice to see such ideas implemented in the U.S..

Costa Rica is a friendly country for travelers, and I can see why it has become a popular retirement destination for Americans. It has no army, and you don't see a lot of bored, heavily armed soldiers standing around, such as in other Central American countries. As in Alaska, ecotourism is a fairly benign growth industry, compared to cattle ranching or resource extraction industries. I find it heartening that the government of Costa Rica views ecotourism as a sustainable industry for the future, and is taking concrete steps to protect the natural resources that tourists come to see. It is a lesson that should not be lost on Alaskans.

Ed Berg has been the ecologist at the Kenai National Wildlife Refuge since 1993. He would encourage readers interested in visiting Costa Rica to enjoy Jack Ewing's new book, "Monkeys are Made of Chocolate," available at http://www.haciendabaru.com/. Previous Refuge Notebook columns can be viewed on the Web at http://www.fws.gov/refuge/kenai/.