Conservation of tropical rain forest birds: a case study from Costa Rica

F. Gary Stiles and
Deborah A. Clark

THE FATE OF THE WORLD'S TROPICAL rain forests is a critical global issue. The most species-rich terrestrial ecosystems, these forests are rapidly disappearing. A graphic case study is presented by the tiny Central American country of Costa Rica, where a combination of massive deforestation, exemplary conservation efforts, and intensive long-term ornithological research is revealing the challenges and potentials for preservation of tropical-forest bird species.

Costa Rica has long held a special attraction for ornithologists and birders from northern climes. Few countries boast so many species of birds per unit area. As of 1989, 840 species have been recorded in this West Virginia-sized country, more than in all of North America (Stiles and Skutch 1989, *cf.* A.O.U. 1983). Its stable democracy and well-educated, friendly people add to the country's attractiveness as a site for studying neotropical biodiversity. The extraordinary richness of the avifauna reflects both Costa Rica's geographic position on an isthmus between two continents and their complements of bird species, and the diversity of Costa Rica's topography and vegetation; this tiny country contains more different kinds of forest than does all of North America (Holdridge 1967). Just as primeval Costa Rica was almost entirely forested, so over 60% of its resident landbird species require large continuous areas, or interconnected blocks, of forest to survive (Stiles 1985a). Thus, the key to preserving this diverse tropical avifauna clearly lies in preserving forests.

When it comes to tropical forest conservation, Costa Rica is a study in contrasts. Relative to its size, it boasts the largest and best-protected system of national parks in Latin America. An impressive 11% of the country is now managed as strictly protected parks, wildlife refuges, and equivalent reserves (Figure 1). Outside of the protected lands, however, forest destruction and poor land use are widespread. Only an estimated 17% of the country's primary forest remained in 1983 (Sader and Joyce 1988). At its current deforestation rate, one of the highest in Latin America, in very few years Costa Rica's primary forests will be restricted to the national parks and equivalent reserves, and to areas where extremely steep slopes render logging impossible. Two questions

Mist-enshrouded mountain forests near the La Selva Biological Station, Costa Rica.

arise how well will the current protected areas preserve the country's great diversity of flora and fauna—in particular the forest avifauna? And perhaps even more important, what are the possibilities of maintaining this system intact in the face of ever-increasing demands for wood and land?

The answers to these two questions are linked. The second question can only be answered by the Costa Rican people and their elected governmental representatives. Spiritual, aesthetic, and educational values of the park system will undoubtedly play some role in the answer, but short-term economic benefits always figure largest in the plans of officials elected to four-year terms. The best present prospect for such benefits is ecotourism—especially birders. Costa Rica currently plays host to thousands of birders and other natural-history tourists annually, and their numbers are rapidly increasing. As a generator of foreign exchange, tourism is now following closely behind coffee and bananas, the country's traditional sources of income. Costa Rica's attractiveness for ecotourism in the future will depend in large part upon the answer to the first question: how successful will the park system be in preserving the country's rich biological heritage for all to enjoy?

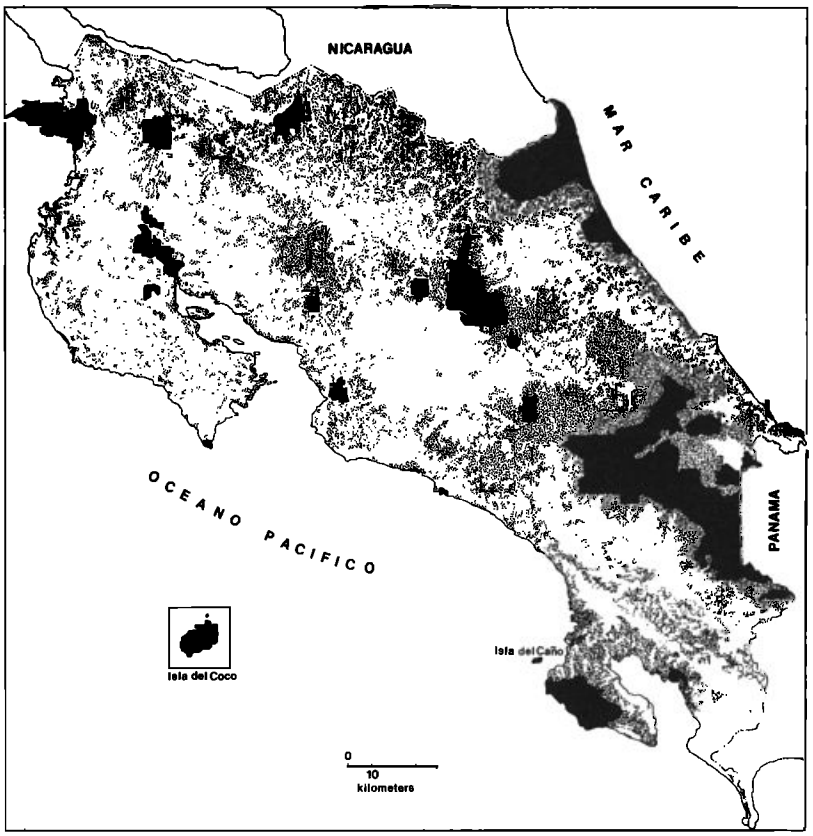

Figure 1. *Protected reserves (national parks and monuments, biological reserves, and national wildlife areas; shown in solid black) cover an impressive 11% of Costa Rica's area. The forest cover remaining in 1985 is shown by stippling. Adapted from Alfaro et al. 1988. Illustration/Beth Farnsworth.*

The status of Costa Rica's forests

Costa Rica was once completely forested, blanketed by a complex intergrading set of ecosystems, from tropical dry forest to high montane cloud forest, to the true rain forests of the volcanic slopes and lowlands. The current conservation status of the country's forested areas can be appreciated by comparing the distribution of protected areas to that of the original forests. A high proportion of the highland forests (along the central volcanic "spine" of the country) are within the park system, but the low-

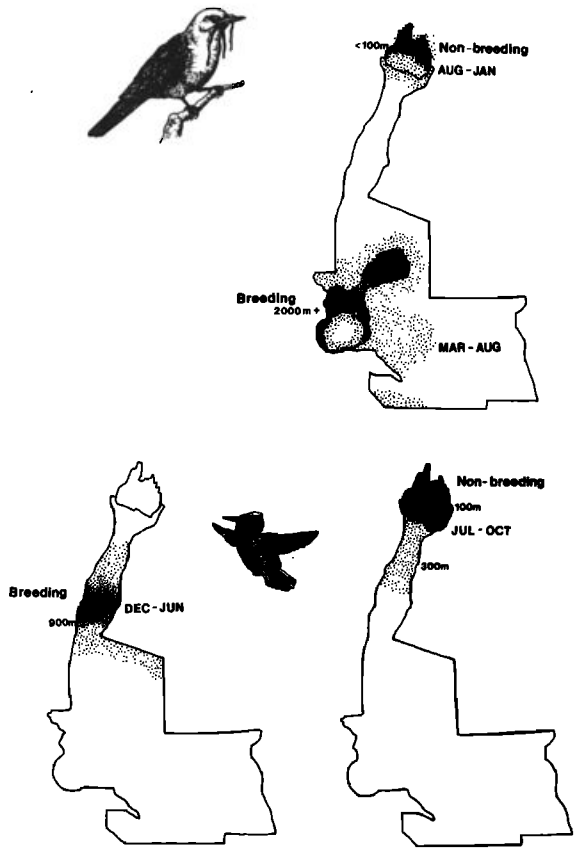

Figure 2. *Two of the diverse altitudinal migration patterns of Central American birds are illustrated by the annual movements of the Three-wattled Bellbird (top) and the Snowcap (bottom) within the Braulio Carrillo-La Selva transect, Costa Rica. Illustration/Beth Farnsworth.*

land forests of both coastal plains are decidedly underrepresented (Figure 1). Only two parks, Corcovado National Park on the southern Pacific coast and Tortuguero National Park on the Caribbean, contain more than 10,000 hectares of lowland tropical wet ("rain") forest, the forest type that once covered over 35% of Costa Rica's land area (Stiles 1985a). These lowland ecosystems contain the country's richest breeding landbird avifaunas, with 200–250 species recorded in areas of only a few square kilometers (Stiles 1983).

Furthermore, it can be misleading to consider area alone in a mountainous country like Costa Rica. The assumption that tropical forest birds are sedentary, implicit in many studies of conservation units and species diversity (*e.g.,* Orians 1969, Terborgh 1974, Lovejoy 1988), is violated by numerous species that make altitudinal movements on a daily or seasonal basis. For instance, on the Caribbean slopes of Costa Rica's central volcanic chain, 20–25% of the approximately 350 breeding landbird species engage in altitudinal movements of a few hundred to over 2000 meters (Stiles 1988, B. Loiselle and J. Blake, unpublished data). The contrasting migrations of the Three-wattled Bellbird and the Snowcap (Figure 2) illustrate the diversity of these movements. The percent of the breeding avifauna that engages in such migrations increases with elevation, reaching 50% in some high mountain forests (Stiles 1983). These species are not a random sample of the resident bird species. The great majority of the seasonal migrants are fruit- or nectar-feeders, whereas those that engage in daily altitudinal movements are aerial insectivores like swifts, and soaring raptors (kites, hawks, and eagles). Significantly, over 80% of the true altitudinal migrants, including spectacular species like the Three-wattled Bellbird and Bare-necked Umbrellabird, require forest habitat. Others, such as the Resplendent Quetzal, tolerate considerable deforestation but still depend upon residual forest resources like fruiting trees in the avocado family, and large dead trees that are used for nesting (Wheelwright 1983). For most of these species a broad band of forest, spanning a wide range of elevations, is required for survival. A park of restricted elevational extent, no matter how large or species rich, will not suffice.

How to preserve the altitudinal migrant birds?

Recognition of the importance of a continuous altitudinal forest gradient for many Central American bird species recently led to a dramatic gain for tropical conservation—the establishment of the Braulio Carrillo-La Selva transect. The success of this effort was due to thousands of people and the cooperative efforts of several organizations. Ironically, it was also partially owed to a highway construction project. The story is by no means ended—long-term preservation of tropical rain forest will be increasingly difficult in the face of growing environmental and human pressures around reserves. However, the history of how this rain forest transect was saved is a bright spot in the bleakness of tropical deforestation, and it perhaps provides some guidelines for last-minute conservation efforts elsewhere.

Conservationists began the quest for a transect location in the 1970s. It was already apparent then that the Caribbean slope of the Central American isthmus was being denuded of its diverse spectrum of forests, an intergrading complex ranging from the elfin cloud forests on the volcano summits, down to the liana-hung forests of the steamy lowlands. Existing protected areas did not include all these ecosystems. It was at this juncture that researchers were gathering the first evidence of the mobility of the Caribbean slope avifauna—the altitudinal migrants were a strong argument for protecting an intact elevational transect of rain forest. The search began, through ground reconnaissance and analysis of maps and aerial photos, for a location for such a park in Central America.

Enter the highway. Through the 1970s access to the central Caribbean lowlands of Costa Rica from the capital city of San José was by a potholed,

tortuous mountain road, the bane of all lowland residents. The solution appeared to be the construction of a modern highway along a more direct route over the volcanos and down the Caribbean slope. From the conservationist's perspective, however, the plan seemed disastrous. The new route cut right through a magnificent roadless area of montane forest, likened by many to the dramatic central mountains of New Guinea. Shrouded by clouds, this was a principal watershed area for the country. Its protective blanket of forest would be at extreme risk if access by road were created.

In one remarkable stroke, this classic development *vs.* conservation conflict was replaced by a development and conservation mutualism. It was decided to let the highway project go through, but simultaneously 79,000 acres of the surrounding forests would be set aside as a new national park of Costa Rica. Braulio Carrillo National Park was created by presidential decree in 1978. It protected a tremendous area of tropical montane forest. Only a 20-minute drive from the center of the country's most populated region, this park also offered an unprecedented opportunity for introducing people to the splendors and values of protected natural areas.

Meanwhile, at the foot of the slopes reaching down from Braulio Carrillo, an area of lowland forest was under protection as part of the La Selva Biological Station. A growing world center for tropical biological research and education, La Selva is owned by the Organization for Tropical Studies, a consortium of Costa Rican and U.S. universities. Its intensively studied forests were still connected to a large sweep of forested lands stretching downslope from Braulio Carrillo. However, by the 1970s the middle elevations were rapidly being cleared. Clearly, it would just be a matter of time before La Selva became an island of forest in a sea of cattle pasture. With over 400 species of birds, La Selva had the richest avifauna of any site in Middle America; at least 8% of these were altitudinal migrants (Levey and Stiles, 1989).

The pieces were in place. This seemed an ideal location for a Caribbean slope forest transect: a large national park protecting the volcano summits, a thriving research station and reserve in the lowlands, and forest cover still surviving in the unprotected middle elevations. Efforts were begun to make the transect a reality. The Costa Rican National Park Service overflew the region, analyzed the maps, and then designed an extension of Braulio Carrillo Park down to the borders of La Selva. This would protect a spectacular transect—a rain forest preserve stretching 21 miles from the summit of Barva Volcano at 9500 feet, down to 100 feet at La Selva. Enthusiasm was high. The Costa Rican government initiated plans for extending the Park.

And then the bottom fell out of the Costa Rican economy. The colón went from 8.5 to the dollar to over 60. With no government monies for the necessary land acquisition, and with a heavily indebted National Park Service, the plan to extend Braulio Carrillo National Park had to be shelved.

Who should pay for tropical rain forest protection? In this case, the tiny country of Costa Rica had already invested an unprecedented proportion of its economy and lands in what had become the stellar national park system in Latin America. This forward-looking Central American democracy had virtually singlehandedly set aside a remarkable sampling of the world's biodiversity. But given the country's economic status, Costa Rica could not assume additional conservation responsibilities unaided. The Braulio Carrillo project, which would protect a world patrimony, could only succeed if there were an international effort to raise the needed funds.

And so it happened. But only after years of delay and with a large dose of serendipity. The key factor was Costa Rica's own interest in the protection of the area. In 1982, President Luis Alberto Monge provided stopgap protection for the vulnerable middle-elevation lands by declaring them a Zona Protectora (Protected Zone). This designation left the lands in private hands but essentially created a land freeze. It

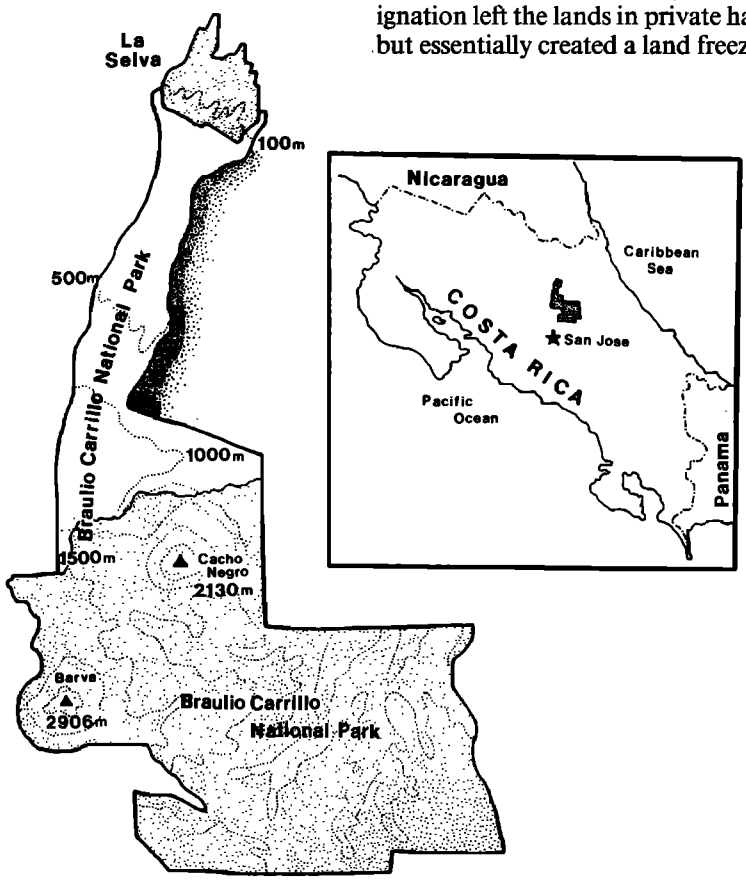

Figure 3. *The Central American tropical rain forest transect was completed in 1986 with the extension of Braulio Carrillo National Park down through the mid-elevation forests (shown in white) to the La Selva Biological Station. Current efforts are under way to widen the corridor through addition of intact rain forest lands still remaining to the east (indicated with stippling). Illustration/Beth Farnsworth.*

stopped the loggers in their tracks and halted further clearing by farmers. This was only a temporary solution, however. A budget of $2 million was needed to acquire all the private holdings in the proposed park extension. Until these funds could be found, the landholders were left in place but with their activities severely restricted. The forest guards needed to enforce the land freeze were being supported by emergency conservation donations. This was clearly not a stable situation.

The year Zona Protectora status was given to the middle-elevation forests, a graduate student in an Organization for Tropical Studies tropical biology course, Catherine Pringle, learned of the transect project and was inspired to get involved. She reasoned that documentation of the biological diversity of the unprotected forests would be a potent argument for fundraising. With support from the Jessie Smith Noyes Foundation fellowship program of the Organization for Tropical Studies, she convened a group of experts on Costa Rican flora and fauna and with them mounted a ten day expedition into the virtually unexplored middle-elevation forests (Pringle 1988). They had very bad luck with the weather—a several-day rainstorm ("temporal") coincided with their entry into the Zona. Undaunted, they climbed through the mud, collected moths from under umbrellas, sprinkled plant specimens with formalin to prevent molding, and birdwatched through the downpours. In spite of these adversities, the expedition's "take" was impressive: 28 plant species new to science, more than 175 species of butterflies and moths, evidence of very abundant populations of large mammals such as tapir and jaguar, and observations of the greatest raptor densities known from any part of Costa Rica. Their findings greatly strengthened the arguments for preserving these threatened forests.

The serendipity in this story was the arrival of a North American birder. In 1984, Murray Gell-Mann, a Nobel laureate in physics, visited Costa Rica on a birding trip. He heard about the Braulio project from his tour leader, and one thing led to another. Gell-Mann was a member of the Board of Directors of the John D. and Catherine T. MacArthur Foundation. He contacted The Nature Conservancy about the project, and as a result The Nature Conservancy submitted to the MacArthur Foundation a proposal to fund the land acquisition. After extensive review by leading biologists and conservationists, the MacArthur Foundation awarded a $1 million one-to-one challenge grant in December 1984.

To raise the matching funds, a consortium was formed. Banding together with the Costa Rican National Parks Service and the private Costa Rican National Parks Foundation were the Nature Conservancy, the World Wildlife Fund-US, and the Organization for Tropical Studies. Many individuals became involved. With donations ranging from $5 to $250,000 (the W. Alton Jones Foundation), the needed total was raised in a year. Carefully orchestrated land acquisition began, and in April 1986 President Monge signed the decree extending Braulio Carrillo National Park to La Selva (Figure 3).

Unraveling the ecology of tropical altitudinal migrants

Continuing research is greatly increasing our understanding of the relationships of the avifauna to their habitats along the length of the Braulio Carrillo-La Selva transect. Evidence is mounting of the importance of an elevational gradient of forest for many bird species, particularly those dependent on fruits or nectar. The birds' movements appear closely tied to fluctuations of food abundance up and down the transect.

Down at La Selva, Douglas Levey has investigated in detail the interrelationships among frugivorous birds and their food resources in different lowland habitats—mature primary forest, treefall gaps, and young second-growth. His findings (Levey 1988) led to interesting speculation about the current and future ecological relationships of the altitudinal migrants. He showed that frugivore densities are closely correlated with local fruit availability. When food resources are seasonally low in the mature forest, many of the birds move into the young secondary forests where fruit is more abundant. The current importance of undisturbed habitat for these birds needs to be taken into consideration for future conservation management plans. His data also revealed an anomalous seasonal increase in the "resident" population of Red-capped Manakins, one of the most abundant avian frugivores at La Selva. The most likely explanation is that this species includes both a sedentary sub-population at La Selva and a substantial proportion of altitudinally migrating individuals. If this hypothesis is borne out, it raises a new series of questions about factors driving elevational movements in these tropical birds. It also suggests that we are underestimating the proportion of the avifauna that engages in altitudinal movements.

A notable on-going study in the Braulio Carrillo-La Selva transect is focused on the altitudinal migration patterns of frugivorous birds in relation to fruit availability at different elevations. Since 1983 Bette Loiselle and John Blake have been netting birds and measuring fruit availability at study sites located at intervals along the length of the transect: at 150 meters elevation (in La Selva), 500 meters, 1000 meters, and 2000 meters (Loiselle 1987, B. Loiselle and J Blake, unpublished data). They have confirmed that fruit is relatively scarce in the highlands towards the end of the year, when a fruiting peak occurs in the lowlands; this seasonal pattern of resource abundance seems to explain well the downslope altitudinal migration patterns of many of the birds (Figure 2). However, based on their findings to date, the relation between fruit supply and the return migration into the highlands is less clear

Other ecological factors may be triggering this part of the cycle. The long-term data Loiselle and Blake are continuing to collect on these birds, their movements, and their food supply will provide key information on the behavior and needs of the frugivorous avifauna of the region.

Colombian ornithologist Loretta Rosselli has just completed an intensive study of the White-ruffed Manakin at a middle-elevation site in the transect (Rosselli 1989). Working at 600 meters elevation at the location romantically named "El Plástico," she has studied the relationships between this frugivore and its fruit resources She found that the manakin only consumed 43 of the 95 species of fruit available to it. Of those eaten, only six appeared to play an important role in

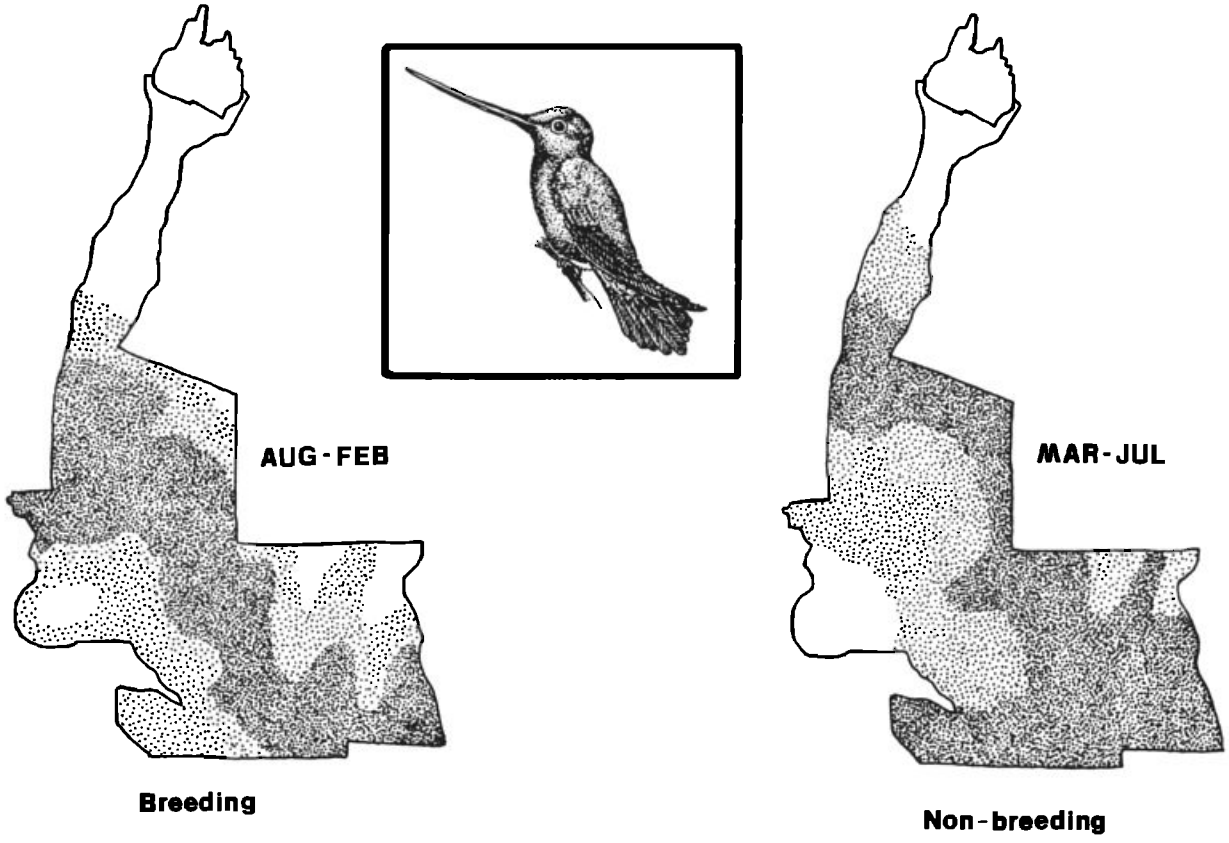

Figure 4. *The Green-fronted Lancebill moves upslope to breed in the peak of the rainy season. Illustration/Beth Farnsworth.*

determining the timing of seasonal movements. Over 90% of Rosselli's marked birds left the study area for several months, presumably to take advantage of the end-of-year fruiting peak in the lowlands. Again, the return migration was not related to a clear peak of fruiting in the study area, although such a peak did occur slightly later, at the height of the breeding season.

Almost the opposite pattern is shown by many hummingbirds, which nest in the highlands at the height of the rainy season and then migrate downward in the dry season (*e.g.*, Green-fronted Lancebill, Figure 4). Here the most important resources for many species appear to be canopy epiphytes of the blueberry family (Ericaceae), which flower abundantly between about October and March or April in the highlands, and perhaps bromeliads, heliconias, or members of the coffee family (Rubiaceae), which flower largely between January and August or September at lower elevations (Stiles 1985b). As with the frugivores, the upward migration and the start of the breeding season for these hummingbirds appear to precede by one or two months the appearance of abundant resources in the highlands.

Thus it is evident that, while we are beginning to understand some aspects of the causes of altitudinal migrations, others still elude us, and unless enough of the forests at all altitudes are adequately protected, we may never be able to elucidate this important aspect of the lives of many species of birds at higher elevations.

Further work has been conducted in areas adjacent to the transect in Braulio Carrillo National Park and at El Plástico-Rara Avis on frugivores, nectarivores, and their resources (Rosselli 1989, Stiles 1985b, and in prep.). These studies have helped to explain some of the relationships between the movements of these birds and patterns of resource availability, although much remains to be done. One important result is the demonstration of much year-to-year variation in the extent of altitudinal movements of many species.

What is needed to preserve these migratory tropical birds?

The results from the research to date on the Braulio Carrillo-La Selva avifauna bring into sharp focus the disparity between the available forest areas in the highlands and lowlands, and the narrowness of the belt connecting the two (Figure 3). It seems likely that in some years, when resources in the highlands reach particularly low levels, there may not be enough forest resources in the existing transect to sustain the volume of altitudinal migrants reaching the lowlands. Indeed, 1983 was apparently an especially hard year in the highlands. Several new species from the highlands (all frugivores and nectarivores) were reported at La Selva for the first time, and populations of other species such as the Black-faced Solitaire reached record levels (Levey 1988).

The protected corridor between La Selva and the main part of Braulio Carrillo National Park is only one to three miles wide over most of its nine-mile length. If all the adjacent forest still remaining were cleared, the fauna dependent on the middle- and lower-elevation forests would have severely limited habitat. In addition, La Selva would be exposed to the "peninsula effect"—the progressive withdrawal of species away from the tip of the peninsula. Indeed, some signs of this process are already evident (Levey and Stiles, in press). It is therefore important that as much as possible of the remaining forested land adjacent to

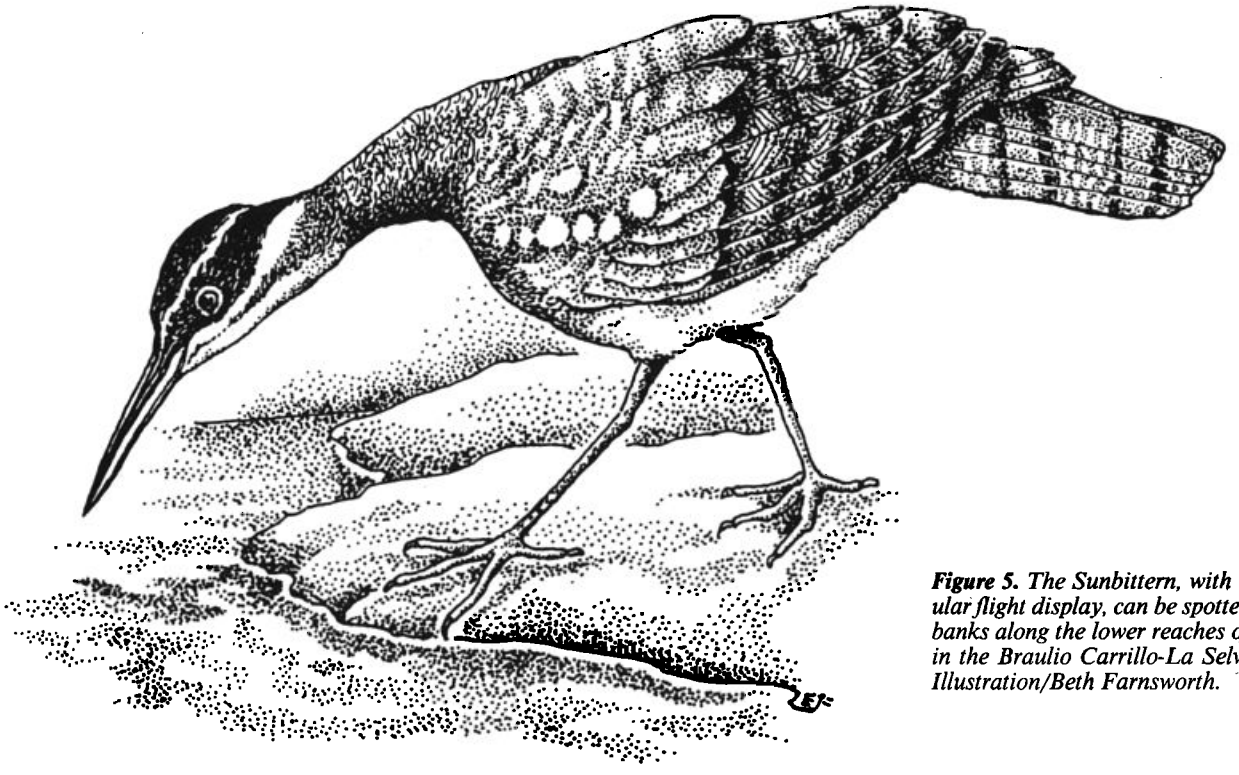

Figure 5. *The Sunbittern, with its spectacular flight display, can be spotted on gravel banks along the lower reaches of the rivers in the Braulio Carrillo-La Selva transect. Illustration/Beth Farnsworth.*

La Selva and the Zona Protectora be acquired and added to Braulio Carrillo National Park. Rapid deforestation in the area adds urgency to this task. As usual, the problem is money: such funds will not be available within Costa Rica, where the park system is still struggling to pay for and protect land in other areas and the government's options are severely limited by the foreign debt and the need to house and feed a rapidly increasingly population.

A second major issue has been the need to guarantee the long-term financial security of the park. With increasing focus on strategies for tropical conservation, it has become clear that land acquisition is just the first step in habitat protection. Provision has to be made for continued funding if protected reserves are to be managed and guarded into the future. In the case of the Braulio Carrillo-La Selva transect project, development of a management and protection endowment fund was part of the strategy nearly from the beginning. The Zona Protectora fund-raising campaign in fact brought in enough donations both to pay for the privately owned lands and to begin the vital park endowment (approximately $300,000 has been raised to date). A very encouraging recent development has been the start-up of FORESTA, a large scale natural resources project of the government of Costa Rica and U.S. Agency for International Development. Included in this regional conservation and forestry effort is endowment funding for Braulio Carrillo and two other major parks.

With the advent of FORESTA, the endowment worries are greatly diminished. However, there is very little time left to increase the ecological security of the transect through the addition of the prime rain forest lands to the east of its narrowest stretch. With the current road construction and lumbering in the area of these intact forests, this is truly an emergency situation. Given the tremendous biological importance of these still unprotected lands, their price tag is almost incredibly low. Doubling the width of the corridor will cost no more than $500,000. It is hard to imagine a situation where such a small infusion of money can achieve such a high return for the conservation of tropical rain forest and its species diversity. Not surprisingly, this is an area where birders have helped in the past. They could help even more in the future.

Rain forest conservation through Christmas Bird Counts

In 1985, the La Selva-Zona Protectora Christmas Bird Count was instituted, largely to help raise money for the original purchase of the rain forest corridor linking La Selva to Braulio Carrillo. The 1987 count also served as a "Birdathon" to raise funds for a protection and management endowment for Braulio Carrillo National Park. In addition to direct donations by count participants, many supporters who could not join in on these counts made contributions in the form of pledged amounts per species seen. Given the remarkable species totals in this event, this was an exciting and generous way to directly aid tropical conservation.

Over the four years of its existence, the La Selva-lower Braulio Carrillo National Park Christmas Bird Count

has averaged 310 species, with a high of 325 in 1987. It is thus one of the highest species counts on record, and with enough observers and cooperative weather, 350 species should be quite feasible! Some of the spectacular sightings in these events have been the elusive Sunbittern, the rarely-glimpsed Rufous-vented Ground Cuckoo (seen by many counters at an army ant swarm, while in the canopy above Bare-necked Umbrellabirds and Yellow-eared Toucanets were passing), and the raucous Great Green Macaw.

Participants in the Christmas Bird Count have always been varied. They have included Costa Rican university students, park rangers, tour guides, bird enthusiasts among the La Selva staff, scientists working at La Selva and elsewhere in Costa Rica, and visiting birders and natural-history tour groups, especially Victor Emanuel Nature Tours. This gives the Count a decidedly international flavor. The staff of the La Selva Biological Station and conservation-minded local landowners, such as Amos Bien of Rara Avis, have enthusiastically provided logistical support. Opportunities for counting range from trekking into the backcountry in Braulio Carrillo on foot, horse, and tractor, to covering the easily accessible trails within La Selva, exploring river edges in the station's dugout launch, or scouting the rich bird communities of the surrounding open lands. The excitement of the compilation provides ample compensation for the hard work of counting and the rustic housing at the station (bunk beds in dormitories).

The direct benefits of the La Selva-Braulio Carrillo Christmas Bird Count are multiple. It is a way for those interested in tropical bird ecology to experience the tropical rain forest avifauna first-hand, in conjunction with many generous, experienced tropical birders. As with all the National Audubon Christmas Bird Counts, this event also is building a long-term database on the status of the regional bird populations. This information will become invaluable for long-term management and protection of these species. And, as mentioned earlier, a special facet of this tropical Christmas Bird Count is that it brings together allies who are interested in contributing financially to the conservation efforts revolving around this unique tropical rain forest transect.

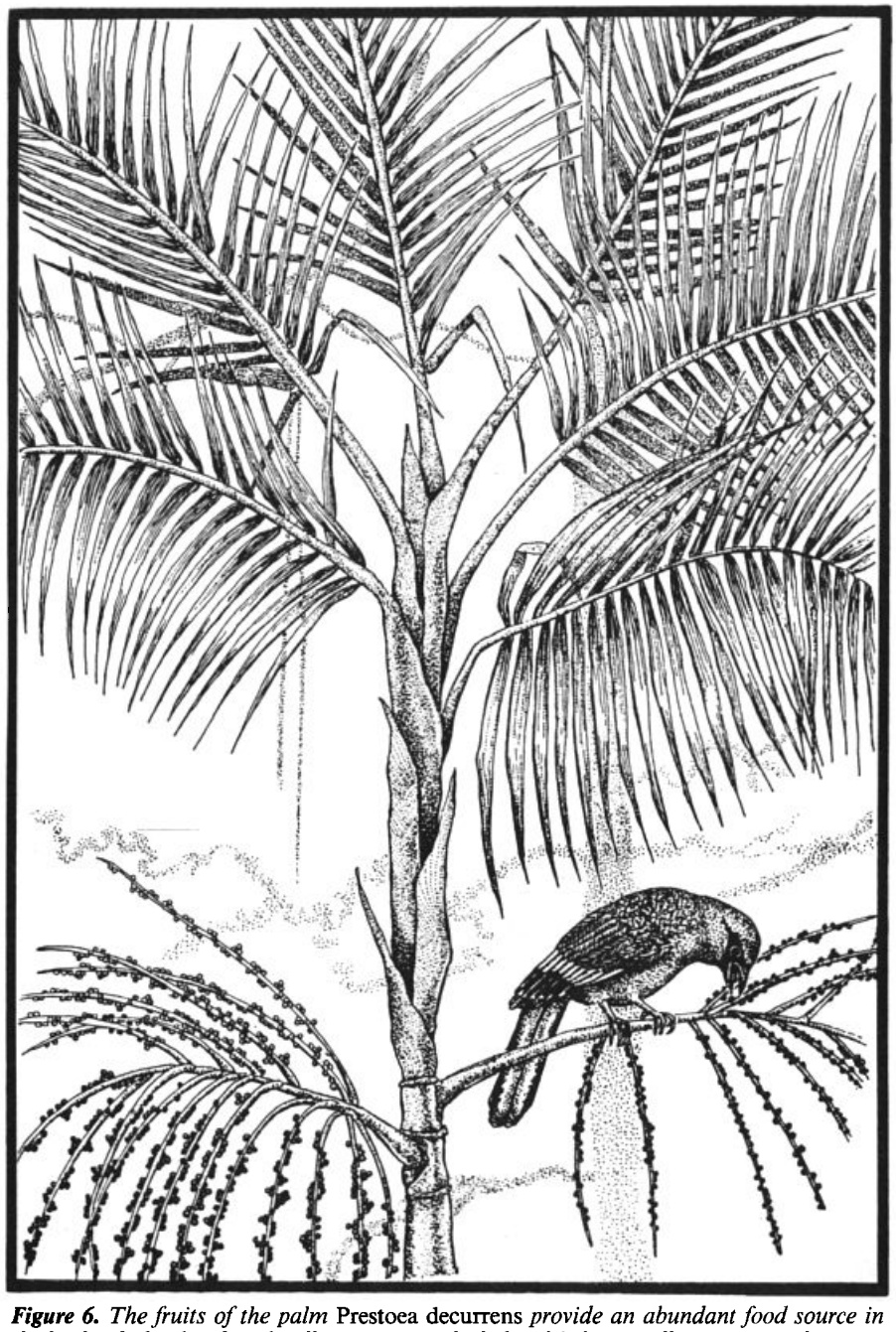

Figure 6. *The fruits of the palm* Prestoea decurrens *provide an abundant food source in the lowlands for the altitudinally migrating Black-faced Solitaire. Illustration/Beth Farnsworth.*

Costa Rica's pivotal role in tropical conservation

For those deeply interested in learning about and contributing to efforts for tropical rain forest preservation, Costa Rica is a site of special significance. In many ways, this tiny country is serving as a role model for efforts elsewhere in the tropics. With its outstanding track record in establishing national parks, its great social awareness, high literacy rates, and army-free democratic government, Costa Rica has a major leg up on the tremendous challenges involved in the conservation of tropical diversity. With its exceptionally open, welcoming attitude toward international scientists, the country also is one of the most intensely studied sites in the neotropics. The growing understanding of the elevational migrant bird species of the

For more information

If you would like to donate to the conservation efforts in the Braulio Carrillo—La Selva transect, make checks payable to Organization for Tropical Studies. Send your contributions to Donald Stone, Executive Director, OTS, attention: conservation in the Braulio Carrillo transect, P.O. Box DM, Duke Station, Durham, NC 27706. Your contributions are tax deductible when donated through OTS.

If you would like to visit the La Selva Biological Station or the Braulio Carrillo—La Selva transect, contact Sr. Jose Arturo Leon, Organization for Tropical Studies, Apartado 676, 2050 San Pedro, Costa Rica (telephone: 506-36-66-96).

If you would like to participate in the 1989 La Selva—Lower Braulio Carrillo Christmas Bird Count, contact Sr. Jose Arturo Leon at the above address.

Central American isthmus is but one example of the rich knowledge base that is developing from the ecological research being concentrated in this tropical country.

A final ingredient in the very exceptional conservation picture presented by Costa Rica is the contribution each natural-history visitor makes to the protection of this country's biological richness. Just by going to Costa Rica for birding outings, such visitors are significantly reinforcing the country's fragile economy with foreign exchange. The development of the ecotourism industry has great potential for bringing direct benefits to rural communities surrounding the protected areas—broadening local economic bases, producing high quality jobs in rural areas, and building a network of neighboring communities with a direct interest in the long-term protection of the forests. Finally, visiting birders often become strong allies and contributors to specific conservation projects which they have seen firsthand—such as the Braulio Carrillo-La Selva transect. Personal involvement in tropical conservation is an exceptionally satisfying follow-up to an educational or recreational visit to the tropics. Such interactions between natural history tourism and tropical conservation efforts are strong and on the increase in Costa Rica. They are cause for optimism that future generations of birders will continue to be able to see the hundreds of bird species that populate the complex tropical rain forests of the Braulio Carrillo-La Selva transect.

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——*Escuela de Biología*
Universidad de Costa Rica
Ciudad Universitaria
Costa Rica

La Selva Biological Station
Organization for Tropical Studies
Apartado 676
2050 San Pedro
Costa Rica