

The Case of the Missing Migrants

Are new methods for cultivating coffee in Latin America bad for birds? Some researchers say the shift from shade to sun plantations is hastening the decline of songbirds

When caffeine addicts try to cut down on coffee, usually they are concerned about their own well-being, not that of the planet. But new findings suggest that that heady dose of espresso may be taking a toll on more than just your nerves. Fundamental changes in the way coffee is being grown in Latin America and the Caribbean may be contributing to the decline of America's songbirds.

The findings implicate a new culprit in a long-running wildlife mystery. Although it is difficult to estimate the continental populations of any of these small, wide-ranging migrants, many once-common species are dwindling. According to the U.S. Breeding Bird Survey, over 25 years, wood thrush numbers have dropped by 40%, and the golden-winged warbler and orchard oriole are down 46% and 29%, respectively. In recent years, researchers have suspected that the loss of natural forests is to blame—whether the burning of tropical forests, where migratory songbirds winter, or the fragmenting of northern woodlands, where the birds breed. But now it appears that the destruction across Latin America of a kind of humanmade woodland—traditional coffee plantations—also poses a threat to songbirds.

Their migration is one of nature's marvels: Each fall, billions of songbirds from the United States and Canada fly thousands of kilometers south to wintering grounds in Mexico, Central America, and the islands of the Caribbean. As agricultural fields have replaced forests throughout the region, the birds increasingly have sought refuge in traditional coffee plantations, where coffee plants are grown under a canopy of trees. "In many parts of the Neotropics, shade coffee is the only forestlike habitat remaining," says Russell Greenberg, president of the Washington, D.C.-based Smithsonian Migratory Bird Center. But now, even this haven is under assault. All across Latin America, farmers are switching to high-yield coffee varieties that are grown in full sun—perhaps cutting further into the thinning ranks of songbirds that make the journey back north each spring.

There is no proof that this agricultural transformation is harming the birds. But stud-

ies from Central America and Colombia suggest that, compared to traditional coffee plantations, sun plantations make poor bird habitat. And as Greenberg points out, as of 1990, nearly half of northern Latin America's 2.7



Going, going. Numbers of Baltimore orioles (above) and Tennessee warblers (below) are steadily declining.

JACK WILBURN/ANIMALS, ANIMALS

million hectares of coffee already had been converted from shade to sun: "If you're seeing such dramatic differences on the ground, [and] if sun plantations are turning out to be biological deserts, then it's not a big leap to say [the shift is] having an impact." This reasoning is spurring new efforts to change consumer's coffee-buying habits and prompted the Smithsonian Migratory Bird Center to host the First Sustainable Coffee Congress in Washington, D.C., 2 months ago.

Naturalists have long observed that coffee farms teem with wildlife. But Joseph Wunderle of the U.S. Forest Service's International Institute of Tropical Forestry in Puerto Rico was one of the first biologists to undertake a systematic census of birds. During a survey of natural and agricultural ecosystems of the Greater Antilles in the late 1980s, Wunderle and his colleagues discovered a host of migrant birds in the plantations, from indigo buntings and ovenbirds to black-throated blue warblers. "We were quite taken by both the numbers and diversity of species," he says.

His interest piqued, Wunderle went on to conduct more detailed surveys in the Dominican Republic. In one study, he looked at "overwintering site persistence"—an indicator of habitat quality measured by how many migrants settle in for the winter. "We found that 68% to 77% of the birds were on the exact same piece of real estate in January as they were in October," says Wunderle. He adds that these fractions—some calculated on farms as small as a quarter of a hectare—rival those found in natural forest.

In Chiapas, Mexico, Greenberg and his Smithsonian colleagues at times found more migrant birds in coffee farms than in nearby

native rain forests. On shade-coffee plantations of less than 5 hectares, the team counted as many as 150 bird species, most of them forest-dependent migrants from North America. The team worked in Chiapas from 1990 to 1994, when the region's peasant uprising forced the group to abandon its research site. "We woke up one day surrounded by Zapatistas," he recalls. "For the next 3 days, we were surrounded by Mexican soldiers, who didn't believe we were really there to study birds." Greenberg now works in Veracruz, Mexico. His results, while still preliminary, support the earlier work in Chiapas.

A handful of studies suggest that other vertebrates are also taking refuge in the region's traditional coffee plantations. In 1986, Robert Seib, then a graduate student at the University of California, Berkeley, reported that Guatemalan coffee plantations can house fully half the number of snake species found in intact forests. In Las Tuxtlas, Mexico, Alejandro Estrada and his colleagues at the Universidad Nacional Autónoma de México censused mammals in shade coffee and found an abundance of small bat species. The plantations were also jumping with mice, tree squirrels, opossums, and howler monkeys.

Recent research shows that arthropods seem to favor traditionally grown coffee too. Using methods developed for studies of insects in natural rain forests, Ivette Perfecto of the University of Michigan fogged the canopy of a shade coffee plantation in Heredia, Costa Rica, with pyrethrin-based insecticides, which quickly kill insects and then dissipate. In a single tree, she and her assistants recorded 30 species of ants and 126 species of beetles—a level of biological richness seen only in some of the region's most pristine forests. In a nearby tree, they counted 27 species of ants and 110 species of beetles, and although the two trees were less than 200 meters apart, only a fraction of the species—14% of the beetles and 18% of the ants—were the same.

Shade coffee's biodiversity stems in part from the ecosystem's structural complexity. A single farm supports not just bushy coffee plants and tall, arching trees, but an intricate network of lianas, epiphytes, and mosses that provides a variety of living spaces and micro-



BATES LITTLEHALES/ANIMALS, ANIMALS

A Brewing Controversy Over Bird-Friendly Coffee

Biologists and conservationists may agree that sun coffee isn't good for birds and other wildlife (see main text), but they are at odds over what to do about it. The nub of the dispute: how to promote bird-friendly coffee in the marketplace.

Last month, the Rainforest Alliance became the first environmental group to give a green seal of approval—an "ECO-O.K."—to coffee from a forested farm in Guatemala. Once consumers know whether their coffee is bird-friendly, says the alliance's Eric Holst, market forces will promote the cultivation of shade coffee. Coffee America, a New Jersey-based trading company, purchased the first shipment of ECO-O.K. coffee, which is now available to roasters and retailers in the United States.

But scientists at the Smithsonian Migratory Bird Center have serious reservations about the alliance's certification program. The alliance worked with a large landowner who allows the use of pesticides—which aren't good for birds—on its certified coffee. Says the center's Robert Rice, "This issue goes beyond shade versus sun. Coffee cultivation falls along a continuum from highly traditional to highly modernized. If [a shade farm] has just one tree species and relies heavily on pesticides, [it] can be as bad as a sun plantation."

Rice also questions the alliance's decision to work independently of the Organic Crop Improvement Association and other

certifiers of organic foods. Organic coffee makes up just 3% to 4% of the specialty coffee market now. But it is the fastest growing sector, and while organic coffee is not now required to be grown in shade, much of it already is, and shade criteria could be added to the certification process, he asserts.

But the alliance's Elizabeth Skinner counters that the biggest threat to biological diversity is deforestation, not pesticides. At the coffee congress in Washington, D.C., in September, she said, "Conservation coffee needs to be promoted aggressively. ... We can't limit it to growers who can go without using pesticides."

Conservation International (CI) has launched yet a third approach that would add shade, pollution-control, and fair-trade criteria—which help ensure that farmers get reasonable prices for their products—to existing organic requirements. According to CI's Michael Saxenian, "While [the organic-certification system] does not yet adequately include social and biodiversity criteria, [it] is the best surrogate for sustainable [farming practices] established in any real way in the U.S. marketplace." He says his organization is developing markets for conservation coffee in the United States and Europe, and providing on-the-ground assistance to shade coffee farmers to help them comply with next-generation organic certification programs.

—L.T.

climates for myriad organisms. These various plants also produce many different leaves, fruits, and nectars that form the basis of complex food webs, say biologists.

But that diversity is disappearing. Throughout the Neotropics, traditional coffee-growing methods are giving way to new, higher yield methods that rely on dwarf coffee plants grown in full sun. In northern Latin America, coffee farms blanket almost half of the permanent cropland, and already about half the area has been modernized. The new farms can cram 3000 to 7000 plants into one hectare, compared to only 1000 to 2000 plants in the same area in a traditional farm. Plied with chemical fertilizers, the sun varieties can outperform traditional varieties by a factor of 3. A typical yield for a modern plantation is 1600 kilograms per hectare, compared with 550 for an old-style farm.

But subtracting the structural complexity of traditional plantations and adding large inputs of agricultural chemicals, including petroleum-based fertilizers, herbicides, insecticides, and fungicides, make for poor bird habitat, biologists suspect. And some field studies are bearing out their fears. Greenberg has found about half the density and diversity of birds in sun plantations in Guatemala. The same holds true for arthropods: In Costa Rica, Perfecto compared 16 coffee plantations—ranging from tradi-

tional to modern—and found that the most modern farms had the smallest numbers of ant species. Wunderle found plenty of bird species on sun plantations in the Dominican Republic. But he notes that many were "brushland" species, not the forest migrants typical of traditional plantations.

It may never be possible to prove that the modern farms are contributing to songbird losses, say ornithologists. By all accounts, migratory songbirds face serious problems along their migration routes and in their North American breeding grounds, including habitat fragmentation and predation by human-associated animals such as cats, raccoons, and crows. "It's tough to generalize about migrants," says biologist Ri-

chard Hutto of the University of Montana, Missoula. "What's happening to them is as varied as the names of the different species."

But a comparison of three dwindling species—the Cape May warbler, the Tennessee warbler, and the Baltimore oriole—seems to implicate the shift to sun farms. All three of these nectar-loving birds winter in Latin American shade-coffee plantations. Data from the U.S. Breeding Bird Survey show that between 1980 and 1994, a period of intense modernization in the coffee industry, all three experienced dramatic population drops—annual declines of 2.2% for the oriole, 4.2% for the Cape May warbler, and 5.7% for the Tennessee warbler.

For the two warblers, events in North America could explain the losses, says Greenberg. The possibilities include habitat fragmentation, nest parasitism by cowbirds, and low densities of a favorite prey, the spruce budworm, as a result of natural budworm population cycles. But the oriole does not depend on budworms, is rarely parasitized by cowbirds, and seems to thrive in fragmented suburban habitats.

Greenberg and other migratory bird specialists say the public's affection for the birds may prove to be a potent weapon in efforts to protect them (see box). They hope that by educating people, they will enlist market forces to help preserve traditional plantations. Says Greenberg, "Birders and bird lovers drink a lot of coffee."

—Laura Tangley



PHOTOS BY R. RICE/SMITHSONIAN MIGRATORY BIRD CENTER



Lost sanctuaries. Traditional coffee plantations (top) are far more bird-friendly than modernized farms (above).