

Watching Birds Disappear

Howard Youth

In the year 2000, Spix’s macaws vanished from northeast Brazil. The large, powder-blue birds’ disappearance was no fluke. Farmers and timber cutters cleared their wooded river forest habitat. Bird traders bagged the birds, and hunters shot them. Today, only 40–60 Spix’s macaws still live in aviaries, where most of them were born. None remain in riverside woodlands where the birds were “discovered” just 183 years ago.¹

While scientists puzzle over the prospects for breeding these birds and releasing their progeny back to the wild, many wonder how re-introduced birds would learn to locate food. With little habitat left, they would need to fly to other scattered habitat “islands” to find enough fruit and seeds to survive. Even if all of this worked out, the birds’ young would be threatened by an invasive introduced insect—the “Africanized” hybrid honeybee—that inhabits 40 percent of remaining tree cavities suitable for macaw nesting.²

The demise of the Spix’s macaw resonates far beyond one tiny Brazilian region, for this is far from an isolated incident. According to

a 2000 study published by the global conservation organization BirdLife International, the Spix’s macaw and almost 1,200 additional species—about 12 percent of the world’s remaining bird species—may face extinction within the next century. Most struggle against a deadly mixture of threats. Although some bird extinctions now seem imminent, many can still be avoided with a deep commitment to bird conservation as an integral part of a sustainable development strategy. For many reasons, such a commitment would be in humanity’s best interests.³

As the growing popularity of bird-watching, or birding, highlights, people have long been inspired by the beauty, songs, and varied behaviors of birds. Central America’s Mayas and Aztecs worshipped Quetzalcoatl, a dominant spiritual character cloaked in the iridescent green feathers of the resplendent quetzal, a bird now sought by binocular-toting birders. Ancient Egyptians similarly revered the falcon god Horus, while many ethnic groups around the world still ascribe strong spiritual powers to various bird species,

as well as deriving protein and ornaments from local birds. Native American tribes continue to incorporate eagle feathers into their rituals, while East African pastoral tribes do the same with ostrich feathers. Birds' powers of flight inspired our flying machines and continue to draw the attention of artists and photographers worldwide.⁴

But more important, people benefit from invaluable goods and services that birds provide in habitats worldwide. Scientists are just now starting to quantify these "behind-the-scenes" contributions. Many birds, for example, feed on fruits, scattering seeds as they feed or in their droppings as they flap from place to place. Recent studies revealed that black-casqued, brown-cheeked, and piping hornbills are among tropical Africa's most important seed distributors. In tropical Central and South America, toucans and trogons provide this vital service.⁵

On plains and other open areas, vultures provide natural sanitation services by scavenging animal carcasses. Hummingbirds, orioles, and other nectar-feeding birds pollinate a wide variety of wildflowers, shrubs, and trees, including many valued by people, while thousands of insect-eating species and hundreds of rodent- and insect-eating raptors keep pest numbers in check. In Canadian forests, for instance, populations of wood-warblers and evening grosbeaks surge to match outbreaks of spruce budworm, an insect that can severely damage forests of spruce and fir. Losing these birds and others tears the natural fabric of ecosystems. As conservationists learned from species like Spix's macaw, conserving healthy bird populations early would prove far simpler than trying to reconstruct them later.⁶

In addition, many bird species are easily seen or heard, making them perfect environmental indicators. In many cases, they provide scientists with the best glimpse at

how humanity's actions affect the world's ecosystems and the more elusive wildlife that share their habitats. In Europe, biologists consider dippers, which are round-bodied stream-living songbirds, valuable indicators of clean water because they feed on sensitive bottom-dwelling insects such as caddisfly larvae, which disappear in sullied waters. Disappearance of dippers and their prey also follows water acidification brought on by acid rain or the replacement of native deciduous forests with pine plantations. Other species are important indicators of threats to humanity, including chemical contamination, disease, and global warming.⁷

Ornithologists are compiling status reports for all of the world's approximately 9,800 bird species, but what they already have tallied is alarming. (See Box 2-1 for some examples.) Human-related factors threaten 99 percent of the species in greatest danger. Bird extinctions are on the increase, already topping 50 times the natural rate of loss, with at least 128 species vanishing over the last 500 years—103 of which became extinct since 1800. (See Table 2-1.) On islands, human-caused bird extinctions are not new: by sleuthing bits of bone found on far-flung archipelagos, scientists recently concluded that even before European explorers sailed to the region, human colonization of Pacific islands wiped out up to 2,000 endemic (that is, only found in one place), often flightless bird species. Today, however, people are crowding out bird populations on the mainland as well.⁸

Birds are by no means the only class of animals at risk, of course. Prominent scientists now consider the world to be in the midst of the sixth great wave of animal extinctions. The fifth wave finished off the dinosaurs 65 million years ago. Unlike previous episodes, however, people are the cause of most of the sudden die-offs. One quarter of the world's

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BOX 2-1. SIGNS OF BIRDS IN DECLINE

- A 1994 study revealed that 195 of 514 European bird species—38 percent—had “unfavorable conservation status.” In Great Britain alone, 139 of 247 breeding bird species (56 percent) are in decline, according to annual surveys.
- Based on the North American Breeding Bird Survey’s records between 1966 and 1998, some 28 percent of 403 thoroughly monitored species showed statistically significant negative trends.
- A BirdLife International study of Asian birds published in 2001 found a quarter of the region’s bird species—664—in serious decline or limited to small, vulnerable populations.
- Some Australian ornithologists claim that half of their island nation’s land bird species—including many endemic parrots—could become extinct by the end of the century, although recent breeding bird surveys chronicled little difference in status for most species over the past 20 years.

SOURCE: See endnote 8.

mammal species are threatened or nearly threatened with extinction; of the other well-surveyed species, 25 percent of reptiles, 21 percent of amphibians, and 30 percent of fish are threatened.⁹

But if we focus solely on the prospects of extinction, we partly miss the point. From an ecological perspective, extinction is but the last stage in a spiraling degeneration that sends a thriving species slipping toward oblivion. Species stop functioning as critical components of their ecosystems well before they completely disappear.¹⁰

Although birds are probably the best-stud-

ied animal class, a great deal remains to be learned about them—from their life histories to their vulnerability to environmental change. In the tropics, where both avian diversity and habitat loss are greatest—in top biodiversity countries such as Colombia, the Democratic Republic of the Congo (formerly Zaire), and Indonesia—experts just do not know the scope of bird declines because many areas remain poorly, if at all, surveyed. Species and some distinct populations that may later be considered separate species may vanish even before scientists can classify them or study their behavior, let alone their ecological importance. Several new bird species are described every year. One of this century’s earliest was an owl discovered in Sri Lanka in 2001, the first new bird species found there in 132 years. These scarce and newly described birds sit at a crossroads, as does humanity. One path leads toward continued biodiversity and sustainability. The other heads toward extinction and imbalance.¹¹

Habitat Loss: The Greatest Threat

Many of the problems faced by birds and other wildlife stem from how we handle our real estate. The human population explosion from 1.6 billion to 6 billion during the last century fueled widespread habitat loss that chiseled once-extensive wilderness into wavering habitat islands. Today, loss or damage to species’ living spaces poses by far the greatest threat to birds and biodiversity in general.¹²

Timber operations, farms, pastures, and settlements have already claimed almost half of the world’s forests. Between the 1960s and 1990s, about 4.5 million square kilometers of the world’s tropical forest cover—20 percent—were cut or burned. Estimates of annual deforestation vary widely, from 50,000 to 170,000 square kilometers. Per-

Table 2–I. Ten Recently Extinct Bird Species

Atitlán Grebe	Gone by 1986, this flightless aquatic bird lived only in Guatemala. Introduced bass, habitat loss, disturbance, and gill nets contributed to its demise.
Colombian Grebe	Last seen in 1977 in Colombia, where a combination of introduced trout, pesticide poisoning, wetland loss, and hunting finished it off.
Wake Island Rail	A casualty of World War II, between 1942 and 1945 this island endemic was likely captured and eaten into extinction by starving Japanese soldiers.
Canary Islands Oystercatcher	Seen perhaps as recently as 1981, this shorebird succumbed to loss of its mollusk prey due to overharvesting by humans, probable predation by introduced cats and rats, and disturbance by people frequenting its coastal habitats.
Paradise Parrot	Probably extinct by 1927, this colorful Australian parrot likely died out due to combined factors including overgrazing, drought, fire suppression, invading exotic prickly pear cacti, disease, trapping, egg collection, introduced predators, and loss of eucalyptus trees.
Bush Wren	A ground-nesting bird roused from New Zealand by introduced predators by 1972.
Grand Cayman Thrush	Last seen in 1938, this wetland songbird disappeared with its habitat.
Aldabra Warbler	Discovered in 1967, this bird was gone by 1983 from its namesake Indian Ocean island due to rat predation and habitat degradation wrought by introduced goats and native tortoises.
Guam Flycatcher	Along with the island's other native birds, this bird was eaten out of its Pacific island home by introduced brown tree snakes by 1983.
Kaua'i 'O'o	Last reported in 1987, this Hawaiian forest bird suffered from habitat loss, predation by introduced black rats, and diseases introduced by exotic mosquitoes.

SOURCE: Alison J. Stattersfield and David R. Capper, eds., *Threatened Birds of the World* (Barcelona: Lynx Edicions, 2000).

haps easier to track are dwindling populations of creatures that must live beneath the trees: habitat loss jeopardizes 1,008 (85 percent) of the world's most threatened bird species, with recent tropical forest destruction affecting 74 percent.¹³

Foresters herald the regrowth of temperate forests as an environmental success story, and in recent decades substantial reforestation did take place in, for example, the eastern United States, China, and Europe. Forest management profoundly affects diversity and natural balances, however, and satellite images

of tree cover do not tell us how much of the regrown habitat is indeed quality habitat.¹⁴

In the southeastern United States over the last five years, for instance, more than 150 industrial chip mills have chewed up vast tracts of natural forest to produce paper, rayon, and pressboard. Foresters replace the clearcut area with rows of same-age, same-species pine saplings. For many native animals and plants, simplified plantation monocultures are no substitute for more complex natural forests, with their old, young, living, dead, deciduous, and coniferous trees and

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their lush, varied undergrowth.¹⁵

Even without plantations, the consistent loss of some forest components can cause birds to abandon areas. For example, studies in intensively managed Finnish forests, where foresters remove older and dead trees, revealed marked declines in large forest birds such as a peacock-sized grouse called the capercaillie and the crow-sized black woodpecker.¹⁶

Losses of other habitats important to birds and other wildlife have been less heralded, but no less dramatic. Grasslands, which cloak more than a third of Earth's surface, sustain bird populations found nowhere else, but they also host almost one sixth of the human population. Few large, undisturbed grassland areas remain. In North America, the great grasslands that once stretched from the Mississippi to the base of the Rocky Mountains are largely gone, including the tallgrass prairie, of which less than 4 percent remains.¹⁷

Following this widespread landscape change, many North American grassland bird populations continue to shrivel, according to the U.S. Geological Survey's annual North American Breeding Bird Survey. Between 1966 and 1998, 15 of 28 characteristic grassland bird species steadily declined. The victims include the burrowing owl and other birds that maintained ecological relationships with once-abundant prairie dogs. After the colonial rodents' populations plummeted by 98 percent, the owls, which nest in old prairie dog burrows, are gone from much of their former breeding range. Even in the largest remaining swath of tallgrass prairie—the Flint Hills region of Kansas and Oklahoma—the once-abundant greater prairie-chicken is rapidly losing ground due to recently intensified burning and cattle grazing methods.¹⁸

In Europe, agriculture covers about half of the land. Most of this excludes grassland birds because intensive, modern cultivation

often requires higher chemical inputs such as harmful pesticides, while weedy growth or hedgerows—once wildlife-hospitable components of more traditional, smaller farms—vanished to make way for large machinery and larger areas of cropland. The last strongholds for many grassland species, including large areas in Portugal, Spain, and central and eastern European countries, are under or will soon be under severe pressure from increased irrigation and modernization programs subsidized by the European Union's Common Agricultural Policy.¹⁹

Grassland remains on about 60 percent of its original span in Asia, Africa, and Australia, although much of it is degraded. One widespread threat is overgrazing. In many areas, light grazing helps maintain healthy grasslands. But the picture quickly changes when a threshold, which varies by region, is passed. And overgrazing is often but one of several threats to these ecosystems.²⁰

For example, 10 of the world's 25 bustard species are either threatened with extinction or close to it due to widespread overgrazing, collisions with fog- or darkness-shrouded power lines, and hunting. The turkey-sized great bustard, once found from Britain to China, has just a few Spanish, Russian, and Chinese strongholds and is disappearing from widely scattered populations elsewhere.²¹

A close relative, the Australian bustard, no longer stalks most of the southeastern part of its namesake country due to introduced rabbits and livestock, which chew down habitat, and to fire restrictions, which allow the intrusion of acacias and other woody plants into grasslands. Argentina's grasslands face a similar onslaught brought on by "exotic" trees—pines and eucalyptus introduced at nearby tree plantations invade grasslands to the detriment of native birds and other wildlife.²²

Many birds flourish where land and water

mix—in wooded swamps, marshes, mangrove forests, coastal mudflats, and other wetlands. Until recently, humanity saw these areas as disease-ridden wilderness asking to be conquered. Draining, filling, and conversion to farmlands or cities destroyed an estimated half of the world's wetlands during the twentieth century. Estimates within individual countries are often much higher. Spain, for instance, has lost an estimated 60–70 percent of its wetland area since the 1940s.²³

Even wilderness areas such as Everglades National Park, in the United States, and Spain's Doñana National Park have not been spared humanity's heavy hand. In and around these two greatly compromised protected areas—both of which are classified as Biosphere Reserves, World Heritage Sites, and Ramsar wetlands of international importance—hydrology has been disrupted, exotic plants and animals have invaded, and pesticides and other pollutants wash in from nearby farms and industries.²⁴

One of Spain's greatest environmental disasters occurred in 1998, when a mine reservoir just north of Doñana burst, flushing 1.58 million gallons of heavy metal-laden water down the Guadiamar River, reaching well into the park's buffer zone. Thousands of birds and fish died, and reproduction will likely be impaired in birds and other aquatic life for years to come.²⁵

Declining bird populations followed habitat degradation in both parks. For example, bird census-takers counted 5,100 white ibis in the Everglades between 1997 and 1999—more than 45 times fewer than were estimated to nest there in the 1930s. In Doñana National Park, the once-abundant but now-threatened marbled duck barely breeds within the park's borders most years because increased demand for irrigation, among other factors, means that marshes dry up by August, before these wetland birds finish nesting.²⁶

Outside protected areas, changes have been far more dramatic. Over the last 70 years, Armenia's Lake Sevan suffered dramatic lowering due to water diversion, and Lake Gilli was drained entirely. With their vital wetlands destroyed, at least 31 locally breeding bird species abandoned the lakes, including the sensitive black stork and the more adaptable lesser black-backed gull.²⁷

Wetlands serve as key stopover sites for millions of transcontinental migrants.

A 1999 survey of 47 wetland sites in Morocco found that only 10 had protected status and that most faced threats from development, habitat alteration, and exotic fish introductions. Researchers compared descriptions from a similar survey of 24 of these sites in 1978 and found that 25 percent of the wetlands were destroyed in two decades.²⁸

Aside from being vital nesting grounds for birds, wetlands also serve as key stopover sites for millions of transcontinental migrants, particularly on coasts, along rivers, or in bays where birds pause to rest and refuel before or after transoceanic journeys. Major examples of these rest spots include China's Deep Bay, Surinam's coastal mudflats, Alaska's Copper River Delta, and Australia's Gulf of Carpentaria.²⁹

Other concentration points favored by migrating storks, hawks, and myriad songbirds include narrow land corridors such as those at Gibraltar, Turkey's Bosphorus Strait, Eilat in Israel, Point Pelee in Canada, and the coastal Mexican city of Veracruz. At many of these sites, development shrinks wetlands and other habitats. This means that more migrating birds must pack into smaller and smaller spaces, increasing the likelihood of botulism and other outbreaks that can kill thousands of birds.³⁰

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In many parts of the world, flat lowland areas have been the first to be exploited for timber or farming. More difficult to clear and cultivate, mountains often hold their habitats longer against human endeavors. In many countries, including Jamaica and Mexico (in terms of the country's dry forest), much of the remaining habitat is found only in prohibitively steep terrain.³¹

Once targeted, though, mountain habitats and wildlife are extremely vulnerable. Altitude and moisture levels dictate vegetation and wildlife occurrence there, creating narrow ribbons of habitat. Humans and migrant birds alike particularly favor temperate and rain-soaked middle elevations. In the Andes, Himalayas, and Central American highlands, among other areas, middle-elevation forests are highly degraded, creating severe erosion problems, fouling watersheds vital to human populations, and providing less and less area for wintering and resident birds.³²

The blazing orange-and-black blackburnian warbler is one bird affected by the widespread loss of mid-elevation Andean forests. Weighing just a third of an ounce, this colorful insect-eater nests in North American spruce and hemlock forests but winters 8,000 kilometers away in northwestern South America. Conservationists expect a dip in blackburnian warbler populations, a scenario faced by many of the 200 or so other Neotropical migrant birds—species that nest north of the Tropic of Cancer but winter in Mexico, the Caribbean, or Central or South America.³³

A recent study of another warbler, the American redstart, used carbon isotopes to determine wintering habitats of birds migrating to New Hampshire to breed. The findings suggest that earlier-arriving, healthier birds winter in humid tropical forests, while weaker, less competitive individuals settle for degraded, drier habitats. This is a likely indi-

cation that optimal redstart wintering areas are already saturated and limited, and implies that although birds can winter in compromised habitats, they may be less fit to compete and breed.³⁴

In many cases, Neotropical migratory birds' winter ranges are more compact than their nesting areas, putting concentrated wintering populations at greater risk from habitat loss. For instance, the Oklahoma state bird—the scissor-tailed flycatcher—nests throughout that state, in most of Texas and Kansas, and in portions of Arkansas, Missouri, and Louisiana. During the winter, however, most of the population packs into an area of northwestern Costa Rica about the size of one Texas county.³⁵

Quite a different situation exists for many tropical birds that do not migrate, many of which live year-round in small areas. All told, just over a quarter of all bird species—2,623—have ranges that are at most the size of Costa Rica or Denmark (about 50,000 square kilometers). More than half of these species are threatened or near-threatened; 62 are now extinct. Within their limited ranges, many of these localized species are pigeonholed into only those prime habitats that remain. Even in these last havens, other factors often come into play, nudging populations closer to extinction.³⁶

Falling to Pieces

Ecologically speaking, what happens around a habitat is as important to its denizens as what happens inside it. In recent years, this revelation began guiding conservationists, who now view protected areas as part of larger landscapes that function together to support or thwart species. When habitats—and mosaics blending different habitats—are diced into smaller and smaller pieces, they often suffer from edge effect, or the negative

influences of an edge on a habitat's interior.³⁷

For instance, when loggers remove a large swath of trees, light-tolerant plants move into the clearing and the adjacent forest's edge. Sunlight penetrates farther into the forest than before, raising temperatures, drying out the forest floor, and increasing the likelihood of fires or of wind or drought damage. Edge effect stresses or kills shade-adapted plants, leaving them to dry up or to become more susceptible to disease or invading competitors. Researchers studying forest fragments in central Brazilian Amazonia found that the amount of above-ground vegetation was greatly reduced, especially within 100 meters of fragment edges, due in good part to increased tree mortality.³⁸

After trees fall, remaining forest fragments may no longer provide an ideal habitat for forest interior birds, which must contend with the invasion of creatures that thrive in more open areas. In forest fragments, North American forest birds face larger predator populations and brown-headed cowbirds. Rather than building their own nests, cowbirds lay their eggs in nests of host bird species, often to the detriment of the hosts' young. In some highly fragmented forests, cowbird eggs turn up in up to 90 percent of wood thrush and 80 percent of warbling vireo nests.³⁹

When isolated in small forest patches, many southeastern Australian birds decline because aggressive, edge-favoring birds called noisy miners out-compete them for food and nesting places. Conservationists now recommend setting aside large forest reserves as one of the only ways to protect smaller, less aggressive species, including many insect-eating birds that live within the miners' breeding range. A similar recommendation is made for wood thrushes in highly fragmented mid-western U.S. forests. Specialized insectivorous birds also suffer from fragmentation in other parts of the world, including Japan.⁴⁰

Roads and power lines frequently cut through forests, increasing the chance of fatal collisions and providing pathways for edge predators, competitors, and exotic plants. Traffic noise may also interfere with birds' attempts to mark territory through song. Via roads, humans and their livestock gain easier access to forest fragments, removing undergrowth and dead, standing trees important to parrots, woodpeckers, and other cavity-nesting birds.⁴¹

In equatorial Africa, Amazonia, tropical Asia, and other regions where forestry roads cut into large remaining tropical forests, intensive hunting—made easier thanks to roads—is also widespread. In equatorial Africa and some other areas, hunters shoot wildlife not only for subsistence but to supply burgeoning urban delicacy markets. On the island of New Guinea, increasing hunting pressure, aided by recent road construction, threatens a growing number of endemic bird-of-paradise species.⁴²

Coming at the fragmentation issue from the other side, some researchers highlight the importance of intact "source" areas—refugia that produce surplus birds that may later disperse to take up slack in more stressed, less productive "sink" areas such as woodlands carved up by suburbs. A 1996–98 survey that took place mostly within Cherokee and Nantahala-Pisgah national forests in the southeastern United States compared results with surveys done at the same sites 50 years earlier. Researchers found that this extensive area "retained and probably regained functional integrity for forest birds during the latter half of the 20th century." Opportunistic, nest-robbing blue jays declined during this time, while nest-parasitizing cowbirds, lacking open feeding areas nearby, were virtually absent. Neotropical migrants declining in many other places held steady or increased in these large forest reserves.⁴³

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An Alien and Danger-Filled Ark

Visit a Hawaiian garden, and you'll likely see Brazilian red-crested cardinals and Asian common mynas, but you will be hard-pressed to find a native bird. Stroll city streets in North America, South Africa, and Australia, and you may find introduced European starlings, house sparrows, and feral pigeons at your feet. What's happening here? Even in otherwise-undisturbed wildlife habitats, a new order is taking hold as exotic, or non-native, species—from pathogens to mongooses—are introduced through human blunder, curiosity, or in hopes of providing food or other goods and services, including control of other rampaging exotics. Over the past century, the pace of introductions greatly accelerated in parallel with the rise in global trade and travel.⁴⁴

Due to their apparent lack of immunity, North American birds today factor as key indicators of the spread of West Nile virus.

Today, exotics threaten birds and their ecosystems in myriad ways, constituting the second most intense threat to birds worldwide, after habitat loss and degradation. (For threatened species, however, exotics rank third, behind exploitation, particularly hunting and capture for the cage bird trade.) Introduced species contributed to most bird extinctions since 1800, and they now menace a quarter of globally threatened bird species.⁴⁵

Once introduced, some exotic predators became all the more lethal on islands, where endemic species evolved with few or no defenses against such hunters. To date, 93 percent of bird extinctions (119 out of 128) have occurred on islands, where extremely vulnerable endemic species succumbed to

habitat loss, hunting, and, in most cases, exotic species. In many cases, introduced mongooses, rats, pigs, and other non-native animals have unsettled unique island ecological balances.⁴⁶

One reptilian invader, the brown tree snake, ate 12 of Guam's 14 land bird species into extinction by the 1980s after its accidental release following World War II. In recent years, this snake has also turned up at Hawaiian airports, raising fears that it could become the latest—and one of the greatest—threats introduced there.⁴⁷

Introduced rats plague many island-nesting seabirds, including albatrosses and petrels. Having found their way to islands via explorers' or colonists' ships, or more recently fishing boats, the opportunistic rodents now dine on bird eggs and young. A recent study on New Zealand's northern offshore islands revealed that rats not only threaten the islands' nesting petrels, they also eat native plants' seeds, stifling the distribution of 11 out of 17 coastal trees and bringing some close to local extinction.⁴⁸

One of humanity's constant companions is another nemesis of wild birds. On far-flung islands, house and feral cats have contributed to the extinction of 22 or more endemic birds. Their effect on mainland wildlife populations is also great. Studies in Australia in the early 1990s documented domesticated and feral cats killing members of almost a quarter of the country's 750 bird species. Annually, cats kill an estimated 1 billion birds in the United States, where at least 40 million house cats regularly roam free and another 60–100 million cats live in a feral state. U.S. cats kill at least nine federally listed species, among many other victims, including beach-nesting least terns and piping plovers.⁴⁹

Tiny predators plague other birds. The yellow crazy ant, a frenetic, fast-multiplying insect, is marching across the Australian ter-

ritory of Christmas Island following its introduction there during the twentieth century. Recently, biologists documented the insects killing the islands' abundant land crabs. Like many other ant species, crazy ants "farm" scale insects—herding and protecting these forest-damaging insects and drinking a sweet secretion they extrude while destroying rain-forest trees.⁵⁰

As they spread across the island, crazy ants will likely kill young native birds, including those of two critically endangered species—the endemic Christmas Island hawk-owl and Abbott's booby, a seabird that nests nowhere else but in the island's forest canopy. In coming decades, both species are expected to decline 80 percent due to the ant invasion. Introduced crazy ants also threaten birds on the Hawaiian and Seychelles islands and on Tanzania's Zanzibar.⁵¹

In North American forests, sap-feeding insects called hemlock and balsam wooly adelgids are changing habitats' ability to support birds and other flora and fauna. These accidentally introduced insects now spread by wind and via birds' feathers and mammals' fur. First a threat to western forests, the hemlock wooly adelgid, originally from Asia, moved east by the 1950s and is now eradicating Carolina and eastern hemlocks, important components of eastern woodlands. Meanwhile, the European balsam wooly adelgid attacks balsam and Fraser firs in north-eastern and Appalachian forests. Heavy loss of Fraser firs leaves intermingled red spruce more vulnerable to wind damage, changing the face of forests in such important bird breeding "source" areas as the Great Smoky Mountains National Park. A recent study in a fir-damaged area found that the combined density of all breeding birds declined by half and that 10 of 11 common breeding birds had declined.⁵²

Sometimes introduced dangers are invis-

ble. On the Hawaiian Islands, mosquitoes, which originally landed in the archipelago in ship-carried water barrels in 1826, unleashed a pair of deadly diseases—avian pox and avian malaria—upon the island's non-immune native birds. These diseases arrived via introduced birds and were injected into natives by the mosquitoes, contributing to at least 10 extinctions and potentially fueling dozens more. Weakened, native Hawaiian birds become even more vulnerable to introduced birds that compete with them for food and habitat.⁵³

Whether introduced, naturally occurring, or strengthened by unnatural conditions, other diseases threaten birds. India's once-abundant long-billed and white-rumped vulture populations have crashed—plummeting more than 90 percent country-wide during the last decade—most likely due to a virus or other contagious illness. A decade ago, these birds swarmed over abundant cow carcasses that litter fields and dumps around Indian cities and towns. Now they are listed as critically endangered. In their sudden absence, feral dog, crow, and rat populations have exploded, taking up the slack in scavengers and posing great health risks to people nearby.⁵⁴

Due to their apparent lack of immunity, North American birds today factor as key indicators of the spread of West Nile virus, which first appeared in New York in 1999. This mosquito-borne disease, present in Africa and Eurasia for decades, has killed scores of people in the United States so far. West Nile virus has taken a far higher toll on birds, killing thousands of birds in more than 100 species and putting endangered species breeding programs in peril. To date, no one knows if transported pet birds, humans, or—less likely—trans-Atlantic migrant birds brought the illness.⁵⁵

Predators and pathogens aside, native birds also face both genetic and direct competition from exotic birds. For example, people around

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the world have dumped familiar domesticated mallard ducks into ponds and other wetlands. In various countries, these green-headed waterfowl vigorously interbreed with closely related species, “swamping” or undermining the native species’ genetic variability. Such hybridization affects South Africa’s yellow-billed ducks, endangered Hawaiian ducks, American black ducks, and mottled ducks. A similar problem occurs in Spain. There, threatened white-headed ducks—already pinched by habitat loss—now mingle and hybridize with North American ruddy ducks, which were introduced to England in the 1940s but have since flown over to the continent. New European legislation aims to curb ruddy duck numbers through hunting.⁵⁶

Introduced plants create their own, very different dangers, changing birds’ habitats until they are eventually uninhabitable. Whether brought over as nursery stock, planted with the blessing of farm programs, or seeded by accident, exotic plant species have gone wild in many parts of the world—at the expense of birds and other wildlife. One of North America’s worst plant invaders illustrates the point. Brought over from Eurasia, rapid-growing cheatgrass has spread far and wide since its introduction to North America in the late 1800s. As it overtakes sagebrush and bunchgrass habitats, cheatgrass fuels the decline of such sage-dependent birds as the sage grouse, which nests among sagebrush shrubs and depends on their leaves and shoots for food. Cheatgrass is now found on more than 40 million hectares, an area larger than Germany, and dominates much of that grassland and pasture.⁵⁷

Unknowingly, birds use their formidable seed-distributing abilities to further spread invasive exotic plants. This is happening, for example, on the Pacific island of Tahiti and in the Hawaiian islands, where birds distribute seeds of the fast-spreading miconia tree, a

South American ornamental that now runs amok, shading out native plant life in more than half of Tahiti’s forests. Many scientists consider this striated, broad-leafed plant to be one of the greatest threats to Hawaii’s remaining native forests as well; there it covers about 4,400 hectares.⁵⁸

In Florida, millions of wintering American robins and other native birds eat Brazilian pepper berries and scatter their seeds across the Everglades and other wild areas. Brazilian pepper, one of the most widespread exotic plants in the state, is now found on at least 324,000 hectares, including 40,400 hectares of mangrove forest in Everglades National Park. Similarly, the introduced common myna is dispersing pervasive South American lantana bush’s seeds in Asia.⁵⁹

Although overlooked by novice nature-lovers, exotic plants now dominate many landscapes. Controlling well-established exotics is neither cheap nor easy. For example, perhaps 5 percent of 283 million hectares (700 million acres) of public land is “seriously infested” in the United States, where at least 400 exotic plant species have gone out of control. No longer can we think that nature can right itself if left alone.⁶⁰

Dealing with exotic introductions often requires active management, including hunting, poisoning, herbicide spraying, and in some cases introducing natural predators of the out-of-control exotic—activities that can also potentially disturb or harm native birds and other wildlife. In the United States alone, the annual cost of damage caused by exotics and the measures to control them reaches an estimated \$137 billion.⁶¹

Bullets, Cages, Hooks, and Chemicals

It is hard not to marvel at tiny birds’ mighty migratory abilities and delight in their return

each year. In some regions, however, human attention to migrants poses an environmental problem: unregulated hunting along migration routes kills huge numbers of birds each fall and spring. The Mediterranean island nation of Malta has long had one of the most publicized problems. There, throughout spring and fall migration, hunters take aim at island-hopping birds during their flights north to mainland European nesting grounds and south to African wintering areas.⁶²

Officially protected birds, from swallows and bee-eaters to harriers and herons, fall to Maltese shooters in staggering numbers. Most of this hunting is just target practice, and hurts already declining European nesting bird populations. Birds, mainly finches, are also illegally trapped as cage birds: in 2001, the nongovernmental organization (NGO) BirdLife Malta used aerial photography to identify more than 5,300 trapping sites, mainly along the coastlines of the country's two largest islands, Malta and Gozo. Thanks in good part to NGOs' efforts, public outcry has grown in recent years, and the Maltese government recently passed more stringent hunting laws. Enforcement remains lax, however, and the hunting lobby is strong. As of October 2002, the government was wavering as to whether to loosen hunting restrictions. BirdLife Malta estimates that 3 million birds are shot or trapped in Malta each year.⁶³

Meanwhile, illegal hunting and trapping of protected birds of prey and songbirds remain problems in other parts of Europe, including Cyprus (another important migration stopover), Greece, France, Spain, and Italy, although growing public support for conservation efforts has helped reduce this threat, particularly in the latter two countries. On the other side of Eurasia, an upswing in commercial hunting of Chinese songbirds raises concerns that migratory and resident species, including yellow-breasted buntings and

Eurasian tree sparrows, are being unsustainably killed for bite-sized snacks. Despite a government ban on killing these birds, since the early 1990s more than 100,000 a year have been caught, killed, frozen, and then fried and sold—from Beijing to Guandong.⁶⁴

While many small species are targeted, robust species attract even more attention. Among the first wildlife species to disappear from Central and South American forest fragments are turkey-like birds called curassows, chachalacas, and guans, 15 of which are threatened with extinction. Large, nonmigratory, and palatable, these herbivores feed on forest fruits, seeds, leaves, and flowers, and some are important seed dispersers.⁶⁵

Almost a third of the world's 330 parrot species are threatened with extinction due to habitat loss and collecting pressures.

Even where hunting laws protect rare guans, such as in Mexico in the case of the horned guan, there is insufficient enforcement. Large, roadless forest tracts provide the best refuge for these birds, but such real estate is now hard to come by in Central America and parts of South America. Elsewhere, unregulated hunting threatens other large birds, including 22 localized Asian pheasant species.⁶⁶

Hunting is less of a threat for parrots, long loved by people the world over for their colorful plumages, potential affection toward their owners, and, in many species, adept "talking" abilities. For these attributes, wild parrot populations suffer greatly from the wild bird trade. Almost a third of the world's 330 parrot species are threatened with extinction due to habitat loss and collecting pressures, part of a burgeoning illegal wildlife trade valued at billions of dollars a year.⁶⁷

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Over the last decade, protection measures helped reduce the international trade in wild parrots. These initiatives include the Convention on International Trade in Endangered Species of Wild Fauna and Flora, which protects rare species from the wildlife trade (see Table 2–2), and wild bird export bans in Australia, Guyana, and other countries. The 1992 Wild Bird Conservation Act in the United States, which limits or prohibits exotic wild bird imports, greatly reduced wild bird imports and fueled a growing U.S. captive-breeding industry.⁶⁸

But protection laws in many parrot-rich countries often go unheeded, and parrot poaching and smuggling remain widespread, due to both domestic and international demand. In addition to parrots, bird traders seek many other colorful species, including

South America's yellow cardinal and a cherry-red bird called the red siskin, both of which have been collected almost to extinction in their remaining habitats. Without concerted in-country efforts to stem unbridled collecting, these and other species will likely disappear.⁶⁹

Far from South American forests, another threat looms. Seemingly endless ocean expanses provide an undulating backdrop for large-scale seabird die-offs brought on by commercial longline fishing. At least 23 seabird species now face extinction largely due to this industry, which became dominant worldwide following the 1993 ban on drift-nets, hulking devices that scooped up enormous quantities of untargeted sea creatures. Today, longline boats set their lines, which can be 130 kilometers long and stud-

Table 2–2. Some International Agreements That Help Conserve Birds

Ramsar Convention on Wetlands (1971)

Nearly 1,200 wetland sites in 133 countries, totaling 103 million hectares, have been designated for protection and monitoring under this international agreement to conserve wetlands and use them sustainably.

Programme on Man and the Biosphere (1972) and World Heritage Convention (1972)

Under UNESCO, these initiatives set a framework for designating, protecting, and monitoring some of the world's most important biodiversity and cultural hotspots. As of May 2002, 94 countries had established a total of 408 biosphere reserves under the Man and the Biosphere Programme.

Convention on International Trade in Endangered Species of Wild Fauna and Flora (1975)

An international agreement by 160 countries to monitor international trade in wild animals and plants and ensure that trade does not put wildlife in jeopardy.

Convention on the Conservation of Migratory Species of Wild Animals (1983)

Eighty countries have signed this agreement, also known as the Bonn Convention, to protect migratory wildlife species, including birds, throughout their international migratory, breeding, and wintering areas.

Convention on Biodiversity (1992)

A total of 185 countries have signed on to this agreement, which was introduced at the Earth Summit in Rio in 1992. Signatories promise to set up strategies for protecting their biodiversity, including habitat protection and restoration. Fewer than 40 have drawn up formal plans so far.

SOURCE: Convention and program Web sites.

ded with up to 12,000 baited hooks, later hauling them in to collect commercial fish such as tuna, swordfish, cod, and halibut. Unfortunately, hundreds of thousands of seabirds drop down on the lines before they sink, grabbing at bait and becoming hooked, only to be submerged and drowned.⁷⁰

Among the birds hard-hit by this activity are 17 of the world's 24 albatross species. These slow-breeding, slow-maturing ocean-wanderers—many already under pressure at their remote nesting sites from introduced predators—are suffering staggering losses. For instance, from 1997 to 2000, illegal or “pirate” longlining in southern oceans killed an estimated 333,000 seabirds, including 67,000 albatrosses. An estimated 10 percent of the black-footed albatross's breeding population perishes each year on longlines set in the North Pacific.⁷¹

To date, no adjustments have been made in fishing practices, despite recent findings that simple measures can reduce bird bycatch by more than 90 percent. Such measures include installing bird-scaring streamers, setting nets at night, and adding weights to lines so that they sink faster. At least 33 countries have longline fleets plying the world's waters; prominent players include Canada, China, Japan, Russia, South Korea, Taiwan, and the United States.⁷²

This situation may soon change, however. In 2001, seven countries—Australia (which initiated the plan in 1997), Brazil, Chile, France, New Zealand, Peru, and the United Kingdom—signed the Agreement for the Conservation of Albatrosses and Petrels, under the Bonn Convention. When ratified, this treaty will legally bind signatories to reduce longlining bycatch of seabirds and to implement other seabird conservation measures. One challenge will be to get boats to use these measures uniformly. And then there is the problem of regulating and policing ille-

gal fishing, which depletes not only bird but also fish stocks. The U.N. Food and Agriculture Organization encourages countries to draw up their own national plans of action for voluntarily reducing longlining bird kills.⁷³

The specter of oil spills also hangs over many seabird populations. An unprecedented volume of oil crosses the seas these days, providing a human-transported disaster waiting to happen at any time. African, Magellanic, Galápagos, and five other penguin species are among the many seabirds affected by oil spills near their nesting and feeding areas.⁷⁴

Large-scale spills highlight oil's effects on ecosystems and birds. The 1989 Exxon Valdez spill, for instance, perhaps killed more than 250,000 birds, and a 1999 spill off of France's Brittany Coast killed an estimated 100,000–200,000 birds of at least 40 different species. But small, less-publicized, daily tanker leaks also kill birds.⁷⁵

The Galápagos Islands—a cradle of endemic species and inspiration for Darwin's evolutionary theories—were similarly threatened by oil in 2001, when 150,000 gallons leaked from an Ecuadorian tanker. The spreading spill seemed likely to mire many of the archipelago's aquatic species, including sea lions, unique marine iguanas, the world's rarest gull, and Galápagos penguins. Fortunately, the current swept much of the slick clear of the islands, so dozens rather than thousands of birds and sea lions died. Some scientists believe, however, that small quantities of oil killed the bacteria in the algae-eating iguanas' guts, causing many to starve. If that proves true, this incident highlights the impacts that even smaller amounts of spilled oil can have on wildlife.⁷⁶

Trade in oil is but one industry that pollutes the environment, as can be seen in bird populations' reactions to the poisoning of their habitats. Effluents released by factories into surrounding waters leave telltale marks

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on bird populations. A recent study of tree swallows breeding in the PCB-contaminated Hudson River seemed to show that young females there molt into adult coloration earlier, a possible sign that the birds' endocrine systems have been disrupted by contaminants.⁷⁷

In the 1970s and early 1980s, biologists and toxicologists monitored severe deformities and breeding troubles in fish-eating Great Lakes birds. Since Canadian and U.S. efforts to stem industrial contaminants such as PCBs and DDE began in the late 1970s, the populations of herring gulls and double-crested cormorants have grown, and the bald eagle returned to the region. But scientists continue to keep tabs on birds and fish to assess industrial threats not only to wildlife but also to human health. They still note bird deformities and breeding troubles in heavily industrialized parts of the Great Lakes.⁷⁸

Even within protected wetland areas, thousands of birds die each year from lead poisoning.

Chemicals also threaten birds far outside heavily industrialized zones. Worldwide, both in water and on land, pesticides kill millions of birds. For example, the persistent organochlorine pesticide DDT builds up in predatory birds' tissues and causes widespread nesting failure—as was seen in the United States and Britain during the 1950s and 1960s. After U.S. law banned DDT in 1972, the country's peregrine falcon, bald eagle, osprey, and brown pelican populations rebounded. Similar rebounds occurred in Britain in such raptors as sparrowhawks after a ban was initiated there. In 2001, 120 countries signed a pesticide treaty that included a phaseout of DDT except for limited use in controlling malaria. (See Chapter 4.) But

DDT has not gone away even where it is now banned: this pesticide persists in soil and water even in places where its use was discontinued 30 years ago.⁷⁹

Although not as persistent, some of the new generation of pesticides, including organophosphates and carbamates, are more toxic to birds. One of the most dramatic recent examples of pesticides' danger to birds came from the Argentinean pampas, where, in the winter of 1995, an estimated 20,000 Swainson's hawks—about 5 percent of the population—died after feeding in alfalfa and sunflower fields sprayed with the insecticide monocrotophos.⁸⁰

In autumn, these western North American nesters fly 6,000–12,000 kilometers south to feed in flocks on field insects during the southern spring and summer. Due to public outcry from NGOs and government agencies in the United States, Canada, and Argentina, a major manufacturer of the organophosphate insecticide, Ciba-Geigy (now Novartis), agreed to phase out its sales in areas where the hawks winter. The Argentinean government also banned its use there.⁸¹

Pesticides also affect birds indirectly, either killing off their prey or destroying vegetation they need for shelter and nesting. British gray partridges, for example, declined after insecticides reduced their chicks' invertebrate prey and herbicides withered wild plants among which they nest and feed. Bustards, skylarks, and other birds living on agricultural lands suffer similar effects.⁸²

Even within many protected wetland areas, thousands of birds die each year from another form of chemical threat—lead poisoning. Carefully regulated hunting is frequently an integrated part of bird conservation efforts. In fact, hunters continue to be instrumental in setting aside vital conservation lands in North America, Europe, and elsewhere. But one traditional hunting tool—lead shot—

poses grave threats not only to waterfowl but to eagles and other wildlife. Waterfowl are most at risk because they guzzle down spent shot either instead of the pebbles they seek as grit or by accident when rooting underwater for food. Several weeks after ingesting the shot, the slowly poisoned birds die. Eagles and other scavengers feeding on shot ducks also succumb to lead poisoning.⁸³

A growing number of countries, including the United States, Canada, and many in Europe, have banned lead shot. But many others have not. The U.S. Fish & Wildlife Service estimates that in 1997 alone, the nationwide ban on lead shot used for waterfowl hunting prevented 1.4 million duck poisoning deaths. In 2001, a partial ban began in Spain, where conservationists estimate that up to 70,000 birds die of lead poisoning each year. A similar fate awaits waterfowl ingesting lead fishing sinkers, a leading cause of death for loons breeding in the northeastern United States.⁸⁴

Modern Conveniences and Climate Change

As technologies advance and human settlements spread, we tailor the landscape to outfit our needs for communication, electricity, modern office space, and other amenities. Some of these advances are setbacks for birds, which evolved in far different surroundings.

Strung across open country, power lines are a leading cause of mortality in Europe's white storks, threatened great bustards, and raptors. Birds taking off in foggy or dark conditions run into the obscured lines. Others are electrocuted when they land on exposed cables atop poles. Studies conducted in Spain, Norway, and elsewhere indicate that putting markers on wires can cut collisions at least in half. This measure is taken by some companies, but it is not yet widespread in

most of the world.⁸⁵

Skyscrapers and television, radio, and cell-phone towers kill millions of night-flying migrants each year, especially during cloudy or foggy nights. In the United States alone, communications towers may kill up to 40 million birds annually. The structures' pulsing red lights distract the birds, which use light as one of their migratory cues. Many collide with towers or their guy wires while circling the lights. Depending upon weather conditions, the death tolls can be staggering: During just one cloudy night in January 1998, between 5,000 and 10,000 lapland longspurs—sparrow-like birds that breed on tundra but winter far south on farms in the United States—died after hitting one 420-foot-tall Kansas tower. Between 1957 and 1994, 121,000 birds of 123 species turned up dead beneath one 960-foot television tower in Wisconsin.⁸⁶

These threats increase as tall towers and buildings continue to spread across landscapes. More than 40,000 towers above 200 feet are found the United States, and this figure may double over the next decade due to the proliferation of towers needed for mobile phones as well as new digital television technology. Weather is not the only consideration—location is important. Towers placed along migration corridors or hilltops increase the risks to birds. Few companies or governments have addressed this growing problem, which requires more study to determine the best measures to minimize the effects of light, towers, and guy wires, as well as tall buildings. Some suggested alternatives include replacing pulsing red lights with white strobe lights that might be less confusing to migrants and building lower towers that do not require deadly guy wires for support.⁸⁷

To the threats posed by these human-made structures must now be added the dangers of human-caused global warming, which

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is hastened by many of the same activities that destroy habitat—forest clearing, rampant forest fires, road building, and urban expansion. Scientists estimate that Earth's climate warmed 0.3–0.6 degrees Celsius over the past century, and that temperature change will continue and possibly intensify. Already, ecological changes seem to be under way in ecosystems around the world.⁸⁸

For one thing, temperate fauna and flora seem to be changing their schedules. Over the past few decades, scientists have documented earlier flower blooming, butterfly emergence, and frog calling—and earlier bird migration and egg-laying dates in Europe and North America. Many temperate bird species' ranges are creeping northward. While this might sound exciting to bird-watchers, it is unclear whether some earlier migrations and northward range extensions match rapid habitat changes. It is unlikely that all natural components will shift simultaneously, adjusting quickly to rapid climate change. Many probably will not. Habitats may change too quickly for many species to adapt. Park boundaries may be rendered useless, and many localized species may have no place to go as their habitat changes around them.⁸⁹

The Kirtland's warbler, an endangered, localized songbird, may prove to be one such victim. This small, lemon-breasted bird builds its grass-and-leaf nest beneath young stands of jack pine, a tree found from northern Michigan through much of the lower half of Canada. The well-draining sand under the warblers' nests is not found far outside of Michigan, however, and the birds nest in only a few of that state's counties. If global warming erases the southern extent of jack pines, northward-moving birds might be left without well-draining nesting substrate, and nesting may fail.⁹⁰

Global warming would endanger more than just temperate-zone songbirds. Vege-

tation and climate models testing moderate climate change scenarios predict that globally threatened spoon-billed sandpipers and red-breasted geese may lose respectively 60 and almost 70 percent of their remaining nesting habitat as tundra turns to forest.⁹¹

Global climate change will also likely increase the frequency and severity of weather anomalies that pound bird populations. El Niño events, when ocean temperatures rise and fish stocks fall near many important seabird breeding islands, could finish off such rare, localized, and declining species such as the Galápagos penguin, which has evolved and thrived on an equatorial archipelago flushed by cool, fish-rich currents. In addition, intensified and more-frequent droughts and fires could accompany El Niño and other cycles, both in the tropics and as far north as Canada's boreal forests.⁹²

"Additional threats will emerge as climate continues to change, especially as climate interacts with other stressors such as habitat fragmentation," wrote biologist John P. McCarty in the journal *Conservation Biology* in 2001. With climate change upon us, conservationists and planners must now think of landscapes and protections as more dynamic than previously supposed. Barriers created by human landscape changes will likely stifle species' movements, and conservation plans will have to take such dangers into account and be flexible enough to accommodate distribution shifts. Some species that are found only in cold regions or on mountaintops may have no place to go as climate changes.⁹³

Flying Straight: For Birds and Humanity

In 1998, conservation biologists Russell A. Mittermeier, Norman Myers, and Jorgen B. Thomsen wrote in *Conservation Biology*: "If

we are to have a real impact on biodiversity conservation worldwide, it is essential that we place great emphasis on the biologically most important regions regardless of their political or social situation and do whatever possible to overcome social and political obstacles.”⁹⁴

Decades of field work, computer modeling, and satellite imagery analysis have pinpointed “hotspots”—areas that harbor disproportionately high diversity and high numbers of imperiled bird species. (See also Chapter 3.) BirdLife International has been instrumental in working with organizations, agencies, and biologists around the world, creating a global partnership that coordinates conservation efforts. Increasingly, the efforts of this NGO and many others have focused not only on affecting government action but also on

working with other NGOs and involving local communities in protecting and learning about endemic birds and other wildlife.⁹⁵

Among BirdLife’s most significant accomplishments in this area has been the identification of 7,000 important bird areas (IBAs) in 140 countries—critical bird breeding and migration spots—and 218 endemic bird areas (EBAs), which are places with the highest numbers of restricted-range and endemic species. While not conferring formal protection, these designations offer a framework from which to set international, national, and local protection priorities. Some IBAs and EBAs are already designated protected areas. Some have active programs to involve local people in protecting the areas. (See Box 2–2.) Many, however, remain

BOX 2–2. SAVING BLUE SWALLOWS: LOCAL INVOLVEMENT IS KEY

Glossy and streamer-tailed, the blue swallow catches the eye as it sweeps over moist, montane grasslands in search of insects. But getting a look at this African species grows harder each year. Only 1,500 pairs survive in scattered parts of eastern and southern Africa. In 2001, a network of conservation groups and government agencies from 9 of the 10 nations home to blue swallows drew up an action plan for saving the birds. Such international efforts are increasingly common, as birds are recognized as knowing no boundaries. One difference with the swallow plan is an effort to train local guides who involve not only tourists but local communities in learning about, saving, and benefiting from the blue swallow’s presence.

In South Africa, where the blue swallow is critically endangered, BirdLife South Africa and the Endangered Species Trust Blue Swallow Working Group initiated a development program for local blue swallow guides. In 2001, its

first guide, Edward Themba, began work in the Blue Swallow Natural Heritage Site, a designated important bird area in the village of Kaapsehoop, close to Kruger National Park.

Visiting tourists hire Themba to show them the birds, although swallow nesting sites are kept secret. After spotting swallows, tourists often patronize local businesses, some of which provide Themba with essential marketing and business support. But birds, tourists, and local businesses are not the only beneficiaries of this effort: Themba also leads trips for underprivileged students and communities, so that they can appreciate the unique beauty that survives in their area. “The success of this project is inspiring,” says BirdLife South Africa project coordinator Duan Biggs, “and we are using it as a basis model for the expansion of these types of initiatives to other parts of the country and possibly even beyond.”

SOURCE: See endnote 96.

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unprotected and poorly surveyed.⁹⁶

Linking IBAs and other key habitats and striking a balance between developed and undeveloped areas will be key in saving birds in our ever-more-crowded world. Over the past 20 years, the emergence of the multidisciplinary field of conservation biology—a blending of biology, conservation science, economics, and social integration—has changed the focus of biodiversity protection efforts from the park to the landscape level, incorporating not just protected areas but adjacent lands and water resources and the people who inhabit and use them. This landscape focus increasingly brings conservation goals alongside—instead of in confrontation with—business plans.⁹⁷

Growing awareness that biodiversity protections can be combined with money-making ventures seems to be bringing enterprise and environmentalism together.

The approach is not only progressive but also pragmatic, since most of the world's remaining wild areas remain in private hands or are managed by no one at all. All told, between 6.4 and 8.8 percent of Earth's land area falls under some category of formal habitat protection. These areas are sprinkled across the globe, and many are quite small. Their management varies from protection only on paper to a mixed strategy that includes core areas closed to visitors surrounded by buffers that allow recreational and commercial activities. In general, the largest and most biologically diverse parks, including Peru's Manu National Park—where up to 1,000 species, about 10 percent of the world's bird species, have been recorded—are the least well staffed and protected, as they are in some of the world's poorest regions. Local support for

these areas—and the buffer zones and green corridors needed to protect them adequately—is critical.⁹⁸

But park protection measures aside, most of the world remains open to alteration, and people who are hungry and lack alternatives cannot embrace or focus on efforts to protect natural resources unless they clearly benefit in the bargain. Boosting economic prospects and educational opportunities—that is, empowering communities to rise above poverty—will allow local people to focus on saving birds and other natural resources for the future. These conditions are still lacking in many parts of the world, yet an increasing number of efforts highlight the potential for conservation and poverty-fighting measures to work in tandem.⁹⁹

The growing awareness that biodiversity protections can be combined with money-making ventures seems to be bringing enterprise and environmentalism together. Nowhere are marriages between commercial and conservation interests more apparent than within the realm of agriculture, the main employer and source of income in many developing nations.¹⁰⁰

Shade-grown coffee is increasingly popular, for instance. This crop is grown the traditional way, beneath a tropical forest canopy that also shelters resident and migratory birds. Shade-grown coffee requires far fewer chemical inputs than coffee grown on pesticide-heavy “sun coffee” farms. Some large coffee shop chains now sell these specialty varieties, but the largest brand-name companies have yet to dabble in more environment- and bird-friendly coffees.¹⁰¹

In addition, cultivations of various fruits, cork, cacao (for cocoa), and other crops support many bird species, although they do not fully substitute for natural forests. Farm operations that minimize use of harmful pesticides, such as organic farms and those using

integrated pest management, provide more diverse food sources and safer habitats for birds.¹⁰²

Some successful incentive programs pay farmers to set aside land for wildlife, water, and soil conservation purposes. From 2002 to 2007, for example, about 15.9 million hectares (39.2 million acres) will be enrolled in the U.S. Department of Agriculture's Conservation Reserve Program (CRP). Hundreds of thousands of farmers enroll land for 10–15 years—taking it out of production, planting grasses and trees, restoring wetlands, or grazing or harvesting hay in a way compatible with wildlife and erosion control. Although some grasses used in this program are invasive exotics, since its inception in 1985, the CRP has helped many declining grassland birds regain ground, including sharp-tailed grouse, dickcissels, and Henslow's sparrows.¹⁰³

Across the Atlantic, some British farmers—inspired in part by conservation-oriented subsidies that began in the 1990s—started preserving hedgerows and wet meadows, and not planting crops that need harvesting at peak nesting season for field birds.¹⁰⁴

In the Netherlands, a program set up by Dutch biologists offers dairy farmers payments to protect and encourage nesting birds as a farm product. An experiment conducted between 1993 and 1996 found that it was cheaper to pay farmers to monitor and manage breeding wild birds as if they were a crop rather than compensate them for restricting farming practices for the sake of bird protection. The project resulted in increased breeding success of meadow-nesting lapwings, godwits, ruffs, and redshanks, while not interrupting the dairy business. By 2002, about 36,000 hectares (89,000 acres) of Dutch farmland were enrolled in this program.¹⁰⁵

When the California state government

restricted rice growers from burning their stubble in the fall, the farmers joined with conservationists to flood their fields and augment available waterfowl habitat in the Sacramento Valley, allowing their stubble to biodegrade instead of going up in smoke. From a pilot project in 1993, the program grew to embrace about 61,000 hectares (150,000 acres) by 1998. The valley is an important wintering and migration area for thousands of ducks, geese, ibis, herons, gulls, sandpipers, and other wetland birds.¹⁰⁶

Meanwhile, in 2001 the Spanish conservation group SEO/BirdLife established an organic rice-growing farm adjacent to one of Spain's most important remaining wetlands at the Ebro River delta to augment bird habitat there, showcase organic agriculture, and promote compatible bird-oriented tourism.¹⁰⁷

Ecotourism, which first arose in Costa Rica and Kenya in the early 1980s, is loosely defined as nature-oriented travel that does not harm the environment and that benefits both the traveler and the local community being visited. Most nations now court ecotourists. Although nature-oriented tourism is not always light on the environment, this industry shows signs of improving and is often an economically viable alternative to resource extraction. Unfortunately, a good deal of the ecotourism revenue is often earned outside the country being toured, limiting the economic gains that trickle down to local people. Increasingly, however, NGOs, tour operators, and governments are trying to boost community involvement, as local residents are recognized as critical to the success of conservation programs.¹⁰⁸

To balance human activities with nature protection, we must ratchet biodiversity protection up to rank high among development priorities such as housing, sanitation, and municipal water supply—as part of a sustainable land use strategy. The increasingly

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crowded peninsular state of Florida, although not directly comparable to many developing nations, provides a compelling example of how local, state, federal, and private concerns set priorities on and commercialize conservation while struggling with relentless development and population growth. Florida is at once one of the most biologically diverse and environmentally challenged states. Fortunately, since the 1980s, careful study and planning have been hallmarks of growing conservation efforts there.¹⁰⁹

One study published by three University of Florida biologists in *Conservation Biology* in 2000 plotted out an interconnected web of wildlife habitat called the Florida Ecological Network, which embraces the state's most diverse remaining habitats and wildlife. More than half of the network is already under protected status, while some of the rest is targeted for acquisition. With the most critical areas mapped out and many of them targeted, planners should be better able to steer and concentrate development into the many areas outside the park and corridor network and incorporate protected lands into landscapes that combine compatible forms of agriculture.¹¹⁰

Another study by two Florida Fish and Wildlife Conservation Commission biologists plotted private lands needed to ensure a secure future for the most threatened wildlife, including the state's 117 rare and endangered listed animals. The researchers deduced that a specifically targeted 33 percent of the state's land area would need protection to lower significantly the chances of rare species extinctions. They included the 20 percent of the state that already falls under protection. Florida has identified at least 6 percent more land for future acquisition or protection through easements.¹¹¹

As prime wild real estate becomes more expensive and hard to find, conservationists

have stepped up efforts to secure targeted Florida lands. In 2001, the nonprofit organization The Nature Conservancy announced that it had helped protect its 1 millionth Florida acre. This organization secures funding to buy acreage that is later turned over to government protection or kept as private preserves.¹¹²

Meanwhile, the Florida state government runs a land-buying program called Florida Forever, an aggressive 10-year effort that targets properties most in need of conservation. Under this, the state spends about \$105 million each year to acquire critical conservation lands, protect watersheds, restore polluted or degraded areas, and provide public recreation. Some properties are held in conservation easements, under which property owners receive state payments or tax incentives in return for managing property as wildlife habitat.¹¹³

A good part of Florida's economy derives from tourism revenue, and more than 40 million people flood into the state each year on vacation. Meanwhile, almost 20 percent of the state's population is over 65 years of age, many of whom are retired and are frequent visitors to state tourist attractions. Combining its huge tourism infrastructure and highway system with a newly honed focus on wild places, the state identified nature watching as vital tourism with The Great Florida Birding Trail, which received federal aid and cooperation from the U.S. Department of Transportation and the U.S. Fish & Wildlife Service. Slated for completion in 2005, but already up and running in the state's center, this sign-marked driving route of some 3,000 kilometers winds its way past most of the state's bird hotspots, including county parks, ranches, state forests, private preserves, an alligator farm or two, and federal lands.¹¹⁴

Texas pioneered the first such driving route

in 1996, including 300 sites where birders may find up to 600 bird species. At least 19 other states and several Canadian provinces followed suit over the last seven years. Local towns benefit from nature tourists, a point not lost on local chambers of commerce in cash-strapped areas of southern Texas and elsewhere.¹¹⁵

The birding trails follow decades of growing interest in birding, a hobby that turns most of its participants into supporters of conservation efforts that protect birds and other wildlife. Two nationwide surveys underscore birding's rising popularity, listing it as one of the fastest-growing outdoor hobbies in the United States.

The preliminary findings of the 2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation by the U.S. Departments of Interior and Commerce note that more than 66 million Americans aged 16 or older observed, fed, or photographed wildlife (particularly birds) during the year, spending an estimated \$40 billion on birdseed, binoculars, field guides, and other equipment and travel expenses. In comparison, 13 million hunters and 34 million anglers were reported pursuing their hobbies in the country that year, spending \$20.6 billion and \$35.6 billion, respectively.¹¹⁶

Another report, the National Survey on Recreation and the Environment, is conducted by government and private organizations and last ran in 2001. It estimated that at least a third of U.S. residents 16 or older—or about 70.4 million people—go outdoors to watch birds sometime during the year, and that these numbers more than doubled between 1983 and 2001. Surveys conducted in Britain by the Royal Society for the Protection of Birds yielded similar results.¹¹⁷

Economic impact aside, the burgeoning ranks of birders also provide a powerful infusion of eyes and ears that assist scientists in

monitoring bird and other wildlife populations around the world. For example, more than 50,000 volunteers participated in the 100th annual National Audubon Society Christmas Bird Count, the largest and probably longest-running bird census. These knowledgeable birders identified and tallied birds wintering at more than 1,800 local census sites throughout North America and in an increasing number of Central and South American, Pacific island, and Caribbean countries as well. The century's worth of wintering bird data gives ornithologists a telling picture of bird abundance and distribution.¹¹⁸

Two nationwide surveys underscore birding's rising popularity, listing it as one of the fastest-growing outdoor hobbies in the United States.

Each year since 1987, birders have conducted similar January surveys across Asia, as teams of local volunteer birders pool their observations in the Asian Waterbird Census. And during the spring nesting season, other large-scale monitoring efforts take place in North America, Europe, Australia, Japan, and elsewhere to canvas bird breeding. Other "citizen science" programs target declining bird species, backyard birds, plants, insects, amphibians, and even stream-living invertebrates to test stream water quality.¹¹⁹

As bird surveyors note, many bird species are in decline and prospects remain bleak for many of the world's most-threatened bird species. Governmental and private efforts to save some, however, are bearing fruit, setting good examples for future endeavors elsewhere:

- The Seychelles magpie-robin is rebounding after being reintroduced to predator-free islands and after reductions in pesticide

WATCHING BIRDS DISAPPEAR

- use in its habitat.¹²⁰
- The Canada-nesting, Texas-wintering whooping crane has been a hallmark of conservation efforts between Canada and the United States—up to about 200 birds after a low of 14 adults in 1938. A non-migratory population was reintroduced to Florida, providing an extra hedge against extinction (and an added ecotourism attraction).¹²¹
 - In 1999, the peregrine falcon was lifted from the U.S. Endangered Species list following the ban on DDT in the 1970s and decades of protection, captive breeding, and reintroduction programs. The bald eagle may soon follow.¹²²
 - Protection combined with apparent adaptability to changed landscapes enabled red kites to return to former haunts in the United Kingdom, Sweden, Germany, and France.¹²³
 - Four threatened parrot species on three Caribbean islands—St. Vincent, St. Lucia, and Dominica—are inching back from the brink thanks to government and NGO protections, public education campaigns, and some captive breeding efforts.¹²⁴
 - On the fabled dodo island of Mauritius, habitat protection and exotic plant and animal eradication efforts benefit now-growing populations of the endemic Mauritius cuckoo-shrike and Mauritius kestrel, a species that also benefited from captive breeding and release programs until the early 1990s.¹²⁵
 - The bright blue Lear’s macaw, a rare parrot of northeast Brazil, appears to be steadily rising in number, from about 170 in the late 1990s to about 250. A local

landowner, Brazilian conservation organizations, the World Parrot Trust, and funding from the Disney Conservation Initiative help conservationists plant licuri palms (essential food plants for the birds), monitor the population, and protect nest sites.¹²⁶

The actions needed to ensure a secure future for birds are the very same ones needed to achieve a sustainable human future: preserving and restoring ecosystems, cleaning up polluted areas, reducing the use of harmful pesticides, reversing global climate change, restoring ecological balances, and controlling the spread of exotic species that knock such balances askew. (See Box 2–3.) Wildlife conservation must be worked into and be compatible with rural, suburban, and urban planning efforts that improve the prospects for the world’s poor while making our cities and industries safer for all living beings.

Canadian Wildlife Service biologist F.L. Filion once wrote about birds: “it is difficult to imagine another resource capable of contributing as fully and as completely to mankind’s diverse needs.” Birds provide us with food, inspiration, a link to nature, and security—in this case as indicators of environmental ills. Today, this feathered resource is in great need of human attention. As we work toward a more sustainable future, keeping an eye on the world’s 9,800 bird species helps us keep ourselves in check—if we care to heed the warnings. Along the way, birds’ colors, songs, and activity will continue to inspire us, reminding us that in protecting the world’s biodiversity, we are doing the right thing for flora, fauna, and ourselves.¹²⁷

**BOX 2-3. A DOZEN STEPS TOWARD
A SUSTAINABLE FUTURE FOR
BIRDS AND BIODIVERSITY**

- Involve local communities in conservation efforts.
- Where possible, combine compatible commercial activities with conservation goals.
- Study bird and other wildlife populations thoroughly and set aside areas most in need of protection.
- Include biodiversity protection as a key goal when planning development, industry, or agriculture.
- Control harmful introduced species.
- Ban chemicals dangerous to birds, other wildlife, and people.
- Improve protections against chemical spills, including oil spills.
- Reign in uncontrolled hunting of birds, particularly along migration routes and in areas inhabited by localized, threatened species.
- Mitigate harmful fishing techniques, particularly longline nets, which needlessly kill many thousands of seabirds.
- Address and mitigate threats posed to birds by communications towers, tall buildings, and power lines.
- Stem the causes of global warming.
- Within communities, raise environmental awareness through bird-watching and other activities.