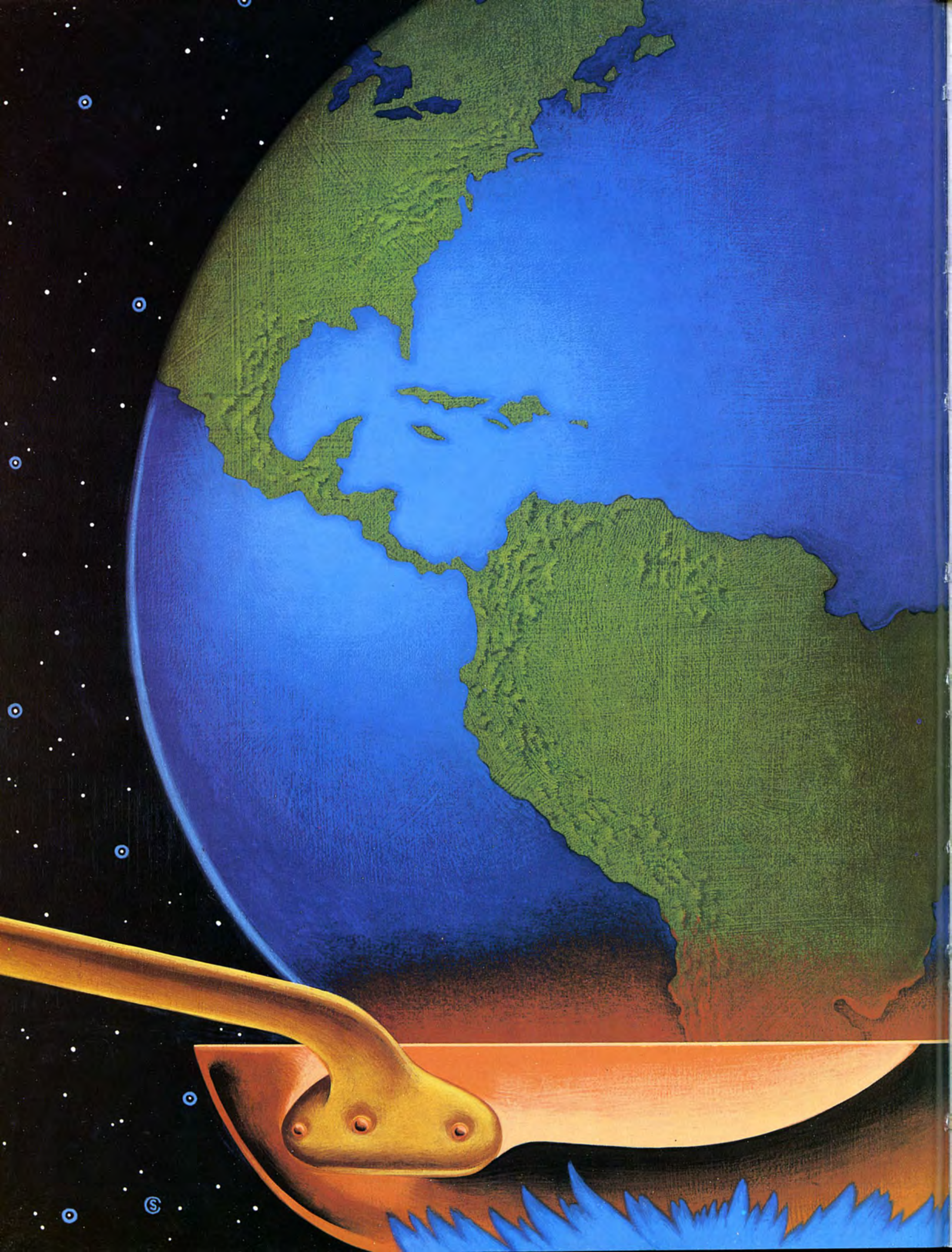


# Global Warming: An Imminent Threat to Birds?

*by Elliot J. Tramer*

*Predicted climate changes may devastate plant communities and the birds that depend on them*

*The sun climbed above the treetops, quickly dissipating a curtain of fog. It was late April in the year 2050. An elderly bird watcher scanned the glade, as he had every spring for nearly 60 years. The forest had changed strikingly in his lifetime, even though the tract had been undisturbed by logging or other human activities. As the climate had grown steadily warmer and drier, most of the beeches, maples, ashes, and elms had died. Many of the oaks survived, but the tall, closed-canopy forest of his youth had been replaced by one in which clumps of trees were interspersed with grassy openings and thickets of sumac and briars.*

*The morning chorus reached a crescendo, and he ticked off the familiar voices: catbird, brown thrasher, song sparrow, Carolina wren, chat, cardinal, prairie warbler. His bird lists were shorter than they used to be. The red-bellied woodpeckers had left after the dead trees fell in the tornado of 2047. Only a few Cape May and bay-breasted warblers passed through each year now, and he hadn't heard a cerulean warbler for 10 years. He could sometimes find a wood thrush in a low spot in the dry creek bed. He would go there next . . . .*

Is this spring bird walk a plausible vision of the future? In the past, wild bird populations have been dramatically affected by the actions of humans. We have destroyed wetlands and tropical forests, converted prairies to agriculture, and broken expanses of temperate-zone forests into small fragments. All of these changes have adversely affected birdlife. Now, in addition to these changes, we must consider the possibility that rapid global warming could occur in the near future. Global warming would further alter plant communities, and the effects of these alterations could be devastating to many bird species.

But before we can predict how global warming might affect birds, we must understand why scientists are expecting this drastic change in climate. Concentrations of certain gases in the Earth's atmosphere are rapidly increasing as a result of human activities such as fossil fuel burning, forest destruction, and expanded livestock production. These gases, including carbon dioxide ($CO_2$) and methane, trap infrared radiation—the wave-

ILLUSTRATIONS BY STEVE CARVER

**_Present Vegetation Zones in North America_**


lengths of solar energy largely responsible for heating the Earth's surface. Predictions of rapid global warming are based on an expected increase in this "greenhouse effect" as the production of heat-trapping gases continues.

Scientists also predict future global warming because they have noted a long history of correlation between atmospheric $CO_2$ concentration and global temperature. Chemical analyses of air bubbles trapped deep within the ice of Antarctic glaciers allow us to reconstruct the global climate for the past 160,000 years. These data reveal that $CO_2$ concentration and temperature have fluctuated in concert; when $CO_2$ is high, temperature is also high, and vice versa. The level of $CO_2$ in the atmosphere today is far greater than at any time in the past 160,000 years. And, at the present rate of increase, $CO_2$ concentration will be nearly twice today's level by the middle of the coming century. In view of the historical correlation between $CO_2$ and temperature, and given the rapid increases in the production of greenhouse gases, future global warming seems likely. The relevant questions about global warming may not be whether or not it will occur, but rather "how much?" and "how soon?"

To answer these questions, scientists are using General Circulation Models (GCMs), which predict the climate of the future using computer simulations. Unfortunately, today's GCMs are not very precise. Their accuracy is limited by our poor understanding of how global warming will affect cloud cover and to what extent the oceans will be able to absorb the excess atmospheric carbon that causes global warming. As we gain a better understanding of these processes in the future, the GCMs will be adjusted.

Despite their current limitations, today's GCMs represent the best guess we can make about the future. They tell us that if atmospheric $CO_2$ doubles, average global temperature will rise by between 1.5 and 7.0 degrees Centigrade. So a 4 degree increase—in the midrange of this prediction—seems a reasonable estimate of climate change in North America in the next 50 years.

The GCMs also predict rainfall patterns. The amount of water in circulation on Earth will increase as glacial and polar ice start to melt; sea levels will rise, perhaps by several feet. On the other hand, the GCMs predict reduced rainfall in many areas, especially in continental interiors. And even if rainfall patterns remain unchanged, soils will be drier and droughts more frequent because higher temperatures will cause faster evaporation.

How will these changes affect our planet's birdlife? They will change the habitats where birds live. All landbirds depend to some degree on plants—trees, shrubs, grasses, and other vegetation—whether for food, cover, nesting, or as habitat for prey. One way of predicting future changes in vegetation is to look at how plants have responded to climate changes in the past. Tom Webb, a paleoecologist at Brown University, has analyzed fossilized pollen deposits from a wide range of sites in eastern North America. These deposits were laid down over the past 18,000 years, since the peak of the last ice age. As the glaciers retreated, spruces migrated north from an area of maximum abundance in what is today Missouri, Illinois, and Iowa to their present area of maximum abundance in central Canada. Other types of trees show similar northward expansions.

With this historical perspective, as well as our knowledge of what climates today's plant species can tolerate, we can extrapolate into the future. Using the climate-predicting GCMs, paleoecologists William Emanuel, Herman Shugart, and

Margaret Stevenson have drawn a map of North American vegetation that shows what plants would grow in different regions if atmospheric $CO_2$ concentrations were to double. Their study reveals a striking northward shift of climate zones. The climate regime that produces Arctic tundra essentially vanishes northward off the face of North America; the future climate in the region now occupied by tundra would support prairie grasslands or boreal spruce forest. The disappearance of the tundra would threaten the existence of snowy owls, jaegers, gyrfalcons, dunlins, sanderlings, lesser golden plovers, and other members of the spectacular Arctic-nesting avifauna.

The eastern deciduous forest climate zone would move northward hundreds of miles, replacing much of the boreal spruce belt. The GCMs predict relatively little temperature increase in the tropics, however, so neotropical migrants would be unlikely to expand their winter ranges northward. Thus, a shift in North American plant communities would force neotropical migrants to lengthen their flight paths. Birds such as red-eyed vireos would have to fly several hundred additional miles when returning to the eastern deciduous forest in the spring. Since the magnitude of the climate shift is predicted to increase with latitude, those migrants that nest the farthest north would experience the greatest extensions of their migratory paths. Migrants that nest in boreal forest, including many thrushes, flycatchers, and wood warblers, would have to hit a "target" that was not only much farther away from their wintering grounds, but also much smaller.

Meanwhile, forests in the southeastern United States would be drier than they are now. Such a change might convert the vegetation of the Southeast to a mixture of oak-pine scrub and savanna. Along the Gulf Coast, one might encounter subtropical woodlands like those now found in the hammocks of south Florida.

It is difficult to think of a single forest bird that would benefit from these changes. As large trees die, woodpeckers and other bark-gleaning, cavity-nesting species might reap a temporary bonanza of food and nest sites. But in the long run, all forest birds would suffer. The cerulean warbler, a species that nests in large tracts of tall-canopied forest, is one songbird whose future seems particularly insecure in a world of patchier, lower-canopied forests.

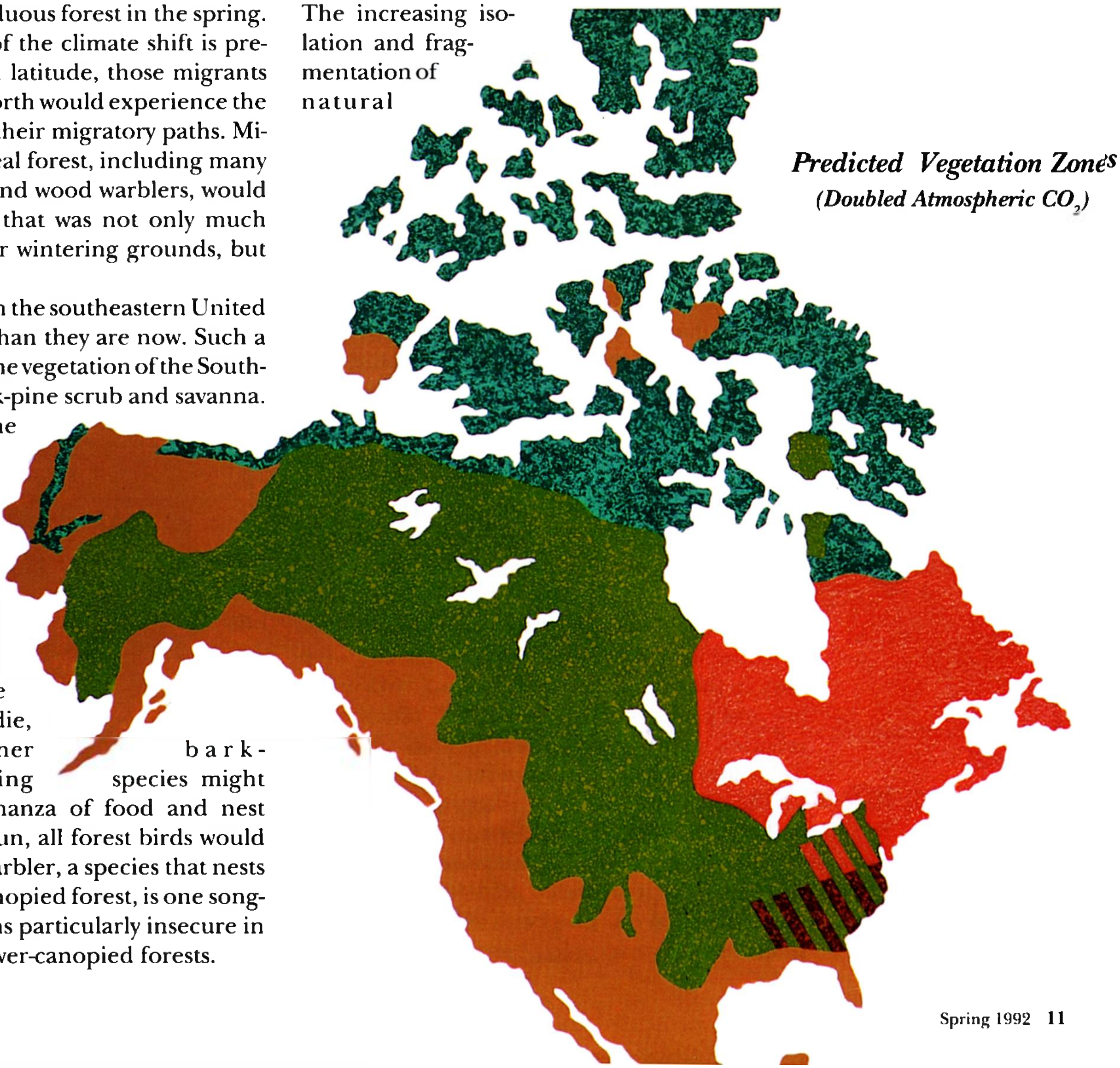
Changes in vegetation on the forest floor—from the present carpet of varied wildflowers and shrubs to dense tangles of just a few relatively drought-tolerant species—could have a profound impact on ground-nesting forest birds, including ovenbirds and Kentucky, hooded, black-and-white, and worm-eating warblers. Ground feeders such as thrushes might also be affected, in ways that are difficult to anticipate.

But in making these speculations, we are assuming that plant communities *can* move north or south as the climate changes. This assumption may be optimistic. Studies of the distribution of fossilized pollen suggest that many plants can keep pace with climate changes as fast as 5 degrees Centigrade in 1,000 years. But the rate of change that scientists are predicting—4 degrees Centigrade in 50 years—is an order of magnitude faster. Most trees don't reach reproductive maturity for 30 years. Can a tree disperse its seeds over 500 miles in just two generations? Margaret Davis, a forest ecologist at the University of Minnesota, believes that for most species the answer is no.

Even if they could keep pace with climate changes, plant populations face another barrier—human land use. The increasing isolation and fragmentation of natural

*If the atmospheric concentration of $CO_2$ doubles (a conservative prediction), the average global temperature will rise, and scientists predict a consequent change in the distribution of major vegetation zones in North America. Climatic conditions suitable for tundra will scarcely exist; boreal and deciduous forest zones may move hundreds of miles northward. Grasslands may expand to the north and east, while the southeastern United States might support a patchwork of grasslands, deciduous shrubs, and southern pine.*

***Predicted Vegetation Zones***
***(Doubled Atmospheric $CO_2$)***



Maps adapted with permission from two figures by W. Emanuel, H. Shugart, and M. Stevenson (*Climate Change* 7:29-43; 1986).

*In the face of global warming, our standards for conservation may be too high. We should purchase as much land as we can get our hands on, no matter what its condition.*

habitats is an already-serious problem that can only intensify with climate change. In the Midwest, for example, forests are small islands in a sea of human development. On the edges of cities, suburban sprawl has converted vast forest and agricultural lands to residential and commercial tracts. Marooned on shrinking islands of natural habitat, plants will find it difficult to follow shifting climate zones northward across large inhospitable "seas" of soybeans and cement. Woodland plants such as trillium and mayapple that have low rates of seed production and spread vegetatively would be especially unlikely to move quickly over large distances. The overall result may be the loss of many plant species. The effect of this botanical poverty on birds is difficult to predict, but it is hardly likely to be favorable.

Of all the bird groups, aquatic birds may be the most severely affected by global warming. Salt marshes and other coastal wetlands, hemmed in on the landward side by human development, would be devastated by a rise in sea level. Prairie potholes in the upper Midwest, vital breeding grounds for many waterfowl species, would be drastically reduced by the drier, warmer conditions. These changes in coastal and inland wetlands, combined with the loss of tundra habitat, would constitute a "triple whammy" that would devastate our aquatic bird species.

Can any birds benefit from global warming? Species adapted to prairie grasslands and dense scrub might increase. If much of central Canada is indeed transformed by climate change into short-grass prairie, then Swainson's hawks, horned larks, longspurs, and Baird's, lark, and grasshopper sparrows could flourish. Tall-grass prairie birds such as the dickcissel and upland sandpiper might proliferate eastward if the deciduous forest becomes more open, unless they are excluded by agricultural activity. In situations where the eastern forest reverts to thickety scrub, brown thrashers, towhees, chats, catbirds, white-eyed vireos, and prairie warblers could be among the winners. This change would reverse the current trend of rapid declines in many thicket-nesting species detected by recent U.S. Fish and Wildlife Service Breeding Bird Surveys.

The possibility of rapid climate change adds a new dimension to the problem of avian conservation. In the past, conservationists have worked to buy and protect the best remaining examples of relatively undisturbed natural habitats. Our standards may be too high, however. A better strategy, in the face of global warming, may be to purchase as much land as we can get our hands on, no matter where it is and no matter what its condition. Even degraded land—abandoned industrial sites in our inner cities—should be considered; this acreage may be available at relatively affordable prices. Under conditions of global warming, ecological succession will convert such holdings into useful bird habitat, even without active management.

And while we must continue to buy up chunks of land, this strategy will not be sufficient in the event of rapid climate change. Most protected habitats in eastern North America are isolated fragments, highly vulnerable to biological impoverishment under conditions of global warming. Wildlife preserves should be connected by corridors of natural vegetation that can serve as dispersal routes for both plants and animals. Long corridors that run north to south would be especially beneficial.

But in the face of an ever-expanding human population and limited financial resources, conservationists and government agencies can't ever hope to obtain enough land to protect birdlife. We should also adopt long-term conservation strategies that don't depend on the existence of protected reserves. Our ultimate goal should be to create a conservation ethic and an American landscape so rich and diverse that protected areas are no longer necessary.

Amateur and professional ornithologists can start working toward this goal by embarking on an aggressive "Save our Birds" campaign, using the mass media to foster an appreciation for birds and to inform the public of the dangers birds face. Surveys show that of all wild creatures, birds are by far the most popular. The vast reservoir of public goodwill toward birds could be tapped once people know that many of our most colorful and popular birds are endangered. Imagine what would happen if an effort to "Save our Birds" became a public crusade? Residential yards, farms, industrial parks, and cemeteries all over America could be landscaped and managed in ways that maximized their attractiveness to the widest possible variety of birds. What if we could convince private landowners to commit an acre or more to great north-south corridors stretching hundreds of miles, along which plants and animals might track climate changes?

Who knows, future historians might write that an inordinate fondness for birds provided the means for saving us from ourselves. ■

*Elliot J. Tramer is a professor of biology at the University of Toledo, Ohio.*

*Further Reading*

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