

The Birdwatcher's Guide to Global Warming



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The Birdwatcher's Guide to Global Warming



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FOREWORD

Birds, by their very existence, enhance our daily lives. For many of us, it is a thrill to see the splash of a Brown Thrasher in a birdbath, or the flash of red in green woods as a tanager darts past. It is a gift of nature that such birds – which play an important role in healthy ecosystems by controlling pests, dispersing seeds, and pollinating plants – are also so beautiful and such a joy to watch. More than sixty-three million Americans are birdwatchers, injecting billions of dollars into local economies throughout the nation as they purchase birdseed, binoculars, and guidebooks and venture into outdoor environments that are made so much more welcoming by the sights and songs of birds. But, as nature’s indicators, birds are also showing signs that our environment is changing.

Human activity – particularly the burning of fossil fuels such as coal, oil, and natural gas – is sending tremendous additional quantities of carbon dioxide and other heat-trapping greenhouse gases into the atmosphere. The buildup of these gases is causing the planet to heat up and is altering the basic climate systems to which nature is adapted. There is a growing body of scientific evidence that some birds (as well as plants and other wildlife) are already responding to the changing climate.

As we explain in this report, recent studies indicate that this global warming could affect birds in many ways, shifting their distributions and altering their migration behavior and habitat, and even diminishing their survival ability. In some places, we may no longer see our favorite birds – as many as 33 states could see a significant reduction in American Goldfinches in the summer! As birdwatchers, we enjoy seeing the same birds we have always cherished in our backyards or on a favorite hike. What’s more, we understand that if a bird’s range shifts even a few miles, it can have a trickle-down effect for wildlife sharing its ecosystem.

We highlight these potential impacts not to cause alarm, but rather to inform and educate the nature-lover in us all and, we hope, to inspire action. Like other environmental problems, we *can* do something about global warming. More than forty years ago, biologist Rachel Carson warned in her classic work, *Silent Spring*, that if pesticide use continued as it had for the previous 20 years, bird populations across the nation would decline and even disappear. Spring would be silent, empty of the



call of birds. We responded then with new laws to bring about the safer development and use of pesticides. Spring still dances to the songs of birds. While there are still many concerns about pesticides, we have made great progress since Carson's day. We can make the same progress with global warming. If not, then we once again run the risk of the songs of spring being diminished, signaling a wider threat to other wildlife, ecosystems, and people as well.

Although the mere thought of trying to deal with a problem big enough to change the climate of the entire world can be paralyzing, the solution is promisingly simple – reduce emissions of greenhouse gases. We can begin at home by making energy efficiency part of our purchasing decisions. We can support adoption of better fuel economy standards for new vehicles and the increased use of clean, alternative energy sources such as solar power and fuel cells. And we can urge Congress to enact caps on emissions of greenhouse gases from major sources such as power plants.

Above all, we must recognize what our beloved songbirds are telling us – global warming threatens our own backyards, and we must begin to confront it.

Mark Van Putten
President & Chief Executive Officer
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George H. Fenwick
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INTRODUCTION

It has been more than 67 years since Roger Tory Peterson completed his original *Field Guide to the Birds*, which remains today a quintessential guide to the brilliant birds whose habitat we share. Whether this classic volume will continue to be relevant for generations to come, however, will depend on our ability to become better stewards of our natural world.

Throughout the 20th century, we made great strides in protecting the nation's environment. We have set aside lands as wilderness, parks, and refuges, reduced air and water pollution, and developed strategies to restore threatened and endangered species. Without these efforts, we may well have lost forever much of the wildlife and wild places we know and love.

But our work is not finished. We continue to see signs that natural systems are in great peril, at home and around the world. Species are declining at an ever-increasing pace, and birds are no exception. A total of 1,111 birds (11 percent of the world's bird species) are considered to be at risk, as many as 200 of which may disappear within the next 20 years (Collar, et al. 1994; BirdLife International 2000). The United

States ranks among the top ten countries in terms of the total number of vulnerable bird species.

To date, the primary threat to birds worldwide has been habitat loss and fragmentation. Neotropical migratory species have lost millions of acres of winter habitat in Mexico, Central and South America as forests have been cleared to make way for agriculture, cattle grazing, and other development. They are also losing important habitat here in the United States, where human activities are destroying the forests, grasslands, and wetlands they use as stopovers and





Painted
Bunting

-Tom Veso, Cornell
Laboratory of Ornithology



THE PROBLEM OF GLOBAL WARMING

summering grounds. As a result, many of these species' populations have dropped significantly. For example, in the past 25 years the number of Cerulean Warblers, which depend on mature, contiguous forests, has dropped by 70 percent. And the brightly-colored Painted Bunting has declined by 50 percent.

The plight of the nation's birds has inspired ongoing efforts to reverse the situation. Through local, national, and international conservation policies, and programs focused largely on reducing air and water pollution and protecting and restoring important habitat, we *have* had conservation successes – the sight of a Bald Eagle soaring overhead is a welcome reminder of what we can accomplish. But we must also look ahead. Despite welcome progress, we continue to lose ground every day as wildlife habitat is destroyed.

Moreover, it is becoming increasingly clear that we could lose much more if we do not also begin to address the very real and potentially devastating problem of global warming. It is not any one factor alone, but rather the combination of these threats that will ultimately be the most consequential environmental danger to birds, and the greatest conservation challenge of the coming century [Intergovernmental Panel on Climate Change (IPCC) 2001b].

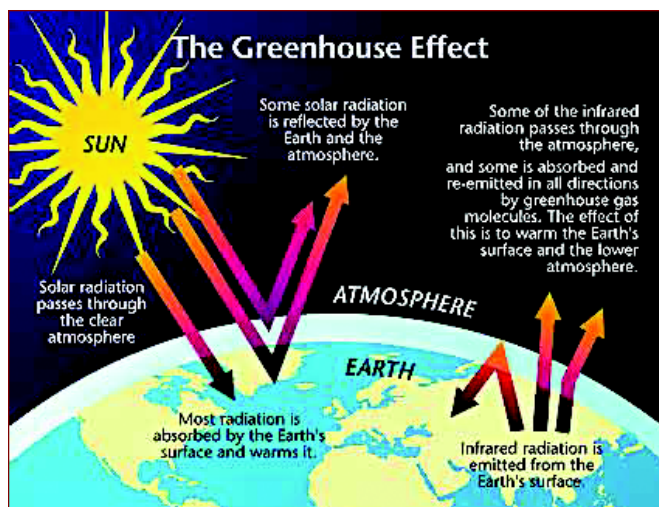


Scarlet Tanager—Dan Sudia Bird Photos

Global warming, also frequently referred to as climate change, is not just a theory or a distant threat.¹ The overwhelming agreement among the world's preeminent scientists and scientific bodies is that the Earth is heating up and that human activities are largely to blame [IPCC 2002; IPCC 2001a; National Research Council (NRC) 2001a]. This global warming is expected to significantly disrupt the planet's climate system by altering the exchange of water among the oceans, atmosphere, and land. As a result, regional temperatures and precipitation patterns will shift, affecting nearly every aspect of the Earth's ecological systems – and the people and wildlife that depend on them.

There is evidence that the late-20th century pattern of global warming is already having an effect on wildlife, including birds. Many of the songbird species we see and enjoy in nature, for example, are shifting their ranges and migrating earlier, often making it more difficult for them to find food such

¹ The terms “global warming” and “climate change” are often used synonymously. According to the United Nations Framework Convention on Climate Change (UNFCCC), climate change is defined as “a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods” (UNFCCC 1992).



Source: USGCRP

as insects, flowers, and berries when they need it. Since songbirds play a critical role in ecosystems by eating insects, pollinating plants, and dispersing seeds, such changes risk throwing ecosystems off balance. Models show that these shifts are likely to worsen unless global warming is abated.

The good news is that solutions are not a distant dream either. There are things each of us can do in our homes and businesses, and actions our governments can take, that will help solve this problem.

What is Global Warming?

Gases such as carbon dioxide (CO₂), methane, nitrous oxide, and water vapor in the atmosphere naturally trap solar heat

and keep some of it from radiating off the Earth's surface back into space. Without this "greenhouse effect," our planet would be about 60 degrees cooler and unable to support life as we know it. However, since the start of the Industrial Revolution, humans have been interfering with this natural balance by sending tremendous additional quantities of these heat-trapping greenhouse gases into the atmosphere as we burn coal, oil, and gas in our power plants, cars, and factories. Additionally, expanses of CO₂-absorbing forests have been destroyed, limiting the ability of the Earth's natural systems to regulate some of these gases.² As a result, too much CO₂ and other greenhouse gases are building up in the atmosphere, essentially creating a "blanket" trapping excess heat near the Earth's surface (an effect known as global warming).³

The Earth's surface temperature warmed more during the last century than any other century during the last thousand

² Put very simply, forests and other terrestrial ecosystems play an important role in the global "carbon cycle" by taking in carbon dioxide as part of the photosynthesis process. Deforestation and other land use changes take away a potential "sink" for some of the excess carbon dioxide that human activities are pumping into the atmosphere. Moreover, when forests are removed by burning, additional carbon dioxide locked up in the trees' wood is returned to the environment (Manchester Metropolitan University 2001).

³ Human activities have already contributed to a significant increase in greenhouse gas concentrations in the atmosphere. Since the mid-1800s, the atmospheric concentration of CO₂ has risen more than 30 percent and is now higher than it has been in the last 400,000 years [U.S. Global Change Research Program (USGCRP) 2000]. In addition, nitrous oxide is up about 17 percent, and methane has more than doubled (IPCC 2001a).



years [World Meteorological Organization (WMO) 2000]. Moreover, 1998 was the warmest year on record, and 7 of the top 10 warmest years all occurred in the 1990s. Unless we begin to deal with the problem by implementing responsible policies to reduce greenhouse gas emissions, global temperatures will rise even more rapidly in the coming decades.

According to the IPCC, an international body composed of the world's top climate scientists, atmospheric concentrations of greenhouse gases, in the absence of effective global warming policies, will continue to increase significantly during the next century. Climate models project that *average* surface temperatures will rise an additional 2.5 to 10.4 degrees Fahrenheit by 2100 – more than ten times faster than what has been the average rate of natural sustained global temperature change since the last ice age (IPCC 2001a; Root and Schneider 2002). This rapid global warming is expected to disrupt the Earth's climate, altering regional temperature and precipitation patterns, and possibly increasing the severity of storms. In addition, global average sea level is projected to rise due to thermal

expansion of the oceans and the melting of some glaciers and ice caps (IPCC 2001a).

How Might Global Warming Affect Us Here at Home?

For the United States, global warming and associated climate change could have a significant impact on natural systems. Recently, the United States government completed a comprehensive study of the impacts of climate change here at home (USGCRP 2000). According to the report, vulnerable systems such as alpine meadows in the Rocky Mountains and coastal wetlands and estuaries could disappear in some places as global warming continues. In the Gulf Coast and mid-Atlantic regions, sea-level rise could destroy important habitat for migratory shorebirds and lead to flooding, erosion, and property damage. Several native species of trees may no

longer be able to grow in some areas as summers become warmer. For example, maple-dominated hardwood forests in the northeastern United States could give way to forests dominated by oaks and conifers, which are more tolerant of higher temperatures. This could reduce the brilliance of fall foliage and disrupt the maple syrup industry.



Golden-cheeked Warbler

–U.S. Fish and Wildlife Service



How many birds does it take to change a light bulb?

That bird perched atop a power line in your neighborhood should be a reminder that our energy choices affect the wildlife around us. Historically, fossil fuels have enabled us to gain light and mobility, cooling and heat. But their use has also polluted our environment, causing smog and acid rain, poisoning our waters with mercury and other toxics, and contributing to global warming. It doesn't have to stay that way. We have the ingenuity to move toward a clean, sustainable energy future, and starting may be as simple as changing a light bulb. If every household in the United States replaced its most commonly-used incandescent light bulbs with more efficient compact fluorescent bulbs, electricity use for lighting could be cut in half, lowering our total annual CO₂ emissions by approximately 125 billion pounds (Geller 2001). This action alone would significantly slow the growth in CO₂ emissions from the United States. Moreover, it would save each consumer at least \$25 over the lifetime of the bulb [U.S. Environmental Protection Agency (U.S. EPA) 2002].

More importantly, global warming is an added stress to wildlife that must already cope with environmental problems such as habitat fragmentation, pollution, and the introduction of exotic and invasive species. We know from experience that human intervention on natural cycles tends to have a ripple effect of negative consequences. Global warming may well be our greatest global experiment yet. Unfortunately, once we know for sure the consequences, it may be too late. Greenhouse gases that we emit today will remain in the atmosphere for decades and, in some cases, centuries, disrupting the climate for generations. It is up to us to turn the situation around.

GLOBAL WARMING AND BIRDS

Like many plants and animals, birds' life cycles and behavior are closely linked with the changing seasons. For neotropical migrant species, including many of the warblers, vireos, and other songbirds we enjoy watching on a summer field trip, changes in weather help signal when they should begin their long flights southward in the fall and back again in the spring.⁴ Variables such as temperature and

⁴ Neotropical migrants are birds that migrate long distances from wintering grounds in the "neotropics" (tropical regions of Mexico, Central and South America, and the Caribbean) to breeding grounds in North America (DeGraaf and Rappole 1995).



**Black-throated
Blue Warbler**

-U.S. Fish and
Wildlife Service



precipitation also affect the timing and availability of flowers, seeds, and other food sources for the birds when they reach their destinations. Moreover, birds that rely on very specific habitats for at least part of their life cycle, such as the endangered Golden-cheeked Warbler in Texas, could become extinct if their habitat disappears. For each of these reasons, many bird species are considered to be particularly vulnerable to global warming and associated climate change (Both and Visser 2001).

Global Warming May Already Be Affecting Some Bird Species

Studies indicate that the ranges of a number of bird species have been changing, consistent with the 20th century trend of rising average temperatures. One study of 35 North American warbler species, for example, has found that the range of occurrence of seven of the species (including Prothonotary Warbler, Blue-winged Warbler, Golden-winged Warbler, Black-throated Gray Warbler, Pine Warbler, Hooded Warbler, and Cape May Warbler) has shifted significantly farther north in the past 24 years, by an average of more than 65 miles. By comparison, none of the species in the study were found to be farther south (Price and Root, unpublished data). Similar trends have been discovered among some seabirds, such as the Sooty Shearwater, whose migration route has shifted toward cooler northwestern areas of the Pacific in

response to rising sea temperatures off the coast of California (Oedekoven, et al., 2001).

There are also signs that recent climate trends are affecting birds' behavior. Studies in the United States and Europe have found that some songbirds are migrating earlier in spring months, corresponding with warmer temperatures. For example, research of migratory birds in North America shows that the arrival dates of 20 species were up to 21 days earlier in 1994 than in 1965, while just a few species were later (Root, unpublished data; Price and Root 2000). This includes long-distance migrants like the Rose-breasted Grosbeak, Black-throated Blue Warbler, and Barn Swallow. Similarly, North American Tree Swallows are now nesting up to nine days earlier than 30 years ago, corresponding with an increase in average spring temperatures (Dunn and Winkler 1999). Because this shift is occurring throughout the species' broad habitat range, scientists believe that the birds are responding to larger trends than just localized climate variations.

These changes may be occurring regardless of whether the birds' arrival is synchronized with the availability of food sources such as insects, flowers, and berries at their destination habitat. Global warming may cause migration and nesting to get out of step with food supplies. As a result, the "early birds" *may not* get the worm.



Modeling Global Warming and Climate Change Impacts

To determine how the summer distributions of birds might change in the future, Dr. Jeff Price of the American Bird Conservancy developed large-scale statistical models of the association between current bird distributions (based on North American Breeding Bird Survey data) and a number of climate variables (such as average seasonal temperature and precipitation and extreme values like the temperature in the hottest and coldest months). These climate variables serve as proxies for many factors possibly limiting a species' distribution, including physiology, habitat, and food availability, and are similar to those used in many bioclimatic studies.

He first checked the models to see how well the predicted species distributions matched maps of actual distributions. The results indicated that the summer distributions of many North American birds can actually be modeled quite well based on climate alone. He then used the Canadian Climate Center's General Circulation Model (CCC-GCM2) to project what average climate conditions may exist in North America if CO₂ concentrations in the atmosphere double from pre-industrial levels (sometime in the next 50 to 100 years). By applying the modeled future climate data to the original bird-climate models, he was able to project the possible future climatic ranges of many North American birds.

While model results cannot be used to look at fine points of how a given species' distribution might change, they can provide an impression of the possible direction and potential magnitude of change in suitable climate for the species. By examining these maps, Dr. Price has been able to develop lists of how the climatic ranges of species would be expected to change in particular states or regions or to estimate how the composition of groups of species, such as neotropical migrants, might change.



Scientists at the Rocky Mountain Biological Laboratory in Colorado, for example, have discovered that American Robins migrating to the region are arriving an average of two weeks earlier than they did 23 years ago. They attribute this shift to the likelihood that the birds are responding to warmer temperatures at the lower altitudes that typify their wintering grounds. The problem is, they are arriving at their higher-altitude summer breeding grounds only to find that there are still winter conditions there. There is now a 65-day gap between the date of the first robin sighting and the first date of bare ground at the snow measuring station, 18 days longer than in 1981. As a result, the birds must wait longer for the snow to melt before they can feed and may be at a greater risk of starvation (Inouye, et al., 2000).

In other cases, migratory birds are arriving *too late* for optimal food availability. The Pied Flycatcher, for example, spends its winters in tropical Africa and migrates north into Europe in the spring. Since 1980, the average spring temperature in parts of Europe has risen about 5.4 degrees Fahrenheit, and the peak insect populations (with which the birds' breeding coincided) have consequently shifted to earlier in the year (Both and Visser 2001). Their environment in Africa, however, has not changed significantly, and the birds are still migrating north about the same time as usual. When they reach their breeding site, they have to find their mates and lay

their eggs quickly in order to capitalize on available food, which may already be past its peak. Consequently, the birds are raising fewer offspring.

The Potential Effects of Global Warming on the Distribution of Songbirds in the United States*

Bird communities, as we currently know them, may look quite different in the future if we do not begin to take meaningful action to reduce the greenhouse gas emissions responsible for global warming. As regional temperatures rise, the climatic ranges of a number of species in the Northern Hemisphere could shift north as they seek habitat, food availability, and other factors to which they are adapted. In turn, in the ranges they leave behind, the birds may be replaced by species from farther south.

When some species move to different ranges, they may face new prey, predators, and competitors, as well as different habitats. So-called "optimal" habitats for many species may no longer exist, at least in the short term (Price and Root 2001). This is particularly true for birds relying on specific plants for food or nesting. While most birds can respond quickly to a changing climate, the ranges of some plants may take

* Adapted from Price, J.T. and T.L. Root, March 20, 2001. "Climate Change and Neotropical Migrants." Presentation to the 66th Annual North American Wildlife and Natural Resources Conference, Washington, D.C.



centuries to move, if they move at all. Studies of past changes in climate suggest that many slow-maturing plants such as trees will have trouble responding to the future rate and magnitude of change that we could expect in the coming century, leading to changes in wildlife communities and possibly the extinction of some species (Webb 1992). Moreover, as the landscape becomes more and more fragmented due to development of roads, buildings, and farms, the ability of forest species to migrate is that much harder (Schneider 1997).

Global Warming Could Lead to a Net Decrease in Neotropical Migrant Species Present in the Contiguous United States

The following table shows how global warming might change the number of neotropical migrant species present in different regions of the country.⁵ “Gross” changes depict the overall loss of species currently found in areas, while “net” changes depict species loss from an area offset by species moving into the area from an outside region. For example, the Great Lakes region could see a potential gross loss of 53 percent of the neotropical migrant species that are currently

⁵ The empirical-statistical technique used in this analysis associates large-scale patterns of bird ranges with large-scale patterns of climate. It does not explicitly represent the physical and biological mechanisms that could lead to changes in birds’ ranges. Therefore, these numbers should be viewed only as illustrative of the potential for very significant shifts with doubled CO₂ climate change scenarios (Root and Schneider 2002).

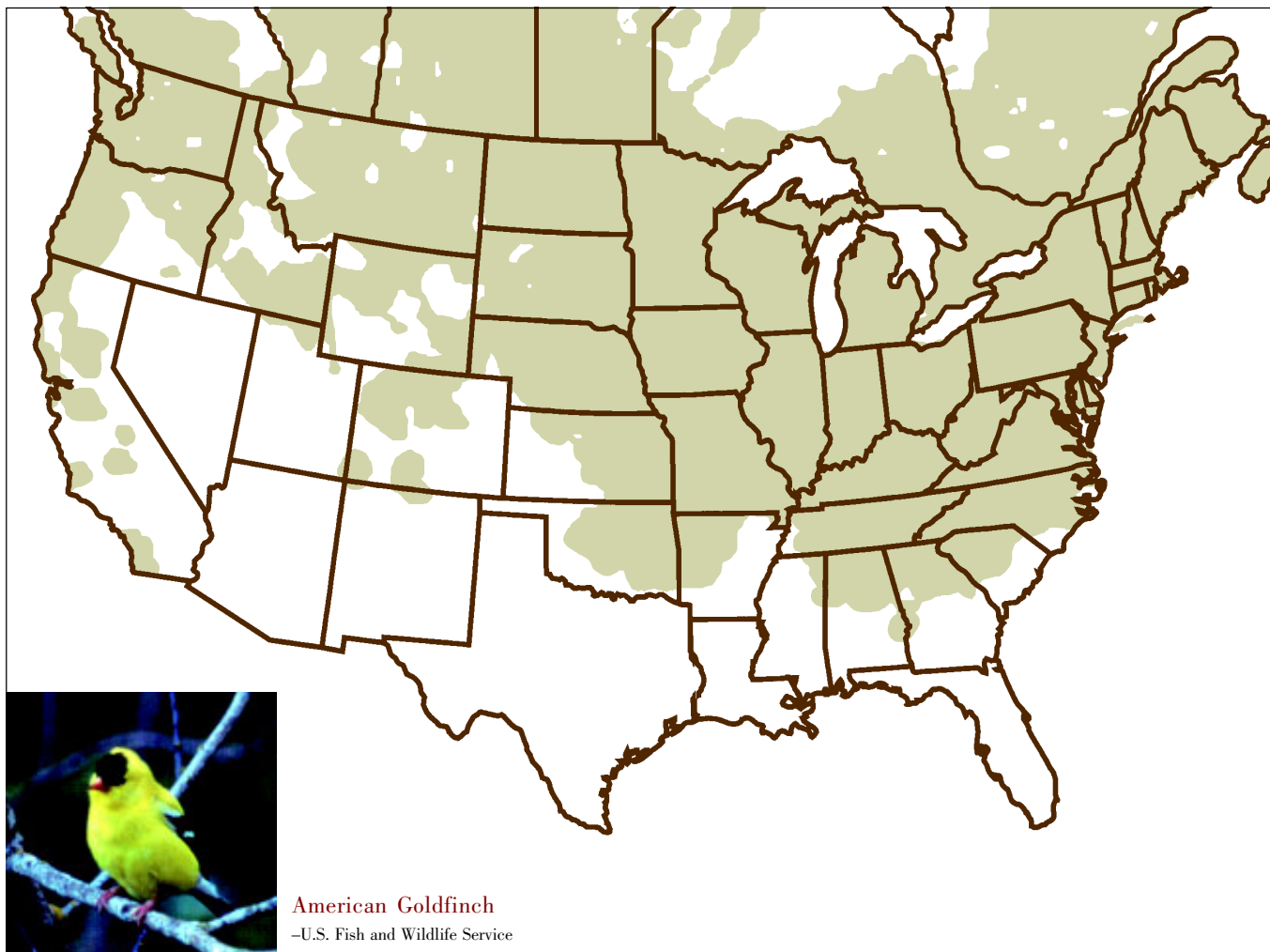


**Indigo
Bunting**

–U.S. Fish and
Wildlife Service



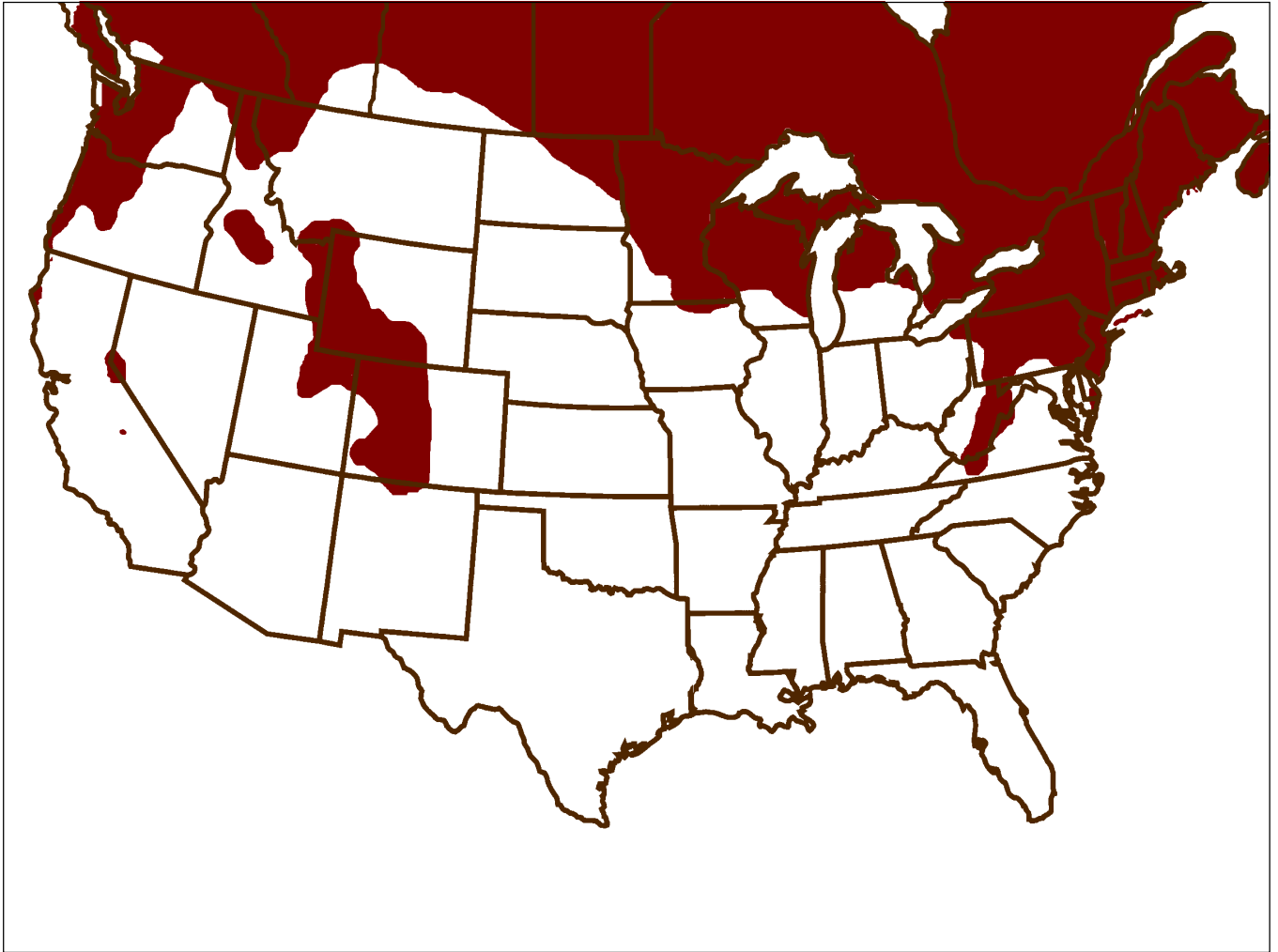
CURRENT POPULATION DISTRIBUTION OF THE AMERICAN GOLDFINCH



*Source: Jeff Price, American Bird Conservancy



**PROJECTED POPULATION DISTRIBUTION
OF THE AMERICAN GOLDFINCH (2 x CO₂)**



*Source: Jeff Price, American Bird Conservancy



found in the region's states. These losses could be somewhat offset by birds colonizing from outside the region – Painted Buntings and Great-tailed Grackles replacing Bobolinks and Evening Grosbeaks in parts of southern Minnesota, for instance – so the net change might be 29 percent fewer neotropical species than are currently found there. On the whole, this analysis suggests that each region of the country

Table: Projected Impacts of Global Warming on the Number of Neotropical Migrant Species Present in Regions of the United States – Percentage Changes (Source: Price and Root 2001)

NEOTROPICAL MIGRANTS	Percentage Changes	
	Gross %	Net %
California	-29	-6
Eastern Midwest	-57	-30
Great Lakes	-53	-29
Great Plains–Central	-44	-8
Great Plains–Northern	-44	-10
Great Plains–Southern	-32	-14
New England	-44	-15
Pacific Northwest	-32	-16
Rocky Mountains	-39	-10
Southeast	-37	-22
Southwest	-29	-4
Mid-Atlantic	-45	-23

Based on modeling results for the U.S. National Assessment Regions using the Canadian Climate Center's General Circulation Model (CCC-GCM2) climate data

could see a net decrease in the percent of neotropical migrant species present if global warming continues unabated.

The accompanying CD-ROM provides more detailed information on how the summer distributions of a number of bird species could change in each of the contiguous United States. These changes include species whose ranges in the particular state might expand, those that might contract, and those possibly eliminated (extirpated) from the state altogether. For example, New York could see a significant reduction in suitable climatic range for in Cape May Warblers, Bay-breasted Warblers, and other birds that are important predators of pest insects such as eastern spruce budworms, which can cause major damage to the state's forests. Arizona, Nevada, and New Mexico could lose Savannah Sparrows, Sage Thrashers, and other birds that help keep outbreaks of rangeland grasshoppers in check. And some states may even lose their State Bird. If global warming continues unabated, there may no longer be Baltimore Orioles in Baltimore (or anywhere else in Maryland). At the very least, the range of the species in Maryland may be greatly reduced.

How quickly these distributional changes might occur is uncertain. The rate of change will largely depend on whether a given species' distributional limits are more closely linked with climate, vegetation, or some other factor. While some



birds that are lost to one state may be found for the first time in another state, key vegetation and other habitat needs may not always be able to change fast enough or may be affected in other ways possibly undermining the birds' long-term survival. The rate of change will also likely be tied to the rate of change of the climate itself. If the climate changes relatively slowly, then species may be able to adapt to the new climate. With continued increases in greenhouse gas emissions, however, scientists project that climate change over the next century is likely to occur quickly, possibly too quickly for species to adapt adequately.

Additional Effects of Global Warming on Birds

In addition to altering species' ranges, global warming could have a direct effect on birds' habitat and behavior. As temperatures rise and precipitation levels change, the abundance of the birds' key food sources may shift. In some cases, the amount of available seeds, insects, or other foods may expand or decline in wintering habitat, affecting birds' health for migration and breeding. Similarly, plants may bloom or insects may hatch too early (or too late) for birds' spring arrival in their summer habitat, which could affect their reproduction success or disrupt important pollination.

State Birds Disappearing?

Birds play an important role in communities by their aesthetic values and as sources of public pride. They provide a value to people through their very existence. Even non-birdwatchers may be thrilled to see a Bald Eagle soaring overhead, and many feel they would be deprived in some way if the birds disappeared. Climate models project that the climatic range of several State Birds could shrink or shift entirely outside of their official states.



Baltimore Oriole,
Maryland's State Bird
—Dan Sudia Bird Photos

Brown Thrasher in Georgia

American Goldfinch in Iowa

Baltimore Oriole in Maryland

Black-capped Chickadee in Massachusetts

Purple Finch in New Hampshire

American Goldfinch in Washington

California Quail in California



Brown
Thrasher

-Dan Sudia
Bird Photos



Sea-level rise could also inundate important coastal habitat in many places. Without meaningful action to reduce greenhouse gas emissions, climate scientists project that sea levels could rise by 3.5 inches to 2.9 feet in this century. This would have major implications for the more than 150 species of migratory waterfowl, shorebirds, and other birds that rely on coastal marshes in the mid-Atlantic region for nesting, feeding or roosting (Erwin 2001).

For songbirds and other wildlife whose populations are already limited by other human-induced problems, global warming could be the last straw. The endangered Southwestern Willow Flycatcher, which breeds in dense riparian areas along rivers, streams, or other wetlands in southern California, Arizona, New Mexico, and parts of Nevada, Utah, Colorado, and Texas, has seen its numbers plummet during the last 100 years due to the loss of these fragile habitats. If global warming and associated climate change contributes to hotter, drier conditions in the region, as some models project, the species could disappear (van Riper, C., III, et al., 1997). Two other endangered songbird species that face a comparable threat are the Golden-cheeked Warbler and the Black-capped Vireo in the hill country area of central Texas (U.S. EPA 1997).

WHY SHOULD WE CARE?

There are many reasons to be concerned about the plight of songbirds.

In economic terms alone, people spend billions of dollars every year on bird- and other wildlife-related recreation in the United States. According to a survey by the U.S. Fish and Wildlife Service, Americans spend more than \$3.5 billion yearly on bird seed, houses, feeders, and baths, and an estimated 18 million adults take annual trips for the express purpose of watching birds (U.S. DOI 1997). On the whole, birdwatchers spend an average of \$100 million in each state which in turn supports more than 200,000 jobs and generates more than \$1 billion in state and federal tax revenues.

Birds also play an important role in nature, pollinating plants, dispersing seeds, and eating insects. Several species of warblers, for example, are thought to be responsible for eating up to 84 percent of spruce budworm larvae, possibly helping to control insect outbreaks in some areas (Crawford and Jennings 1989). In parts of the Great Lakes and Rocky Mountain regions, the loss of warblers and other insect predators could allow populations of spruce budworms, mountain pine beetles, and other pests to balloon, potentially damaging commercially and ecologically important forests.



Photo of
Birders at
Bosque del
Apache
—supplied by Wild
Birds Unlimited

Top Ten States for Spending by People Watching and Feeding Wildlife (Primarily Birds) in 1996 (Source: U.S. DOI 1997)

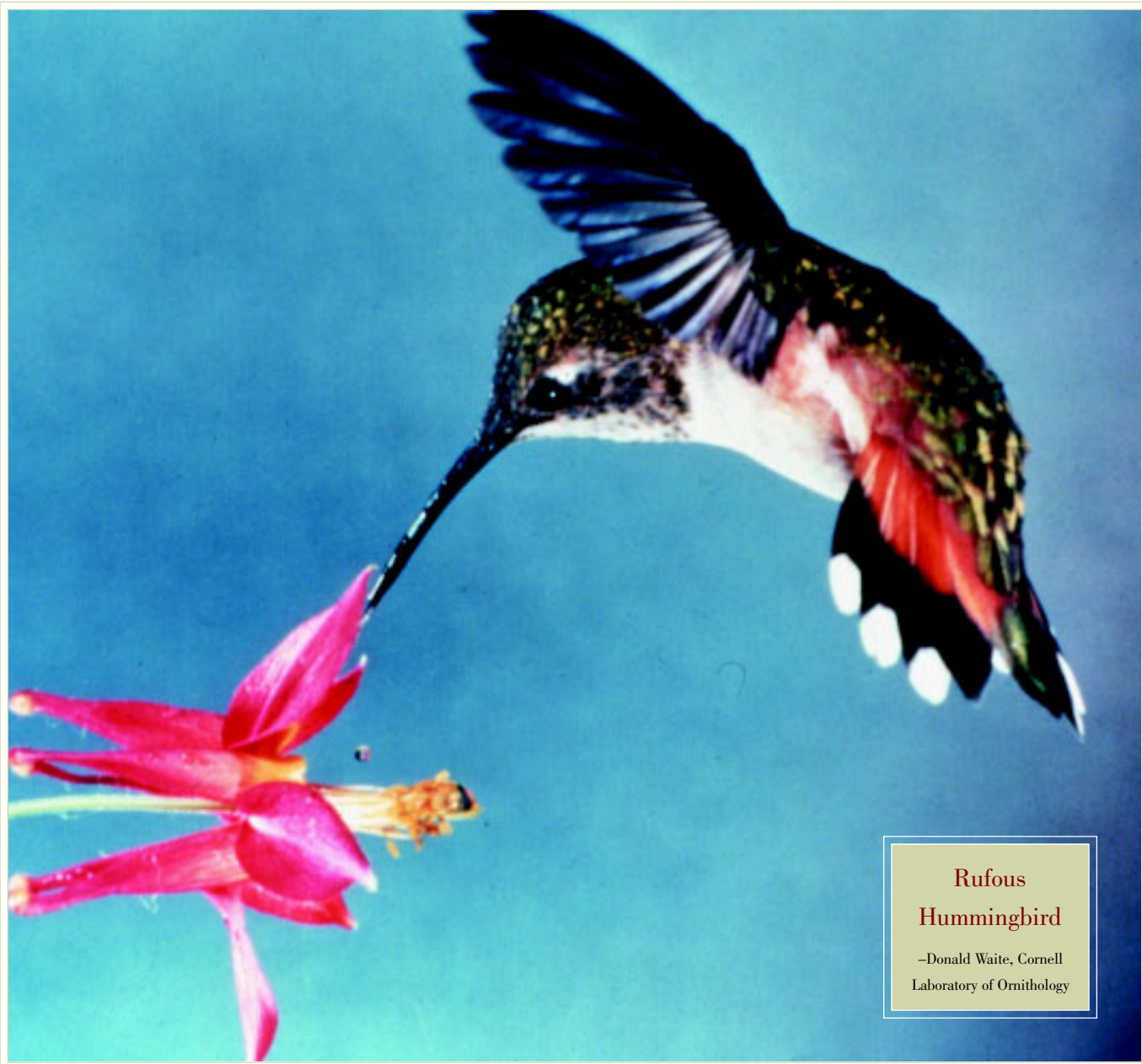
State	Expenditures
1. California	\$2.4 billion
2. New Jersey	\$1.8 billion
3. Florida	\$1.7 billion
4. Wisconsin	\$1.6 billion
5. Washington	\$1.6 billion
6. Michigan	\$1.4 billion
7. New York	\$1.3 billion
8. Texas	\$1.2 billion
9. Pennsylvania	\$0.9 billion
10. Georgia	\$0.8 billion

In addition, some birds are critical to the reproduction of plants. The long-distance migrating Rufous Hummingbird, for example, is the primary pollinator for the wild blueberry in southeast Alaska. Since many other wildlife species in the region depend on the blueberry for food, the hummingbird helps benefit the entire ecosystem (Calder, 1993).

In summary, birds are important for natural systems — and they are important to people, too. The pure joy of awakening to the chorus of birds is enough to make us realize just how tragic it would be if even one species were to disappear because we ignored the serious *but solvable* problem of global warming. Like the proverbial “canary in the coal mine,” birds’ responses to global warming are signals of the wider threat to wildlife, people, and ecosystems if we do not act.

THE SOLUTION: REDUCE GREENHOUSE GAS EMISSIONS

By taking responsible action to cut emissions of CO₂ and other greenhouse gases, we can slow global warming and help reduce the threat it poses to people and wildlife alike. One of the most important things we must do is put technology and the ingenuity of American business to



Rufous
Hummingbird

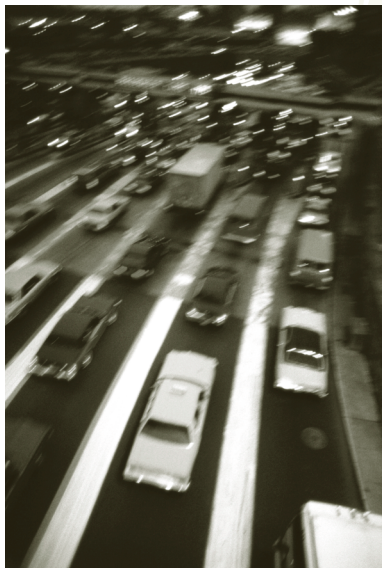
—Donald Waite, Cornell
Laboratory of Ornithology



work for the environment by improving energy efficiency and promoting the development and use of renewable energy sources such as the wind and sun.

Improve Energy Efficiency

Increasing the energy efficiency of our homes, offices, motor vehicles, and factories is not only environmentally wise and technologically feasible; it also represents significant economic savings for households and businesses. Measures such as implementing stronger efficiency standards for air conditioners and appliances and improving energy efficiency in buildings over the next 20 years could eliminate the need



to build more than 600 electric power plants, preventing as much as 200 million tons of CO₂ emissions per year (Interlaboratory Working Group 2000). In addition, we can save more than one million barrels of oil and reduce at least 400 thousand tons of CO₂ emissions every day just

by raising Corporate Average Fuel Economy (CAFE) standards for sport utility vehicles, pickups, and minivans from the current low of 20.7 miles per gallon (mpg) to 27.5 mpg. In a recent report, the National Academy of Sciences concluded that the technologies are readily available to all car companies to significantly improve fuel economy without sacrificing vehicle performance, affordability, and safety (NRC 2001b).

Promote Clean, Renewable Energy Sources

Abundant, clean, and reliable energy sources such as wind, biomass, and solar power also have tremendous potential to help us reduce our use of fossil fuels. Thanks in part to federal programs, the cost of renewable energy has fallen dramatically, and use of these technologies continues to grow. Over the past decade, worldwide sales of photovoltaic cells have increased more than six-fold – from 46 megawatts capacity in 1990 to 288 megawatts in 2000 (Brown 2001). The United States is currently the world's second-largest producer of solar cells, which supports thousands of jobs and positions the nation as a leader in the booming international market for solar energy [Energy Information Administration (EIA) 2001]. Although most of the solar technologies produced in the United States are currently exported for use in other countries, there are significant



Reducing the Toll from Coal

Despite the enormous potential for cleaner energy, more than half of all electricity in the United States is still generated by burning coal, often by utilities using old, highly-polluting technology. According to the U.S. Environmental Protection Agency (U.S. EPA), Coal-fired power plants are responsible for more than 60 percent of the nation's sulfur dioxide and 23 percent of its nitrogen oxide emissions, which contribute to acid rain, smog, and nitrogen pollution that damage forest and aquatic ecosystems. These plants also produce more than 32 percent of mercury pollution, which ends up in our waters poisoning wildlife throughout the food web and imperiling human health. Moreover, coal-fired power plants emit close to 40 percent of the nation's CO₂, the gas chiefly responsible for global warming that threatens wildlife, ecosystems, and communities around the world.

The effects of these pollutants cut across all regions and endanger the entire range of wildlife, from the tiniest invertebrates to top predator mammals, in addition to threatening our health and economy. The good news is, technological advances in energy efficiency and exploitation of renewable energy sources could steadily lessen our dependence on coal (and other fossil fuels). With the right policy strategy, a sustainable energy future that is environmentally sound, affordable, and reliable could rapidly become a reality. To learn more about what you can do to help reduce the toll from coal, visit www.nwf.org/climate/tfc_index.html.





National Wildlife Federation's Backyard Wildlife Habitat™ Program.

The National Wildlife Federation's Backyard Wildlife Habitat program can help you save a place for birds and other wildlife right in your own backyard while opening your eyes and heart to the natural world. Backyard Wildlife Habitat landscapes nurture wildlife and, at the same time, benefit the overall quality of the environment by improving air, water, and soil throughout the community.

opportunities to expand solar energy here at home. The Sacramento Municipal Utility District (SMUD), for example, is planning to add 30 to 40 megawatts of solar energy to its existing 10 megawatts, which will be enough solar power to serve over 8,000 homes (SMUD Aug/Sep 2001).

Finally, in addition to reducing greenhouse gas emissions, we must begin to consider the potential effects of global warming as we develop our long-term conservation plans (Root and Schneider 2002). Current protected areas may no longer be sufficient in protecting wildlife whose ranges have shifted. Moreover,

the ability for species to migrate in search of more favorable habitat is hindered by human development outside of park borders. For these and other reasons, we need to consider a broader, more long-term approach to conservation that

takes into consideration the general threat of global warming, and provides the greatest amount of flexibility to expand protection plans as we learn more about the potential impacts on particular species or ecosystems. Now is the time, for example, to develop buffer zones in coastal areas and around parks as continuing pressures for development will likely make it much more difficult – if not impossible – to protect such areas in the future (Glick, et al., 2001). And we can reap multiple benefits by protecting the nation's and the world's forests. Not only do healthy forests provide important habitat for birds and other wildlife, they help maintain nature's ability to regulate carbon.





10 Steps You Can Take To Combat Global Warming –Save Energy and Money While Protecting the Environment!

5 Things You Can Do Starting Today

- 1) Change or clean your furnace and air conditioner filters regularly to keep heating and cooling systems running efficiently.
- 2) Recycle aluminum cans, glass bottles, plastic, cardboard, and newspapers, which helps reduce the energy needed to make new products.
- 3) Regularly check your car's tire pressure – poorly inflated tires waste gas and cause extra pollution. Better yet, carpool or take mass transportation whenever possible.
- 4) Set your water heater to a lower setting or call a service person to adjust it for you.
- 5) Contact your representatives in Congress and encourage government to enact policies that reduce greenhouse gas emissions and support clean, renewable energy sources and energy conservation.

5 Ways to Make Your Purchases Work to Protect the Environment

- 1) When you need to replace the light bulbs in your home, buy compact fluorescent bulbs, which reduce energy use by up to 75%.
- 2) When shopping for home appliances and electronics, look for the “Energy Star” label.
- 3) When you purchase a car, buy the most fuel-efficient model that meets your needs. This will reduce your gas consumption, cut CO₂ pollution, and save you money at the gas pump.
- 4) Install a clock thermostat to save heating and cooling energy at night and when no one is home.
- 5) If available, buy “Green Power” that comes from non-polluting sources of electricity such as solar cells and windmills.

For more information on these and other steps you can take, go to www.nwf.org/climate.



Each of us can make a difference. Whether we improve the energy efficiency of our homes, or promote strong public policies to curb greenhouse gas emissions, or even develop a Backyard Wildlife Habitat™, we will help ensure that our natural world – and the birds that call it home – will endure for generations to come.

To learn more about global warming and its effects on birds and what you can do to make a difference, go to www.nwf.org/climate or www.abcbirds.org. You can also see how global warming could affect songbird distributions in your home state by viewing the enclosed CD-ROM.

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American Bird Conservancy (ABC) is a 501(c)3 not-for-profit organization whose mission is to conserve wild birds and their habitats throughout the Americas. The fundamental role of ABC is to build coalitions of conservation groups, scientists, and members of the public to tackle key bird priorities using the best resources available.

The mission of the **National Wildlife Federation (NWF)** is to educate, inspire and assist individuals and organizations of diverse cultures to conserve wildlife and other natural resources and to protect the Earth's environment in order to achieve a peaceful, equitable and sustainable future.