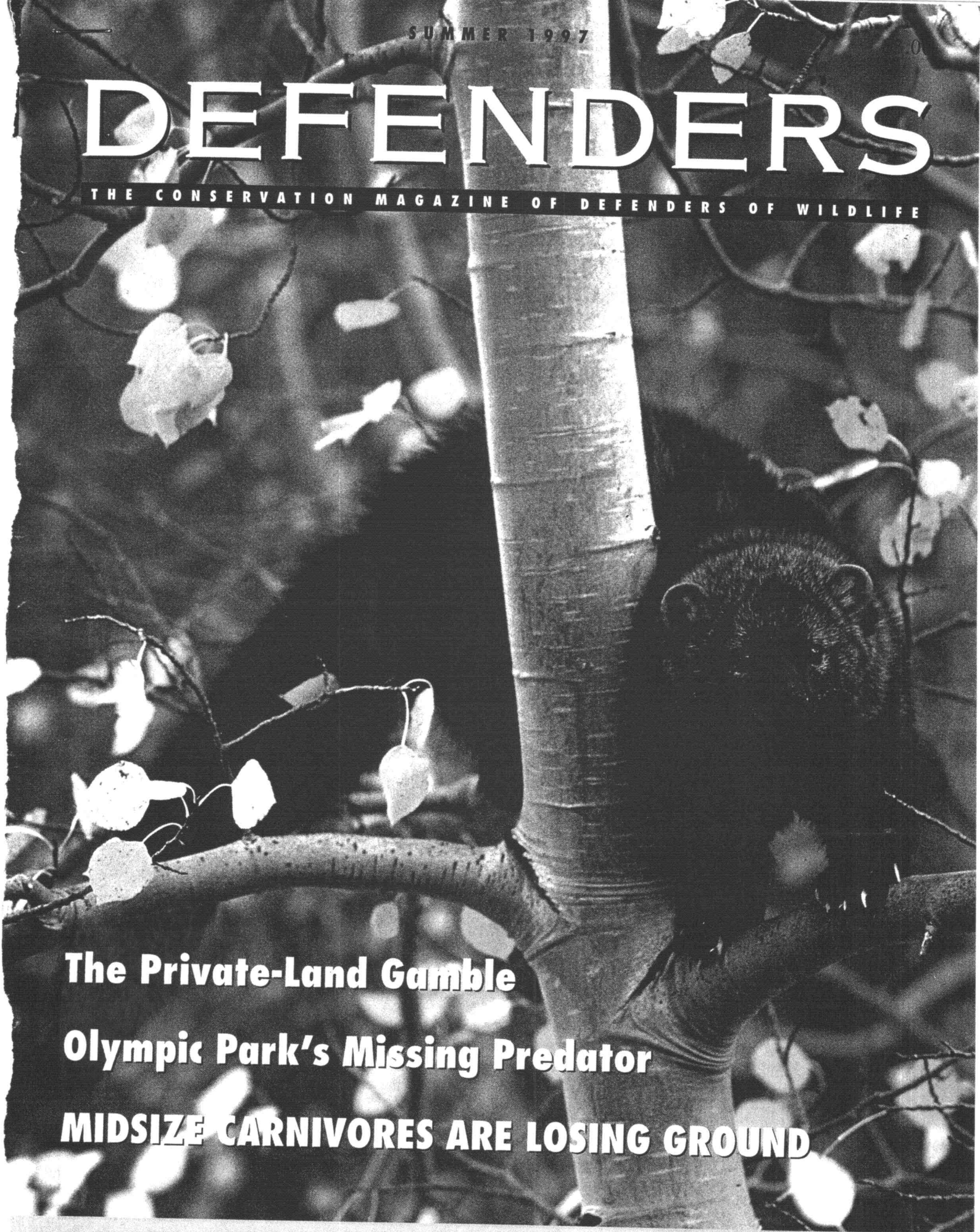
SUMMER 1997

DEFENDERS

THE CONSERVATION MAGAZINE OF DEFENDERS OF WILDLIFE



The Private-Land Gamble

Olympic Park's Missing Predator

MIDSIZE CARNIVORES ARE LOSING GROUND

DEFENDERS' GOLDEN ANNIVERSARY YEAR

THE GREENHOUSE CHALLENGE

BY SUSAN L. BASSOW AND PETER C. FRUMHOFF

The global atmosphere is changing. Concentrations of carbon dioxide, methane, nitrous oxide and other "greenhouse gases" in the atmosphere have been rising rapidly, particularly during the last few decades. By allowing solar radiation to penetrate the atmosphere and trapping some of the Earth's reflected heat energy, these gases act like a glass roof on a greenhouse, warming the planet. Without natural greenhouse warming, the Earth would be 60 degrees Fahrenheit cooler than today – uninhabitable for humans and many other species. However, human activities, especially excessive burning of fossil fuels and deforestation, have increased atmospheric concentrations of greenhouse gases to higher levels than anytime in at least the last 160,000 years. The further warming projected to arise from these increases has prompted serious concern over global climate change and its ecological and social consequences.

As detailed in recent reports of the U.N. Intergovernmental Panel on Climate Change, scientists widely expect human-caused increases in these heat-trapping gases to lead to many changes in global climate. Among them are increased global temperatures of 1.8 to 6.3 degrees *F* by the year 2100, with the greatest increases at higher latitudes; altered patterns of precipitation leading to increased frequency of both drought and floods; a sea-level rise of six to 36 inches by 2100; and more frequent and severe storms and heat waves. Such shifts are likely to have markedly negative impacts on many natural and managed ecosystems and on human health.

Projections of the impact of global warming on ecosystems and biodiversity rely on observations of changes now under way, on paleoecological studies of changes during past periods of rapid warming and on increasingly sophisticated computer models of projected future changes. Current models suggest that most terrestrial ecosystems in North America are likely to experience a warming-induced shift in their climatic zones of 90 to 340 miles northward or 500 to 1,800 feet higher in elevation over the next century. The extent to which plants and animals will be able to "migrate" in response to these shifts, however, remains widely debated.

Because plants don't physically move, their successful migration depends upon seeds being transported by wind, water or animals to the newly suitable region and on their ability to grow and reproduce in high enough densities to establish viable populations. Studies of long-lived tree species indicate that they can migrate between 130 and 1,640 feet a year – several orders of magnitude slower than what would be necessary under expected warming. Large cultivated areas and large urban areas such as metropolitan New York and the Northeast Corridor may present significant barriers to migration for many species. Massive reforestation programs might thus be necessary to enable many forest ecosystems to remain intact.

Populations and ranges of many animals will also be affected by global warming. Some striking shifts associated with current warming trends are already under way. While uncertainties remain about whether current trends are the early stages of expected global warming, they are probably indicative of impacts that may be expected to occur more extensively if global warming is not abated. For example, populations of the sooty shearwater, a pelagic seabird, decreased 90 percent between 1987 and 1994 along the west coast of North America. In part, this sharp decline appears to have been caused by a decline in the zooplankton populations on which these seabirds feed, which in turn may have resulted from rising sea temperatures documented in this region.

In a recently published paper in the journal *Nature*, scientist Camille Parmesan of the University of California, Santa Barbara, reported a marked shift in the range of a butterfly species, Edith's checkerspot, that matches the predicted impacts of global warming. Historically found along the west coast from Mexico to Canada, this species now is dying out at the southern end of its range. In southern sites where it is still found, populations are shifting toward sites at higher elevations. Species lacking sufficiently intact "escape routes" or sufficient genetic variation to adapt to changing conditions may be faced with local or even global extinction. Indeed, the evolutionary record indicates that past periods of rapid environmental change were usually associated with heightened extinction rates.

In mountainous regions, warmer temperatures imply that a particular suite of environmental conditions will probably be displaced to higher elevations. There is typically less land area at higher than at lower elevations simply because of the geometry of mountains. Under projected warming, species restricted to particular climate conditions will be displaced upward and into smaller areas. For species in these habitats this could lead to greater competition and ultimately to higher local extinction rates.

Even species able to move in response

RON AUSTING

A female Kirtland's warbler with her own chick and a cowbird chick (left) in her nest in Lovells, Michigan. Some scientists say global warming might destroy the Kirtland's jack pine nesting habitat, leading to possible extinction. Parisitizing cowbirds already threaten these endangered warblers. Photographing Kirtland nests is now forbidden by the government because of the species' rarity. This photograph was taken in 1969.

to shifting climate may suffer because of a resulting displacement from critical resources. Daniel B. Botkin, professor of biology at George Mason University and president of the Center for the Study of the Environment, Santa Barbara, California, and two colleagues analyzed the case of the endangered Kirtland's warbler in northern Michigan. Kirtland's warblers nest exclusively on the sandy soil in stands of young jack pines growing in that region. This is the southern end of jack pine range. Forecasts based on computer models of climate change and forest growth, according to Dr. Botkin, suggest that jack pines in this region will die off sometime in the next 30 to 90 years. If the models are correct, the warbler then would have no breeding habitat, because scientists believe it would be unable to nest on heavier, less sandy soil found to the north. This presumably could mean extinction for this warbler species.

Some species of migratory shorebirds may face a warming-induced disruption of critical food resources. Many migrate annually from their wintering grounds in the Caribbean and Central and South America to summer breeding grounds in the Arctic. For populations of semipalmated sandpipers, red knots, ruddy turnstones, sanderlings, dunlins and other species, the timing of migration is bounded by two periods of feeding. First they stop at Delaware Bay to eat and stock up fat reserves. This stop historically has been timed to coincide with the emergence of horseshoe crabs from the ocean to lay their eggs on the bay's beaches. Horseshoe crab eggs are a critical food source for the shorebirds. Their arrival at their arctic nesting sites coincides with the mass emergence of chironomids, diptera and other insects that serve as their early summer food. The new generation of shorebirds depends on this food for early growth and survival.

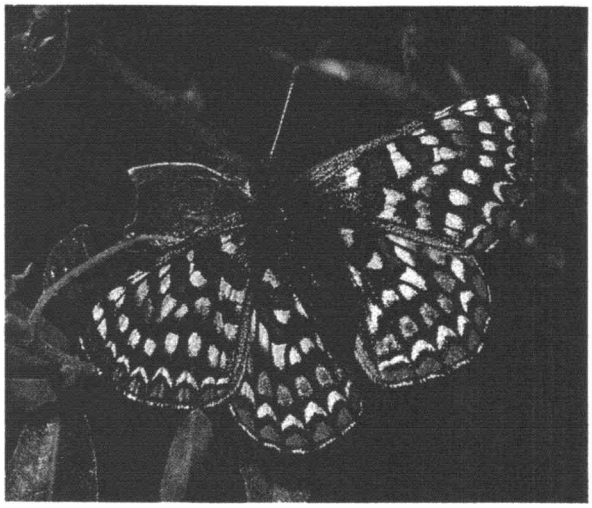
Under many global warming scenarios, scientists anticipate that higher latitudes will experience more dramatic warming and a greater shift in the timing of spring's onset than will lower latitudes. The expected warmer temperatures in the Arctic are projected to cause insects to emerge weeks earlier, while the timing of horseshoe crab spawning is expected to shift only slightly. As a result, the interval between the production of these two critical food resources is expected to shorten substantially. If this occurs, the survival of these shorebird populations may be severely threatened.

Rising sea levels are also expected to damage coastal ecosystems through increased flooding, saltwater intrusion and erosion. Consider Florida's Everglades, a region comprised of vast freshwater peatlands with sedge, sawgrass, mangroves and other coastal wetland species. About half of the Everglades was severely damaged in the past century by drainage for agriculture and urban development, with nitrogen runoff from agricultural fields continuing to threaten the health of the ecosystem. With global warming, rising sea levels are projected to increase the salinity of coastal wetlands and promote the spread of salt-tolerant species into these wetlands. This process may be exacerbated by increased evaporation rates associated with warmer temperatures. Warmer temperatures may also promote the spread of frost-restricted species such as the invasive *Melaleuca quinquenervia,* a bamboo-like Australian eucalypt, to expand and occupy much of the Everglades system.

In southern Louisiana, the impacts of current patterns of increased flooding and saltwater intrusion on coastal ecosystems may be indicative of future changes associated with global warming. Here flooding and salinity are significantly damaging tidal marsh bald cypress populations. Trees that are weakened by these changes are also rendered more susceptible to defoliation by leafroller insects. In 1993, 50,000 acres of Louisiana wetland bald cypress were defoliated by these in-

sects. Fortunately, some bald cypress varieties may be more tolerant of the flooding and salinity, offering sufficient genetic diversity for some prospect of effective restoration projects.

Scientists attempting to identify specific impacts of climate change on natural ecosystems and biological diversity confront a host of challenges. Ecosystems and their interactions with climate are complex, and site-specific impacts will depend not only on the future of those interactions, but also on their linkages with other stresses that humans continue to place on ecosystems, such as the introduction of exotic species, deposition of nitrogen (e.g., acid rain) and patterns of land use. It is clear, however, that many species and ecosystems are highly vulnerable to expected changes in climate and sea level.



PAUL A. OPLER

The Edith's checkerspot butterfly, here in California's Contra Costa County, is shifting its range possibly because of change caused by the greenhouse effect.

What can we do? The most effective way to prevent these and other projected impacts of global warming is to reduce substantially the rate at which greenhouse gases are accumulating in the atmosphere. As the largest producer of these gases, the United States is uniquely qualified to play the leadership role among nations in ensuring their reduction. Domestically we can reduce our reliance on fossil fuels through investments in energy efficiency and economically viable sources of renewable energy. Internationally we can provide assistance to other nations, transferring needed energy technology and helping developing countries to slow deforestation. Well-structured investments to help slow deforestation will not only help retain the capacity of threatened forests to serve as globally important carbon sinks but also will conserve their biological diversity and value as watersheds and buffers of regional climate.

The measure of United States leadership will be taken in December in Kyoto, Japan, when specific targets and timetables for reducing greenhouse gas emissions and specific steps to achieve these reductions will be negotiated at a Conference of the Parties to the Framework Convention on Climate Change. Yet there is considerable uncertainty over whether the U.S. and other nations will exercise the necessary political will in these negotiations. The Clinton administration has voiced support for binding targets and timetables to reduce emissions but has yet to state what specific measures it will back. Moreover, as journalist Ross Gelbspan recently documented in his book *The Heat Is On*, the voices of support for strong measures among prominent scientists, economists and religious leaders are being countered by a well-funded public relations campaign by many in the fossil fuel industry. This campaign misrepresents the science as highly uncertain and exaggerates the costs of reducing emissions. Much will hinge on whether the American public voices concerns to policy makers so that our children and the other species with which we share this planet need not cope with a world severely altered by the human-enhanced greenhouse effect. □

Dr. Susan L. Bassow, a plant ecologist, is an American Association for the Advancement of Science environmental fellow at the U.S. Environmental Protection Agency. She is currently assigned to the White House Office of Science and Technology Policy. Dr. Peter C. Frumhoff, a biologist, directs the global resources program of the Union of Concerned Scientists in Cambridge, Massachusetts.

New President's Council Members

Gifts Received on or before June 3, 1997

We would like to thank all of our President's Council members for their leadership and generous support. Each President's Council supporter contributes $1,000 or more annually to Defenders of Wildlife. We welcome our newest Council members who have joined since January 8, 1997.

Bill Becker
Catherine D. Brown
Bernice Clark
Mrs. Genevieve H. Coonly
Mrs. Douglas T. Denault
Marie M. Fugiel
Dr. Mark Geisberg
Alan C. Greenberg
Louis Hecht and Elaine Walling
Joseph M. Hixon
Phyllis I. Kerdasha
Andrew and Mary Pilara
Mr. and Mrs. Lyle Poncher
Mrs. Mary Sellmann
Ellen Bruce Terry