

Global Warming Threatens to Undo Decades of Conservation Efforts: ...

By WILLIAM K. STEVENS

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Earth's web of life may also be destabilized.

By WILLIAM K. STEVENS

GLOBAL warming, if it proceeds as many scientists predict, threatens to undo decades of conservation work and could mean the destruction of the monarch butterfly, the edelweiss, the polar bear and innumerable other species living in fragile ecosystems, an emerging body of scientific evidence suggests.

Even more ominous than the prospect of the extinctions, some scientists and conservationists say, is the possibility that the vast global web of life that plays a key role in keeping the planetary earth-atmosphere system stable could ultimately be weakened and made less resilient. Plants, animals and microbes are essential to the system's functioning through the transfer of energy and the emission and absorption of critical gases like oxygen and carbon dioxide.

The potential problem, as some scientists see it, is not so much the predicted warming itself. Studies of ancient ecosystems and climates show that the natural world has adapted many times to drastic global warming and cooling. But because major natural changes in climate take place slowly, nature in the past has had hundreds or thousands of years to adjust.

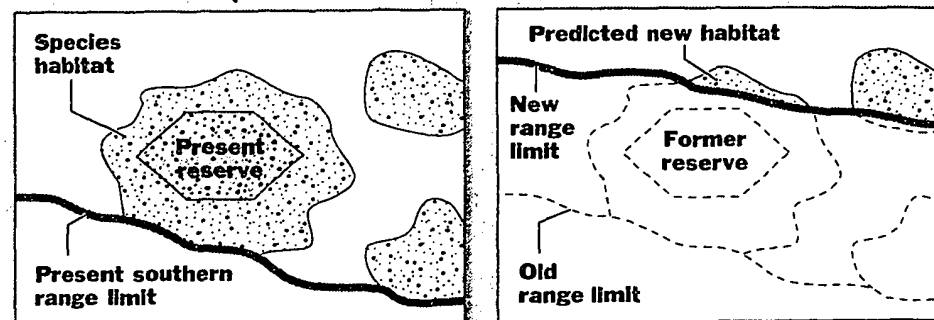
By contrast, an international body of scientists convened by the United Nations predicts that if humans continue to pour heat-trapping gases like carbon dioxide into the air at the present rate, they will cause the average surface temperature of the earth to rise 3 to 8 degrees Fahrenheit by the end of the next century from the present level of nearly 60 degrees. That is a rate of change 10 times greater than the natural changes of the last 10,000 years, and it would push global temperatures higher than they have been in 150,000 years.

Whether that will actually happen is uncertain; some scientists say the warming predictions are flawed and exaggerated. Moreover, the international group of scientists, the Intergovernmental Panel on Climate Change, has called attention in its latest report, published last week, to a lack of information about the sensitivity of ecosystems and species to global warming.

But on the basis of what is known, the panel concluded, natural ecosystems "could face significant environmental impacts" from global warming. The nature and severity of the impact, it said, would depend on the rate of climatic change.

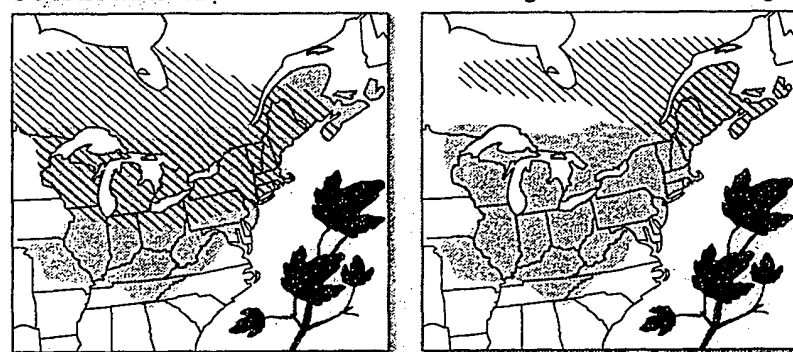
A Potential Forced March North

The geographical distribution of plant and animal species could be forced to change in response to greenhouse warming. The schematic map at right shows the present distribution of a hypothetical endangered species and its reserve; as temperatures rise, the limits in which it can survive (stippled areas) would move, but its designated preserve would stay in the same place. The maps below show estimates of warming's impact on the sugar maple and the hemlock, if atmospheric carbon dioxide doubled.



SUGAR MAPLE

Current range Potential range



Present range of sugar maple (gray areas) and potentially suitable range (diagonal lines), using two climate models. Under one estimate of warming (right), sugar maple would die out throughout its range except in Maine, eastern Quebec and Nova Scotia. The variables are mean January and July temperatures and total precipitation.

Sources: Dr. Margaret B. Davis and Dr. Catherine Zabinski, in "Global Warming and Biological Diversity," Peters and Lovejoy (Yale)

If the warming does take place at the rate the panel suggests, biologists say, many species, particularly trees and the plants and animals that depend on them, may not be able to migrate to cooler climes fast enough. Some, like the monarch butterflies that spend the winter in a precise, narrow band of temperature and humidity in the mountains of Mexico, may find their habitat wiped out altogether. The same is true of the Alps' beloved white-flowered edelweiss. Mangrove swamps, the scientists say, would surely be inundated by rising seas, with great loss of species — possibly including the mangrove-dependent Bengal tiger. Plants and animals that live in the far north, like the polar bear and the walrus, would find nowhere to go, and would die out.

Many of the world's conservation reserves, the backbone of international conservation, would become useless, conservationists say; warmer temperatures would render the reserves' environment unsuitable for the diversity of species now under protection there.

"If the projected rates of climate change have any validity at all, then we have no historical evidence of

species' being able to disperse at that rate," said Dr. Thomas E. Lovejoy, a conservation biologist at the Smithsonian Institution. "It doesn't mean they can't disperse faster than they have in the past, but you sure can't count on it."

Even if they were able to migrate rapidly enough in search of more favorable conditions, he and others say, they would be thwarted in many cases by human-imposed barriers like cities and wide stretches of agricultural land. Some species would be more successful at negotiating the barriers than others, they say, leading to the disassembly of ecosystems and their eventual reconstitution, in other locales, in entirely new combinations.

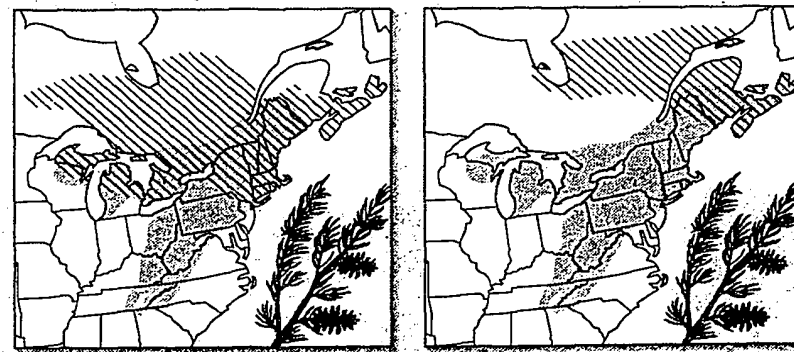
Ecosystems Ranked by Risk

Dr. Lovejoy, along with Dr. Robert L. Peters of Conservation International, a group based in Washington, is the co-editor of a new book, "Global Warming and Biological Diversity," that includes a range of studies on the question. The book is to be published by the Yale University Press in May.

Another compendium of scientific evidence, assembled by the World

HEMLOCK

Current range Potential range



The hemlock would face similar pressures on its geographical range under both estimates of the impact of global warming, except that the hemlock's range would be more restricted in the West. This pattern reflects its lower tolerance for warm, dry conditions.

Polar bears, monarch butterflies, Bengal tigers and walrus may vanish.

Wildlife Fund International, was presented last week in New York and timed to coincide with negotiations on a multination treaty to control global warming now going on at the United Nations. It ranks three categories of ecosystems in terms of the risk posed by global warming:

① "Front line" ecosystems, where "compelling evidence" suggests an acute near-term threat. These include coral reefs, mangroves and Arctic seas, where the ecosystem would be changed by melting ice.

② "Highly vulnerable" ecosystems, where there is strong evidence of a significant near-term threat. These include mountain ecosystems, coastal wetlands threatened by rising seas, Arctic tundra and sub-arctic and temperate-zone forests.

ture their tissues. This, some experts argue, will increase agricultural output. The intergovernmental climate panel says it should be possible for agriculture to adapt to global warming.

But the same assurance, many scientists say, cannot be given for natural ecosystems. The consequences, says Dr. Agardy, go far beyond the loss of species and involve impairment of the functioning of the earth-atmosphere system.

The effects of warming on forest ecosystems would manifest themselves over decades, according to a study by Dr. Margaret Davis and Dr. Catherine Zabinski, ecologists at the University of Minnesota, reported in the Peters-Lovejoy book. Dr. Zabinski is now with the United States Forest Service in Berkeley, Calif. In their study, based on the known impact of climatic change on forests in the past, they found that Eastern hemlock, yellow birch, beech and sugar maple would gradually shift their ranges northward by 300 to 600 miles if, as scientists predict, carbon dioxide concentrations in the air double in the next century.

Loss of 4 Tree Species

Seedlings at the southern limits of the trees' ranges would disappear from the forest first. Most adult trees would continue to live for several decades, although growth rates would decline. But when they died, no others of their species would replace them. Meanwhile, seedlings would colonize northern regions that were warming. But this new range would be severely limited by the warming, with the result that all four species would largely die out. With their disappearance, the plant and animal habitats that they anchor would also disappear.

Another study reported in the Peters-Lovejoy book, by Dr. Daniel Botkin and Dr. Robert A. Nisbet, ecologists at the University of California at Santa Barbara, found that the forests of Minnesota and Michigan would be similarly affected. The result, they said, could be loss of habitat for endangered species like the Kirtland's warbler, which could become extinct.

To forestall wholesale extinctions of plants and animals, the authors of both forest studies say, it may be necessary to acquire land for new conservation parks and reserves in regions of potential habitat that would open farther north as warming proceeds. Dr. Botkin and Dr. Nisbet say "there may be little time to wait before making policy decisions."

But for some conservationists, there is only one solution. "I fail to see that there's any conclusion to draw from all of this other than that there will be massive extinction no matter what we do in the way of conservation," said Dr. Lovejoy. "Therefore, the only logical conclusion is to prevent as much of the climate change as possible."

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