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As originally published in *The Atlantic Monthly*,
January 1992

The Butterfly Problem

Because the government doesn't have the means to preserve endangered species, let alone a coherent plan its decisions are haphazard -- and private landowners often find themselves paying for the preservation of species they've never heard of

by **Charles C. Mann and Mark L. Plummer**

RICHARD Schroeder was five when he moved into the new house. It had a big backyard that opened up into the tall grass of the dunes--his own private slice of the Oregon coast. He played there almost every day until he was ten or eleven. Then his father began taking him to play golf. Richard loved the game, and was soon working as a caddy at the country club. In college he won several regional amateur tournaments. After graduation he went into the securities business, but he still played whenever he could. And he kept thinking about the land behind his parents' house. The rippling

dunes, the smell of the surf--he could create a world-class golf course, eighteen holes as good as Pebble Beach, right there in Gearhart, Oregon. People would come from thousands of miles away just to play on his course.

Dropping out of securities, he spent the mid-1970s working as a club pro, learning the golf trade. He also learned the development business. For the scheme to be profitable, the course had to be built in conjunction with a destination resort--a mixture of hotel and residential space. Schroeder was looking at a \$100 million project. The acreage was split into a dozen parcels, each with a separate owner. Schroeder got them all behind the scheme and found a backer who would build it and a famous golf-course designer who would lay it out. All this took ten years--a long time, but Schroeder knew that dreams do not come true easily. Only in 1986, he says, did he learn about the "butterfly problem."

Schroeder was hardly planning to build on pristine wilderness. Part of the site is fenced off for cow pasture; the rest, to his annoyance, is strewn with beer cans and the tracks of four-wheel-drive vehicles. But the land is also one of the few remaining habitats for the rare Oregon silverspot butterfly (*Speyeria zerene hippolyta*). A finger-sized reddish-brown insect, *S.z. hippolyta* is registered as a threatened species under the Endangered Species Act of 1973, which directs the U.S. Fish and

Wildlife Service, a branch of the Department of the Interior, to maintain a list of species that are either endangered (in imminent peril of becoming extinct) or threatened (likely to become endangered in the near future) and to fine or imprison people who "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect" species on the list. Fines, jail--all at once Schroeder was in different territory. In addition to the usual obstacles facing developers (lawsuits, permits, bonding agents), he would now have to guarantee that his golf course could be built without killing a single Oregon silverspot butterfly.

The Endangered Species Act first gained notoriety in 1978, when the Supreme Court stopped work on an almost finished dam in Tennessee because it menaced a little-known fish. Since then the act has reached its long fingers into many aspects of American life. The Fish and Wildlife Service has forced the cancellation of one dam, in Colorado, because it put whooping cranes at risk; pushed the Bureau of Reclamation to postpone expanding another, because it jeopardized the humpbacked chub; induced Massachusetts to close beaches just north of Boston at the height of summer, to protect the piping plover; started a lengthy political battle by proposing to settle packs of gray wolves in western states; sent a warning to 600 landowners in Polk and Highlands counties, Florida, spelling out the consequences if the development of their property harms the

Florida scrub jay; and hauled the town of Ranchos Palos Verdes, California, into criminal court for inadvertently driving the endangered Palos Verdes butterfly into apparent extinction, in part by turning one of its major breeding grounds into a baseball field (the suit was thrown out on a technicality).

None of this comes cheap. Buying land for the Mississippi sandhill crane has cost more than \$20 million. Riverside County, California, is spending an equal sum on the Stephens' kangaroo rat, and would have authorized an additional \$100 million had voters not rejected the idea. Voters will not get the chance to refuse in the Pacific Northwest, where the Fish and Wildlife Service plans to save the northern spotted owl, a native of forests in Washington, Oregon, and California, by halting most logging on 8.2 million acres, an area nearly the size of Massachusetts and Connecticut combined. Some estimates of the cost of locking up the timber reach into the tens of billions of dollars. In the case of the California gnat-catcher, now proposed for the endangered-species list, the costs may rise even higher, for the bird lives in Los Angeles, and efforts to save it will require clamping down on the most powerful real estate market in the nation.

Richard Schroeder worked diligently to accommodate *S.z. hippolyta*. He met with the silverspot recovery team, the group of scientists and Fish and Wildlife Service

staffers in charge of the butterfly's future. He hired the world's expert on the insect, Paul Hammond, of Oregon State University, to put together an official lepidopterist-certified conservation plan for the Fish and Wildlife Service. But all came to naught. Last March, Hammond found an additional patch of butterfly habitat. Exasperated, Schroeder's financial backers pulled the plug--it seemed they would never know where the butterfly might turn up next. When we visited Schroeder last summer, he was a deeply frustrated man. "The whole thing's crazy," he said, shaking his head. He seemed to be trying to control his anger. Society had chosen an insect over the dream of a human being, and for the life of him Schroeder couldn't see the logic in it, or how anyone was better off for it.

THE NOAH PRINCIPLE

THE endangered species act is up for reauthorization this year, and tales like Schroeder's are why a political brawl has already begun. Most Americans would be appalled if a shopping center wiped out the last bald eagle. And it is likely that they would be dismayed to learn the fate of the obscure Tecopa pupfish, which lost its sole habitat, a hot springs in Death Valley, to a bathhouse that could easily have been redesigned to save the fish. Instead, it became the first species to be removed from the endangered list by reason of extinction.

But feelings are much less certain when it comes to canceling a \$100 million golf course to save a bug nobody has ever heard of.

Perhaps fifty silverspots live on the land for Schroeder's project. How can anyone imagine that they are worth keeping in place of a multimillion dollar resort? On the other hand, how can anyone sanction the elimination of a species from this earth to profit a few people? Would the decision be different if the land housed five insects, rather than fifty? Or if it held not butterflies but bald eagles? What if chemicals within butterflies turn out to have medical benefits, whereas eagles are useful only as a national symbol? And what if saving the eagle required canceling not one but ten resorts?

Until recent decades Americans were untroubled by such questions. The nation was still empty. It didn't seem possible that preserving a few animals could impose real hardship. There seemed no need to choose between a species and economic growth. But now the country's empty corners are filling up, and biologists warn that in the next decade or two the fate of thousands of species will be decided. In making those decisions, ordinary notions of balancing the benefits against the costs may seem inappropriate, inapplicable, or even immoral. Yet any time we decide that a course of action makes some entity "better off"--butterfly, golf-course builder, or society as a whole--we are perforce judging

that whatever the benefits, they are greater than the costs. At present these decisions are governed by the Endangered Species Act. Unfortunately, the act fails to balance costs and benefits meaningfully. Indeed, it is put together in such a way that it explicitly avoids the terrible choices that must be faced.

Federal wildlife-protection laws go back to the end of the past century, when a famous poacher named Ed Howell slaughtered bison in Yellowstone National Park with impunity because no statute forbade it; public outrage at Howell's cheeky remarks to the newspapers pushed Congress into passing the Yellowstone Park Protection Act of 1894. Other laws followed. Mostly aimed at poachers, they cost society little, and roused little opposition. In 1964 the Bureau of Sports Fisheries and Wildlife, the bureaucratic ancestor of today's Fish and Wildlife Service, compiled a "redbook" of sixty-three endangered species. Assembled informally by a panel of nine biologists, the redbook was the government's first endangered-species list. Laws passed in 1966 and 1969 directed the Department of the Interior to formalize the list and to protect the species on it by acquiring their habitats. These statutes were weak--they did not actually ban killing members of endangered species except in national wildlife refuges. When President Richard M. Nixon called for stringent legislation in 1972, the bid fell on receptive ears. Congress passed the Endangered Species

Act by a large majority in December of 1973, and Nixon quickly signed it. Neither seems to have had a clue about what they were setting in motion.

"They thought they were writing a law about saving bald eagles and elk- what I call the 'charismatic megafauna,'" says Dennis Murphy, the director of the Center for Conservation Biology at Stanford. "Instead, they got a law protecting species"--a difference with unexpected implications. According to Edward O. Wilson, a renowned entomologist at Harvard, there are only a few thousand types of the mammals and birds that people like to anthropomorphize, but there may be something on the order of 100 million species, of which only about 1.4 million have been named. Creatures such as fungi, insects, and bacteria form the vast majority of this horde; mammals, birds, and other vertebrates are little but colorful epiphenomena. (Asked what years of research had taught him about God, J.B.S. Haldane, one of the founders of evolutionary biology, replied that the Creator had an "inordinate fondness for beetles.") Those not initiated into the ways of biological thought may equate "preserving global biodiversity" with saving whales and whooping cranes, but scientists who use the phrase are concerned with protecting organisms that most people wouldn't hesitate to step on.

Because the majority of species are

unknown, no one can say with certainty how many are going extinct. Moreover, extinction itself is hard to observe--one can never be certain that a few specimens somewhere have not been overlooked. Thought for more than a decade to be extinct, the Shoshone pupfish, a cousin of the Tecopa pupfish, turned up in its native hot springs in 1986. The long-lost black-footed ferret was rediscovered accidentally a decade ago, when a ranch dog near Meeteetse, Wyoming, returned home with a dead one in its mouth; excited conservationists then found a small colony of the weasel-like creatures. But no one doubts that extinction occurs, and most biologists believe that it is now taking place at an accelerating rate. Worldwide, Wilson guesses, the rate may be 50,000 species a year. Figures for the United States are surprisingly uncertain, but Peter Hoch, of the Missouri Botanical Garden, has calculated what he calls a "rough but defensible approximation": some 4,000 domestic species are at risk of extinction within five to ten years.

Biologists advance three arguments for avoiding this prospect. On a utilitarian level, living creatures are the source of almost all foods and many medicines; wiping out even the humblest mold might deprive humanity of the genes for a future penicillin. Wilson has calculated that the genetic information encoded in the DNA from the common mouse, if represented as ordinary-size letters, would almost fill the

fifteen editions of the Encyclopaedia Britannica printed since 1768. Who, conservationists ask, would like to see that information vanish, along with its potential benefit to humanity?

More generally, the web of species around us helps generate soil, regulate freshwater supplies, dispose of waste, and maintain the quality of the atmosphere. Pillaging nature to the point where it cannot perform these functions is dangerously foolish. Simple self-protection is thus a second motive for preserving biodiversity. When DDT was sprayed in Borneo, the biologists Paul and Anne Ehrlich relate in their book *Extinction* (1981), it killed all the houseflies. The gecko lizards that preyed on the flies ate their pesticide-filled corpses and died. House cats consumed the dying lizards; they died too. Rats descended on the villages, bringing bubonic plague. Incredibly, the housefly in this case was part of an intricate system that controlled human disease. To make up for its absence, the government was forced to parachute cats into the area.

These reasons for protecting biodiversity are practical and anthropocentric. But the "foremost argument for the preservation of all nonhuman species," the Ehrlichs argue in *Extinction*, is neither. It is the "religious" belief "that our fellow passengers on Spaceship Earth . . . have a right to exist." Far from being extreme, the "Noah Principle," as this argument was named by

the biologist David Ehrenfeld, is shared by many scientists and conservationists. As a species, the Noah Principle says, the smallest grub has the same right to exist as the biggest whale; so does every species of cockroach, every species of stinging nettle (all plants are included in these arguments), and even the microorganisms that cause malaria and syphilis. Anthropologists refuse to categorize cultures as "higher" and "lower" civilizations, because all have intrinsic worth; biologists believe that there is no inherent difference in value between "higher" and "lower" organisms. All are precious, and human beings have a moral responsibility to each and every one. "It's a matter of stewardship," Wilson says.

The practical and moral costs of losing the nation's biological endowment may be enormous. But so may be the cost of saving it. To halt the spasm of extinction, Wilson and Paul Ehrlich wrote in a special biodiversity issue of *Science* last August,

the first step . . . would be to cease 'developing' any more relatively undisturbed land. Every new shopping center built in the California chaparral, every hectare of tropical forest cut and burned, every swamp converted into a rice paddy or shrimp farm means less biodiversity. . . . [Even so,] ending direct human incursions into remaining relatively undisturbed habitats would be only a start. . . .

The indispensable strategy for saving our fellow living creatures and ourselves in the long run is . . . to reduce the scale of human activities.

"To reduce the scale of human activities" implies telling people to make do with less; nations must choose between their natural heritage and the economic well-being of their citizens.

THE endangered species act is this country's response to that choice. It strongly favors preserving biodiversity--more strongly, conservationists say, than any other environmental law in the world. "Quite frankly," Murphy says, "it is the best weapon we have." It didn't start out that way. Indeed, few grasped the act's implications until its first test before the Supreme Court. On one side was the Tellico Dam, a Tennessee Valley Authority project frequently described as a boondoggle. On the other was the snail darter, a three-inch snail-eating fish that was first observed in 1973, six years after Tellico began construction and shortly before the act became law. Handed this unexpected weapon, Tellico's opponents petitioned the Fish and Wildlife Service to list the fish on an emergency basis in 1975. The amazed TVA complained that Tellico's environmental-impact statement had passed two federal court reviews, that \$50 million in taxpayers' money had already been spent,

that the dam would provide flood control, hydroelectric power, and recreational facilities (a lake). It claimed that the snail darter was found elsewhere, and thus was not endangered. Nonetheless the service listed the darter, and a civil action ensued, based on the Endangered Species Act. By 1978 the suit had wound its way up the legal trellis to the Supreme Court.

Attorney General Griffin Bell personally argued the case, attempting to demonstrate the snail darter's insignificance by displaying one to the justices. The tactic failed. In June of 1978 the Court ruled that "the plain intent of Congress" was to stop extinction no matter what the cost. The language of the act, the Court said, "shows clearly that Congress viewed the value of endangered species as 'incalculable'"--in practical terms, infinite. Obviously, a \$100 million dam was worth less than an infinitely valuable fish. Simple logic dictated halting Tellico.

The decision had a "bombshell impact on Capitol Hill," says Donald Barry, of the World Wildlife Fund, who was then a staff attorney in the solicitor's office of the Department of the Interior. Even some of the law's most ardent congressional supporters were alarmed by its inflexibility, although that inflexibility, of course, endeared the act to environmentalists. Tellico's principal sponsor, Senate minority leader Howard H. Baker, Jr., of Tennessee, set out to change the act. The ensuing

political maneuvering led to the establishment of a small escape hatch: a committee that could be convened when all other attempts had failed to resolve conflicts between protecting a species and building a project requiring federal funds or permits. Because it included several Cabinet members, the committee could not be summoned every time an endangered species was threatened. On the other hand, it could authorize the extinction of a species, as long as the benefits of the project strongly outweighed the benefits of actions aimed at saving the species. In its first meeting the "God Committee," as it was soon nicknamed, unanimously found in favor of the snail darter, though mostly because the group regarded Tellico as a waste of money.

Baker rammed through legislation exempting Tellico from the Endangered Species Act. The dam was built and, as predicted, proved to be less than an economic dynamo; a few years later more snail darters turned up in other rivers nearby. (The fish was downgraded to "threatened" in 1984.) But the whole affair set a pattern that has continued to the present. People who care little about the endangered species frequently invoke them as an excuse to stop projects; the science used to justify the actions of one side or another is often rushed, as it was for Tellico, and can be so incomplete that it verges on the fraudulent; and, most important, the law still insists that species

must be saved no matter what the cost.

For the Fish and Wildlife Service, this set of circumstances has turned the Endangered Species Act into a bureaucratic horror. The agency, formerly a haven for guys who liked to work outdoors, is now a hot spot of sophisticated partisan arm-twisting.

Hundreds of petitions flow in every year, and the service must evaluate them all, with litigious interest groups scrutinizing every move. Consequently, listing moves at a crawl. As of November, the most recent date for which official figures are available, 668 domestic species, more than half of which are plants and invertebrates, clung to their places on the list. Another 100 had been accepted for the list, but the service had not yet published a final notice about them in the Federal Register, the last step in listing. Some 500 species resided in a curious state of limbo called Category I: the Fish and Wildlife Service agreed that they merited listing but had not got around to accepting them officially. A further 3,000 occupied a second limbo, Category II: the service thought they might merit listing but had not yet investigated fully. At the current rate of progress, according to a 1990 report by the Department of the Interior's own Office of Inspector General, clearing today's backlog may take up to forty-eight years, during which time many more species will be menaced. Already, several species have vanished while the government was trying to decide whether they were endangered.

After listing a species, the Fish and Wildlife Service puts together a "recovery plan" for it. And here too, the agency is behind, though the reasons are as much budgetary as political. It has approved 364 recovery plans, covering about half the listed species, but few have been implemented. In its 1990 report the Office of Inspector General estimated the recovery cost for all species currently listed or expected to be at \$4.6 billion, spread over ten years. The service's 1990 budget for recovering species was \$10.6 million. Other agencies pitch in, but even so, in 1990 the total state and federal budget for all aspects of endangered species--listing, research, land acquisition, and so on--was just \$102 million, less than a fourth of the annual amount needed for recovery alone.

In reading these figures, one conclusion is inescapable: more species- many more--will be driven, like the Tecopa pupfish, to extinction. Few species are unsavable today; concerted human effort can save most of them. But we are unlikely to have the means to save them all. In this deficit-ridden age Fish and Wildlife Service budgets will not climb to the altitude necessary to save the few hundred species on the list, let alone the thousands upon thousands of unlisted species that biologists regard as endangered. Like cost-conscious Noahs, Americans will pick which creatures to bring with them and which to leave behind. The choice is inescapable--but the Endangered Species Act, in its insistence

that we save every species, implicitly rejects this responsibility. As a result, the government is left with little guidance. It moves almost at random, with dismaying consequences.

THE FALL OF A SPARROW

THE heart of the last dusky seaside sparrow sits in a freezer in the genetics department of the University of Georgia. Orange Band (the bird was named for the colored identity band on its leg) had lived in captivity for seven years, much of the time in a cage at Walt Disney World. It died on June 16, 1987, twenty years after the Fish and Wildlife Service included the dusky seaside sparrow on its first official endangered species list. Orange Band's death, environmentalists said, was a signal failure of the Endangered Species Act. But it might be more accurate to say that the bird was a casualty of trying to follow the Noah Principle on a limited budget.

Knowing that it did not have the resources to save every species, the agency sought impartial scientific criteria that would enable it to focus its efforts on some species rather than others; politics and guesswork would be eliminated. From the beginning this goal proved elusive, and the sparrow's disappearance came at the end of a roller-coaster ride through the rankings.

Ammodramus maritima nigrescens, as scientists now refer to the dusky, was discovered in 1872. One of nine subspecies of the seaside sparrow (ornithologists dispute the exact number), the dusky was native to the complex waterlogged terrain of east central Florida. Scattered through this coastal area are brackish marshes that breed mosquitoes at a staggering rate--more than a million can spring from a square yard of mucky turf in a day. The marshes also bred dusky seaside sparrows. Less than six inches in size, their bellies streaked in black and white, dusksies were finicky creatures; they nested only in patches of marsh grass that had no shrubs or trees in sight. Because this kind of open space is hard to come by, *A.m. nigrescens* had the smallest range of any North American bird: two bits of Brevard County, Florida. One was a few miles inland, near the St. Johns River; the other was offshore, on marshy Merritt Island.

This part of Florida first acquired renown in the late 1950s, when NASA bought Merritt Island and turned it into what is now called the John F. Kennedy Space Center. (Cape Canaveral is a point on the east side of the island.) Many daunting obstacles faced the country on its path to space, but one of the worst was the mosquito. "I was grilling hamburgers outdoors, and hordes of mosquitoes were landing on them to get the blood," recalls Herbert Kale, the vice-president for ornithology of the Florida Audubon Society, describing a visit to a

piece of Florida wetland with no mosquito control. "You'd flip the meat and dozens of mosquitoes would burn up as they clung to it." Pesticides had become available in the 1940s, and Brevard County drenched itself with them until the mosquitoes became resistant. Switching tactics in 1955, the county sliced the marsh into large squares, built low walls around the edges, and waited for the pools to be filled up by rain, storm tides, and pumping. Because salt-marsh mosquitoes can't lay their eggs in standing fresh water, NASA employees were soon able to drive to work with the windows open. Bird watchers were thrilled too. The paddy-like pools attracted huge numbers of herons, egrets, and ducks. Allan Cruickshank, a well-known ornithologist who lived nearby, urged NASA to turn the northern part of its land, bought as a buffer zone, into a wildlife refuge. The space agency was happy to oblige -it was never going to build on the land--and Merritt Island National Wildlife Refuge was born.

The refuge didn't help the dusky. DDT and other pesticides had shrunk the Merritt Island population, never large, by perhaps 70 percent; impounding the marsh reduced it further, because it killed the grass habitat that duskies required. By 1968, when, at Cruickshank's suggestion, a graduate student from the University of Wisconsin surveyed the refuge, no more than thirty-five males lived on the few hundred remaining acres of dusky habitat. (Females were much harder to spot, and researchers

didn't try to count them.) Five years later only two males were left on Merritt Island.

On the mainland the second population was in trouble too. Ranchers drained the marshes with ditches, turning them into pasture. To provide green forage, they burned off the dead marsh grass. Several hundred duskies had managed to hang on, but the situation was desperate. *A.m. nigrescens* had support from bird watchers and scientists like Cruickshank and Kale. They lobbied the Jacksonville branch of the Fish and Wildlife Service, which in 1969 begged headquarters to buy out the ranchers, a measure that it said "could mean the difference between survival and extinction of a species."

The agency now had to decide what it was going to do about the dusky. Was it going to lead the bird onto the ark, or strand it ashore? The choice was not easy. In 1969 Congress had appropriated \$1.3 million for acquiring endangered-species habitat. Several thousand acres of Florida swamp would cost more than a million dollars. Spending that money on *A.m. nigrescens* would mean not spending it on other, equally desperate species. Should the Office of Endangered Species save the dusky and lose, say, the American alligator or the key deer? What Solomon could tell the agency which course to follow?

Absent biblical authority, C. Eugene Ruhr, the office's supervisor for domestic species, had to figure out the answer himself. He

thought the decision could best be made by coming up with a coherent set of priorities. In 1971 he set down a method for ranking species, by giving them a numerical score in each of ten biological and economic categories. At the end Ruhr added the ten scores together; the higher the sum, the higher the priority awarded to that species.

Critics attacked the procedure as ridiculous. Because scores were subjective, the same species might be ranked differently by different people. Moreover, the plan suffered from what Lynn Llewellyn, a service officer, later called the "apples + oranges - grapes = fruit salad" problem. A species might receive a 50 in the population-change category and another 50 in the recovery-cost category. But nobody knew if one 50 should count as much as the other, and so the system was never fully applied.

Determined to produce a rational basis for making choices, Ruhr asked two migratory-bird specialists, Howard M. Wight and the aptly named Rollin Sparrowe, to come up with a less subjective one. In 1973 the two men created a plan that separated biological factors from non-biological factors, such as public interest in a species, creating two priority systems. In a test of the biological priority system, the highest score awarded--78.25 out of 100--went to the (California condor. With a score of 61.75 the dusky was tied with the American peregrine falcon and the Mississippi sandhill crane. Its score

would have been higher if the American Ornithologists' Union had not that year officially downgraded the bird from a full species to a mere subspecies. As a subspecies, the dusky ranked forty-second among the 180 species surveyed; as a species, it would almost certainly have ranked in the top twenty, and maybe Wight and Sparrowe would have placed it in the top ten.

Keith Schreiner, then the head of the Office of Endangered Species, was still dissatisfied. The Wight-Sparrowe system gave highest priority to species on the brink of oblivion, like the condor. These "basket cases" (Schreiner's term) were always expensive to resuscitate, which implied that the government would be spending all its money on species with little chance for success. Moreover, the system didn't take into account whether species were favored by powerful members of Congress. ("You had to allocate your resources in a way to avoid shutting off future monetary resources," Schreiner says, matter-of-factly.) In 1976 Schreiner asked another service biologist, David Marshall, to construct a third ranking system, this one directly taking into account that Capitol Hill was more likely to support what Marshall calls "glamour species" than "creepy crawlies." Reluctant to endorse a policy that courted Congress at the expense of biological principles, Marshall nonetheless produced a scheme that added in political factors. His plan combined a biological

score similar to that of Wight and Sparrowe with an ecopolitical score determined by the amount of "support" for a species inside and outside the scientific community. (Wight and Sparrowe kept the two scores separate, de-emphasizing the political.) In short, a species got a boost for doing well in a popularity contest.

This badly hurt the dusky. When the bird was downgraded to a subspecies, it lost an important ecopolitical constituency--bird watchers, who collect observations of species, rather than subspecies. The dusky plummeted to ninety-seventh place in the general rankings, far below the falcon, which rose to eighth place, and somewhat below the crane, which dropped to seventy-seventh.

The Fish and Wildlife Service paid little attention to the ups and downs of the bird's ranking. Even before Ruhr had written up his ranking system, it had decided to put much of its land-acquisition budget into buying dusky habitat. (We could find no one able to explain this decision.) By 1972 the agency had set up a second wildlife reserve in Brevard County, the St. Johns National Wildlife Refuge, on more than 2,000 acres of former ranchland. The price was \$787,000--almost a third of the agency's total land-acquisition expenditures for endangered species in that year. Over the next four years it spent almost a million dollars to add another 2,000 acres.

What happened next has been eloquently

described by Mark Jerome Walters, a journalist whose book on the dusky's extinction, *A Shadow and a Song*, will be published this fall by Chelsea Green. Despite the high cost of acquiring dusky habitat, the service failed to take care of it. Specifically, it didn't plug a major drainage--a task that Walters says would have taken "a couple guys with shovels a couple of days." As a result, the land dried out further. Nearby ranchers continued to burn fields. In December of 1975 a pasture fire went out of control and burned three quarters of the refuge. Only eleven males survived.

The recovery team, of which Herbert Kale, the Brevard County ornithologist, was a member, had already urged the service to buy a second piece of habitat to the south, near a proposed extension of the Beeline Expressway (so called because it cuts straight across central Florida). The agency agreed; it bought 1,500 more acres for the dusky. But again, it did not fill in the ditches--it was still negotiating to buy a big ranch in the middle of the reserve, and could not legally cut off its drainage. By mid-1978 Washington had bought some 6,200 acres at a cost of \$2.6 million.

That summer the agency surveyed the dusky population. It found twenty four males: four on the burned northern part of the refuge, twenty on the new southern part, and none on Merritt Island. On August 31 staffers in the Atlanta office met to discuss the bird's future. Costs, they believed, had

to be balanced against benefits. In view of the small number of surviving birds, they asked Washington for permission to "hold the line on future land acquisition." The remaining dusky money, as much as a million dollars, could go to another endangered species, the American crocodile. Schreiner concurred. "We always went for the ones with the best chance of recovery with the least money," he told us recently. "It would have been senseless to commit a large sum of money to that species when other species could have used the money and actually survived." The service stopped negotiating to buy the last ranch, an act that effectively doomed the last wild population of *A.m. nigrescens*. Amazingly, the agency had a fourth priority system at the time--and in this one the dusky was placed in the fifth highest of forty possible recovery categories. (The St. Johns refuge still exists, its northern half a favorite landing spot for migratory birds, its southern half a testament to the effects of what Kale calls "benign neglect.")

Kale and Will Post, then a biologist at the Florida Game and Fresh Water Fish Commission, suggested breeding the sparrow in captivity. No female duskies had been seen since 1976, but the bird still had a chance. If dusky males were bred to females of a related subspecies, the Scott's seaside sparrow (*A.m. peninsulae*), the chicks would be half dusky. Female hybrids could then be "back-crossed" to the dusky males, producing birds that were three-quarters

dusky. The sixth generation would be 98.4 percent pure.

After requesting a legal opinion about the propriety of the program, the Fish and Wildlife Service allowed Kale to capture the last five wild birds in 1979 and 1980. The first generation of hybrids was healthy and fertile. Pleased, Kale asked for permission to continue--only to discover that the service had changed its mind. A new legal opinion said that the Endangered Species Act covered pure species only, and that federal money therefore could not be spent on hybrids. Despite an offer to fund the project privately, the service declared *A.m. nigrescens* off limits.

The stubborn Kale made his pitch again in 1983, this time working with curators at Walt Disney World's Discovery Island. With Mickey Mouse picking up the tab, taxpayers' funds would not be involved. In the meantime, Kale says, the service had been working on a similar back crossing project for a more popular, "macho" bird, the peregrine falcon. Yet another legal opinion was issued by the agency's solicitor, and both the falcon and sparrow projects were allowed to proceed.

Nothing went right. One of the dusky males died of old age. Some of the female hybrids turned out, on closer inspection, to be males. The Scott's sparrows tended to die of unknown causes. One hybrid female was mated to three dusky males, ultimately building six nests and laying eleven eggs.

Only one hatched. Many of the other pairs were incompatible. The males, Kale realized, were too old. He was bitter about the two-year delay caused by the service's confusion over its hybrid policy. In a half-hearted fashion the breeding project continued at Disney World. Care of the hybrid birds was imprecise. They were killed by storms; they were killed by rats; some simply disappeared. The pure birds died, one by one, until only Orange Band was left.

Extinction was not the final blow. After Orange Band died, researchers at the University of Georgia analyzed part of the bird's genetic makeup. As best they could determine, Orange Band's DNA was almost identical to the DNA from other seaside sparrow subspecies. ("The last *A.m. nigrescens*," they wrote, "appears to have been a routine example of the Atlantic coast phylad of seaside sparrow"--a conclusion that Kale hotly disputes.) If the bird was not even a separate subspecies, the service's extraordinary conservation effort had been misapplied.

Meanwhile, the service has continued to fumble over the question of which species to help into the ark. Its current priority system--the sixth, by our count--was adopted in 1983. Three factors are considered: the degree of threat faced by a species, its potential for successful recovery, and its taxonomic status (whether it has close genetic relatives). Recovery

priorities rank from a high of 1 to a low of 18; species that are in conflict with land development are supposed to receive speedier treatment. Explicitly left out of consideration is the type of species involved; despite the widespread perception that Congress prefers "glamour species," it has officially instructed the Fish and Wildlife Service to award equal protection to "higher" and "lower" forms of life. The Oregon silverspot butterfly and Fassett's locoweed are thus supposed to be on equal terms with the bald eagle and the northern spotted owl, because they all have the same priority rank.

The ranking system does not set rules for deciding how much to spend on which species. Nonetheless, some correlation should exist between a species's recovery priority and what is spent on it.

Unfortunately, none does, raising the specter of more duskies to come. *A.m. nigrescens* itself rated a 6 in the 1983 system, sharing that rank with thirty-eight other species, including the northeastern beach tiger beetle and the Florida panther. In 1990 the service spent not one penny to bolster the beetle's chances for survival; other federal agencies spent \$500.

Meanwhile, the Florida panther, a "higher" life form, received \$3.8 million. The aberrations are by no means restricted to priority 6. Average expenditures for the eight species with a recovery priority of 1 were \$100,000 LESS than those for species with a priority of 6. The government

lavished an average of \$53,200 on priority-15 species, but starved priority-4 species with an average per-species budget of \$5,500. More than half of the \$100 million that state and federal governments devoted to endangered species was awarded to eleven species--less than two percent of those on the list. A hundred and fourteen species received no money at all.

On average, the service spent more on subspecies than on full species, more on species with a low recovery potential than on those with a high recovery potential, and, despite congressional instructions to the contrary, fourteen times as much on "charismatic megafauna" as on other types of species. Perhaps most troubling, average federal and state disbursements are actually lower for endangered species than for threatened species. Two of the three most expensive species--the northern spotted owl (\$9.7 million, the highest single expenditure) and the grizzly bear (\$5.9 million)--are threatened, not endangered. (The third species, a bird called the least Bell's vireo, is endangered; it received \$9.2 million.)

Kale was still angry at the Fish and Wildlife Service when we spoke to him last fall. (He seemed as irate as Richard Schroeder.) The service, Kale said, had paid lots of money for habitat that it had not managed; it had then spent still more, only to decide that a final, key parcel of land was not worth the trouble. Even when somebody else was

willing to pay, it had refused for several years to allow a last-ditch captive-breeding effort. The whole business, he thought, was senseless and sad. The service had made decisions, but in the most haphazard way, and everyone was the worse for it. He could remember going into the marshes in the 1950s and seeing duskies lined up singing in the grass by the road.

THE AMERICAN WAY

NEAR the town of Mima, in Southwestern Washington State, an acre of rich dark soil is stitched with neat rows of small plants. From a distance the field seems to be growing a thriving crop of carrots. But these plants will not find their way onto a dinner plate. The field and nine more acres nearby contain a million seedlings of a tree, the Pacific yew (*Taxus brevifolia*).

Ten acres of seedlings is not a large tract by the standards of its owner, the Weyerhaeuser Company, of Federal Way, Washington, which plants almost 280 million seedlings a year. Nonetheless, this tree farm has attracted extraordinary attention. The bark, needles, and roots of *T. brevifolia* contain taxol, a potential treatment for ovarian cancer. Resistant to chemotherapy, cancer of the ovary is one of the most intractable forms of the disease; it has an overall five-year survival rate of less than 40 percent. This single crop of yew

seedlings could yield enough taxol to treat a large proportion of the 20,000 women who are stricken each year with ovarian cancer.

The discovery of taxol is exactly what Congress had in mind when it passed the Endangered Species Act. "Who knows, or can say," asked one congressional report on the act, "what potential cures for cancer or other scourges, present or future, may lie locked up in the structures of plants which may yet be undiscovered, much less analyzed?" But the yew is also an implicit rebuke to the means Congress chose to safeguard those potential cures. A few years ago *T. brevifolia* was treated as a weed, burned on the ground as slash whenever bigger and more valuable trees were cut down. It was not officially endangered or threatened, but its numbers were decreasing. Now the species is flourishing as never before, but the recovery occurred by means so far from the Fish and Wildlife Service that one cannot help wondering if orthodox governmental plans to save biodiversity are asking the right questions, let alone providing the right answers.

The yew's journey to salvation started in the late 1950s, when the National Cancer Institute began randomly testing the cancer-fighting potential of thousands--nobody knows the full number--of plants, bacteria, fungi, and molds. The procedure now followed by the NCI Developmental Therapeutics Program is complex in detail but simple in principle: Researchers grind

up a small sample of an organism and administer it to cancer cells. If the cells react, the sample is separated into its chemical constituents, which are tested separately in a procedure analogous to sifting through a set of ever-finer sieves. According to Michael Grover, the associate director of the program, approximately one quarter of today's cancer drugs were discovered through such random screening, either by the NCI or by private drug firms. Taxol, the latest example, emerged from the NCI's program in 1971.

Testing the compound was no easy task. One mature tree's worth of bark- about forty pounds--yields one twentieth of an ounce of taxol, not enough to treat one patient. A big research push would require tons of bark. The first, small-scale clinical trials, in 1983, produced such severe allergic reactions that many had to be abandoned. Researchers resumed them after discovering that patients had probably reacted to the medium in which the taxol was administered--a form of castor oil--rather than to the drug itself. Subsequent results showed that taxol might have power over breast and lung cancer as well as ovarian cancer. The trials were small because taxol was so scarce. Nonetheless, NCI officials told reporters last June that the drug "may be one of the most important anticancer agents discovered in the past decade."

The prospect created almost as much fear as elation. The yew and its cousins have been

revered since the Stone Age, when spears were hewn from their tough yet flexible wood. The finest English longbows were made from yew. Growing often in cemeteries, they developed gnarled roots that were supposed to wrap the dead. In contrast, the modern timber industry has had little use for the tree, because it grows too slowly; unable to produce big logs, the yew was cut down and not replanted. Only in old-growth forests have yews survived long enough to grow tall (for a yew, forty feet is tall) and accumulate a lot of bark. When the NCI issued a call for large-scale taxol research, in June of 1990, conservationists feared that continued clear-cutting would wipe out the yew--along with the taxol it contains--and the mighty forests it lives in. The Environmental Defense Fund called for changes in the way timber is sold; Jerry Rust, an Oregon county commissioner, formed a Native Yew Conservation Council; the Oregon Natural Resources Council threatened legal action to force the government to prospect for yew logs in old clear cuts rather than relying on new ones. "The waste is appalling," says Wendell Wood, the conservation coordinator of the Oregon Natural Resources Council. "They're still burning countless yews on the slash pile. It's like Ollie North on the shredder. They're burning the evidence and denying the problem ever existed."

To satisfy the demand for taxol, yew logs are now being plucked out of old clear-cuts

by single mothers, laid-off loggers, and surly countercultural leftovers who live in the woods and make their livelihood by picking brush for flower arrangers, herb specialists, and plant stores. Piled high with gunny sacks of yew bark, their battered pickup trucks line up outside the taxol-extraction plant in Cottage Grove, Oregon. The procedure seems innocent enough, but the conversation in the line on the day we visited would have alarmed Wendell Wood. The trucks had anti-corporate and anti-military bumper stickers. Despite these sentiments, the drivers joked about how they could drive into national forests and rustle some yews. "The bark's real loose," one man explained to us. "You can stick in a screwdriver and peel them like sausages." Another had his rig loaded dangerously high. "I got to get it now," he said. "Pretty soon there won't be any left."

These words exemplify the notion that extinction is an inevitable by-product of what is called "the tragedy of the commons." Coined by the biologist Garrett Hardin in 1968, the phrase refers to the instructive tale of the communal pasture in medieval villages. All nearby herdsman were allowed, the story goes, to graze their cattle on this land. As individuals, the herdsman benefited by grazing as many cattle as possible; but the community as a whole was better off when herdsman restricted grazing enough to keep the grass alive. Because what one person conserved another could use, nobody had an incentive

to conserve anything, and the commons was doomed. In general, Hardin argued, there is little incentive to maintain common property, for the costs may be borne by one while the benefits are enjoyed by all.

Similar reasoning applies to wildlife, which is owned, so to speak, by everyone. Society as a whole may benefit from its continued existence but few people are prepared to pay for it by themselves. Passenger pigeons, a favorite game bird in the nineteenth century, were driven to extinction because hunters had no incentive to stop taking them when their fellows could keep blasting away. Conservationists believe that the yew, being a common resource, is a future passenger pigeon. Before the benefits of taxol were discovered, humanity was indifferent to the tree's fate and its numbers declined slowly; now the yew is valuable, and its future, according to this reasoning, is bleaker still.

The customary response to this prospect is a law to protect common property. Few people oppose such legislation when it involves, say, anti poaching laws to protect bison in Yellowstone Park. Opinions change when the Endangered Species Act compels the Richard Schroeders of America to abandon their golf courses. These people are not profiting from rare animals; they simply want to build something on their property. In some cases the government pays for the land, as the Fish and Wildlife Service did for the St. Johns National

Wildlife Refuge. More often the law simply limits what landowners can build or change, forcing them to bear the cost of saving the species while others reap the benefits. People who would ordinarily be neutral toward rare animals are thus converted into outright antagonists. "If they had just let the cows run loose and eat the [caterpillars' food plants] down, they would never have had a butterfly problem," says Dewey Youngblood, one of Schroeder's financial backers. "The problem was, we tried to work with the butterfly. But it became apparent after two years that there was no end in sight to the problem." Not everyone is so nice. In a case that may be a harbinger of the future, one developer is widely reported to have sped a project along by destroying one of the three known populations of the endangered San Diego mesa mint.

This hostility, economists say, shows that the Endangered Species Act works against people's incentives, not with them. Instead, the argument runs, we should compensate those who bear the brunt of saving a species. Gardner Brown, Jr., an economist at the University of Washington, points to the plight of the small landholders who live around Kenya's elephant parks. The parks are too small, and the roaming elephants eat up the crops outside their borders. Because the farmers cannot shoot the beasts, they must silently pay the price for their existence. "Why not give them something in return?" Brown asks. "Why should they

suffer so that people in the developed world can feel good? What if we banned the importation of film by tourists, and awarded the farmers the exclusive Kodak franchise? Let them sell film at twenty dollars a roll! The tourists, who are the main beneficiaries of the elephants in any case, would be shelling out to save them. The farmers, who are being ruined by them, would have a leg up." This example, Brown cautions, is merely illustrative, but it typifies economists' approach to conserving biodiversity. If the benefits of saving a species are tangible and measurable, they point out, why not turn over the task to a private party who is willing to bear the cost in exchange for a share of those benefits?

In the best cases the method is simple: convert the commons into private property that can be marketed. Weyerhaeuser's five acres of yew seedlings embody this transformation. The nursery is the result of an agreement between the tree company and a drug company, Bristol-Myers Squibb. Bristol-Myers researchers were interested in taxol as soon as they learned of its novel properties, but they were dismayed by the obstacles involved in producing it. When the hopeful results from the first clinical trials appeared, the firm began thinking that production might be worth the effort. Last January the National Cancer Institute signed an agreement with Bristol-Myers to cooperate in the development of the drug. Bristol Myers had been investigating three major methods of increasing the taxol

supply: synthesizing the drug, growing yew cells in the laboratory, and tree farming. For their part, Weyerhaeuser researchers had begun in 1987 to explore the chemistry, genetics, and husbandry of yews. After Bristol Myers Squibb concluded its agreement with the NCI, Weyerhaeuser quietly negotiated with the drug maker. Last August the two companies announced a joint project to learn more about yew trees. If research and regulatory hurdles can be overcome, the domesticated yew could become a renewable source for a cancer medicine. In that case, says Steve Hee, Weyerhaeuser's nursery manager, "growing yews will become something that a lot of different people get involved in--it's the American way."

In the next few years Weyerhaeuser will plant ten million yews, preserve yew seeds from the wild to ensure the tree's continued genetic diversity, open its land to yew-bark collectors in areas where the company is about to harvest its prime crop, Douglas fir, and search for ways to increase the taxol yield in the tree. Other forest-product companies will doubtless follow. No government agency ordered them to save the yew. Acting out of greed, that disquieting emotion, the same companies that burned yews indiscriminately only a few years ago will now spend hundreds of thousands of dollars to grow and protect millions of *T. brevifolia*. The yew will join the rose, the orange, and the cow--species that flourish because of the marketplace.

Economists concede that not all stories can have such a happy ending. Yews stay in one place, making them easy to own. When a species has a large range, however, establishing property rights isn't practical. No one person could own monarch butterflies in the wild, because they migrate from Mexico to Canada. Moreover, the number of species with medical potential is small compared with the range of the world's living things. Most of the useful ones, NCI microbiologists say, are likely to be protozoa, algae, soil fungi, and the like--millions of unlovable organisms that contain a staggering array of genetic diversity. Finally, as David Ehrenfeld, the author of the Noah Principle, has written, "economic criteria of value are shifting, fluid, and utterly opportunistic in their practical application." Again, the yew may be an example. Weyerhaeuser's investment in the tree is a gamble: the company is betting that nobody will find a cheap way to synthesize taxol. But in 1988 researchers were already calling the drug "the number one target today of synthetic organic chemists," and interest has only increased since then. From a patient's point of view, cheaper taxol is better taxol. If that taxol comes from a vat, Weyerhaeuser and other timber firms will drop the yew like a weed. The species will be on its own again.

"What exasperates me is the reluctance to try [the market] approach even when it is practical," says John Goldstein, an economist at the Department of the Interior.

"Sure, markets won't save everything. But why won't people set them up when they can be useful?" One reason is that preserving the yew in a nursery is not the same as preserving it in the deep green-black shade of the forests that are the tree's natural setting. To conservationists, species are not sustained if they live only in zoos, on farms, or in seed banks. Biologists have scientific reasons for worrying about zoo populations--these tend to be small enough to risk losing genetic variability--but their larger distress is aesthetic and moral. Trained to view all living things as worthy, they are reluctant to assign high value to one species, because it implies assigning lower value to other species. "By assigning value to diversity," Ehrenfeld has argued, "we merely legitimize the process that is wiping it out." Markets, in this view, ineluctably sin against the Noah Principle. Our fellow passengers on Spaceship Earth should not be for sale.

To economists, this attitude is baffling. "We can't save every species out there," Gardner Brown says. "But we can save a lot of them if we want to, and save them in ways that make sense economically and scientifically. To do that, we have to make some choices about which species we're going to preserve. And nobody wants to do that! Nobody!"

Is that because they are dismayed by the prospect of playing God?

"Oh, sure. But in this case God is just sitting

on His hands, which is a pretty dangerous thing for Him to do."

THE BUTTERFLY SOLUTION

RICHARD Schroeder is not the only person in Clatsop County, Oregon, with a butterfly problem. A few miles up the coast Northwest Conference Resorts, of San Carlos, California, is trying to build another golf course and housing complex in another patch of silverspot butterflies. Northwest Conference is run by Frank Hildreth and Donald Wudtke, two developers who would like people to know that they are not the sort of rapacious individuals one sees in the movies. "We're not fighting the system," Wudtke says. "We really believe in it." After the two men began thinking about the Oregon coast, Wudtke attended meetings of the butterfly recovery team, the group of scientists and bureaucrats set up by the Fish and Wildlife Service to guide the agency's efforts to restore the silverspot. Twenty-five professionals for a butterfly! He thought it astonishing. The scientists, Wudtke decided, were frustrated. "After eight years they hadn't established anything," he says. "They just talked and talked." In March of 1990 Northwest Conference signed a contract to buy 276 acres of grassy sand dunes. Like Schroeder, they had a butterfly problem. Hildreth and Wudtke were confident, however, that they had a solution: building a golf course and housing right around S.z.

hippolyta.

Their notion is more promising than it might seem at first glance. Silverspots, like many butterflies, are choosy about where they place their eggs. Because their caterpillars eat only the common blue violet, an inconspicuous wildflower that is customarily referred to by its scientific name, *Viola adunca*, they lay eggs exclusively near it. Because *V. adunca* grows only on open coastal grassland, that is as where *S.z. hippolyta* lives. As it happens, the silverspot tied its fortunes to the wrong flower, because such grassland is, in ecologists' terms, at a low "successional state," which means that it is inevitably overrun by brush--especially Scotch broom, a tall shrub with brilliant yellow flowers--and then by lodgepole pine. Luckily for the butterfly, it is also linked to a second species: *Homo sapiens*. Preferring to hunt in open fields, Native Americans periodically set fire to the grasslands, stopping the natural succession to brush and pine. The violets, a pioneering species, sprang up again after each burn, and in this way the butterfly flourished for centuries. Only in the 1930s did the silverspot meet its nemesis: Smokey Bear. The U.S. Forest Service campaigned against fires, and the ecological succession from grasslands to forest began anew. Scotch broom overwhelmed the six inch violets, and with them the butterfly. Although development has joined ecological succession in shrinking the silverspot's habitat along the

coast, more than nine tenths of the loss has been natural, according to Paul Hammond, the lepidopterist who is the principal expert on *S.z. hippolyta*. Eight small populations have managed to hang on, two of which are in Clatsop County. Without human intervention, Hammond told us, Mother Nature will expunge the butterfly from the Clatsop plains by the year 2000.

Options are limited. Because the land is far more valuable than the butterfly, no market will save *S.z. hippolyta*. It is unlikely to be the key to a new cancer cure, and it isn't nutritious. No nationwide group of amateur lepidopterists will pay admission to a silverspot park. Without the Endangered Species Act, the last silverspots in Clatsop County would already have been bulldozed out of existence. But with the act the butterfly has a slim chance. The law prevents private-property owners from acting to destroy a species. Where the threat is of natural origin as it is for the silverspot, nothing compels the landowners to act to reverse the course of nature. They can twiddle their thumbs and wait for Scotch broom to annihilate the insect. With a recovery priority of 9, the silverspot is tied for 456th place on the Fish and Wildlife Service's priority list. Hence no federal wildlife refuge will be established on the site of either of the two proposed resorts.

The butterfly's existence in Clatsop County depends on finding a compromise that will allow the insect to be saved by its apparent

enemy; developers. Such a compromise is one of the many solutions that Schroeder, working with Hammond, tried without success; it is also what Hildreth and Wudtke hope to devise. The notion is far from foolish. "Golf courses and resorts are a perfect match for the butterfly's management needs," Hammond says. Although the habitat would have to remain separate from the golf course, putting them together could still be "a win-win situation."

Before 1982 such compromises were nearly impossible. Initially aimed mainly at poachers, the act's prohibition against killing endangered species gradually expanded to encompass the destruction of their habitat as well. People were almost completely barred from altering the territory of a listed species, no matter how low its numbers. (On the land belonging to Hildreth and Wudtke, the last survey found exactly one butterfly.) Developers had no reason to cooperate with the law. Recognizing the problem, Congress altered the Endangered Species Act to create what it called an opportunity for a "unique partnership between the public and private sectors in the interest of endangered species and habitat conservation." The amendment authorized the Fish and Wildlife Service to perform what are in effect swaps. People like Hildreth and Wudtke create a "habitat conservation plan," which ensures that private development will not hurt a species's chances of survival. If the plan is acceptable, the service issues an "incidental

take permit," which promises that nobody will go to jail if a bulldozer operator inadvertently flattens a butterfly. The permit does not allow anyone to wipe out a species; only a few individuals of the species, if that, may be taken, and then just by accident. But it gives developers legal protection--provided that their plans do not imperil the species.

Habitat-conservation plans are intended to reconcile private interests with public efforts to save species. They identify a species's needs and then, where necessary, redirect and scale back the developer's project. "If you trim away the fat, you rarely end up with an either-or situation," explains Michael O'Connell, a conservation biologist at the World Wildlife Fund and a co-author of *Reconciling Conflicts Under the Endangered Species Act*, a recent book on habitat-conservation plans. The plans are not a magic solution to all controversies over endangered species--a point noted by Michael Bean, the chairman of the Environmental Defense Fund's wildlife program and one of O'Connell's co-authors on *Reconciling Conflicts*. But, Bean argues, the plans are well suited to situations where urban development threatens an endangered species's habitat. In these cases both sides can get what they want, and society as a whole is well served.

These hopes are unlikely to be realized with any frequency. The travails of Shroeder, Hildreth, and Wudtke illustrate the near-

impossibility of such compromises. Schroeder proposed a trade: he would put a few fairways on existing habitat to the south, and plant violets in an area to the north. The Fish and Wildlife Service said neither yes nor no; it stalled, asking for more studies. Then Hammond discovered more butterfly habitat. The resort, to be economically viable, would extend into that newly found habitat. An honest man, Hammond reported his findings. The plan collapsed. No one believed that the service would expose itself to the charge of compromising the interests of a species. "They just sat on their hands," says Dennis Murphy, the conservation biologist, who is on the butterfly recovery team. "It was better than making a decision."

Despite this unhappy history, Hildreth and Wudtke are pressing on. Last summer the two men showed us a color map depicting their preliminary habitat-conservation plan. It set aside twenty-five acres, a tenth of the resort, for the butterfly. Hildreth said they had spent more than \$50,000 determining the right area; another \$200,000 was destined for environmental studies. "We'd like to think we're doing it as just part of good planning," Wudtke explained. Construction would be starting soon, and when the complex was finished the butterfly land would be managed properly instead of being overgrown by Scotch broom.

A few weeks later Hammond listened politely to our description of their plan. He

sat in an office full of wide wooden trays, each of which contained dozens of spotted butterflies mounted on pins. He was, he stressed, not opposed to such projects. But he thought that the area the two men had set aside was probably too small. They would need to add more land. "And then," he said, "it will get expensive."

No doubt Hildreth and Wudtke will add as little as possible, and the Fish and Wildlife Service will find some reason to nitpick. One might call the resultant paralysis the silverspot syndrome: no resort, no butterfly, a lose-lose situation that combines the worst of both worlds.

Such an outcome may not be rare. The two butterfly plans were created by the developers alone. A likelier route to success, according to the authors of *Reconciling Conflicts*, is to enlist the aid of local governments and environmental groups, all parties investing time and money in drafting the plan. (Among other things, this makes the plan less litigation-prone.) But that drives up costs substantially, and sometimes drives them beyond the \$250,000 spent by Hildreth and Wudtke. Ultimately, preparation of the plan becomes so expensive that it is worthwhile only when the stakes are high--that is, when the value of the land in question is high. If land is expensive, so is setting it aside for the species, as many habitat conservation plans require. Near Palm Springs, California, for example, a plan has carved out a 17,000-

acre reserve for the Coachella Valley fringe toed lizard, using \$25 million from developers, the Nature Conservancy, and federal and state agencies. If it survives internecine squabbling, a plan under development in Austin, Texas, will buy habitat for two bird, five invertebrate, and two plant species at a cost of more than \$93 million. Unsurprisingly, only ten habitat-conservation plans have been accepted in the past nine years.

More important, the plans are only a means of choosing how to save a species. They do not decide whether to save it. In the eyes of the law, listing a species is equivalent to making that decision; if human plans threaten the species, they must be set aside. Conservationists often claim that such stark conflicts will be uncommon. (Peter Raven, the director of the Missouri Botanical Garden, has argued that trade-offs are "truly necessary" only in "rare cases.") But the United States has thousands of people like Richard Schroeder and it has thousands of endangered species. Inevitably, they will collide--everywhere and often. In these fights, according to the law, only one side is supposed to win.

Technically, losers do have one hope: the God Committee. But it can be convened only when the controversy involves the federal government; if private developers do not need federal permits, there is no avenue of appeal. In practice even this limited way out is rarely used, because making the

appeal places the appellant in the unenviable position of going on record as wanting to do in a species. Few wish to be seen that way- one reason that the God Committee has been called on only three times in the fourteen years of its existence. (The third appeal occurred just last September, pitting the Bureau of Land Management against the northern spotted owl. A decision is expected later this year.)

AS a practical matter, endangered species almost always win in conflicts with development--an outcome that flows from the act's grounding in the Noah Principle. Yet the Noah Principle makes choices next to impossible, and in this regard the Endangered Species Act must be changed. In the eyes of the law all species are equal, because each is of incalculable worth. Americans are willing to set aside some human concerns to save the bald eagle and the grizzly bear. But no one has demonstrated that they will give their informed consent to laws that grant the same privileges to the Kretschmarr Cave mold beetle. Indeed, a casual glance through the magazines of the environmental movement reveals a marked preference for charismatic megafauna over creepy-crawlies; the pages of Sierra and National Wildlife are devoted to lush color photographs of mammals and birds. As a result, funding for species preservation is awarded with blithe disregard for the

principle of equality. On the infrequent occasions when the Noah Principle is invoked, it creates contempt for the law. If society prefers charismatic megafauna, priority should be given to them without apology. If biologists think otherwise, it should fall to them to change public preferences.

More important, the claim of incalculable value forces all sides into acting as if cost meant nothing. Powerful interests don't want endangered species anywhere near them, yet the law states with great specificity that their wishes are not to be heeded. The situation invites hypocrisy. Thousands of jobs and billions of dollars are at stake, and economic considerations WILL be heard. Unable to get in the front door legitimately, money and influence sneak in through the back. (The same Congress that declared endangered species to be of "incalculable" value evaded the intent of the act by allocating little for their welfare, and subsequent Congresses have not done much better.) Many species never make it onto the list for fear of the consequences--not to the species but to the economic and political forces that may be crimped if they are listed. And little wonder, for those who cannot prevent listing are forced, actively or passively to restore the species for the enjoyment of the rest of society. Compensating them for their costs may not, as some economists claim, be the easiest resolution. But it would stop the law from turning property owners into the

enemies of the endangered species on their land. Without the support of property owners, the "incalculable" value of species will eventually become a chimera.

The thought of deliberately consigning any species to extinction, let alone thousands of them, is repugnant, and no one we spoke to liked it. (Asked if he would like to see the silverspot vanish, Schroeder looked surprised. "Of course not," he said.) But we will inevitably cause extinctions; we cannot hide from it. Taking responsibility for our actions is a better course than letting species die of our indecision. To pretend that we are acting to save everything is intellectually dishonest. It turns the hard choices over to the forces of litigation and bureaucratic inertia. Clinging to the Noah Principle may make us feel good, but it ensures that the nation's biological heritage will be managed, as Lewis Carroll would have had it, by Helter and Skelter.

Last June we drove down the coastal highway to Richard Schroeder's proposed golf course. We found it just north of a gas station and across from a driving range, as Schroeder had said. A dirt road led into the property; we took it, rocking through the ruts left by four-wheel-drive vehicles. In a moment we came to a cow pasture: prime butterfly territory. Dotted with the bright-yellow blossoms of Scotch broom, the field was a sad sight--if you were interested in

butterflies. The owner, one of Schroeder's neighbors, wants to retire after decades on the farm. He is waiting for the shrub to take over. Then, maybe, the land can be sold for condominiums.

It was too early in the season to see silverspots. We looked anyway--but of course we didn't find them.

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The Atlantic Monthly; January 1992; The Butterfly Problem; Volume 269, Number 1; pages 47-70.*

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What's the problem? Butterfly keys use a butterfly mechanism that's different from the scissor mechanism used for traditional keyboards. It's called a butterfly mechanism because the components underneath the key resembles a butterfly's wings, with a hinge in the center rather than overlapping like a pair of scissors. Apple swapped to a butterfly mechanism to make a thinner keyboard, which is possible because each key moves less when pressed so less space is needed. The Butterfly problem is a geometry problem involving a circle and chords that dates back to the early 1800s. The problem can be stated as follows: Butterfly Problem. In a circle (O), let M be the midpoint of a chord XY. Draw two chords AB and CD passing through M. Suppose the two lines AD and BC meet XY at P and Q, respectively. Prove that M is the midpoint of PQ. You can see a diagram at this link: [The butterfly problem](#). You can see one solution of the Butterfly problem at this link [The meaning of butterfly effect is "small causes can have larger effects"](#). Problems, problems, problems who does not live with any problems in everyday life? It is normal to be faced with problematic situations during your life , although this does not necessarily mean that you can solve them | the truth is that experience does not always teach. When it comes to our problems, it's not uncommon to end up getting dragged into the vicious circles that we ourselves create around them.