

National Programs to Protect Genetic Diversity - The US Example

FRANCIS R. THIBODEAU*

Research Associate,
Department of Urban and Environmental Policy,
Tufts University,
Medford, MA 02155, U.S.A.

SUMMARY

A country which truly wishes to preserve the full range of genetic diversity with which it has been endowed must look beyond large biosphere reserves. It must inventory and protect individual species and habitat types in smaller preserves as well. The United States provides an example of a country which has a legacy of preserves. Much of the land that would be necessary for an effective preserve system has already been acquired, but basic information and coordination among agencies is lacking.

Inventory and preservation of plant and animal genetic diversity

The *World Conservation Strategy* sets prevention of species extinction among the highest priorities for environmentalists. The authors regard *in situ* preservation as the prime device toward this end and the biosphere reserves as the greatest hope of achieving it.

"One of the major objectives of the international network of biosphere reserves is to conserve for present and future use the diversity and integrity of plant and animal communities within natural ecosystems, and to safeguard the genetic diversity of species on which their continuing evolution depends." (IUCN, 1980)

However, the biosphere reserves can only do part of the job; by intention they are large, integrated, and buffered areas meant to preserve whole ecosystems (US MAB, 1979).

A serious program to preserve 'the genetic diversity of species' will have to inventory and protect individual endangered species and habitat types. The United States, for example, has thirty

*Dr Francis Roy Thibodeau graduated in Environmental Sciences from Boston College. He later took his Masters in Urban, Social and Environmental Policy, and his Doctorate in Ecology and Environmental Policy, both degrees from Tufts University. His research interests are in the field of relationship between ecology and land use, especially as they influence the preservation of genetic diversity.

biosphere reserves and more than 40 million acres of protected land, but yet Low (1979) predicts that "15% of the remaining types of plant and animal species in the U.S. will disappear within the next 20 years unless action is taken to preserve their habitats" and the US/IBP Conservation of Ecosystems Program estimates that between 5,000 and 6,000 prime reserves will be necessary to insure the survival of all the ecosystem types that can still be found in the United States (Darnell, 1976).

The example of the United States is a particularly good one to use when examining the features of a national system of reserves that will insure the survival of nearly the full complement of species and habitat types. The U.S. is actually rather near that goal already. It would not be necessary to face the social, economic, and political problems of acquiring vast amounts of land for new preserves—but it would be necessary to examine carefully the unfulfilled preservation needs, to coordinate the efforts of the myriad conservation agencies, and to enforce the protective legislation already in place. Limited, but successful, examples of a complete national preserve system prove that these tasks can be accomplished. They are a strong indication that it would be possible to preserve the diversity of species in the United States.

All of the programs described below contribute directly to the preservation of genetic diversity. They comprise the *de facto* U.S. national system. Their combined efforts have not been enough to stop the decline of genetic diversity. In the many other countries with a legacy of preserves and preservation programs, the situation is undoubtedly similar: many agencies holding much land. The data presented here demonstrate how close a country can be to an effective preserve system without having one. They also suggest ways in which an effective system can be developed.

THE FEDERAL GOVERNMENT

By far, the federal government's land present the greatest unrealized opportunities for conservation. The United States Government owns approximately 762 million acres, more than one-third of the country (Bureau of Land Management, 1978). The Bureau of Land Management (BLM) itself holds 475 million acres. Most of the remaining federal land is controlled by The Forest Service, The Fish and Wildlife Service, The Department of Defense, and the National Park Service. All of these agencies operate under regulations which mandate the protection of some biological phenomena and allow the protection of others. Many of the most pressing preservation needs could be met without any further land acquisition, but they are not being met.

Federal Government's lands present the greatest unrealized opportunities for conservation

The most egregious example of the federal government's present lack of commitment to the protection of the resources on its land is the Research Natural Areas (RNA) Program, a program created specifically

"To preserve a representative array of all significant natural ecosystems and their inherent processes as base-line areas. This action provides a potential range of diversity, including common, rare and endangered species or disjunct populations." (Federal Committee on Ecological Reserves, 1977, p. 5)

These 'significant natural ecosystems' are not officially 'preserved': the 4.4 million acres of Research Natural Area are owned by one of the federal land-holding agencies and "the additional protection afforded (to RNAs) is derived from the individual agencies which designate them" (Federal Committee on Ecological Reserves, 1977, p. 5). Neither are they a 'representative array': this year, the Fish and Wildlife Service alone will establish between 30 and 40 new RNAs. At least half of them will never be identified for inclusion, or even seen, by any authority higher than the National Wildlife Refuge managers who proposed their designation. The RNAs are an *ad hoc* collection of areas without effective protection.

Stronger programs do exist. Under existing codes, the Forest Service can create 'Special Interest Areas' (36 CFR 294.1) and BLM can establish 'Outstanding Natural Areas' (43 CFR

2071.1). Both of these designations are land-use planning classifications which have a number of purposes, one of which is the protection of biologically important areas. However, neither of these designation programs separates sites of biological importance from areas which are particularly scenic or which should be kept in their natural state for other reasons; neither the Forest Service nor BLM inventories its land to determine which sites are worthy of preservation; and neither set of regulations insures that the land will be preserved in the future—both designations can usually be cancelled at the agency's discretion. The 1.4 million acres controlled by these programs (derived from TNC, 1977) are best seen as a random sample of the sorts of land that the federal government should systematically identify and protect.

Both the Fish and Wildlife Service and the National Park Service should be clearly dedicated to biological preservation.

The Fish and Wildlife Service's 34 million acres of National Wildlife Refuges (Fish and Wildlife Service, 1976, p. 27) could be an integral part of the national preservation effort:

"All national wildlife refuges are maintained for the primary purpose of developing a national program of wildlife and ecological conservation and rehabilitation. These refuges are established for the restoration, preservation, development and management of wildlife and wildlands habitat; for the protection and preservation of endangered or threatened species and their habitat; and for the management of wildlife and wildlands to obtain the maximum benefits from these sources." (50 CFR, 25.11)

However, despite the wide responsibilities recognized in the Code, the bulk of the system consists of 354 migratory bird areas, 16 big game areas, and over 2,300 waterfowl production areas (TNC, 1977, p. 61). Most of the National Wildlife Refuge System is clearly dedicated to raising waterfowl and other species more favored by hunters than preservationists.

The Fish and Wildlife Service's Endangered Species Refuges, which have been established as a result of the 1978 Amendments to the Endangered Species Act (16 USCA 1531-1543), differ from the majority of National Wildlife Refuges. These 70,220 acres (Fish and Wildlife Service, 1980) have been carefully chosen to aid the species which need habitat preservation the most. However, such Refuges aid fewer than 50 of the 276 federally listed threatened or endangered species, and the officially listed species themselves are only a small fraction of those which are currently diminishing due to habitat loss.

✓

The National Park Service is the nation's principal conservation agency (National Park Service, 1980, p. ii). The National Parks should include protected examples of the full range of our ecological heritage. At present, the Service recognizes 41 natural regions of the United States. However, 24 of the 41 regions receive less than 50% representation and 15 are not represented at all (National Park Service, 1972). The General Authorities Act of 1976 (P.L. 94-458) offers some hope that the selection of future parks will correct this problem, but it is still too soon to assess the new law's effect.

Most of the National Wildlife Refuge System is clearly dedicated to raising waterfowl and other species more favored by hunters than preservationists

Even after areas enter the park system, there is no assurance that their biological resources will be fully protected. Visitor use and external threats have been problems since the Service was established (Beltran, 1964), but since World War II, these problems have increased dramatically. As only one example, a full 40% of the parks now report threats to at least some of their plant species (National Park Service, 1980). The National Park System is not yet a representative collection of American ecosystems, and by its admission, it is having difficulty protecting those resources that it does hold.

Ironically, two of the most important federal programs which preserve biological diversity were created for a substantially different purpose. The Wilderness and Primitive Areas programs protect more than 17.5 million acres in their natural condition (derived from US Congress, 1979; and The Nature Conservancy, 1977). While these areas are not normally inventoried to assess their biological importance, the Wilderness Act (16 USCA Section 1131) insures that they will remain substantially as they were in presettlement times. These Wilderness Areas serve as important *de facto* biological reserves.

While much of the legislative foundation for a strong federal program to preserve biological diversity already exists, most current programs neither identify their biologically-important land nor do they insure the protection of the areas that have been 'preserved'. Only the Fish and Wildlife Service's Endangered Species Reserves uniformly meet these two most basic criteria for a preserve system.

THE STATE GOVERNMENTS

The natural resource programs conducted by the individual states seldom have the preservation of biological diversity as a primary goal, although there are a few superlative programs which demonstrate how effective state-level agencies can be.

More than 8.4 million acres are dedicated to some sort of natural resource activities by the states. Of this area, 5.7 million acres comprise wilderness systems established by either New York, New Jersey, or Alaska. A full 80% of the remaining 2.7 million acres is managed for hunting, camping, and other forms of outdoor recreation. Another 9% is held in comprehensive programs which do recognize the importance of protecting lands of biological importance but which also include many other kinds of natural areas. Only the remaining 11%, 290,000 acres, is held by programs primarily engaged in protecting critical habitat. Almost all of this critical habitat, 275,000 acres, is in the State of Alaska alone (derived from The Nature Conservancy, 1977).

The comprehensive programs mentioned above provide a model for the way in which administrative reform and clear planning can create a dramatic improvement in governmental biological protection efforts. For example, in 1951, a private organization known as The Michigan Natural Areas Council began identifying state-owned land that should be preserved. Often these areas were then given official protection by the state government. In 1972 the Michigan Wilderness and Natural Areas Act (Michigan Compiled Laws Annotated 322.75-322.76.3) was passed. This established an official state board, The Natural Resources Commission, which performs the same inventorying and dedication functions that the Council began (The Nature Conservancy, 1977, V. II, pp. 295-297). In this way, Michigan has been able to insure that much of its ecological heritage will not be lost without appropriating major funding for land acquisition.

Ironically, two of the most important Federal programs which preserve biological diversity were created for a substantially different purpose

State efforts of this sort are few. Twenty-five states have comprehensive programs, broadly defined, but only 8 of these programs include more than 5,000 acres. Not all of this land is held for preservation, these acreage data include

4-3

some lands put to active uses, but the part of the land which should be preserved is identified by professionals and protected by law. No matter which agency the land, it receives the sort of protection that it deserves.

PRIVATE ORGANIZATIONS

The more than 200 private land conservation organizations control a relatively small portion of the preserved acreage in the United States. Jenkins (1978) estimates that they owned under 2 million acres in 1975, although a detailed survey of their holdings has never been performed. Much of this land is carefully selected for its ecological importance and strictly protected once it is acquired.

State efforts of this sort are few

The National Audubon Society and The Nature Conservancy have particularly extensive programs. At the time of Jenkin's estimate, these two groups owned more than one-third of the privately held land.

The Audubon Society's preserves include more than 175,000 acres of prime habitat (National Audubon Society, n.d.). In all cases, their primary management objective is "to preserve the diversity of flora and fauna found on the land when Audubon acquired it" (J. Anderson, personal communication, 1980). However, because the Society has only 63 sanctuaries and seldom acquires others, it can only preserve some of the range of species and ecosystems which should be protected.

The Nature Conservancy, by contrast, owns 693 preserves with a total of 464,000 acres (The Nature Conservancy, 1980). In addition, it has acquired another 1.2 million acres and transferred them to other governmental and private agencies for management. Its primary purposes are to identify, acquire, and manage areas where important species or ecosystems occur (TNC, 1979).

In addition to operating the largest private preserve system in the United States, the Conservancy has made giant strides in preservation philosophy and methodology. Undoubtedly the best examples of TNC's methodological sophistication are the Natural Heritage Programs. To date, there are 21 Heritage Programs, operated under contract to state conservation agencies (TNC, 1980). These programs provide a thorough listing of a state's rare, declining, threatened, and endangered species.

DISCUSSION

There are more than 40 million acres of 'natural areas' in the United States, but the biological diversity of the country is still declining rapidly. Obviously, a national program to preserve diversity needs more than land. It needs information and coordination.

In the United States vast tracts have been set aside without a clear statement of priorities. If a country seriously wishes to preserve its genetic diversity it must know which species and habitat types are in greatest danger of being lost. In the United States the initiative for this sort of survey work has fallen to a private organization, The Nature Conservancy. They have shown that it is quite possible to locate occurrences of rare species in the field, to assess their condition, and to assign priorities for preservation from this information. Moreover, they have shown that it is possible to develop such careful inventories for huge areas. The Nature Conservancy's Heritage Programs have inventoried almost half of the states—at reasonable cost and with far better accuracy than we have ever had before. While certain species obviously need attention and should be receiving it now, many others slowly decline because they are little known, or small, or live in out-of-the-way places. A program to preserve diversity must begin by discovering occurrences of the elements of diversity; individual species and habitat types. A national program to survey genetic diversity is virtually a prerequisite to an intelligent protection effort.

In the USA vast tracts have been set aside without a clear statement of priorities

Once clear priorities for action have been determined, it is then possible to build an effective system of preserves. Large areas, carefully chosen, will be the backbone of such a system. As IUCN (1980) notes, the biosphere reserves provide a model for such areas. However, they are clearly not enough to protect all endangered species. They must be supported by a system of smaller protected areas which support occurrences of individual 'elements of diversity'. These areas need not command large amounts of land: the average size of the Nature Conservancy's reserves is less than 700 acres.

The reservoir of land from which these smaller reserves can be drawn is often enormous. In the United States only 820,000 acres of land have

been chosen as preserves based on the results of careful inventories and have been strongly protected by law or private ownership. Another 40.31 million acres of less certainly valuable land are more weakly protected as 'natural areas' in such programs as the Research Natural Areas. Yet another 57.87 million acres are undeveloped protected land set aside in their natural state by agencies which do have protection programs, such as BLM. Ecological knowledge and political initiative are all that would be necessary to protect the most valuable parts of these 98.18 million acres. The remaining 493 million acres of state and federal land are the next most logical areas to consider for preservation. Almost all of the agencies that hold public land have some sort of protective regulations (Fig. 1).

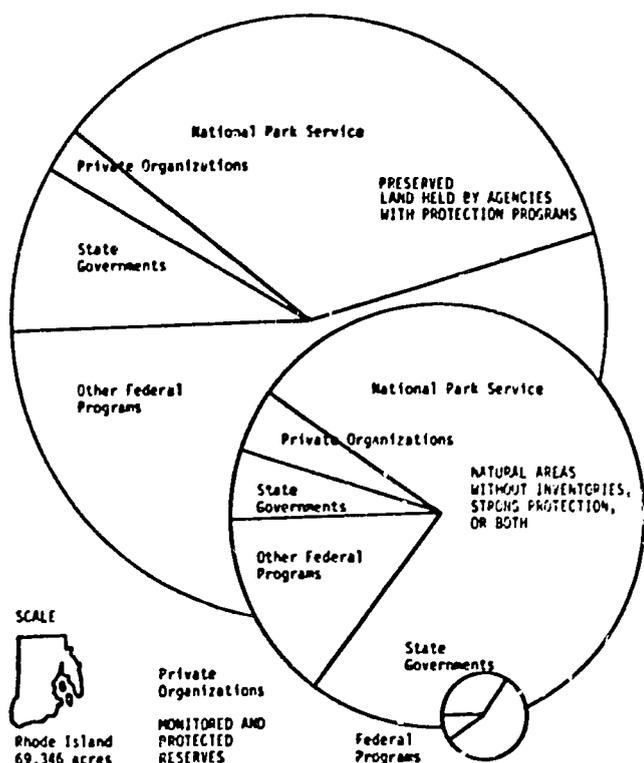


Fig. 1.

If the 40% of the United States that is owned by the federal and state governments was receiving the degree of protection that it deserves, then the work remaining for private conservation organizations will be reduced to a manageable scale. By far the most active private organization, The Nature Conservancy, has preserved 1.4 million acres during the last 10 years alone (Boren and Blair, 1980). Private efforts could concentrate on smaller, privately owned sites if the government protected the land that it now has.

The US experience provides a warning and a challenge to other countries. Large biosphere reserves are not enough; neither are a large num-

ber of small reserves, although both are necessary. The effort to preserve natural diversity in the United States is hampered more by institutional impediments than by the size and complexity of the tasks to be performed. The Nature Conservancy's Heritage Programs have shown that it is

The US experience provides a warning and a challenge to other countries

possible to inventory whole states and to set priorities for acquisition. The State of Michigan, and a very few other states, have shown that they can protect the most ecologically important government lands in a coordinated way. Both the Nature Conservancy and the Audubon Society have shown that private organizations have the ability to acquire and manage significant preserve systems. It would be quite possible to protect the biological diversity remaining in the United States—but it remains unprotected.

REFERENCES

Beltran, E., (1964) Use and recreation: two conflicting purposes. In A. Adams (ed.) *Proceedings of the First World Conference on National Parks*, U.S. Government Printing Office, Washington, D.C., 471 pp.

BLM (Bureau of Land Management), (1978) *Public Land Statistics*, U.S. Government Printing Office, Washington, D.C., 191 pp.

Boren, F. D. and Blair W. D., (1980) Decade of diversity, *The Nature Conservancy News*, 30(3) 2-7.

Code of Federal Regulation, (1979) Title 36, Part 294.1, Recreation areas. Title 43, Sub-part 2011.1, Type and effect of designations—recreation lands. Title 50, Section 25.11, The natural wildlife refuge system—purpose of regulations.

Darnell, R. M., (1976) Natural areas preservation: The US/IBP conservation of ecosystems program. *BioScience*, 26(2) 103-108.

Federal Committee on Ecological Reserves, (1977) *A Directory of Research Natural Areas on Federal Lands of the United States of America*, Forest Service, Washington, D.C., 280 pp.

Fish and Wildlife Service, (1976) *Annual Report 1976*, U.S. Government Printing Office, Washington, D.C., 221 pp.

Fish and Wildlife Service, (1980) Habitat acquisition: costly but necessary to the recovery of many endangered species, *Endangered Species Technical Bulletin*, 5(6) 5-10.

IUCN (International Union for the Conservation of Nature and Natural Resources), (1980) *The World Conservation Strategy*, IUCN, Morges, Switzerland.

Jenkins, R., (1978) Habitat preservation by private organizations. In Brokaw, H. P. (ed.), *Wildlife and America*, U.S. Government Printing Office, Washington, D.C., pp. 532.

Low, L. G., (1979) Unpublished xerox, April 19, 1979.

Michigan Compiled Laws Annotated, The Wilderness and Natural Areas Act of 1972, MCLA sections 322.751-322.763.

National Audubon Society, (n.d.) *Islands of Life, The National Audubon Society Sanctuaries*.

- NPS, (The National Park Service), (1980) *The State of the Parks—1980, A Report to Congress*, Office of Science and Technology, National Park Service, Washington, D.C., 57 pp.
- National Park Service, (1972) *Part Two of the National Park System Plan: Natural History*, U.S. Department of the Interior, Washington, D.C.
- TNC (The Nature Conservancy), (1977) *Preserving Our Natural Heritage*, V. 1 Federal Activities, 323 pp., V. 2 State Activities, 671 pp., U.S. Government Printing Office, Washington, D.C.
- TNC (The Nature Conservancy), (1979) 1978: Year in Review. *The Nature Conservancy News*, 20(3) 2–5.
- TNC (The Nature Conservancy), (1980) Decade of diversity, *The Nature Conservancy News*, 30(3) 2–7.
- U.S. Bureau of the Census, (1979) *Statistical Abstracts of the United States*, U.S. Government Printing Office, Washington, D.C.
- U.S. Congress, (1964) The Wilderness Act, P.L. 88–577, 16 U.S.C. 1131–1136.
- U.S. Congress, (1976) General Authorities Act of 1976, P.L. 94–458.
- U.S. Congress, (1978) Amendments to the Endangered Species Act of 1973, P. L. 95–632, 16 U.S.C.A. 1531–1543.
- U.S. Congress, (1979) *National Wilderness Preservation System, 14th Annual Report*, U.S. Government Printing Office, Washington, D.C., 96 pp.
- U.S. House of Representatives, Subcommittee on National Parks and Insular Affairs, (1977) H. R. 6268, 95th Congress, U.S. Government Printing Office, Washington, D.C., 192 pp.
- US MAB (United States Program on Man and the Biosphere), (1979) *Guidelines for the Selection of Biosphere Reserves: an interim report and key*, US MAB, Washington, D.C. 26 pp.
-