visualize a laboratory bioassay experiment that could realistically represent all of these parameters.

On the basis of data from several studies of the carbon, nitrogen, and phosphorus cycle, I hypothesize that schemes for controlling nitrogen input to lakes may actually affect water quality adversely by causing low N/P ratios, which favor the vacuolate, nitrogen-fixing blue-green algae that are most objectionable from a water quality standpoint. Conversely, when phosphorus control causes an increase in the N/P ratio, the resulting shift from "water bloom" blue-green algae to forms that are less objectionable may be as important as quantitative decreases in algal standing crop. Several authors have observed such species shifts with changing N/P ratios (*19*).

It is clear that management decisions on nutrient control measures must be based on controlled field tests as well as simple laboratory bioassays.

References and Notes

1. For a summary of these, see J. Vallentyne, *Can. Fish. Mar. Serv. Misc. Spec. Publ. No. 22* (1974), p. 162.
2. The general assemblies of both the International Limnological Congress and the International Ecology Congress unanimously passed resolutions recommending widespread phosphorus control as a solution to eutrophication. Almost all of the freshwater scientists in the world were represented.
3. For example, see J. W. G. Lund [*Nature (London)* **249**, 797 (1974)] for a critique of phosphorus control, including my report of the same year (*4*).
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5. P. Dillon and F. Rigler, *J. Fish. Res. Board Can.* **32**, 1519 (1975); R. A. Vollenweider, *Schweiz. Z. Hydrol.* **37**, 53 (1975); D. W. Schindler, *Limnol. Oceanogr.*, in press.
6. See papers in G. E. Likens, Ed., *Am. Soc. Limnol. Oceanogr. Spec. Symp. No. 1* (1972).
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8. For example, W. Lange, *Nature (London)* **215**, 1277 (1967); *J. Phycol.* **6**, 230 (1970); M. Sakamoto, *J. Fish. Res. Board Can.* **28**, 203 (1971); A. Christie, *Ont. Water Resour. Comm. Res. Publ. No. 32* (1968).
9. D. W. Schindler, G. Brunskill, S. Emerson, W. Broecker, T-H. Peng, *Science* **177**, 1192 (1972); D. W. Schindler (*10*); S. Emerson, W. Broecker, D. W. Schindler, *J. Fish. Res. Board Can.* **30**, 1475 (1973).
10. D. W. Schindler, *Int. Ver. Theor. Angew. Limnol. Verh.* **19**, 3221 (1975).
11. ——— and E. Fee, *J. Fish. Res. Board Can.* **30**, 1501 (1973).
12. S. Emerson [*Limnol. Oceanogr.* **20**, 743 (1975); *ibid.*, p. 754] showed that gas exchange is roughly proportional to the square of the wind velocity at the lake surface. He also reported that chemical enhancement of gas exchange in soft-water lakes may yield values five to ten times higher than unenhanced values, once nutrient additions have caused depletion of inorganic carbon, so that alkalinity is dominated by hydroxyl ions.
13. These views are summarized by D. W. Schindler (*10*).
14. In lake 226, nitrogen fixation contributed 38 percent of the total nitrogen income in 1974 and 19 percent in 1975 (R. Flett, University of Manitoba, thesis, 1976).
15. For example, T. P. Murphy, D. R. S. Lean, and C. Nalewajko [*Science* **192**, 900 (1976)] showed that *Anabaena* requires iron for fixation of atmospheric nitrogen and that this genus can suppress the growth of other species of algae by excretion of a growth-inhibiting substance.
16. M. Turner and R. Flett, unpublished data. As yet no quantitative estimates of nitrogen fixation for an entire season are available. G. Persson, S. K. Holmgren, M. Jansson, A. Lundgren, and C. Anell [in *Proceedings of the NRC-CNC (SCOPE) Circumpolar Conference on Northern Ecology (Ottawa, 15 to 18 September 1975)*] reported similar results for a lake in Sweden that was fertilized with phosphorus.
17. Possible additional mechanisms are outlined by D. W. Schindler [in *Environmental Biogeochemistry*, J. O. Nriagu, Ed. (Univ. of Michigan Press, Ann Arbor, 1976), pp. 647–664]. In particular, nitrogen appears to be more efficiently recycled from sediments than phosphorus.
18. Whole-lake experiments with phosphorus-deficient fertilizations in lakes 226 southwest and 304 have confirmed the lack of either biological or geochemical mechanisms for enhancing inputs of phosphorus.
19. For example, see P. Sze, *Phycologia* **14**, 197 (1975); M. Michalski and K. Nicholls, *Phosphorus Removal and Water Quality Improvements in Gravehurst Bay, Ontario* (Ontario Ministry of Environment, Rexdale, Ontario, 1975); M. Michalski and N. Conroy, *Proc. 16th Conf. Great Lakes Res.* (1973), p. 934; W. T. Edmondson, *Verh. Int. Ver. Limnol.* **18**, 284 (1972). Other members of our staff have recently been able to cause shifts in dominance from blue-green to green algae in hypereutrophic lakes by adding nitrogen (J. Barica and H. Kling, personal communication).

20. My thanks to T. Ruszczynski, who performed the calculations for Figs. 1, 2, and 4, to D. Findlay, whose plankton identifications and counts allowed these interpretations, and to J. Prokopowich for chemical analyses. The critical comments of K. Patalas, R. Flett, and E. Fee are greatly appreciated.

The Biosphere Reserve Program in the United States

A program has been developed to select key sites for environmental research and monitoring.

Jerry F. Franklin

Biosphere reserves are major elements in Unesco's "Man and the Biosphere" (MAB) program and in the U.S.–U.S.S.R. Environmental Agreement. They are part of an international system of reserves with the primary objectives of conservation of genetic diversity, environmental research and monitoring, and education.

The scientific community must be aware of the existence and potential of the biosphere reserves if they are to fulfill their intended functions. I will outline the conceptual development of the Unesco effort, the philosophy guiding its implementation in the United States, and the utilization and expansion of U.S. biosphere reserves expected in the future. The views presented are those of the U.S. National Committee for Man and the Biosphere.

Development of the Biosphere Reserve Concept

The concept of biosphere reserves was developed as a major element of Project 8, *Conservation of Natural Areas and of the Genetic Material They Contain*, in the Unesco-sponsored Program on Man and the Biosphere (*1*). This project, which emerged as an important component early in the MAB planning, was initially considered in detail by an expert panel, which met in Morges, Switzerland, in September 1973. Establishment of a worldwide network of biosphere reserves was this panel's first recommendation. A task force with the responsibility of defining "criteria and guidelines for the selection and establishment of biosphere reserve" (*2*, p. 9) met in Paris in May 1974. The task force report is the source of the following information on the international program.

Biosphere reserves have three basic purposes or objectives: (i) conservation or preservation—"to conserve for present and future use the diversity and integrity of biotic communities of plants and animals within natural ecosystems, and to safeguard the genetic diversity of species on which their continuing evolution depends" (*2*, p. 6); (ii) research and

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monitoring—"to provide areas for ecological and environmental research including, particularly, baselines studies . . ." (2, p. 6); and (iii) education—"to provide facilities for education and training" (2, p. 6).

In concept, the core of the biosphere reserve program includes natural areas representative of the major biomes or biotic divisions of the world, including their main subdivisions and transitional zones. Biosphere reserves of other types are identified, notably natural areas with unique features of exceptional interest and man-modified landscapes in regions where natural conditions no longer exist. The rationale for the objectives and design of each kind of biosphere reserve has been developed (2). The U.S. program has focused, at least initially, on the first type, representative natural areas (3).

The system used for classifying the world into biotic regions or biomes was developed by the International Union for Conservation of Nature and Natural Resources (IUCN) (4, 5). This system is being further divided and refined for the continental United States (see Fig. 1). Additional criteria for identifying reserves include size (areas large enough to be effective conservation units and to include complete watersheds) and adequate legal protection from nonconforming uses.

All three objectives—conservation, research, and education—are viewed as important and generally compatible. Priorities among the objectives will vary with the nature of the biosphere reserve and the primary thrust of the national programs. In some countries, establishing reserves for conservation will have priority, and research programs will have to be developed as quickly as possible. In other countries with numerous existing conservation reserves, current research and educational activities as well as the potential for their expansion will be more important criteria in selecting biosphere reserves.

The biosphere reserve program "is not meant as a substitute for programmes to establish national parks or equivalent reserves" although they may "often coincide partly with or incorporate national parks . . ." (2, p. 6). The objective con-

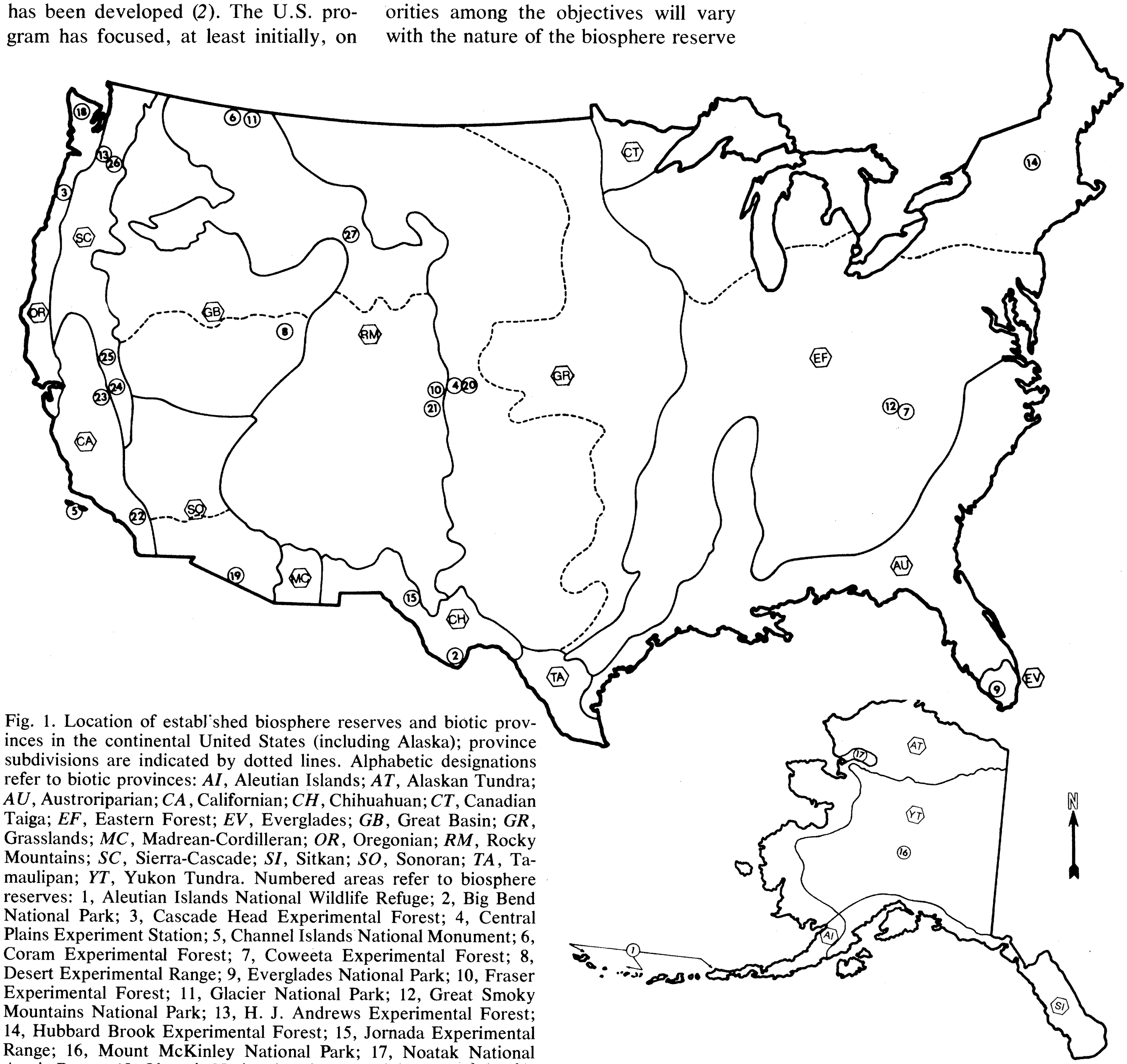

Fig. 1. Location of estabI'shed biosphere reserves and biotic provinces in the continental United States (including Alaska); province subdivisions are indicated by dotted lines. Alphabetic designations refer to biotic provinces: *AI*, Aleutian Islands; *AT*, Alaskan Tundra; *AU*, Austroriparian; *CA*, Californian; *CH*, Chihuahuan; *CT*, Canadian Taiga; *EF*, Eastern Forest; *EV*, Everglades; *GB*, Great Basin; *GR*, Grasslands; *MC*, Madrean-Cordilleran; *OR*, Oregonian; *RM*, Rocky Mountains; *SC*, Sierra-Cascade; *SI*, Sitkan; *SO*, Sonoran; *TA*, Tamaulipan; *YT*, Yukon Tundra. Numbered areas refer to biosphere reserves: 1, Aleutian Islands National Wildlife Refuge; 2, Big Bend National Park; 3, Cascade Head Experimental Forest; 4, Central Plains Experiment Station; 5, Channel Islands National Monument; 6, Coram Experimental Forest; 7, Coweeta Experimental Forest; 8, Desert Experimental Range; 9, Everglades National Park; 10, Fraser Experimental Forest; 11, Glacier National Park; 12, Great Smoky Mountains National Park; 13, H. J. Andrews Experimental Forest; 14, Hubbard Brook Experimental Forest; 15, Jornada Experimental Range; 16, Mount McKinley National Park; 17, Noatak National Arctic Range; 18, Olympic National Park; 19, Organ Pipe Cactus National Monument; 20, Pawnee National Grassland (9); 21, Rocky Mountain National Park; 22, San Dimas Experimental Forest; 23, San Joaquin Experimental Range; 24, Sequoia–Kings Canyon National Parks; 25, Stanislaus Experimental Forest; 26, Three Sisters Wilderness; 27, Yellowstone National Park.

cerning research and monitoring is a major distinguishing feature between parks and biosphere reserves. To avoid potential conflicts between conservation and research, the task force encouraged the designation of core areas with strict conservation objectives and adjacent buffer zones where destructive types of research, such as might be associated with studies of various land uses, could be carried out.

What seems clear from the expert panel and task force efforts is that a variety of kinds of areas will be accommodated as part of the biosphere reserve program, with varying degrees of naturalness and of relative emphasis on conservation and research. Ultimately, the unifying concept is a worldwide system of reserves representing all the globally significant biotic regions and unique features, each with active research and monitoring programs associated with the preservation effort, and all linked by an international understanding of purposes and standards and by frequent exchanges of personnel and information. Each country must work toward this goal in the context of its peculiar national potentialities and programs.

Initial Implementation of the Biosphere Reserve Program in the United States

The U.S. MAB Committee on Project 8 (U.S. MAB 8 Committee) weighs conservation and research equally in its deliberations on biosphere reserves. Selection of representative sites in each biotic province is, of course, an essential element; the sites should provide superlative examples of the ecosystems found in a province. Conservation of genetic resources is implicit. However, the existence of or potential for major ecological research and monitoring programs is crit-

Table 1. Established biosphere reserves in the United States and its territories. The reserves are administered by the Department of the Interior (Interior), the Bureau of Land Management (Land Management), the United States Fish and Wildlife Service (Fish and Wildlife), the National Park Service (National Park), the Forest Service (Forest), the Department of Agriculture (Agriculture), or the Agricultural Research Service (Agricultural Research). The orientation of an area is toward conservation (C), experimental research (E), or both.

Biotic province or subdivision (8)	Name and location of area	Outstanding features	Size (hectares)	Administering agency	Orientation
Alaskan Tundra	Noatak National Arctic Range, Alaska	Major arctic river basin (tundra ecosystems)	3,000,000	Interior, Land Management	C
Aleutian Islands	Aleutian Island National Wildlife Refuge, Alaska	Includes essentially all the Aleutian Island chain	1,100,000	Interior, Fish and Wildlife	CE
Austroriparian*					
Californian	Channel Islands National Monument, California	Two islands (453 hectares) and adjacent ocean; abundance of endemic biota and marine fauna	7,440	Interior, National Park	C
	San Dimas Experimental Forest, California	Typical chaparral ecosystem; history of ecological and watershed research	6,947	Agriculture, Forest	E
	San Joaquin Experimental Range, California	California Central Valley annual grassland and oak savanna; history of ecological and range management research	1,861	Agriculture, Forest	E
Chihuahuan	Big Bend National Park, Texas	Representative desert mountain and lowland ecosystems	286,600	Interior, National Park	C
	Jornada Experimental Range, New Mexico	Typical desert grasslands; history of ecological and range management research	77,000	Agriculture, Agricultural Research	E
Eastern Forest* (south)	Coweeta Experimental Forest, North Carolina	Typical southern Appalachian mixed hardwood forest; history of watershed and ecological research	2,300	Agriculture, Forest	E
	Great Smoky Mountains National Park, Tennessee and North Carolina	Appalachian mountainscape with rich biotic diversity including hardwood and spruce-fir forests; history of ecological/biogeographical research	207,500	Interior, National Park	C
Eastern Forest (northeast)	Hubbard Brook Experimental Forest, New Hampshire	Typical northern Appalachian mountain drainage of mixed hardwoods and spruce; history of ecosystem and watershed research	3,075	Agriculture, Forest	E
Eastern Forest† (north central)					
Everglades	Everglades National Park, Florida	Subtropical forest, mangrove, swamp, marshland, and near-shore marine ecosystems; rich biota; substantial ecological research including experimental manipulations	566,800	Interior, National Park	CE
Grasslands (short grass)	Central Plains Experiment Station, Colorado	Typical short-grass prairie ecosystems; history of ecological and range management research	6,280	Agriculture, Agricultural Research	E
Grasslands (true prairie)					
Great Basin* (north)					
Great Basin (south)	Desert Experimental Range, Utah	Typical salt-desert shrub (saltbush-greasewood) and juniper-pinyon pine ecosystems; history of ecological and range management research	22,513	Agriculture, Forest	E
Greater Antillean	Luquillo Experimental Forest, Puerto Rico	Tropical rain forest, montane thicket, palm and dwarf forest ecosystems; rich biota; history of ecological and silvicultural research	11,300	Agriculture, Forest	EC
Hawaiian†					

ical. The manipulative research is also linked to the educational use of reserves since these are areas in which various management practices can be tested and demonstrated.

From the earliest stage in the selection process it was obvious that some conservation and experimental reserves in the United States were outstanding candidates for biosphere reserves. This was true in a majority of the biotic provinces. This appraisal was based on (i) the significance and representativeness of their features and (ii) long histories of biotic preservation, ecological research, or both. From these candidates an initial series of 19 reserves was selected in 1974 under the impetus of a Unesco MAB conference in the United States and agreements between the United States and the U.S.S.R. on joint designation and study of biosphere reserves. Nine additional areas were established in November 1975.

The areas (Table 1) are generally of two types, experimental tracts and large conservation preserves. Experimental tracts have histories of ecological research and monitoring, which often include major manipulative research and demonstration projects (Fig. 2). Examples are the Coweeta, H. J. Andrews, Fraser, and Luquillo Experimental Forests, the Jornada Experimental Range, and the Central Plains Experiment Station. These areas typically have at least small natural areas or preserves associated with them as control sites for the experiments. The large conservation preserve typically has a relatively limited history of research and monitoring and limited options for experimental or manipulative research. The Three Sisters Wilderness is an example, as are most of the designated national parks and monuments (Fig. 3) (*6*).

It was seldom possible to identify a single area that satisfied all criteria—a large, strictly preserved tract for conservation of a full array of organisms with a substantial history of research and

Table 1 (continued)

Biotic province or subdivision (*8*)	Name and location of area	Outstanding features	Size (hectares)	Administering agency	Orientation
Lesser Antillean	Virgin Islands National Park, Virgin Islands	Tropical ecosystems including near-shore marine areas	6,130	Interior, National Park	C
Micronesian†					
Oregonian	Cascade Head Experimental Forest and Scenic Research Area, Oregon	Coastal Sitka-spruce-western hemlock forests and estuary; history of ecological and silvicultural research	7,051	Agriculture, Forest	E
	Olympic National Park, Washington	Coastal mountain system with dense coniferous forest, coastal and alpine ecosystems; abundant glaciers and large elk herds	362,850	Interior, National Park	C
Rocky Mountain (north)	Coram Experimental Forest, Montana	Typical montane mixed-conifer forests of Douglas fir, western larch, and lodgepole pine; history of ecological and silvicultural research	2,984	Agriculture, Forest	E
	Glacier National Park, Montana	Broad range of typical mountain landscapes and ecosystems from prairie margin to alpine	410,000	Interior, National Park	C
	Yellowstone National Park, Wyoming, Idaho, and Montana	Unique area with abundant thermal phenomena and larger mammals; history of ecological research	900,000	Interior, National Park	C
Rocky Mountain (south)	Fraser Experimental Forest, Colorado	Subalpine forests of subalpine fir, Engelmann spruce, and lodgepole pine and alpine tundra; history of ecological and watershed research	9,300	Agriculture, Forest	E
	Rocky Mountain National Park, Colorado	Typical montane and subalpine forest ecosystems and alpine tundra	106,160	Interior, National Park	C
Sierra-Cascade (north)	H. J. Andrews Experimental Forest, Oregon	Dense coniferous forest ecosystems of Douglas fir, western hemlock, cedars, and true firs; history of ecosystem and watershed research	6,050	Agriculture, Forest	E
	Three Sisters Wilderness, Oregon	Dense montane and subalpine forests of Douglas fir, hemlocks, and true firs, alpine ecosystems, and recent volcanic formations	80,900	Agriculture, Forest	C
Sierra-Cascade (south)	Sequoia–Kings Canyon National Parks, California	Representative Sierran mixed-conifer forests (sugar pine, incense-cedar, true firs); subalpine and alpine ecosystems	342,754	Interior, National Park	C
	Stanislaus Experimental Forest, California	Representative Sierran mixed-conifer forests; history of ecological and silvicultural research	683	Agriculture, Forest	E
Sitkan†					
Sonoran (typical)	Organ Pipe Cactus National Monument, Arizona	Desert ecosystems including rich diversity of cacti	134,000	Interior, National Park	C
Sonoran (Mojave)†					
Yukon Taiga	Mt. McKinley National Park, Alaska	Representative tundra and taiga ecosystems including large ungulate and predator components	784,900	Interior, National Park	C

*The Savannah River (*SC* in Fig. 1), Oak Ridge (*TE*), and Arid Lands Ecology (*WA*) Reservations of the Energy Research and Development Administration (ERDA) have been proposed for sites in the Austroriparian, Eastern Forest (south) and Great Basin (north) Biotic Provinces, respectively. Thus far, ERDA has not designated any portions of these sites as biosphere reserves because of concerns over agency prerogatives. †Good candidates for biosphere reserves have been identified, but a final selection has not been made.

monitoring and potential for major experimental treatments. [The only area that is clearly of this type is the Arid Lands Ecology Reserve, at Hanford, Washington, which is controlled by the Energy Research and Development Administration (ERDA) (7).] Because of this difficulty, the U.S. Committee on Biosphere Reserves developed the concept of multiple reserves whereby experimentally oriented tracts are matched with large preserves similar in biologic and environmental features. Together they provide a single conceptual biosphere reserve for a biotic province. For example, in the northern half of the Sierra Cascade Biotic Province (Table 1), the H. J. Andrews Experimental Forest is linked to the nearby Three Sisters Wilderness to provide a "complete" biosphere reserve for this province. Coweeta Experimental Forest, Great Smoky Mountains National Park, and, if designated, the Oak Ridge Reservation of ERDA will function as a single conceptual reserve for the southeastern subdivision of Eastern Forest Biotic Province.

In many biotic provinces and subdivisions, appropriate sets of biosphere reserves have been selected (Table 1). Twenty-eight areas have been established, and additional sites have been nominated and await agency designation. Some gaps remain, for example, in the Grasslands and Sonoran Provinces and in the north-central subdivision of the Eastern Forest Province. Selection of candidates to fill these needs or to augment existing biosphere reserves in other provinces will proceed much more slowly as a continuing activity of the U.S. MAB 8 Committee.

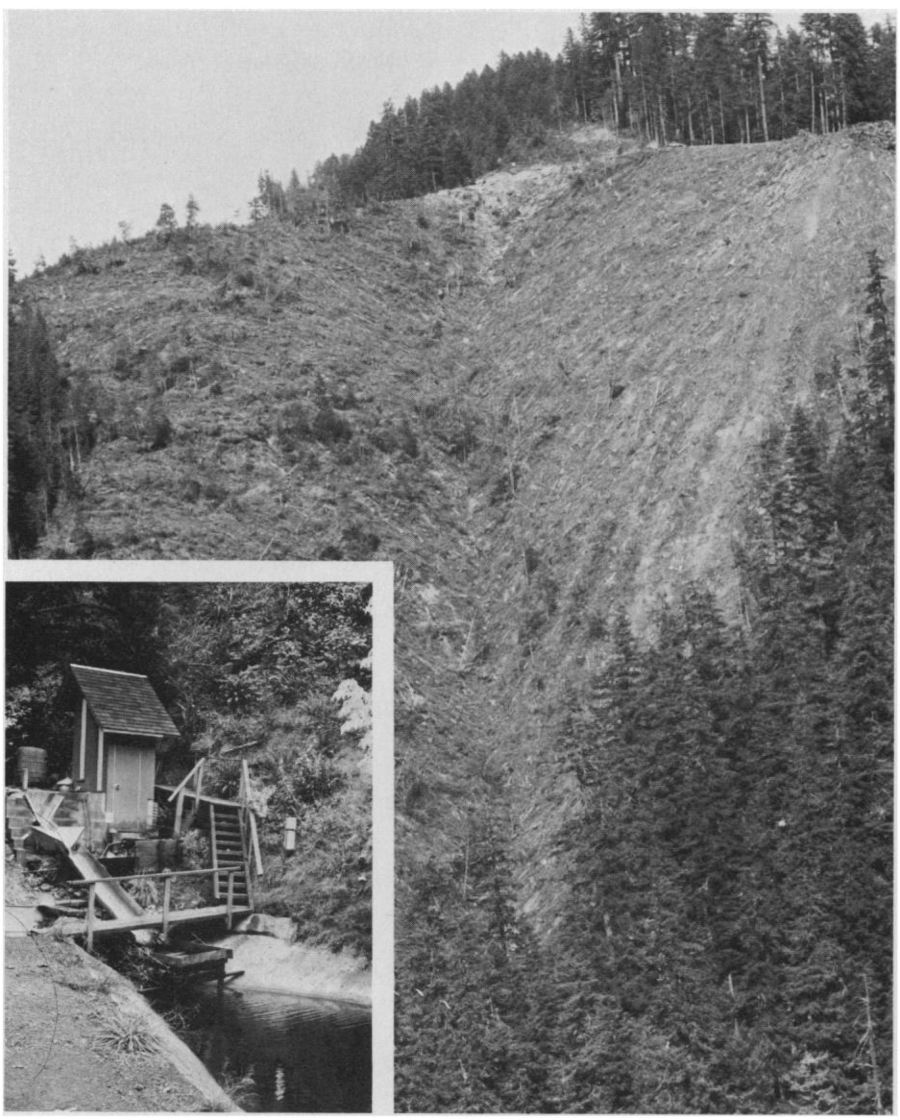

Fig. 2. Experimentally oriented biosphere reserves are tracts that, in addition to providing outstanding representations of a biotic province, have long histories of ecological research and monitoring. Major manipulative research projects, such as this study of the effects of logging at H. J. Andrews Experimental Forest in Oregon, are typical.

Use and Management of Biosphere Reserves

The Unesco task force has specified several kinds of desired research and monitoring activities (2). (i) Long-term baseline studies of environmental and biologic features (relating to the community, flora, or fauna), which are essential as bases for management of the area and for other research projects; (ii) research designed to assist in determining management policies for the reserve; (iii) experimental or manipulative studies (outside the strictly preserved areas) particularly of the ecological effects of human activities; (iv) environmental monitoring, including use as part of the Global Environmental Monitoring System; and (v) study sites for the various MAB research projects.

The relative emphasis on different research and monitoring activities will obviously vary with the nature of the reserve, with the opportunity to continue existing research, and with the availability of new sources of funds.

The U.S. MAB 8 Committee subscribes to these views on the potential use of the reserves for research and monitoring. Agencies and institutions supporting research programs on biosphere reserves are expected at least to continue and, it is to be hoped, to expand their support. In many cases, the U.S. reserves are already major ecological research centers in their respective provinces. The most difficult tasks will be (i) obtaining the necessary funding for baseline surveys, studies, and monitoring; and (ii) persuading ecologically oriented scientists to use these sites more extensively. The developing support of field research facilities by the National Science Foundation should be of major assistance; all of the experimentally oriented biosphere reserves are clearly of national significance, and most are recognized centers for applied and basic environmental research.

The U.S.–U.S.S.R. biosphere reserve project under the bilateral Environmental Agreement is adding further impetus to plans for utilizing the reserves. The lead agencies for this project in the U.S.S.R. are the Academy of Sciences and the Hydrometeorological Service. At the first meeting of the bilateral project in New York in October 1975, it was apparent that the U.S.S.R. is emphasizing ecological research and environmental monitoring in selecting their biosphere reserves and planning for their use. High priority in the U.S.–U.S.S.R. project is placed on (i) monitoring and research aimed at understanding the structure and function of ecosystems and their components; (ii) environmental consequences of various land management practices; and (iii) ensuring the effectiveness of biological reserves in maintaining biotic diversity and gene pools by considering size, habitat heterogeneity, and external influences. The U.S.S.R. Hydrometeorological Service is particularly interested in developing comparable environmental monitoring programs for various pollutants. Utilizing biosphere reserves for such activities was explored at a joint symposium in Moscow in May 1976, a meeting which laid the groundwork for some concrete collaborative efforts.

Designating areas as biosphere reserves in the United States is not expected to require major alterations in existing objectives and management. All existing reserves are federally owned and already dedicated to biotic preservation, ecological and environmental research, or, typically, both. The relative emphasis on preservation or experimental research will vary with the area; preservation of biota remains the keystone in national park reserves, for example, as experimental research does in the experimental forests designated as reserves. Indeed, it was the need for both types of activities in a biotic province that led the U.S. MAB group to develop the concept of matched areas.

It may become necessary to alter attitudes about and plans for the areas as those responsible for their management recognize that they are resources of worldwide as well as national or agency significance. Controlling agencies must thus be responsive to the needs of a much larger community in managing these areas than has hitherto been the case.

Some actions are required soon. Management plans for each of the biosphere reserves are important even if they only supplement comprehensive existing plans. These should particularly address the long-term objectives in biotic preservation, research and its support, monitoring and education, and the identification of major problems requiring managerial action or research. Emphasis should be on expanding scientific efforts in reserves with relatively small existing research programs. Emphasis in reserves with strong programs in research and experimentation should include adequate provision for strictly reserved natural areas for experimental controls and biotic preservation.

Fig. 3. Some established preserves which are outstanding representations of the biota of a region, such as Great Smoky Mountains National Park pictured here, have been established as biosphere reserves. These are designed to provide the large control area for experimental tracts with which they are matched and to serve as sites for the conservation of biotic diversity.

An outstanding need is for interagency development of plans for linked reserves (such as between an experimental forest and a national park or wilderness) to see that they are managed and used as unitary biosphere reserves and not as isolated tracts. This cooperative development is critical if the biosphere reserve program is ever to realize its full potential, since rarely will a single tract be able to adequately fulfill all functions—preservation, research, and education—because of existing legal mandates and charters. The linked reserves allow different and appropriate functional emphasis and objectives in different reserves within a biotic province.

The U.S. MAB 8 Committee is developing regional working groups to encourage the development of collaborative programs of this type and to stimulate the development of research and monitoring programs. Participants in these regional groups will include not only agency administrators and scientists from the biosphere reserves but also academic scientists who do or could use the sites. Regional working groups will also be represented on the national committee.

Summary

The objective of the biosphere reserve program is to identify and protect representative and unique segments of the world's biotic provinces as major centers for biotic and genetic preservation, ecological and environmental research, education, and demonstration. It is intended to be more than simply another program of preservation layered onto existing parks and reserves. The success of the program will depend in large measure on the overall significance of the selected reserves and the degree to which they are active sites for scientific research and monitoring.

References and Notes

1. *Conservation of Natural Areas and of the Genetic Material They Contain* (Unesco MAB Report Series, No. 12, Paris, 1973), p. 64.
2. *Task Force on: Criteria and Guidelines for the Choice and Establishment of Biosphere Reserves* (Unesco MAB Report Series, No. 22, Paris, 1974).
3. U.S. National Committee is also interested in unique and in man-modified areas, such as degraded areas with potential for conservation of genetic diversity and for experimental research on reclamation and recovery.
4. R. F. Dasmann, *Int. Union Conserv. Nat. Occas. Pap. No. 7* (1973); International Union for Conservation of Nature and Natural Resources (Secretariat), *ibid., No. 9* (1974).
5. M. D. F. Udvardy, *Int. Union Conserv. Nat. Occas. Pap. No. 18* (1975).
6. The possibilities for manipulative research in national parks are not as limited as one might suppose, as anyone familiar with the research on fire ecology at Everglades and Sequoia–Kings Canyon national parks can attest. Nevertheless, opportunities for studying the ecological effects of many land use practices, such as in agriculture and forestry, are limited.
7. Several ERDA tracts have been identified by the U.S. MAB 8 Committee as outstanding candidates for biosphere reserves: Arid Lands Ecology Reserve (Washington), Oak Ridge Reservation (Tennessee), and the Savannah River Reservation (South Carolina). Although ERDA has been asked to nominate these reservations or portions of them as biosphere reserves, it has not done so.
8. Biotic provinces are as defined by Udvardy (*5*) with additional subdivisions by the U.S. MAB 8 Committee.
9. Since the preparation of this article, it has been learned that Pawnee National Grassland will not become a biosphere reserve.