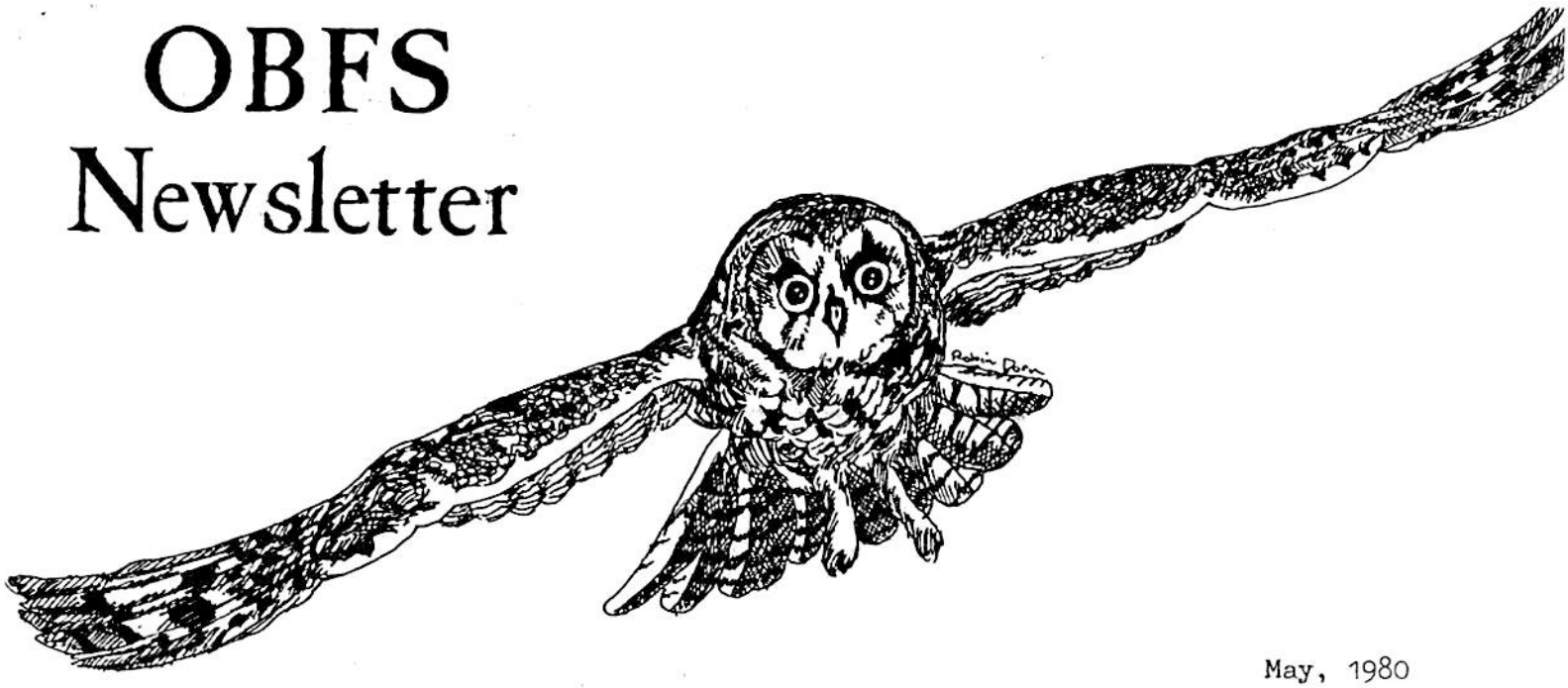
Organization of Biological Field Stations

Newsletter
No. 30
May 1980

OBFS Newsletter



May, 1980
Number 30

SUMMERTIME!!

Now that classes and finals are over for the Spring semester, it is time to open the field station for the summer and send out the newsletter for Spring. This newsletter contains the following items:

A. Results from the January election.

B. Tentative schedule for Annual OBFS meetings for 5 years, and for the September meeting at Portal, Arizona.

C. A summary of a meeting with the Director of Environmental Biology and Director of Environmental Education.

D. Results from the January questionaire.

E. New member stations.

F. Changes in directorship of standing members.

H. Description of the Biological Research Resources, NSF.

A. Election Returns

Officers elected:

President: Robert C. Dalgleish
Vice-President: Richard T. Hartman
Secretary-Treasurer: Richard W. Coles

Revision of Constitution and By-laws:
Passed but barely made the necessary 2/3 majority.

B. Annual Meetings

1. The schedule until 1984 was approved by 26 members. Only 3 members suggested a change. The schedule approved was the following:

1980- Southwestern Research Station; Portal, Arizona
1981- The Huyck Preserve; Rensselaerville, New York
1982- Douglas Lake Station; Michigan
1983- Kananaskis Science Center; Calgary, Alberta
1984- Mountain Research Station; Colorado

2. Tentative Schedule--1980 Annual Meeting at Southwestern Research Station (SWRS), Portal, Arizona, on September 25 - 28.

Thursday evening, September 25:
Arrive in Tucson and meet at the Spanish Trial Inn.
(More information about lodging later)

Friday, September 26:
AM: Tour of Arizona Sonora Desert Museum
1 PM: Leave for SWRS by caravan via Chiricahua National Monument
Evening: Cocktail hour.
Talk and slide show on SWRS

Saturaday, September 27
Day: Meetings, including the business meeting
Other program topics: Contact President Dalgleish with ideas. Some suggestions from Vince Roth include costs of station operations, ways to reduce costs, and future of field stations.
Evening: Slideshow on Trogon or more meeting time.

Sunday, September 28
AM: Leave for Tucson via Douglas, Agua Prieta, Bisbee

Arrive Tucson Airport at approximately 3 PM.

Costs: Room and Board at SWRS, $30.00
Transportation: Depends on the number of people in rental cars.
Late arrivals could take a bus to Lordsburg and be met late Friday night.

More information about the meeting and the Southwestern Research Station will be sent to you in late July or early August.

C. President Dalgleish made the following report after a November trip to Washington, D. C. when he and Dick Hartman and Dick Coles had the following meetings:

Richard Hartman, Dick Coles and me, met with Dr. Frank Golley, Director of Environmental Biology and Dr. James T. Callahan, Acting Director, Biological Research Resources Program, the National Science Foundation, on Thursday, November 29th. It was a very cordial and informative meeting of about two hours. The purpose of the meeting was to improve communication between N.S.F. and OBFS, to identify the interests of N.S.F. in the programs at existing biological stations , and their (N.S.F. staff) perception of the role of existing biological stations within the array of field research facilities proposed under the Biosphere Research Reserves, Federal Research Ecological Areas, Experimental Ecological Reserves and I.B.P. sites. We also wanted N.S.F. to identify where OBFS could be of assistance in identifying programs or issues of vital interest to our members which were in need of support or endorsement from OBFS. Enclosed is a copy of the last report of the Biological Research Resources Program, Division of Environmental Biology. The enclosed program announcement for a new program in Long-term Research in Environmental Biology should be included in the Newsletter.

Attached newsletter.

See November 79 issue

C. Dalgleish report continued:

After our meeting with staff at N.S.F., we met with Mr. Walter Bogen, Director, Environmental Education, Department of Education. This office is presently without a budget for the fiscal year 1981, and it is uncertain where it will be placed in the Department of Education, once the department structure settles down. On the question of what constitutes "Environmental Education", Bogen was inclined to be comfortable with any definition. "It depends with whom you are dealing, for some see it (environmental) in a scientific context, others see it in a social context." Inquiry as to what could be the role of biological stations in environmental education was answered both from a positive view and negative. Teacher training was an obvious and fairly well established role, but one that should be greatly expanded. Additional field centers did not appear to be compatible with the other uses of existing field stations, i.e. bringing classes of school students to field stations without providing instruction, supervision and especially unless the station director provided training prior to the trip for the teachers, were not attractive opportunities for teachers, students or station directors. Neither was funding available for such activities. I think I have a couple of double negatives above, in short; provide additional courses for teacher training in "Environmental Education", do not go out of your way to encourage school trips.

D. Questionaire Results

The following information comes from answers to the January questionaire. Some questions were phrased improperly so that no consensus could be made of the wide range of answers. The others were consolidated to the following information. The raw data is available for any who would like to rework the analysis.

1. Costs for Lodging and Food

a. Lodging costs for visitors

$/day	winter	summer
1-2	7*	11
3-4	7	8
>4	2	6
0	0	3
Not Available	10	3

b. Food costs

$/day	summer
<5	3*
5-7	4
7-8	9
>8	1
Not Available	11

*The number of stations that fit this category.

c. Tuition costs for students

$/semester unit	Instate	Out-of-state
25-50	16*	8
51-75	3	9
76-100	1	1
>100	1	3

Stations that have equal tuition for both= 10.
*The number of stations in this category.

d. Student Room and Board Costs

$/week	
35-40	2*
41-50	8
51-60	4
61-75	3
76-100	2

D. Questionaire Results Continued.

2. Number of Researchers and Staff

a. Researchers -- Mature Investigators (MI), graduate students (GS), assistants (A)

#	Winter MI	Winter GS	Winter A	Summer MI	Summer GS	Summer A
0	1*	3	3	1	1	3
1-4	5	2	4	13	10	11
5-8	1	1	1	9	6	4
>8	1	1	0	5	10	7

*The number of stations in this category.

b. Support staff

1.) Kitchen Staff

#	winter	summer
0	23*	12
1-5	7	16
6-10	1	1
>10	0	2

Mean ratio of kitchen staff to number served = 0.16, N = 19, S.D. = 0.15 range = 0.02 - 0.33

* As above.

2.) Other staff

#	winter	summer
0	5*	1
1-5	19	17
6-15	5	8
16-50	1	3
>50	1	1

Mean ratio of support staff to number at station = 0.19, N = 21, S.D. = 0.18 range = 0.02 - 0.7

3. Course Structure -- Summer only

a. Number of faculty

#faculty	#stations
1-5	11
6-10	6
11-15	3
>15	4

b. Number of courses

#courses	#stations
1-5	10
6-10	7
11-15	4
>15	3

c. Course Length

#weeks	#stations
1-2	6
3-4	12
5-6	4
>6	5

d. Course size

Number of students

1-10	9 stations report this as average, 1 station as maximum number.
11-15	9 stations report this as average, 14 as maximum.
>15	6 stations report this as average, 9 as maximum.

e. Number of students in 1978 and 1979 summer.

# students	1978	1979
10-20	5*	4
21-30	4	2
31-50	3	3
51-70	2	2
71-100	5	3
100-150	1	3
150	2	1

Mean # students 1978 = 64.8 1979 = 60

#stations showing enrollment decrease in 1979 = 10 (N = 23)

* Number of stations in this category

E. We welcome three new members.

1. Dr. Richard H. Podolsky
   Stockton State College
   Pomona, N. J. 08240

2. Dr. Peter F. Buissard, Director
   Rocky Mountain Biological Laboratory
   Langmuir Laboratory
   Cornell University
   Ithaca, N.Y.

3. Dr. Williard W. Payne
   The Carey Arboretum
   Box AB
   Millbrook, N.Y. 12545

F. Changes in Directorship

1. Black Hills Natural Science Field Station, South Dakota

   James E. Martin replaces Sven Froiland

2. Cedar Point Biological Station, Nebraska

   John Janovy replaces Brent B. Nickol

G. The attached sheets are the report of the Biological Resourses Program that President Dalgleish sent from Washington, D.C.

NATIONAL SCIENCE FOUNDATION
Washington, D. C. 20550

DIRECTORATE FOR BIOLOGICAL, BEHAVIORAL AND SOCIAL SCIENCES

Division of Environmental Biology

The objective of the Division of Environmental Biology is to advance knowledge of the attributes and interrelations of organisms as they exist in their natural environment. Taken as a whole, this encompasses the subdisciplines of systematics, population biology and physiological ecology, ecology, and ecosystem studies. In addition to the proposals for project support, programs in these subdisciplines consider proposals for specialized research equipment, doctoral dissertation research (not including stipends), and research conferences and workshops that relate to the described areas. Another program consolidates support for biological research resources by providing support for several kinds of research facilities.

SYSTEMATIC BIOLOGY PROGRAM

The Systematic Biology Program supports basic research on the affinities, adaptations, and evolutionary histories of all groups of the earth's biota. The dominant research emphasis is evolutionary, involving such interrelated subdisciplines as comparative morphology-physiology, chemical and numerical systematics, biogeography, floristics, faunistics, and elements of paleobiology except studies that deal with man, or that are primarily ecological or stratigraphic in approach.

POPULATION BIOLOGY AND PHYSIOLOGICAL ECOLOGY PROGRAM

The Population Biology and Physiological Ecology Program provides support for studies of evolutionary, ecological, behavioral and population genetics, plant and animal demography, and evolutionary, behavioral and physiological ecology. Support is provided for research utilizing theoretical, experimental, laboratory and field approaches to the analysis of populations. The focus is on the understanding of populations of single species with regard to genetic relationships, population dynamics, and physiological adaptation to specific environments.

ECOLOGY PROGRAM

The Ecology Program provides support for basic ecological research on relationships within communities of animals and plants in terrestrial and inland water habitats. This includes studies of interspecific competition, predator-prey relationships, and symbiosis between species, as well as studies of the sets of species that make up communities. The program supports, for example, research on the co-evolution of animals and plants, and on microbial ecology. It also supports paleoecology, the study of animal and plant distribution in the past.

ECOSYSTEM STUDIES PROGRAM

The Ecosystem Studies Program supports mainly multidisciplinary studies of the structure and function of complex biotic-abiotic associations. Processes and mechanisms comprise a major research focus as in the study of energy and nutrient transfer through ecosystems. Landscape scale experiments leading to a better understanding of the spatial and temporal relations within and among ecosystems can be supported. The development of new elements and syntheses of ecological theory is emphasized, and mathematical modeling of ecosystems for analysis and simulation is encouraged.

BIOLOGICAL RESEARCH RESOURCES PROGRAM

The Biological Research Resources Program provides support for the operation of research resources in the biological sciences that are considered essential at the national level. Included are living organism stock centers of known genetic characteristics, biological field research facilities, and systematic research collections.

Division of Environmental Biology

Division Director:	Frank B. Golley	202/632-7318
Deputy Director:	John L. Brooks	202/632-7318
Systematic Biology Program		
Director:	John H. Beaman	202/632-5846
Associate Director:	W. Wayne Moss	202/632-5846
Population Biology and Physiological Ecology Program		
Associate Director:	Donald W. Kaufman	202/632-7317
Ecology Program Director	David W. Johnston	202/632-7324
Ecosystem Studies Program		
Director:	Melvin I. Dyer	202/632-5854
Associate Director:	James T. Callahan	202/632-5854
Biological Research Resources Acting Associate Program		
Director:	James T. Callahan	202/634-4135

Inquiries may be addressed to the program staff listed above. Formal proposals should be submitted to the Central Processing Section, National Science Foundation, Washington, D.C. 20550, following instructions in "Grants for Scientific Research." In addition to ad hoc review provided by mail reviewers, proposals for project support are evaluated by advisory subcommittees that meet three times a year (usually October, January, April-May). Applicants should allow 6-9 months for the review process and should submit proposals at least two months before the appropriate subcommittee meeting. Target dates for receipt of proposals are published in the NSF Bulletin.

DISSERTATION RESEARCH

The Division of Environmental Biology awards small grants to improve the overall quality of doctoral dissertation research. Allowable budget items on these competitive awards include travel to research sites, specialized research equipment not otherwise available, and space rental at research facilities. Funds may not be used for student stipends, tuition, or dependents of students. For further information call or write Mr. Mark Courtney, Program Coordinator, or the pertinent Program Officer.

BIOLOGICAL RESEARCH RESOURCES

Mr. William E. Sievers

The Biological Research Resources Program is designed to ensure an orderly continuum of support for major scientific tools and facilities that are of crucial importance to research in biology. Such resources are expensive to maintain and cannot be expected to be the sole financial responsibility of the organization immediately responsible for their administration. Of immediate concern are systematic research collections, living-organism stock centers, controlled environmental facilities, and field research facilities. It should be stressed that our responsibility transcends the boundaries of the Division of Environmental Biology. This is evident from our support of genetic stock centers and the marine facility at the University of Washington. Although Program funds are directed towards a few major resource centers, their service to scientists in every state of the Union and many countries abroad remains outstanding.

We continue to work closely with scientific societies to identify and meet the research needs of biologists by pursuing plans for the development, management, and utilization of biological research resources of national importance. It is only through this mechanism that the Program can remain highly responsive to the trends of research in biology. Examples of this relationship are the studies, completed or in process, concerning systematic resources (Figure 58).

BIOLOGICAL RESEARCH RESOURCES PROGRAM

STUDIES-EVALUATION OF SYSTEMATIC RESOURCES*

	STATUS
AMERICAN SOCIETY OF MICROBIOLOGY	
THE PALEONTOLOGICAL SOCIETY	COMPLETED
ENTOMOLOGICAL SOCIETY OF AMERICA	COMPLETED
AMERICAN SOCIETY OF MAMMALOGISTS	COMPLETED
THE AMERICAN ORNITHOLOGISTS UNION	
AMERICAN SOCIETY OF ICHTHYOLOGISTS AND HERPETOLOGISTS	COMPLETED
SOCIETY OF VERTEBRATE PALEONTOLOGY	COMPLETED
AMERICAN SOCIETY OF ZOOLOGISTS	
AMERICAN SOCIETY OF PLANT TAXONOMISTS	PHASE I COMPLETED
AMERICAN SOCIETY OF ICHTHYOLOGISTS AND HERPETOLOGISTS HERPETOLOGISTS' LEAGUE SOCIETY FOR THE STUDY OF AMPHIBIANS AND REPTILES	COMPLETED

Fig. 58

Figure 59 shows our past commitments to systematic research collections. This represents the support of 43 collections at 15 different institutions. An area of future concern is the application of electronic data processing to collection management. There appears to be a consensus that it will be only through electronic data-handling systems that any progress will be made in controlling the quality and quantity of data provided by natural history collections.

BIOLOGICAL RESEARCH RESOURCES PROGRAM

AWARDS-MUSEUM AND HERBARIUM SUPPORT*

(THOUSANDS OF DOLLARS)

INSTITUTIONS	FY 72-77
HARVARD UNIVERSITY	1,918.3
AMERICAN MUSEUM OF NATURAL HISTORY	1,789.8
CALIFORNIA ACADEMY OF SCIENCES	1,193.2
FIELD MUSEUM OF NATURAL HISTORY	1,089.3
UNIVERSITY OF MICHIGAN	921.7
ACADEMY OF NATURAL SCIENCES, PA.	884.7
MISSOURI BOTANICAL GARDEN	836.0
NEW YORK BOTANICAL GARDEN	704.6
LOS ANGELES COUNTY MUSEUM OF NATURAL HISTORY	701.1
UNIVERSITY OF CALIFORNIA, BERKELEY	650.3
CARNEGIE MUSEUM OF NATURAL HISTORY	243.7
BERNICE P. BISHOP MUSEUM	226.6
NEW YORK STATE MUSEUM	143.6
LOUISIANA STATE UNIVERSITY	47.6
FLORIDA STATE MUSEUM	23.5
TOTAL	11,296.0

SOURCE: PROGRAM RECORDS

Fig. 59

Research programs related to collections increasingly are oriented toward specific questions that frequently require material other than that typically associated with conventional museum specimens. New materials, including karyotypes, fluid-preserved specimens, allozyme profiles, and information on populations in nature, will become as important to the future users of systematic collections as the traditional materials have been in the past. Where there is interest and expertise, we have encouraged museums to move in this direction. An example of our effort is the establishment of the "Tissue Museum" at the University of California, Berkeley in connection with their mammal collection.

The primary emphasis in living-organism stock centers (Figure 60) continues to be genetic stocks. Considering the work function of genetic stock centers, their great usefulness in facilitating and improving research may consist of providing authentic samples of strains along with complete and accurate information on their properties and history, introducing uniform and refined nomenclature in their particular subfield, moving genetic markers into standard strains of

BIOLOGICAL RESEARCH RESOURCES PROGRAM

CONTINUING COMMITMENTS LIVING-ORGANISMS STOCK CENTERS*

(THOUSANDS OF DOLLARS)

	FY 77	FY 78-80
BACTERIA		
AMERICAN TYPE CULTURE COLLECTION	57.1	188.1
YALE UNIVERSITY	77.2	154.4
PARAMECIUM		
AMERICAN TYPE CULTURE COLLECTION	40.0	41.3
ALGAE		
UNIVERSITY OF TEXAS	47.0	103.9
FUNGI		
AMERICAN TYPE CULTURE COLLECTION	49.2	154.4
UNIVERSITY OF CALIFORNIA, BERKELEY	32.4	
HUMBOLDT STATE UNIVERSITY, ARCATA	44.4	199.2
MAIZE		
UNIVERSITY OF ILLINOIS	94.3	
TOMATO		
UNIVERSITY OF CALIFORNIA, DAVIS	31.0	32.6
DROSOPHILA		
BOWLING GREEN STATE UNIVERSITY	34.9	199.9
CALIFORNIA INSTITUTE OF TECHNOLOGY	34.0	104.0
ASCOBOLUS		
INDIANA UNIVERSITY	21.0	225.0
MOUSE		
JACKSON LABORATORY	94.4	298.7
TOTAL	646.5	1,547.5

Fig. 60

known background, assembling or constructing strains that are particularly useful for genetic analysis, and serving as a center for coordinating information. The Program continues to work closely with the Committee on Maintenance of Genetic Stocks of the Genetics Society of America and the Committee on Germplasm Resources of the National Academy of Sciences.

Controlled environmental facilities may be defined as laboratories designed primarily for studying the response of plants or animals to their environment. They are organized in such a way that many combinations of environmental factors can be studied simultaneously. Considerable investment has been made by the Foundation in the construction and operational support of the Phytotrons at Duke University and North Carolina State University and the Biotron at the University of Wisconsin. Although they were built as regional or national facilities, they have not lived up to this expectation. The situation is further complicated because they are under-utilized and very few researchers supported by NSF take advantage of these unique resources. As the result, we have phased out support of all but the Phytotron at Duke, which is presently in a phase-down situation. However, our position in respect to Duke is not irreversible depending upon the progress made in the coming year.

The support of field research facilities was a new area of emphasis this fiscal year (Figure 61). In the initial phase, support was directed primarily to those sites where there was a strong ongoing research activity rather than to the development of sites where research might take place. Two major types of field facilities exist. One is the traditional "field station" where the research is not programmed, in the sense of emphasis on restricted scientific areas or problems, but arises from the interests of individual investigators whose topics, collectively, may span the biological sciences. The other type, of crucial importance, provides long-term availability of field sites for ecological research. Provision of facilities of the latter type has presented a problem of considerable magnitude to the scientific community and the Division of Environmental Biology. A recently completed

BIOLOGICAL RESEARCH RESOURCES PROGRAM

AWARDS - FIELD RESEARCH FACILITIES*

(THOUSANDS OF DOLLARS)

	FY 77	FY 78-79
ORGANIZATION FOR TROPICAL STUDIES	299.2	--
UNIVERSITY OF MICHIGAN BIOLOGICAL STATION	63.2	--
IOWA LAKESIDE LABORATORY	45.0	--
H. J. ANDREWS EXPERIMENTAL FOREST	95.0	251.3
LAKE ITASCA FORESTRY AND BIOLOGICAL STATION	22.2	--
FRIDAY HARBOR LABORATORIES	361.4	--
TOTAL	886.0	251.3

SCIENCE PROGRAM RECORDS

Fig. 61

study by the Institute of Ecology with support from the National Science Foundation evaluates the need and feasibility of establishing a network of field resources for experimental ecological research (Figure 62). Large research sites representative of major ecosystems and designated for manipulative research are defined as Experimental Ecological Reserves (EER). They complement Research Natural Areas (RNAs) in the research reserves system. RNAs are primarily intended for observational research and can serve as control sites for the long-term, manipulative experimentation provided for at an EER. The concept of a national system of field research sites is predicated on the fact that man is an integral part of his environment. Assessment of the consequences of human activities on the future well-being of society and the environment will require a concerted effort to understand our natural and managed ecosystems to which we are intricately and inescapedly connected. The existence of a comprehensive array of experimental sites, each representative of the regional environment and offering the opportunity for manipulative research, could contribute to development of the experimental data base and theory necessary for effective management of the Nation's natural resources.

Fig. 62

It is impossible for the scientific community, today, to correctly anticipate all the ecological information that will be needed 25 or 50 years hence. Yet, sites available for certain types of ecological research presently are limited and daily are being further jeopardized by consumptive land uses. To answer questions regarding the ecological consequences of resource utilization and management strategies, sites must contain adequate natural or control areas, and the sites must be of sufficient size to permit manipulative types of research. The scientific community has recognized that a whole new staging platform is necessary for broad-scale, comparative biological experiments. To examine these complex biological problems, adequate research sites and facilities must be available.

The approach to the problem of defining the feasibility of a comprehensive network of sites for experimental ecological research had to be, of necessity, original in concept and implementation. No common reservoir of data or recognizable focus of expertise regarding field research facilities existed. Further, the spectrum of interests concerned with ecological research includes Federal, state, and local agencies, colleges and universities, and private instituiions and organizations. The ownership of the resource base for the proposed network is equally broad and diverse. With consideration of these factors, the study was pursued through coordination of inputs from a broadly based, interdisciplinary group of scientists who (1) adopted a classification scheme to ensure that all major ecosystems were covered and considered; (2) inventoried the existing sites in the United States, Puerto Rico, and the Virgin Islands; (3) developed criteria for Experimental Ecological Reserves; and (4) evaluated inventoried sites both in terms of coverage of the classification system and quality of the sites when compared to the criteria.

The proposed initial network of Experimental Ecological Reserves includes 71 of the 171 sites inventoried. These sites are at 67 locations (Figure 63). Five of the sites have been grouped into three "composite" sites. The sites are located in 28 states, including Alaska, in addition to Puerto Rico and the Virgin Islands. Their distribution results from land use, population, and related societal pressures that historically have influenced the location of forests, parks, preserves, and research areas. The sites represent, in part, the relatively large and unencumbered tracts of land that have been dedicated for ecological research. In most instances, these lands have a biological diversity and a degree of physical control that have fostered an interest on the part of the scientific community. Areas not well represented, such as the South Central and North Central regions, have been influenced strongly by agriculture, grazing, forestry, or other resource management practices that have tended to reduce or eliminate all but isolated remnants or preserves of the natural ecosystem.

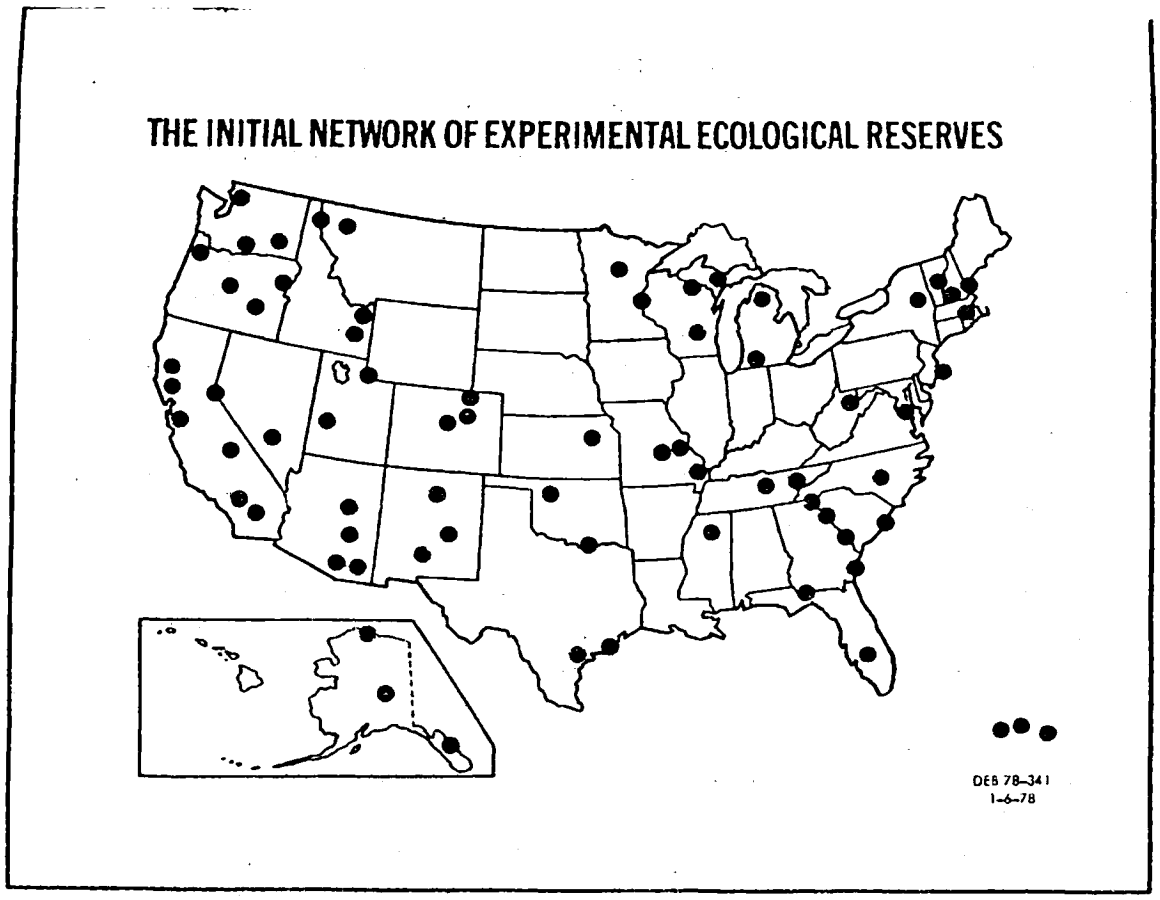


Fig. 63

The financial resources required to establish and operate a comprehensive system of field research sites for experimental ecological investigations are modest for a network of this scale and potential value. Over 70 percent of the required landscape is already under the control and management of Government agencies or academic and private institutions. One-third of the sites have highly developed physical plants, including well-equipped research laboratories and supporting facilities and scientific and technical personnel of excellent caliber. The physical plant and research support base that already exists at EER sites represent an investment of several hundred million dollars. Facilities for support of field research and related capital improvements necessary to bring each of the 67 EER sites to an optimal operation level would require $17 million (estimate based on 1975 costs). An additional $5.1 million would be required for operational support. Although this Program feels that the National Science Foundation should have a role in the development of the proposed network, it is our position that a network of this kind should be developed over a period of time. Initial support should be channeled to those sites that can demonstrate a strong ecological research program.

The EER Study focused primarily on terrestrial ecosystems. While classifications were developed for freshwater, coastal marine, and cultural ecosystems, these large and

important environments could not be effectively included in the scope of the EER project. Hence, emphasis should be placed on these aquatic ecosystems, as well as agricultural, silvicultural, and grazing lands when adding sites to the initial network. Decisions probably will be strongly influenced by particular needs to assess impacts from changing land uses and the availability of sites.

It is axiomatic that the development of such a national network must encompass the need for long-term ecological monitoring, which is so important for the detection of both trends in, and variance of, critical ecological parameters. Such measurements are essential because many ecological processes are so slow that only a long-term investigation can shed any real light on the functioning of an ecosystem. This need has been reemphasized by the report of the Conference on Long-Term Ecological Measurements recently held at Woods Hole (Figure 64).

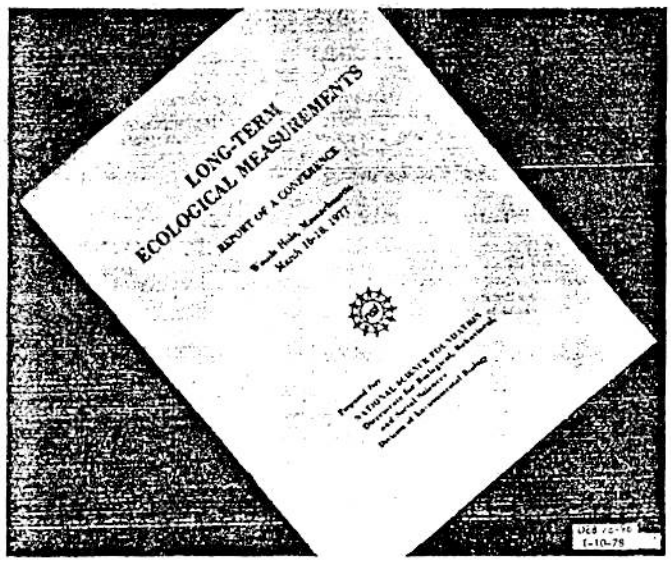


Fig. 64

It was the recommendation of this Conference that the following steps be taken to promote long-term ecological measurements.

1. Pilot projects should be established to conduct long-term ecological measurements under the auspices of the National Science Foundation.

2. An ad hoc committee of ecologists should be established by NSF to develop the initial pilot projects. This committee would deal with the selection of sites, storage and retrieval of the data, integration of activities among pilot sites, standardization and calibration of measurements, manpower requirements and availability, and coordination with Federal agencies involved in data acquisition.

3. The establishment by the Ecological Society of America of a Standing Committee on Long-Term Ecological Measurements.

4. The establishment, at a periodic interval, of ad hoc review committees to make site visits, to review a program, to determine what measurements should be added or omitted, what measurement frequencies should be increased or decreased, and whether the program should continue.

A second workshop recently convened considered the design of a long-term ecological measurements program based on these recommendations. The recommendations of this conference when available should make an invaluable contribution to future courses of action in this area.

ISSUES

Dr. John L. Brooks

Two aspects of the Division's many activities discussed above are matters of great concern to the entire Division--tropical biology and long-term research.

Tropical biology becomes an issue because of the immediacy of the need to know more about humid tropical forests. As noted above, knowledge of tropical biology is necessary to complete our understanding of the systematics and evolution of the world's biota. It is also necessary to place in perspective our current understanding of ecological interactions derived principally from study of temperate-zone systems. In addition, only such knowledge can indicate to governments increasingly hard-pressed to feed growing populations the range of economically sound alternatives to total forest destruction. The view that this need is not of concern to the U.S. is short-sighted and potentially dangerous. From what we know, land from which humid forest has been removed usually will not support stable agriculture. Some land use, such as selective silviculture, seems the brightest hope of making these forests productive of food--or income. But we must know more about the nature of the organisms, especially kinds and properties of the plants, and their ecological relationships before credible recommendations can be made for diverse forest types.

For administrative purposes tropical biology is not a program element in the budgetary sense. Since it is an important area of interest within each program it is considered a Division emphasis. To organize our efforts in this area, we have appointed Dr. Seymour Sohmer as Staff Associate. His primary goal is to analyze our current efforts, strengthen developing thrusts, and identify missing elements.

Reference has been made at least twice in preceding pages to the need for the acquisition of long-term data sets. Dr. Kaufman spoke of this need in population biology; Mr. Sievers mentioned this in relation to ecological reserves. The latter reported his program's support for a conference on "Long-Term Ecological Measurements." The first paragraph of the report of that conference aptly states this need:

> Ecology requires long-term studies. They are indispensable and must be initiated. All ecosystems are in a process of long-term change. Some changes may be long-term cycles, others unidirectional. Some may be due to natural climatic, geological and biological events and processes, some to subtle long-term anthropogenic influences. At present, few research strategies allow us to separate long-term cyclic from unidirectional changes; or anthropogenically induced changes from natural ones. This and other central ecological issues make clear the need for long-term quantitative data sets which have irreplaceable theoretical and applied utility.

The report goes on to state that American science "seems peculiarly lacking in long-term research" and suggests that the two-year funding pattern typical of U.S. support may be responsible, in part, for that lack. We believe that this suggestion is correct. To be sure, there are instances in which investigators have put together a series of 2- or 3-year awards to acquire data sets a decade or more in extent. The Hubbard Brook Ecosystem Study in New Hampshire is a notable example. This collaborative study, involving Forest Service personnel and academic scientists supported by NSF, has followed a major watershed perturbation for 17 years; but this is exceptional. The report goes on to state that ecological research in the U.S. "seems to appear out of a temporal and spatial vacuum, lacking the context which can make results more meaningful. Clearly, for the benefit of American science as well as science in general, the situation needs changing."

In considering mechanisms to make possible and promote long-term studies, the report recognizes two basic approaches--through individuals and through institutions. The report makes two suggestions for individuals. The first is that NSF consider funding the projects of competent scientists for longer award periods than has been typical in the past. This suggestion essentially endorses the new Foundation policy to encourage longer durations for highly rated proposals. The second is to develop a "funding program for young scientists that provides small sums to do inexpensive, long-term studies needing comparatively infrequent measurements which could be done easily as part of their other research." The Division staff sees some problems in implementing this suggestion; but when this is juxtaposed to the concept of institutional support, a possible mechanism emerges.

A method for the support of long-term ecological measurements being considered in the Division involves the following aspects. Proposals for such projects, submitted for consideration by the Biological Research Resources Program, would be prepared by the director of a field research site, such as, but not limited to, the 67 representative experimental ecological reserve sites already designated by a committee of the Institute of Ecology (TIE). Each proposal would include an umbrella statement presenting an overall plan for the collection and maintenance of long-term measurements at that site. It would also include a series of subprojects that would accomplish parts of the overall program. It is possible that any one proposal from a site might address only some subset of the entire project. These subprojects for short-term segments of the long-term project are envisioned as being prepared by scientists in response to the publication of the overall plan by the site director. Such publication would include a call for individual participation by qualified investigators prepared to devote several months (more or less) to the acquisition of data sets appropriate to the interest and background of the participant. These subprojects are an integral part of any overall project for long-term measurement. These would provide for the participation of young investigators as suggested in the report, "Long-Term Ecological Measurements." In the review process each of these subprojects would be evaluated separately and only those deemed suitable to the overall objectives would be included in the award recommendation. The Division foresees establishment of a committee of concerned and qualified environmental biologists to review periodically the success of the effort at each site and to assure the usefulness and intersite compatibility of the data gathering, storage, and analysis.

To conclude, these two issues--tropical biology and long-term ecological measurements--although treated quite separately, are both responses to the same basic scientific requirement. Man is modifying his environment in many ways. In the tropics the alterations are drastic and immediate. In our own temperate-zone, man's myriad activities are inducing changes even in relatively pristine ecosystems. Many of these changes are slow, but it is nonetheless important that we know the consequences of all these modifications as soon as possible if remedial action is to be effective.

*U.S. GOVERNMENT PRINTING OFFICE: 1975 724-794/492 1-3