Organization of Inland Biological Field Stations

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ORGANIZATION OF INLAND STATIONS NUMBER 3

NEWSLETTER

OCTOBER, 1966

FIRST ANNUAL MEETING FOR OIS

A meeting of directors of inland stations was called by C. A. Tryon and W. H. Marshall to discuss mutual problems and to establish a suitable organization for the group. Bill Marshall, Director of Field Biology at the University of Minnesota, was host to the group at the Cedar Creek Natural History Area of the University of Minnesota. As the site of Lindeman's germinal work on trophic levels, it was an appropriate place for the founding of an organization of biological stations.

The meeting was also intended as a response to the interest and support provided by the National Science Foundation to this group in the past. It was felt to be time that we did something on our own. The opportunity for free discussion, without formal presentations, was felt to be desirable at this first meeting and it proceeded accordingly.

NOTES

W. H. Marshall, with the assistance of John Warnock (The editor has taken the liberty of rearrangement and restoration.)

Introduction The meeting convened at 9 A. M. on September 6, 1966, and W. H. Marshall was named as chairman. Sessions were held 9-12; 1:30-4:55 on September 6 and 7. An evening session was held 7-9 P. M. on the 6th. Discussion sessions were informal with leaders for special topics as given below.

Dr. John Olive (AIBS) and Dr. E. I. Wallen (Smithsonian) had planned to attend but were unable to do so. Dr. Harve Carlson (NSF) expressed the foundation's interest in the group and their regret at being unable to send a representative. Dean Richard Caldecott, College of Biological Sciences, University of Minnesota, welcomed the group and outlined the newly established college. He presented interesting information on the rationale behind the creation of a college of biological sciences as well as their commitment to a program of field biology. Carl Riggs reviewed the brief history of the group from the initiation of interest by NSF through George Sprugel, the Dale Arvey study, the Washington meeting, and the Boulder meeting. A committee was appointed at the latter meeting, consisting of Carl Riggs, Austin Williams, and C. A. Tryon, and they produced the newsletter which led to the present meeting.

Justification of Stations Discussion led by W. H. Marshall.

Each participant was asked to state how he justified his station to the administration of his parent institution. Basically the justifications were the familiar ones of all academic institutions, teaching and research. Uniqueness of habitat, close raport of staff and students, and the need to be close to natural situations, increasingly difficult with the growth of universities and colleges, were emphasized.

Dick Bovbjerg provided a more fundamental justification in comparing the importance of ecology to that of molecular biology. In the discussion it was pointed out that molecular and ecosystem biology are at opposite ends of the biological spectrum and must balance each other if any equilibrium is to be achieved in biology.

John Parsons brought out the value of the field station in terms of preservation of natural areas. Don Whitman remarked on a recent development in California - the formation of a state-wide committee on field stations operated by the state colleges. This would certainly provide integration and support although most states have only one or two stations.

(Ed. Note) In retrospect, it might have been challenging to probe deeper by attempting to state what new biological concepts (not techniques) are taught and researched at field stations, that cannot be learned or derived in any other way. This presumably would drive us to attempt an operational definition of ecology and its research field.

Support Discussion led by Carl Riggs.

Carl Riggs presented a brief summary of the sources of the money that had been obtained for the development of the Lake Texoma Biological Station. Aside from the federal granting agencies he stressed the importance of approaching local foundations. Also the necessity of keeping the administration of the parent institution fully informed through reports on progress and accomplishments. It is also considered important to arrange visits to the station for administrators. The University Board meets at the Lake Texoma Station once a year. Several other people recounted various means of attracting the attention of the administrators.

Grant Support

The chief federal sources of money for training and research grants at the various stations represented were:

1. National Science Foundation
   Research
   Special Facilities-Buildings, boats, docks, air conditioning
   Grants-in-Aid
   Research Participation
   Summer Institutes

2. Atomic Energy Commission
   Research in environmental biology. Grants may include money for staff time, research assistants, technicians, etc.

3. Federal Water Pollution Control Center, U. S. Dept. Interior
   Research
   Training Grants, stipends, tuition costs, equipment, renovation of laboratories, supplies, staff time. Pre and Post doctoral stipends.

4. Office of Naval Research
   Research in ecology

5. International Biological Program
   Possibility of research and staff support in productivity studies, terrestrial and aquatic.

Archie Tryon pointed out that as [illegible] grants rose in volume, it was feasible to convince the administration that about [illegible]% of the overhead on grants associated with the station, should be given to the station. Since the overhead on federal grants is usually negotiated by the university in terms of the value of facilities and services, it may range as high as 40 to 50 %. Return of approximately half of this to the station may be a considerable sum. Such money may be used for any purpose without red tape. In another case, a station had been appraised at its value and participates in general university overhead funds on a percentage basis in relation to the total value of the university plant.

Programs Discussion led by Loren Putnam.

1. Teaching

Considerable discussion was brought forth on the question of length of terms, and here a line was drawn between those stations which open and close immediately before and after their course offerings and those which keep their facilities open, either wholly or partially, for longer periods. Time period for a single course should not exceed five to six weeks, after that student interest lags. Dick Bovbjerg was in favor of teaching courses full-time for four week or five weeks. A staff member should be expected to teach only one course in a summer. The underlying problem represented in much of the discussion was the commitment of the summer staff member, i. e. what a teaching load should be. So much variability exists between stations that it may be useful for the OIS to provide some sort of standard.

Loren Putnam described an M. S. program which may be taken entirely in the summers at the Put-in-Bay Station. Wayne Porter described the usefulness of Gull Lake Station for course work on the main campus during fall and winter. Such use delights the administration of the parent institution. Wayne Burbanck provided an interesting view of the program at Emory where the station is a part of the campus and intensive work can be accomplished throughout the year by main campus staff. Archie Tryon presented a different system in which an eight-week exploration of a particular ecosystem was undertaken by all staff and students (graduate)at the Pymatuning Laboratory. Four different ecosystems are studied - streams, lakes, and ponds, woodlands, and grasslands, the cycle requiring four summers.

2. Research

Vincent Roth described the use of high school student volunteers. Applicants are selected for "orientation towards science" and work four hours a day for room and board. They are assigned to research workers on specific projects for the other hours available. Dave White suggested continuing research on populations of a particular species and mentioned work with the white bass. Archie Tryon described a data retrieval system being set up to handle information on chipmunks received from cooperators throughout the country. Jim Cragg pointed out that a station has major research potential when a central theme of research is developed as a basis for common discussion and a gathering point for persons interested in particular ecosystems. He cited the Windermere Station of the British Freshwater Biology as an example.

(Ed. Note. Time did not permit really adequate exploration of this area. Much of the status of field stations rests entirely on the type of research undertaken, especially in the eyes of the rest of the scientific community. Some of the more scathing criticism, such as "fun and games in the woods" not only displays ignorance, but indicates the need for the OIS to present a true picture of the vital research undertaken at most of the stations. And especially why it is vital.)

Facilities Discussion led by John Parsons.

Some of the many problems associated with the use of equipment were emphasized. The general problem is much more pronounced in field laboratories where boats, motors, and vehicles are involved. John Parsons brought up the very real problem of liability, particularly the rather unfortunate position of the station director should accidents occur. His solution is to carry a personal insurance policy. One station has a student responsible for the condition and operation of each boat. At another station, a boat committee checks out all potential operators for ability. The use of private vehicles for land transportation should be discarded entirely. Some stations have their own vehicles, some obtain them from a motor pool, others may rent buses, but the methods of paying for them is very diverse. Transportation may be included in station budget, paid from research grants, collected from students by a laboratory fee, direct charge for mileage, etc.

Parsons requested a more detailed account of the facilities at three stations: -

Cedar Creek - University of Minnesota - W. H. Marshall

In 1958 about $75,000 was spent for the main building. The main building was designed for use by small conferences, large classes, and research personnel with field problems. The garage plus a forty food extension has become the location for a shop, radio and telemetry equipment, and office space. Three farmhouses on the area are rented and the residents keep an eye on the boundaries for trespass. The boundaries of the area are marked by a single strand "sanctuary"wire. The main building includes an apartment for resident personnel, four offices, records room, men's and women's dormitories, conference room, freezer room, and utility room. This is a station designed primarily for use by campus staff (40 miles) and is used also by 4-H clubs, conservation groups, etc.

Pymatuning Laboratory - University [illegible]burg - C. A. Tryon

The facilities consist of several buildings, put up by a caretaker with a minimum of help, on 13 acres within a state wildlife sanctuary. Buildings are concrete slab with surplus steel truss and four foot section "sandwiches" of steel, glass wool, and plywood inside. All are 20' wide but may be extended to any length. As an example, a 72' x 20' building was constructed in 1965 with four offices, two labs, instrument room with air and humidity conditioner, wiring, plumbing, and with hot water heat for $5,000, including new thermopane windows. Each staff member has a small office plus a 20' lab. The laboratories are fitted with built-in counters, drawers, and tables supplied from renovation money in a training grant for aquatic ecology from the Federal Pollution Center, U. S. D. I. Mess Hall supports itself from food charges. All instrumentation, including microscopes, has been purchased from grants, and vehicles (4), boats (5) as well as land, from returned overhead on grants. Housing has been the main bottleneck and is entirely inadequate, consisting of one winterized cabin, one with a circulation heater for fall and spring, and 5 unheated wooden tents. Waterline extends from nearby village (1/2 mile).

Bear Lake - Utah State University - William Helm

Consists of three acres of lakeside property brought from unexpected, unexpended funds. N. S. F. supplied 25,000 to build laboratory. An estimated $5,000 breakwater was built for $17,000, paid by the university. The university has built

a two-story house. Much of the activity at station results from a research grant. Waterline from city of Pickleville.

(Ed. Note. Lack of time prevented further development of this important subject. What are minimal requirements for a station to be a station?)

Publications

Most stations have a series of papers published in regular research journals, and the opinion was expressed that these recognized journals, where papers are judged by an editorial board, were more suitable than a station journal. Pymatuning Laboratory has been able to publish the papers given at symposia held at the laboratory, by selling the proceedings. One publication of the results of research done for a federal agency was supported by them. The greatest advantages were exchange, thus building up the laboratory library, and publicity since the publications were purchased by libraries throughout the world.

Organization

Archie Tryon assumed the chair. He read Dale Arvey's letter of June 1, 1964, which suggested an organization of director's may be desirable. He passed out printouts of IBM cards which have been prepared for (1) all stations included in Arvey's NSF report plus three new ones since then and (2) the names and addresses of all 1966 staff members at these stations, coded according to the station at which each taught. It was suggested that staff members also be coded for their research specialty. Some members noted absences from the list and these were thought to be due to lack of information. (To make this list complete, please send information on staff (name, home institution, specialty) to the editor.)

Various comments and suggestions were made as to the need and usefulness of a field station organization. Some of them were:

1. Bibliography of field station publications.
2. List of research projects at stations.
   (Ed. Note. If it is desirable, we can put these citations from (1) and (2) on IBM cards and thus have a continuing list from year to year. Printouts can be furnished to directors as requested.)
3. Prepare and distribute a newsletter.
4. Act as a clearinghouse for dates and programs of stations; be a self-help group.
5. Act as a voice to federal agencies, administration of parent institutions, and the public in general. It could focus attention on a national scale on the needs of the stations.
6. Develop policy statements on the role of field stations in biological sciences.

In general discussion the feeling appeared that a formal organization of directors was needed at present, each member station to have one vote on all matters. A director could appoint a substitute for a meeting to vote for him. Anyone interested could attend and enter the discussions.

1. John Parsons made the following motion:
   I move that we establish a formal organization of station directors.
   Seconded: Carl Riggs
   Passed unanimously.

2. Bill Schmitz made the following motion:
   I move that the membership should be composed of directors of stations.
   Seconded: Bill Burbanck.
   Passed unanimously.

3. Don Wooton made the following motion:
   I move that a full slate of officers, who will act as an executive committee, be established.

   After discussion, the motion was amended by motion of Carl Riggs to read- a slate of officers consisting of President, Vice-president, Secretary-Treasure and Editor, who will also serve as the executive committee of the organization, be elected.

   Seconded: Dick Bovbjerg.
   Passed unanimously.

4. Jim Cragg made the following motion:
   I move that a $10 membership fee be established.
   Seconded: Dick Bovbjerg
   Passed with one dissent.

5. Carl Riggs made the following motion:
   I move that for the present we stand on our own feet without affiliation.
   Seconded: Jim Cragg
   Passed unanimously.

It was then suggested by Archie Tryon that the group elect temporary officers who will initiate steps toward providing a constitution to be submitted to station directors. After approval, those who became members will be eligible to vote in an election for regular officers.

Temporary officers were elected as follows:

President	W. H. Marshall
Vice-president	R. V. Bovbjerg
Secretary-Treasurer	L. D. Putnam
Editor-	C. A. Tryon

It was decided to hold a meeting around the first part of September in 1967. Carl Riggs extended an invitation to hold the meeting at the University of Oklahoma Biological Station, Lake Texoma, Willis, Oklahoma. Invitation accepted by acclamation.

Summation: The meeting was successful. A tremendous amount of discussion went on during and after sessions. In future meetings some sharpening of specific viewpoints can be accomplished by advance preparation of material by selected speakers and discussion leaders. The whole-hearted participation of everyone present, which the notes do not adequately reflect, indicated the vitality of the issues under consideration.

Special note should be taken of J. B. Cragg, a guest from Canada, who contributed greatly to the discussions. A letter from Bill Marr indicates he would have joined us but did not receive the notice of the meeting. From now on all notices will go first class.

The next newsletter will contain information on the proposed constitution.

Participants - OIS Meeting

Robert L. Birch
West Virginia University

Richard V. Bovbjerg
University of Iowa

W. D. Burbanck
Emory University

J. B. Cragg
University of Calgary

Lester E. Harris
Columbia Union College

William Helms
Utah State University

W. H. Marshall
University of Minnesota

John Parsons
University of Southern Illinois

T. W. Porter
Michigan State University

Loren Putnam
Ohio State University

Carl Riggs
University of Oklahoma

Vincent Roth
American Museum of Natural History

William Schmitz
University of Wisconsin

Archie Tryon
University of Pittsburgh

John Warnock
Western Illinois University

David A. White
University of Wisconsin
(Brigham Young University)

Don Wooton
Chico State College

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Inland Biological Field Stations Of the United States

M. DALE ARVEY AND WILLIAM J. RIEMER

NATIONAL SCIENCE FOUNDATION

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NATIONAL SCIENCE FOUNDATION

"Study nature, not books," Louis Agassiz exhorted his students. This terse statement by an early and great American naturalist is usually cited out of context, and the bristling reaction of many scholars to what seems a very narrow view is probably quite unjustified. Nonetheless it can be said with assurance, following Agassiz's advice, that studying biological objects and phenomena out-of-doors and firsthand does provide a kind of understanding — an insight, a comprehension, an appreciation — that is not gotten from reading the selected facts and interpretations of others who may or may not have known Nature.

Modern adherents of the philosophy that to be a really well-rounded biologist one must study nature too, not books alone, include the persons usually responsible for establishing and maintaining the biological field stations that are scattered over this land. These shoestring operations — only a few can claim to be more than that — play a varied, usually small, but perhaps highly important role in the field of biological education.

The National Science Foundation in seeking to learn more about these field stations and their significance to biological science and education found only frustration. Little information about them is published. Therefore it resolved to go directly to the best possible source, the stations themselves. The Biological and Medical Sciences Division has now assessed the state of affairs in three groups of field stations. A study of marine stations in the United States was completed in 1962, and during the same year another study on biological research centers in tropical America was finished. The latter survey included, among other things, field stations of all types. Besides providing better understanding of the scope and problems of these groups of organizations, and therefore a basis for development of Federal support practices, the studies have served to bring together in varying ways and to varying degrees the persons responsible for operating these facilities. In the third and most recent study, this is what we learned.

Biological field stations in the United States are easily divisible into two groups: those that are mainly concerned with oceanography and marine biology, and those that are not. Our discussion is concerned primarily with those of the nonmarine sort; for the lack of a better term, we shall call them inland field stations.

But when we try to delimit what we mean when we speak of an inland biological field station, real difficulties arise. Such stations are varied indeed. They defy simple description. From what one might picture as a typical station, they rapidly grade off in all directions into a diverse lot of miscellaneous facilities that have little in common and no pertinence to our discussion. The "typical" field station we have in mind is administratively tied to a university or college, it has facilities for field research and offers instruction in field biology, and it consists of a few rustic buildings tucked away among the trees of a distant wood. It is foolish, of course, to think that many are like that. A rather good idea of the varied size, location, and setting of a number of stations can be gotten by quickly scanning the list at the end of this article. We specifically exclude from our discussion of field stations installations such as arboreta, agricultural stations, research farms, and other off-campus laboratories devoted to applied research or separated from the main campus largely for reasons of space needs.

Biological stations were first established to exploit the out-of-doors as a teaching aid. Emphasis was on nature study. Only gradually was research added to the program.

By 1945, there were 53 such stations operating in this country. Of these, only 20 survive today — most in a much altered condition. Partly offsetting this attrition are 15 stations established since 1945, plus 6 more in various stages of development. This net loss of 12 stations in the last 20 years is much greater proportionately than that suffered by biological marine stations.

Functions

A primary function of the biological station always has been one of providing field instruction to students. An asso-

ciated activity that offered public education through displays or museum-type exhibits has largely disappeared in recent decades. Another basic function is that of offering suitable facilities and resources for ecological, systematic, physiological, and behavioral research. This opportunity, depending on the station, may be available only to professional scientists or to students or to both. Of the 42 stations that are most active today and are considered here in some detail, half have some formal course work in their program; the other half are devoted exclusively to research. The stations that have survived over the years generally are those with a multipurpose program. It seems that a dual role promises more for the future than one of specialized research or the teaching of classes alone. Those stations that are currently in the planning stage appear to be designed wisely as centers for both teaching and research.

Many of the values derived from work at a field station are intangible ones. It is surprising how many prominent biologists of today had experience at a station sometime during their formative years. Even more revealing is the fact that many think the station experience contributed importantly to their decision to adopt biology as a career.

Location

The uniqueness and strength of the biological field station lies in its physical setting and in the opportunity it provides for study of organisms in their natural environments. Site selection must be made with adequate thought given to the primary goal of the station. Ecological diversity is advantageous if instruction is the basic concern. Conversely, location deep within a single ecosystem might provide best for intensive long-range studies of specific environmental situations. Accessibility to workers also must be considered. Ideally, stations should be present in all types of habitats and so situated geographically that the student in any part of the country can find the environment or type of ecosystem he needs with minimum difficulty.

With more geometry than realism evident, the suggestion has even been made that a chain of stations be established longitudinally across the country and another from the Arctic to the Tropics so that in sum they would encompass a spectrum of all altitudes, latitudes, and longitudes together with their full array of natural attributes. This arrangement may never be realized. The fact is that the altitudinal variation and associated biotic diversity found in the western mountains seem far more favorable to the development of field stations than the low relief and less striking diversity of other areas. While an extensive sample of differing habitats may be useful in teaching and a stimulant for research projects, student instruction in the principles of field biology, natural history, behavior, etc., may be accomplished almost anywhere. Though there has been no over-all planning or coordination involved, it must be recognized that the stations now extant are located rather favorably on a geographic basis (see map), and in total they sample a wide range of environmental types.

A majority of inland stations are located on lakes or sizable streams and emphasize limnology in their research or teaching programs. Among these are eight stations whose programs extend well beyond aquatic studies however, for their favorable location provides considerable diversity in terrestrial habitats as well. It is worth noting that the aquatic-terrestrial stations are augmented in number by a small group of marine stations that include within their activities a terrestrial biology program.

Next most abundant are mountain stations; most of these are located in the West. Terrestrial stations other than those classified as mountain stations or those associated with aquatic areas are generally established with a particular research theme in mind. Thus, one station is primarily concerned with forest ecology and the effects of fires, two others conduct long-range ecological studies, and a fourth concentrates on studies of the original prairie conditions of the Great Plains. Only one station has as its major purpose a long-range study of desert conditions, although a second one is being planned in Arizona. Existence of several special stations should be noted. Two are for research in animal behavior, and at least one other is being established for research on ecosystems under controlled conditions. Not included in this study because of its special nature, but nevertheless of considerable importance, is the Arctic Research Laboratory of Point Barrow, Alaska.

It is possible that some of the National Parks could serve as the base for a biological center of research without detracting from the park's basic functions. At present the only one so situated is the Jackson Hole Biological Station, located within Grand Teton National Park on a long-term lease. While the Park Service itself is coming to recognize that absolute protection of the biota at times may be undesirable, the mere presence of the park serves to maintain a more stable habitat than is generally possible in most natural or unprotected areas. Research investigators and their studies also might provide a foundation on which park personnel could build an outstanding interpretive program as an adjunct to their own.

Problems faced

Physical Facilities. Historically the field station grew out of the local field trip and later the permanent camping site. In the early days of field station development, primitive facilities were adequate, especially so because the site often was used only briefly during the summer months. Personnel housing began with tents or crude cabins. Some installations remain essentially unmodified to this day. The idea gradually grew that a station could serve as a base for research studies; later the idea for year-round use developed. It was soon realized that much physiological work could be conducted in the field. Station laboratories were then constructed so that delicate equipment could be utilized effectively and also kept safely stored when not in use.

Exploitation for a summer respite from formal academic courses still insures that only token utilization during winter months is the rule at most inland field stations, but indications are that even a small amount of winterizing of laboratories and housing would allow, and might encourage, occupancy on a year-round basis at many stations. Greater use of existing facilities should be encouraged.

It is rare today to see a successful station that does not have good laboratory space for investigators and students and adequate, though perhaps somewhat "woodsy," housing and dining facilities for the personnel. Some station directors adhere to the principle of austerity in all physical facilities while still realizing that field work is physically demanding and best results require comfortable quarters, good food, and some degree of recreation. Some directors feel that they must maintain good library facili-

ties for both teaching and research functions; others feel that needed materials should be brought in individually and seasonally. Greater year-round utilization of a station will generally mean that far more and far better reference material will be needed at the station than is usually found there today.

Station Personnel. Generally a single individual serves the function of administrator. He often is the person responsible for the development of the station, and he frequently is called upon to make decisions of profound variety, ranging from those requiring a high degree of scientific and educational sophistication to those concerned with road maintenance and keeping faculty children entertained but out of reach of the experimental aquaria. His most serious problems generally concern the type and number of persons that can or should be housed, how to meet financial needs, and how to enable at least a caretaker crew to remain in residence throughout the year.

It seems mandatory that a station that extends its activities to the entire calendar year have a resident director who is also a professional biologist. This is so because a man at the caretaker-maintenance level who has adequate professional biological experience would be a rare find indeed. Few stations have been in a position to afford the luxury of a trained resident director however, because most are university affiliated and an academic staff member is not ordinarily released for such off-campus, academic-year residence. Full-time administrative personnel are not easily found moreover, for there is usually a lack of adequate and properly winterized housing. Good schools for the staff's children are not ordinarily available in areas near field stations. And there is little intellectual stimulation from colleagues, seminars, etc., compared to that which a university campus normally offers.

A station director is usually recommended or appointed to his position by an executive committee composed of representatives from several departments. Often an assistant is named to take part of the administrative load from the director, for this work load may be heavy during the season of full operation. Presence of an assistant also insures continuity upon the retirement or transfer of the director. Some stations without such administrative provision have been unable to survive release of the key person, an event that often reveals personal rivalries, insufficient interest on the part of other university staff, or simply lack of adequate experience needed for successful operation.

In some instances the station with its director is an effectively autonomous institution with departmental status and a great degree of latitude in such administrative matters as hiring of staff, salaries, acceptance of students, and program direction. In other instances, the director is told whom he may hire, what types of programs are to be given, etc. In most stations the administration lies between these extremes.

Habitat Conservation. All biological stations, but inland ones in particular, must exercise caution to insure that the biotic changes that are inevitable in an area utilized by man do not become excessive lest the very reason for a station's existence be removed. This can be appreciated most readily in certain parts of the arid West, where the biota is exceptionally fragile and any disturbance can cause serious and long-lasting degradation within the plant communities and therefore to the animals dependent on them.

Similarly, certain lakes tend to become heavily utilized for recreational purposes with a consequent threat to the natural biota. There are numerous water skiers on inland waters. The effect of such human intrusion on aquatic life may be great, and it would be of interest to have a limnological comparison made between an undisturbed lake and one of comparable nature that is much used by power boats.

It is important in future planning that stations attempt to obtain sufficient surrounding land to insure that an adequate outdoor biological laboratory will remain intact. It seems appropriate to suggest that serious consideration be given to the allocation of funds for purchasing prime habitats around field stations as such land becomes available. Such property, not necessarily contiguous to the station itself, may be purchased at times for relatively little money and might be a sound investment for the future when higher prices are likely to prevail. The intent should be not merely to preserve lands but to insure that research areas remain available.

Status of Field Stations. It must be emphasized that the present-day biological field station is in competition with all other types of biological activities. It cannot be assumed that stations automatically will survive at most universities; their status is not high, and stations are often dismissed as mere nature study camps. Though there is real value even if limited to this function, it must be realized fully that modern field biology with its sophisticated approach to ecology bears little relationship to the flora-and-fauna courses of a few years back! It must be remembered also that the biologist of today is often a chemist or physicist too, who will in time realize that field work has its value and will then appreciate again the worth of persons trained to recognize taxonomic and ecological differences. The field station will continue to be of tremendous value in training students in the areas of ecology and systematics in a manner that usually cannot be approached on a university campus.

Descriptive Data

The number associated with each station identifies its location on the accompanying map. For each installation information is provided on its location (and postal address if different), administering officer, physical habitat, research program, instructional program, and dates of operation.

1. **Museum of Northern Arizona,** P.O. Box 402, Flagstaff, Arizona. Edward B. Danson. Eighty acres of forest and grassland; Lower Sonoran to Arctic-alpine areas nearby. Research in anthropology and biology. No instruction. All year.

2. **Southwestern Research Station** (American Museum of Natural History), Portal, Arizona. Vincent D. Roth. Sonoran to Hudsonian zones; 9800-foot Chiricahua, Mountains nearby. Research in biology, geology, meteorology, and astronomy. No instruction. All year.

3. **Deep Canyon Desert Research Station,** Deep Canyon, near Palm Springs, California. Address: Division of Life Sciences, University of California, Riverside. Rodolfo Ruibal. Edge of the Colorado Desert. Biological and nonbiological research. No instruction. No charges. All year.

4. **Eagle Lake Biological Station,** Eagle Lake, Lassen Co., California. Address: Chico State College, Chico, California. Thomas L. Rodgers. Twenty-five acres

Numbers show the locations of field stations and correspond with the descriptive paragraphs.

of forest on lake shore. Aquatic and terrestrial ecology. No facilities for visitors. Graduate and undergraduate summer biology courses. Dates of operation not determined.

5. **Field Station for Animal Behavior,** Berkeley, California. Address: Department of Psychology, University of California, Berkeley, California 94720. Frank A. Beach. Controlled research on behavior of vertebrates. Fenced area adjacent to campus, enclosures, cages, pits. No instruction. No charges. All year.

6. **Hastings Natural History Reservation** (University of California, Berkeley), Jamesburg Route, Carmel Valley, California. John Davis. Oak woodland, grassland, chaparral. Ecology of biota. No instruction. No charges. All year.

7. **Mendocino Biological Field Station,** Albion, California. Address: Pacific Union College, Angwin, California. Donald V. Hemphill. Rocky shore, estuary, stream, redwood forest. Marine and coastal biota. Graduate and undergraduate courses in nature education, field biology, and carpentry. No fees for research. June through August.

8. **Sagehen Creek Biological Station** (University of California, Berkeley), Box 447, Truckee, California. Director not known. High mountain streams, forest, lakes. Environmental research. Special building for observing understream conditions. Field zoology and plant taxonomy taught each summer. Fees for classes. Research all year.

9. **White Mountain Research station.** (University of California, Berkeley), in White Mountains, near Bishop, California. Address: P.O. Box 31, Big Pine, California 93513; or 2517 Life Sciences Building, University of California, Berkeley, California 94720. Nello Pace. Southern Sierra Nevada and isolated desert ranges. Physiological responses to high altitudes, high mountain ecology. Four laboratories at different elevations up to 14,250 feet, major facility at Barcroft (12,500 feet). Special research equipment including helicopter. Housing for investigators only. No instruction. All year.

10. **Rocky Mountain Biological Laboratory,** Crested Butte, Colorado; or address Biology Department, Swarthmore College, Swarthmore, Pennsylvania. Robert K. Enders. Forested area, 9500 feet. Biological research. Six-week summer courses on demand. Research all year.

11. **Science Lodge Mountain Research Station** (Institute of Arctic and Alpine Research, University of Colorado), Nederland, Colorado; or address 102 Hale Science Building, University of Colorado, Boulder. John W. Marr. Two-hundred acres surrounded by National Forest. Mountain ecosystems; emphasis on montane forest, alpine tundra, and ecotones. Special equipment includes snow vehicles. No instruction. All year.

12. **Archbold Biological Station** (American Museum of Natural History), Lake Placid, Florida. Richard Archbold. There are 1060 acres of oak-hickory, pine, and palmetto; lakes nearby. Biological research. No instruction. All year.

13. **Tall Timbers Research Station,** Route 1, Box 110, Tallahassee, Florida. Edward V. Komarek. Pine forest, lakes. Forest biota and ecology; fire effects. No housing. No instruction. No charges. All year.

14. **Lullwater Field Laboratory** (Emory University), Atlanta, Georgia. W. D. Burbanck. Twenty acres of forest adjacent to main campus. Aquatic biology; radiation effects. No facilities for visitors. Instructional program on main campus. No charges. All year.

15. **Pine Hills Field Station,** near Wolf Lake, Illinois. Address: Southern Illinois University, Carbondale, Illinois. John Parsons. Mississippi River, marshes, and oxbow lakes; broad-leaf and coniferous forests. Biological research. No instruction. All year.

16. **David Worth Dennis Biological Station** (Earlham College), near North Webster, Kosciusko Co., Indiana. Address: Rural Route 3, Syracuse, Indiana; or Department of Biology, Earlham College, Richmond, Indiana. Cameron E. Gifford. There are 550 acres on Dewart Lake. Ecology and limnology. Undergraduate summer courses in limnology. Early June to early August.

17. **Indiana University Biological Station,** Crooked Lake, 7 miles north of Columbia City, Indiana. Address: Department of Zoology, Indiana University, Bloomington. Shelby D. Gerking. Twenty-seven acres of wooded shoreline. Limnology and fish ecology. No instruction at present, but courses planned. No charges at present. June through August.

18. **Iowa Lakeside Laboratory** (University of Iowa), West Okoboji Lake, Dickinson Co., Iowa. Address in summer: Milford, Iowa; in winter: University of Iowa, Iowa City. Richard V. Bovbjerg. One-hundred acres of lake shore and forest. Aquatic and terrestrial ecology; 26-foot launch. Many graduate and undergraduate summer courses in biology; 2 terms of 4 weeks. Mid-June through mid-August.

19. **Robinson Farm,** near Lawrence, Kansas. Address: Department of Zoology, University of Kansas, Lawrence. Henry Fitch. Rolling hills, forests, and ponds. Ecology of terrestrial communities. No instruction. No charges. All year.

20. **Potamological Institute,** University of Louisville, Louisville, Kentucky. William M. Clay. Ohio River and environs. Ecology of flowing streams. Power boats. Instruction on campus. No charges. All year.

21. **University of Michigan Biological Station,** Pellston, Emmet Co., Michigan. Address in summer: Pellston, Michigan; during academic year: Ann Arbor, Michigan. A. H. Stockard. Almost unlimited wild and forested land; large lakes, streams, marshes, bogs, and upland areas. Environmental biology: atmospheric, terrestrial, and aquatic. Graduate and undergraduate summer instruction; many courses in biology. Instruction, late June to mid-August; research, all year.

22. **W. K. Kellogg Biological Station** (Michigan State University), Gull Lake, near Battle Creek, Michigan. Address: Hickory Corners, Michigan. George H. Lauff. Lakes, streams, bogs, and swamps. Terrestrial and aquatic biology. Adjoining Kellogg Bird Sanctuary, Farm, and Feed Research Project are part of the Biological Station complex; Kellogg Forest is nearby. All available for research. Variety of graduate and undergraduate summer courses in biology and geography. Instruction, June through August; research, all year.

23. **Associated Midwest Colleges Field Station,** Basswood Lake, Lake Co., Minnesota. Address: c/o Wilderness Outfitters, Ely, Minnesota. Robert V. Drexler. Forests, rivers, lakes. Primitive area with only canoe transportation. No facilities for visitors. Undergraduate summer courses in biology and geology; postsession student research. June-August (2 sessions).

24. **Lake Itasca Forestry and Biological Station** (University of Minnesota), Lake Itasca, Clearwater Co., Minnesota. Address: Lake Itasca P.O., Minnesota; or 300 Coffey Hall, University of Minnesota, St. Paul. William H. Marshall. Within Itasca State Park; 50 square miles of forest, lakes, bogs; portions of original prairie nearby. Aquatic and terrestrial ecology. Graduate and undergraduate biology and forestry courses; emphasis on research-study combination. Mid-June to early August.

25. **Prairie Research Station,** near Columbia, Missouri. Address: Department of Botany, University of Missouri, Columbia. Clair Kucera. Section of original prairie. Controlled research on flora and controlled burns. No facilities for visitors. No instruction. No fees. All year.

26. **Flathead Lake Biological Station** (Montana State University), Flathead Lake, Yellow Bay, northwestern Montana. Address: Bigfork, Montana; or Montana State University, Missoula. Richard A. Solberg. Lakes, bogs, streams, and rivers; sagebrush to forest to tundra. Aquatic and terrestrial biology; 25-foot vessel available. Graduate and undergraduate summer courses in biology. Summer Institutes for high school teachers. Late summer session in conservation education; 5- and 8-week summer sessions. Research at other times by arrangement.

27. **Field Station for Animal Behavior,** Duke University, Durham, North Carolina. Edward C. Horn. Forty acres of woodland. Duke Forest is available nearby. Controlled research on vertebrate behavior. Pens, cages, fenced plots. No facilities for visitors. No instruction. No fees. All year.

28. **Highlands Biological Station, Inc.,** Highlands, North Carolina, 28741. Thelma Howell. Research emphasis on ecology and biota of the Appalachian and Blue Ridge Mountains. No instruction. All year.

29. **Franz Theodore Stone Laboratory** (Ohio State University), Gibralter Island, Put-in-Bay, Lake Erie, near Sandusky, Ohio. Address: Put-in-Bay, Ohio; or Department of Zoology and Entomology, Ohio State University, Columbus. Loren S. Putnam. Shoreline, islands, marshes. Productivity of lakes, marshland ecology, terrestrial communities. Three vessels (25-42 feet). Graduate and undergraduate summer courses in biology; emphasis on aquatic habitats. Research, all year; classes, June through September.

30. **University of Oklahoma Biological Station,** Lake Texoma, near Madill, Oklahoma. Address: Willis, Oklahoma 73462. Carl D. Riggs. There is a 95,000-acre impounded lake, rivers, streams, ponds, prairies, oak forests. Biology of aquatic and terrestrial communities. Large inboard power boat. Many summer courses in biology. Classes, June and July (aproximately 8 weeks); research, all year.

31. **Pymatuning Laboratory of Field Biology,** Linesville, Pennsylvania; or address: University of Pittsburgh, Pittsburgh. Clarence A. Tryon, Jr. Pymatuning Lake, Ohio River, ponds, marshes, bogs, forests. Environmental biology. Graduate summer courses in ecology and limnology; research all year.

32. **Reelfoot Lake Biological Station** (Tennessee Academy of Sciences), Walnut Log, near Union City, Tennessee. Address: R.F.D., Hickman, Kentucky; or Southwestern College, Memphis, Tennessee. C. L. Baker. Naturally impounded stream bed, swamp, and bog.

Aquatic and terrestrial ecology. No instruction. No fees. All year.

33. **Brackenridge Field Laboratory,** Austin, Texas. Address: Department of Zoology, University of Texas, Austin. Frank Blair. Off-campus; river flood plain. Controlled research on ecology and experimental systematics. Enclosures, ponds, aviaries. No housing facilities. No instruction. No fees. All year.

34. **Bear Lake Biological Station,** Bear Lake, Rich Co., Utah. Address: Utah State University, Logan. William T. Helm. Limnology, aquatic ecology. No housing. No instruction. All year, but principal activity in warm season.

35. **Lakeside Laboratory,** Brigham Young University, Provo, Utah. Wilmer W. Tanner. Lakeshore and streams. Limnology. No research facilities at present. No instruction. March to December, but can be available throughout year.

36. **Columbia Union Biological Station,** Head Waters, Highland Co., Virginia; or address: Biology Department, Columbia Union College, Takoma Park, Maryland. Lester E. Harris, Jr. Meadows and forest in Shenandoah Mountains. No facilities for visitors. Two summer terms, June through August; all year for research.

37. **Mountain Lake Biological Station,** near Blacksburg, Montgomery Co., Virginia. Address: Route 1, Pembroke, Virginia; or University of Virginia, Charlottesville. James L. Riopel and J. J. Murray, Jr. Lake nearby; 1200 acres of forest; mountain biota. Graduate and undergraduate summer courses in biology. June through August, about 10 weeks.

38. **Terra Alta Biological Station,** Terra Alta, West Virginia. Winter address: Department of Biology, West Virginia University, Morgantown. Earl L. Core. Forested Appalachian Mountains; lakes and rivers nearby. Lake and terrestrial ecology. Graduate and undergraduate summer courses in biology. Late July through August.

39. **Laboratory of Limnology and Associated Field Units** (University of Wisconsin), Lake Mendota, Madison, Wisconsin 53706. Arthur D. Hasler. Lakes, ponds, streams, terrestrial habitats. Biological research. Hydrobiological laboratory on campus at Madison. Small laboratory at Trout Lake in northern Wisconsin (39a on map). University Arboretum and all departments with water interests cooperate. Formal instruction on Madison campus. All year.

40. **Jackson Hole Biological Research Station** (University of Wyoming), Moran (in Grand Teton National Park), Wyoming; or address: University of Wyoming, Laramie. L. Floyd Clarke. Lakes, streams, forest, alpine meadows. Aquatic and terrestrial biota. No instruction. June to early September; but available at other times by arrangement.

41. **Summer Science Camp,** Medicine Bow Mountains, near Centennial, Wyoming. Address: Centennial, Wyoming; or University of Wyoming, Laramie. S. H. Knight. Rocky Mountain habitats from sagebrush to 12,000 feet; streams, lakes, forests. No accommodations for families. Graduate and undergraduate summer courses in botany, zoology, and geology. June through August.

42. **Hydrobiology Station,** Horner, Minnesota. Address: Saint Mary's College, Winoma, Minnesota 55987. Brother L. George. Mississippi River shores and sloughs. Aquatic biology. No instruction. All year.