RESEARCH PROPOSAL SUBMITTED TO THE
CONSORTIUM FOR THE STUDY OF MAN'S RELATIONSHIP
WITH THE GLOBAL ENVIRONMENT

Title: A Comparison of Genetic Diversity in Selected Insect and Tree Species in Managed and Unmanaged Areas of a Northern Idaho Forest

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Endorsements:

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Department of Forest Resources
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C. R. Hatch, Associate Dean, Research
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Range Sciences
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J. H. Ehrenreich, Dean
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for D. McKinney, Financial Vice-President
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ABSTRACT

Conservation implies a responsibility to prevent, to the best of our ability, the depletion or destruction of natural areas and of the natural genetic diversity of life. Assessment of current conservation status is a prerequisite for action to improve conservation and is a dynamic and integral component of plans for the management and utilization of renewable forest resources. Baseline scientific studies in wilderness areas can serve as benchmarks for monitoring changes in the structure and functioning of natural ecosystems. Parallel studies of areas variously altered by human activity can serve to monitor changes resulting from such activity. The effect of silvicultural practices on the genetic diversity of forests is not known. In a managed forest, the gene pool can be continually contracted through treatments which selectively remove trees. Sufficient diversity must be conserved to protect the needs of future generations. In this study, we will assess the inherent genetic diversity in a co-evolved insect/tree (lepidopteran/Douglas-fir tree) system in a northern Idaho forest. We will sample both managed and unmanaged stands to estimate the effect of specific practices (clearcutting and thinning) on the genetic diversity of the trees and their associated insect fauna. The study will take 1.5 years and will encompass two full summer field seasons. This research is a step toward a systematic resolution of man-related problems of the environment, one of the major objectives of the Consortium. It will provide information directly relevant to the establishment and management of protected areas in northern forests.

PROBLEM STATEMENT

Background and Justification

Conservation of forest resources was defined by G. Pinchot (1973) as "wise use of resources for the good of the greatest number of people for the longest possible time" (quoted in tne New Zealand Journal of Forestry). Conservation thus has a profound and manifold significance for the present and future. While the attitudes and needs of future generations cannot be accurately predicted in many cases, and because of probable long-range climatic shifts to which populations respond genetically, we have a responsibility to prevent, to the best of our ability, the depletion or destruction of natural areas and of the genetic diversity of life, thereby keeping our options open for the future (MAB final report 1973). Assessment of current conservation status is a prerequisite for action to improve conservation and is a dynamic and integral component of plans for the management and utilization of renewable forest resources. Distribution maps, inventory data, floral and faunal surveys, and estimates of inherent genetic diversity are all useful tools in determining the extent to which representative samples of forest ecosystems and their constituent species are already conserved (Roche 1975). Baseline scientific studies in wilderness areas can serve as benchmarks for monitoring changes in the structure and functioning of natural ecosystems. Parallel studies of areas variously altered by human activity can serve to monitor changes in the structure and functioning of managed ecosystems.

Mature ecosystems, such as found in many of Idaho's wilderness areas, have been referred to by Odum (1969) as "protective" ecosystems in which there is maximum information content and minimum rate of entropy gain. There is a growing body of evidence that this natural diversity is a valuable means

for maintaining community stability. In addition, since each species represents a unique array of genetic materials, each has a potential value to human welfare (Dasmann 1972).

In northern Idaho and other parts of the U.S., various silvicultural techniques are practiced in an attempt to increase productivity of forest resources. The effect of these practices on the genetic resources and genetic diversity of forest areas is not known, however. In 1914 an experiment was initiated aimed at comparing Scots pine progenies differing in the age of maternal stands but otherwise identical as regards provenance, site, and other characteristics (Busse 1924). In early years the progeny of younger mother stands grew better, but 59 years later the opposite was true, suggesting that the traditional thinning practices applied to the older stands have produced a genetic gain, expressed in the progeny as an improvement of tree diameter and basal area per hectare (Wilusz and Giertych 1974). The results of this study suggest that silvicultural practices can have a profound and long-lasting effect on the genetic structure of forest ecosystems.

In unmanaged, virgin forests, variability in the existing gene pool is high for most species and most characteristics consistent with individual survival (Odum 1969). Population studies using electrophoresis, initiated in 1966 (Hubby and Lewontin 1966, Lewontin and Hubby 1966), have shown that natural populations of plants and animals may be polymorphic at 25-50% of their gene loci and individuals heterozygous at 5-15% of their loci (Selander 1976). The evolutionary significance of these high levels of variation is a subject of debate among geneticists today. Some believe that polymorphism results from the accumulation of "neutral" genes (Kimura 1979). However, there is considerable evidence that variation is maintained by selection and represents a reservoir of adaptive flexibility (i.e., to permit survival when

environmental conditions fluctuate) within these organisms. Thus, the optimum genetic strategy under natural conditions appears to be one of high levels of inherent genetic diversity.

In a managed forest, the gene pool can be continually contracted through treatments which selectively remove individual trees. An important objective in regeneration of forest stands should be to ensure that the new stand has sufficient diversity to avoid unacceptable losses due to insect and disease pests, unexpected changes in factors such as temperature or precipitation, and changes in utilization (Daniel et al. 1979). There are, theoretically, some genetic consequences in the use of the various forest reproduction methods commonly employed (W. J. Libby, pers. comm.). However, very little experimental evidence is available to assess the impact of silvicultural practices on the genetic resources of forests. Modern methods of genetic analysis provide a means whereby the genetic resources of forest ecosystems can be measured and used as a basic comparative index in studies aimed at increasing our understanding of the effect of human activities upon these forest ecosystems.

Objectives and Scope

In itemizing researchable questions posed by protected areas, Cutler (1980) listed "What are the natural conditions of wilderness..?" The study proposed here directly addresses the genetic aspect of this question. The first part of the study is an assessment of inherent genetic diversity in an associated insect and tree species in a mature, unmanaged forest area in northern Idaho.

Parameters to be considered in selecting species for a study of this type include length of life, behavior, breeding system, density and space

requirements, and vagility. Selected species should fit criteria based on these considerations and should also be representative of different forms of life (MAB final report 1973). The co-evolved insect/tree community is well represented by various lepidopteran herbivores acting as primary consumers on coniferous trees species in northern Idaho and certain members of this community fit the requirements listed above and make ideal subjects for a study of this type. Douglas-fir (Pseudotsuga menziesii) is well represented in both unmanaged and managed areas over the study location, the Priest River Experimental Forest. It is a species of substantial economic importance in northern Idaho and, for this reason, has been much harvested and the subject of silvicultural manipulation of various types. Electrophoretic techniques have been worked out for seed tissue (Yang et al. 1977, Yeh 1979) and these methods can be modified to be used on needle tissue. The lepidopteran associates of Douglas-fir are numerous and well-documented (Carolin and Stevens 1979, Furniss and Carolin 1977). A first step will be to survey the diversity of Lepidoptera species feeding as larvae upon Douglas-fir in the study area. From this survey, one common species (probably a member of the common family Geometridae) will be chosen as the insect species for this study.

Using techniques of electrophoresis, we will then measure levels of genetic diversity in both the insect and tree species. Both managed and unmanaged stands will be sampled to assess the effect of specific management practices on levels of genetic diversity in the trees and their associated insect fauna.

This study will take 1.5 years to complete and will encompass two full summer field seasons thus providing time to develop laboratory techniques and to carry out the proposed field studies.

Relationship to Objectives of Consortium and to Goals of One or More U.S. MAB Directorates; Anticipated Benefits of Study

A major objective of the Consortium is to carry out research directed toward a systematic resolution of man-related problems of the environment. This research deals specifically with assessing the impact of forest management practices upon the genetic resources of the northern Idaho forest ecosystem. Besides the fundamental biological information to be obtained from this study, we will therefore provide information directly relevant to the establishment and management of protected areas in northern forests.

The research project described here also directly addresses the goals of the Biosphere Reserve Project. Safeguarding the genetic diversity of biota can only be carried out in a realistic manner when we have an understanding of man's impact upon it and empirical evidence of the effects of human management practices upon the genetic resources of wilderness areas. The results of this study, when reported in clear, nontechnical form to forest managers and natural resource personnel, can be applied toward the betterment of conservation practices and of forest resource management policies.

In addition, the research project outlined here will provide an excellent opportunity for two graduate students in natural resources to study field ecology and conservation as a complement to their graduate training in the College of Forestry, Wildlife, and Range Sciences at the University of Idaho.

METHODS

The study area is the USDA Forest Service research facility, the Priest River Experimental Forest (PREF) in northern Idaho (Fig. 1). The PREF lies on the westward slope of a spur of the Selkirk Mts. Almost all of the PREF is forested and many of the forest cover types of the northern Rocky Mts. (Daubenmire 1968) are found within the forest's boundaries (Fig. 2). Almost two-thirds of the forest is covered with timber over 100 years old (Wellner 1976). Most of this is timber in the 100-120 year class (resulting from an 1860 fire) and the remainder is timber over 200 years old. The other third of the forest is in nonstocked areas or young timber on cutovers and burns that have occurred since the forest was established in 1911.

As can be seen in Figure 1, there are two large natural and reserved areas in the PREF -- one in the northcentral portion of the forest and one in the southeast corner. Adjacent to these natural areas are areas where trees have been removed using different management practices. These include:

1) Clearcuts (#14 in Fig. 1) where the entire standing crop of trees has been harvested. The new crop of young trees growing in such clearcut areas may derive from the adjacent unmanaged stand or from small trees left intact when the area was clearcut.
2) Thinning (#27 in Fig. 1) where some trees have been removed to improve the value and quality of the remaining trees. Presumably, the less economically desirable trees have been removed.

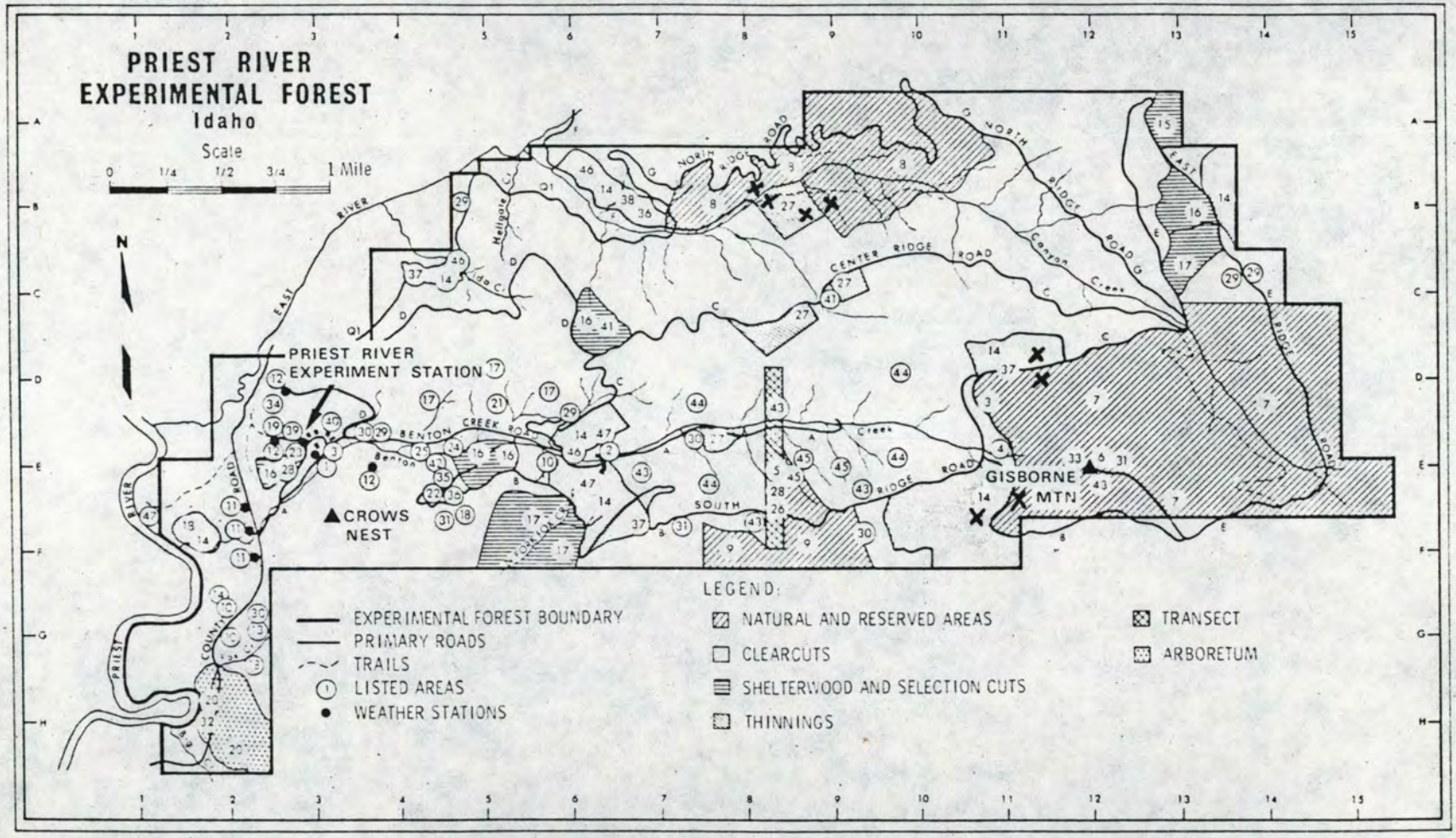


Fig. 1. *Areas of special interest on the Priest River Experimental Forest.*

(For key to numbers, see next page.)

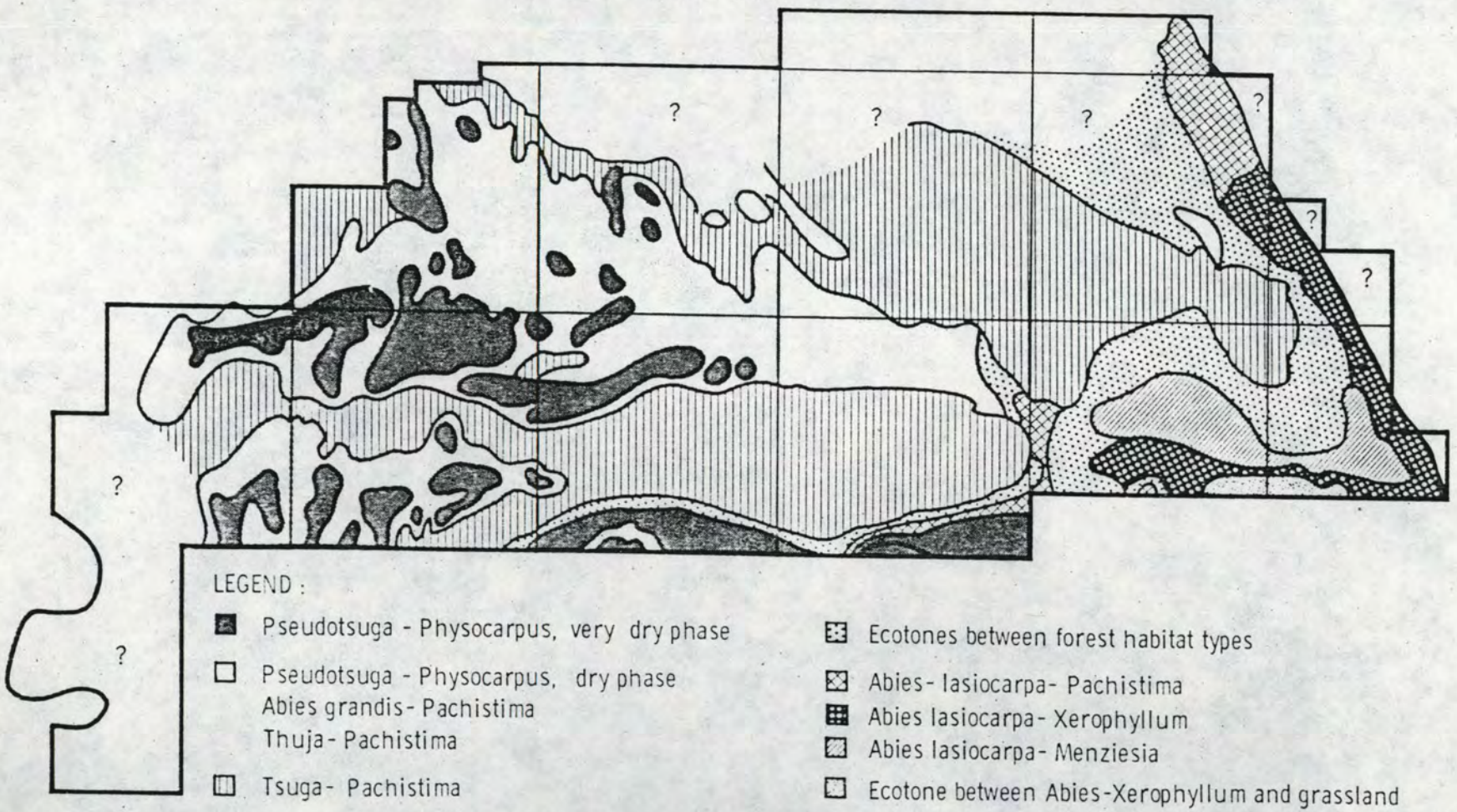
INDEX TO NUMBERED AREAS ON MAP

Area Number	Map Location	Subject
1	E3	Control weather station
2	E6	Benton Creek streamflow gaging station
3	E3, DF11	Cooperative snow courses
4	E11	Benton spring measurement station
5	DF8-9	Cleared transect
6	E12	Gisborne plaque
7	CF11-15	Canyon Creek research natural area
8	AB7-11	Canyon Bluffs reserved area
9	F8-10	Benton Creek reserved area
		SILVICULTURAL STUDIES
10	G2, E6	Natural regeneration
11	EF2	Haig seedling survival
12	DE2-3	Larsen site factors
13	G2	Knoll seed group
14	FG2, B6-7, C4, E6, E11, D11, B14	Clear cuttings
15	A13	Seed tree cuttings
16	E5, C6, B13, E2	Shelterwood cuttings
17	C13	Selection cuttings
18	G2, F2, F5	Plantations
19	D3	Tests of planting stock
20	H2	Weidman arboretum
21	D5	Pruning
22	E4	Fertilization
23	E3	Brewster thinning test
24	E5	Larsen thinning test
25	E4	Kempff thinning test
26	EF8	Transect thinnings
27	BE9, B9, CD9, E8	Other thinning tests
28	E8, E3	Intensive timber culture plots
29	E4, B5, D6, C14	Coniferous Biome environmental grid stations
30	E7, E3, F10, G2	Growth and yield plots
23	E3	Forest weather tower
11	F2	Flammability stations
31	F4-5, F7, E12	Altitude and aspect stations
32	H2	Outdoor slash laboratory
33	E12	Gisborne Mountain Lookout
		GENETICS STUDIES
34	D2	Racial variation in ponderosa pine
35	E5	Lodgepole pine hybrids
36	E5, B7	Blister rust resistant white pines
37	C4, F7, D11	Genetic variation in white pine
38	B7	Genetic variation in Douglas-fir
39	E3	Nursery
		FOREST DISEASE STUDIES
40	E3	Pole blight
39	E3	Dwarfmistletoes
41	C6, C9	Root rots
		FOREST INSECTS STUDIES
42	E4	Larch casebearer
		WATERSHED MANAGEMENT STUDIES
43	DF6-12	Snow studies
33	E12	Precipitation gages
44	D10, E10, D7, E8	Benton Creek watershed
45	E9-10	Benton Creek subwatersheds
46	B6, E6, C5	Water quality
		WILDLIFE HABITAT STUDIES
47	E1, E6	Development of vegetation after burning
28	E3, E8	Intensive timber culture plots

Fig. 2. **HABITAT TYPES**

PRIEST RIVER EXPERIMENTAL FOREST

(DAUBENMIRE 1968)



Study Design

Plot selection. For each of the two management systems listed on page 6 (clearcuts and thinning), two plots of approximately 10 acres each will be established for collection of tree and insect material. For each of these plots, an adjacent unmanaged plot will also be established and sampled. Thus, we will have a total of 8 plots -- two each in thinned and clearcut areas and undisturbed plots adjacent to each of these. Potential sites are indicated on Fig. 1 by X's at D10-11 (clearcuts) and B8-9 (thinned areas).

Variable to be measured. Allele frequencies and levels of average heterozygosity and population polymorphism will be compared in trees and larval Lepidoptera in undisturbed plots and plots where trees have been thinned or clearcut.

Sampling procedures. Within each plot, 50 Douglas-fir trees will be randomly selected either by fixed-point or transect sampling techniques. From each tree, 3-4 branch tips will be removed from the lower crown using either pruning hooks or rifles as necessary.

Larval Lepidoptera on these trees will be collected by handpicking, beating, and branch sampling. Insect sampling will take place over a full season (May-August) so that the full spectrum of species represented can be ascertained and the more common species selected for genetic analysis.

Tree tissue and live larvae, labelled with plot and tree number, will be transported to the laboratory in styrofoam containers.

Data collection. A modification of the forms shown on the next page will be used to standardize data collection in the field and in the laboratory.

[Sample field data sheet -- one for each plot accompanied by a detailed map showing the location of all trees in that plot.]

Plot No._____

Date Sampled_____

Location T____R_____Section_____

Elevation_____

Forest Cover Type_____

Habitat Type _____

_____

Age of Stand_____

Disturbance History _____

_____

Insect and Disease Remarks _____

_____

General Comments_____

_____

Tree No.	Location
.	
.	
.	
.	
etc.	

[Laboratory analysis data sheet -- one for each insect and tree series collected at each plot.]

Plot No._____

Date_____

Tree [or insect] no.	Enzyme Classification
	GOT EST LAP ..... etc.
1	
2	
3	
.	
.	
etc.	

Method of Analysis

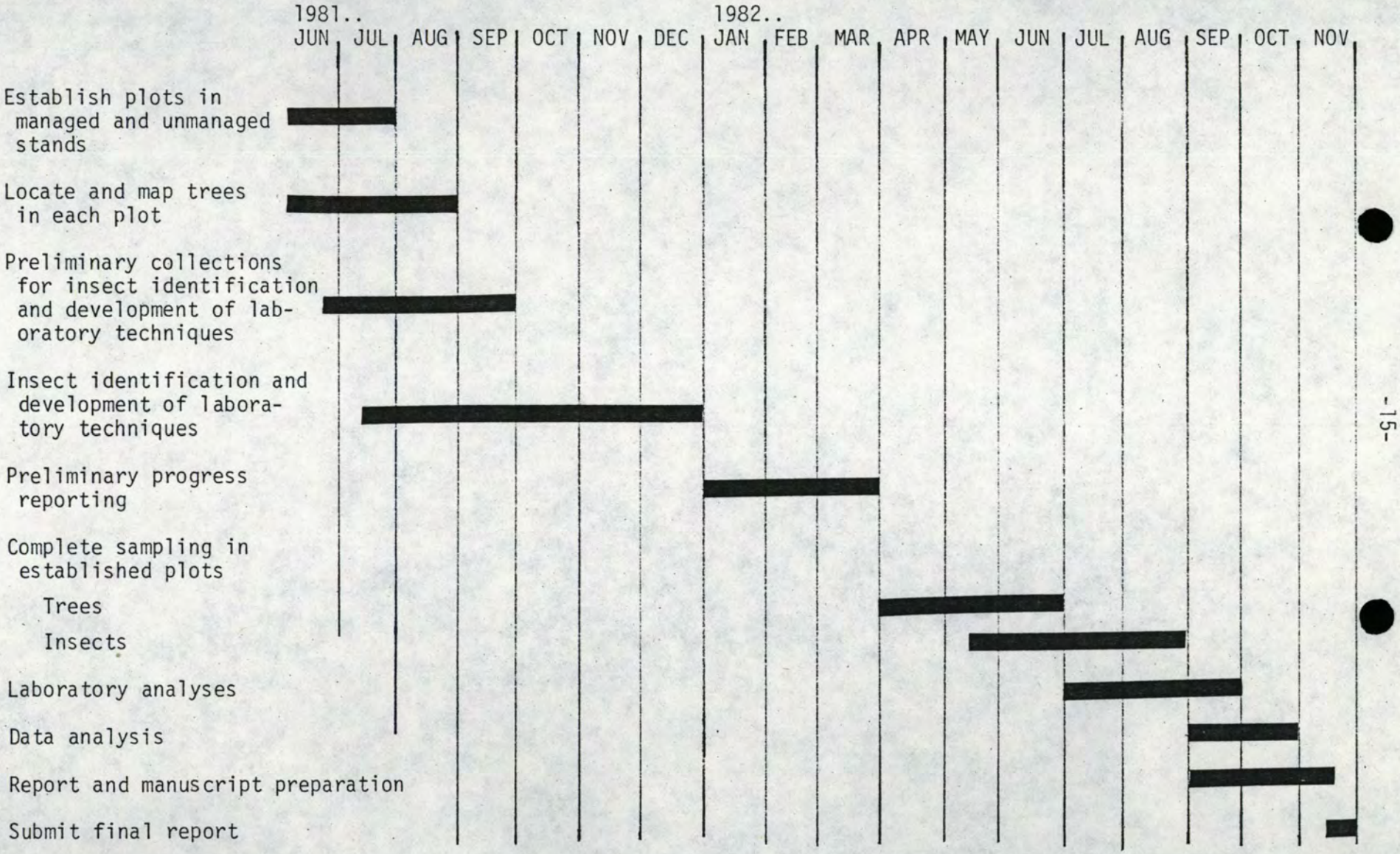
Lepidoptera larvae collected from Douglas-fir trees on the test plots will be identified using keys prepared by Carolin and Stevens (1979) and Peterson (1967). Electrophoretic techniques will follow those developed for Lepidoptera larvae by D. Pashley (pers. comm.), University of Texas, and by Willhite and Stock (1980) for western spruce budworm species. Techniques have been established for routine assay of 11 enzyme systems in the western spruce budworm and modifications of these techniques will be made to suit the size and genetic characteristics of the different species examined for this study. Larvae are homogenized individually in 3-5 drops of distilled water, the homogenate centrifuged briefly, and the supernatant absorbed onto small paper wicks. Starch gels are prepared from a 13% solution of hydrolyzed potato starch and the appropriate buffer solution.

Immediately prior to electrophoresis, needle tissue will be frozen in liquid nitrogen. Electrophoretic techniques for genetic analysis of needle tissue will follow those described by Mitton et al. (1979). Mature needle tissue is ground to a fine, dry powder with a mortar and pestle under liquid nitrogen. A thick slurry of needle-tissue powder and grinding buffer is centrifuged at low speed under refrigeration for 5 mins, the supernatant applied to wicks and subjected to horizontal starch gel electrophoresis. Mitton et al. (1979) have developed staining procedures for 6 variable enzyme systems in ponderosa pine, lodgepole pine, Engelmann spruce, subalpine fir, and quaking aspen. These procedures will be modified, if necessary, for Douglas-fir and additional assays will be developed to increase the sample size for the genomes being compared for this study.

A diversity of computer programs are available at the University of Idaho for analysis of genetic differences between and among groups. These

programs will be used to analyze data on allele and genotype frequencies obtained by electrophoresis from samples of insects and trees in each of the test plots. Thus analyses will include analysis of variance, contingency tests, comparisons of heterozygosity, and other statistical techniques as appropriate.

SCHEDULE OF FIELD AND LABORATORY OPERATIONS



REPORTS AND MANUSCRIPTS

A progress report will be submitted in early 1982 following the first full field season of the project. This report will provide more detailed plot location, sampling plans, etc., than it is possible to provide in this proposal. It will also identify the species of insect to be used in the study and specific laboratory techniques developed for genetic analysis of this insect and for Douglas-fir needle tissue. At the completion of the granting period (November 1982), we will submit a comprehensive final report on the project. At that time we will also have prepared at least two manuscripts for submission to reviewed technical journals. Several appropriate outlets for the results of this work that will be considered are the journals: Forest Science, The Canadian Journal of Forestry, Silva Genetica, Theoretical and Applied Genetics, and Environmental Entomology.

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FACILITIES

With the addition of the 4 power supplies requested, the population genetics laboratory at the University of Idaho will be fully equipped to handle genetic analyses of the extent and kind proposed here. Data analyses can all be conducted using the computer facilities of the University of Idaho and Washington State University (8 miles away). The Priest River Experimental Forest is within a 3 hour drive of the University of Idaho and its facilities continue to be available for scientific research conducted through the University.

APPENDIX A

VITA: M. W. Stock

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EDUCATION:

Pennsylvania State University, 1960-62. Major: zoology.
University of Connecticut, 1962-64. Major: invert. zool. B.A.1964
University of Connecticut, 1964-65. Major: marine biology and parasitology. M.S.1965
Atlanta University, 1965. Major: science education and political science. Teacher Cert.
Oregon State University, 1968-72. Major: entomology. Minor: physiology and biochemistry. Ph.D.1972

PROFESSIONAL EXPERIENCE:

1968-69: Research Assistant, Oregon State University.
1972-73: Research Associate (insect biochemistry and physiology), Washington State University.
1973-75: Research Collaborator (Entomology), Washington State University.
1974: Acting Assistant Professor (Entomology), University of Idaho.
1975-77: Project Leader (Entomology), Washington State University.
1976: Acting Assistant Professor (Entomology), University of Idaho.
1976-78: Assistant Professor (Entomology), University of Idaho.
1978-present: Assistant Research Professor (Forest Resources), University of Idaho.

TEACHING EXPERIENCE:

Advanced Insect Ecology, Biochemical Genetics, Insect Anatomy and Physiology, Insect Physiological Ecology, Immature Insects, Insect Morphogenesis, Aquatic Insects, Entomology for Biology Teachers, General Biology, General Zoology. Team-taught: Agricultural Entomology, Insect Behavior, Medical Entomology, Comparative Invertebrate Embryology.

RESEARCH AREA: Applied population genetics of forest insects.

SOCIETIES:

Entomological Society of America
Society of American Foresters
Genetics Society of America
Washington State Entomological Society
Oregon Entomological Society
Sigma Xi
Northwest Scientific Association
Kansas Entomological Society
Idaho Academy of Sciences
Entomological Society of Canada
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PUBLICATIONS:

1976 Stock, M. W., and J. D. Lattin. Biology of intertidal Saldula palustris (Douglas) on the Oregon coast (Heteroptera:Saldidae). J. Kansas Entomol. Soc. 49:313-26.

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Stock, M. W., and P. J. Castrovillo. Genetic relationships among five Choristoneura species.

Stock, M. W., and J. L. Robertson. Genetic markers for quality control of a western spruce budworm laboratory colony.

Stock, M. W., and J. L. Robertson. Effects of insecticides on esterase isozymes of western spruce budworm during larval development.

CURRICULUM VITAE

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DEPARTMENT: Forest Resources

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PRESENT SALARY: $21,000

DATE OF FIRST EMPLOYMENT AT UI: June 1979

DATE OF TENURE:

DATE OF PRESENT RANK OR TITLE: June 1979

ADMINISTRATION POSITIONS AT UI: Executive Secretary, Inland Empire Tree Improvement Cooperative

EDUCATION BEYOND HIGH SCHOOL:

1965, Bachelor of Arts (Psychology) with honors, New York University
1973, Master of Science (Forest Genetics), Colorado State University
1979, Doctorate (Genetics), University of California (Berkeley)

EXPERIENCE:

In Educational Institutions Since Receipt of Bachelor's Degree:

see pages following

TEACHING EXPERIENCE

1971-1973 Dendrology. Taxonomy of forest trees with emphasis on evolution. Colorado State University, Fort Collins, Colorado. Graduate and undergraduate.

1973-1974 Genetics 100. Molecular, mendelian, population and quantitative genetics. University of California, Berkeley, California. Upper division with many graduate students.

1977 Tree Improvement and Forest Genetics. Principles of genetics and application to the field of forestry. USFS Silvicultural Certification program, Region 5, Placerville, California. Graduate level.

1977 Forest Genetics. Guest lectures. University of California. Berkeley, California. Senior level silviculture course.

1977 Tree and Shrub Improvement Shortcourse. Principles of genetics, practical tree improvement, design of experiments and plantations. Western Forest Genetics Association, Fort Collins, Colorado. Graduate level.

1977 Resource Genetics. Basic molecular, mendelian and population genetics, with emphasis on the role of genetic theory and practice in the modern world. University of California, Berkeley, California. Upper division with participation of graduate students.

1978 Tree Improvement and Forest Genetics. Principles of genetics and application to forest practices. USFS Silvicultural Certification program, Region 5. Berkeley, California. Graduate level.

1978 Tree Improvement and Forest Genetics. Principles of genetics and tree improvement. USFS Silvicultural Certification program, Region 2 and 4. Logan, Utah. Graduate level.

1979 Tree Improvement Shortcourse. Principles of genetics and practical tree improvement. USFS Silvicultural Certification program, Region 9. Hill City, Minnesota. Graduate level.

1979 Tree Improvement and Forest Genetics. Principles of genetics and practical tree improvement. USFS Silvicultural Certification program, Region 2 and 4. Logan, Utah. Graduate level.

1979 Tree Improvement and Forest Genetics. Principles of genetics and practical tree improvement. Continuing Education in Forestry, Ecology and Silviculture. USFS Region 1. Moscow, Idaho. Graduate level.

1979 Forest Genetics and Tree Improvement. Guest lectures. University of Idaho, Moscow, Idaho. Senior Silviculture class.

TEACHING EXPERIENCE (Continued)

1979 Genetic Education in Northwestern Ecosystems. Principles and application of genetics theory and practicum in forest genetics. USFS Region 1. Inland Empire.

RESEARCH EXPERIENCE

Completed

1973 Effects of heavy metal salts on the *in vitro* germination of Engelmann spruce pollen. Master's thesis. Colorado State University, Fort Collins, Colorado.

1973-1978 Graduate research assistant, University of California, Berkeley, California.

1979 Genetic architecture of giant sequoia. Ph.D. dissertation. University of California, Berkeley, California.

Four manuscripts in progress from this work.

a) Isozyme Analysis of the Genetic Architecture of Giant Sequoia. To be submitted to Silvae Genetica.
b) Vegetative Propagation of Giant Sequoia by Rooting Cuttings. To be submitted to the International Plant Propagator's Journal.
c) Seed Germination of Giant Sequoia. To be submitted to Tree Planter's Notes.
d) Popular article: If you've seen one Redwood, have you seen them all? To be submitted to National Parks Magazine.

In Progress

Population differences in cold hardiness of giant sequoia trees. Young trees will be vegetatively propagated and the clonal material will be subjected to several environments including both field and laboratory conditions.

Effects of inbreeding on vegetative propagation. Selfed and cross pollinated families of Douglas-fir and ponderosa pine will be compared for speed and level of vegetative propagation. Inbred families are expected to produce fewer rooted cuttings and at a slower rate than outcrossed families.

Proposed

A study to explore the relationship between initial survival in plantations and heterozygosity of individual plants. Clones of known heterozygosity will be planted under different environmental conditions to test for the presence of genotype-environment interactions. Proposal submitted to the U.S. Forest Service.

RESEARCH EXPERIENCE (Continued)

A study to determine the level of genetic control of resistance and susceptibility of western larch to larch casebearer. The study will include vegetative propagation of a sample mature tree randomly selected with respect to casebearer attack, and exposure of the cloned material to casebearer under controlled and field conditions. Seed will also be collected from the same mature trees and seedlings will be planted under field conditions to determine the inheritance patterns and resistance mechanisms of casebearer susceptibility and resistance. Proposal to be submitted to U.S. Forest Service.

Extension and Service

Public Information Specialist, Lake Tahoe Visitor Center
Caseworker for New York City Department of Welfare, 1965-67.

Administration

Executive Secretary, Inland Empire Tree Improvement Cooperative (June 1979-present). This is a key position in the cooperative which has the following responsibilities: Genetic advisor for all species programs (presently six major Inland Empire species); screen all proposed research; plan and conduct annual meeting of all cooperators; attend and secretary all species meetings; inform cooperators of current events through periodic newsletters; conduct research program. Cooperative membership includes:

Boise Cascade Corporation
Burlington Northern, Inc.
Champion International Corporation
Diamond International Corporation
Inland Empire Paper Company
Potlatch Corporation
St. Regis Paper Company
Washington-Idaho Forest Products, Inc.
Idaho, Department of Lands
Montana, D.N.R.C. Division of Forestry
Washington, Department of Natural Resources
Coeur d'Alene Indian Reservation
Colville Confederated Tribes
Flathead Indian Reservation
Spokane Indian Reservation
USDA Forest Service, Region 1
USDA Intermountain Forest & Range Experiment Station
USDI, BLM, Idaho State Office
USDI, BLM, Montana State Office
University of Idaho
University of Montana
Washington State University

The cooperative currently operates on a budget of $31,000 per year. It is my responsibility to administer this budget, reporting directly to the Dean of the College of Forestry, Wildlife & Range Sciences and the Chairman of the Cooperative (an elected position).

Other Professional:

Employment:

Membership in Professional and Scholarly Organizations:

International Plant Propagators Society
Society of American Foresters

Other Experience:

Armed Forces:

Community and Service:

Volunteer in a kibbutz (Israel) 1969

Scholarly and Creative Activities:

Libby, W.J., David Kafton, and Lauren Fins. 1975. A case study of California conifers. In Methodology of Conservation of Forest Genetic Resources. FAO publication, ed. Laurence Roche.

Honors and Awards:

Xi Sigma Pi (honor society)
Gamma Sigma Delta (honor society)
Sigma Xi (honor society)
Babcock Fellowship (U. of CA, 1973)
Sigma Xi grant (1972)

BUDGET

	Univ. of Idaho	C.S.M.R.G.E.
1. Salaries and Wages		
Principal Investigators		
M. Stock (20%)	---	$ 7,500
L. Fins (10%)	$ 3,600	---
Graduate Assistants (2)	---	16,200
Temporary Help	---	4,500
2. Fringe Benefits		
20% Principal Investigators	720	1,500
10% Graduate Assistants	---	1,620
8% Temporary Help	---	360
Total Salaries, Wages, and Fringe Benefits	4,320	31,680
3. Expendable Materials and Supplies		
Chemicals for electrophoresis	---	2,940
Misc. expendable supplies	---	2,250
Total Materials and Supplies	---	5,190
4. Non-expendable Supplies		
4 high-voltage power supplies (Heathkit SP2717 @ $260 each)	---	1,040
5. Travel and Per Diem		
Travel (vehicle charges and gas)	---	850
Per diem (60 days @ $35/day)	---	2,100
Total Travel	---	2,950
6. Computer Costs	---	300
7. Other Direct Costs		
Phone, copying	---	150
Publication	---	800
8. Total Direct Costs	4,320	42,110
9. Indirect Costs		
Off-campus experiment station research (15.6%TDC minus equipment)	674	6,407
TOTAL COSTS (direct and indirect)	$ 4,994	$ 48,517

Total requested is $48,517. Total contributed by the University of Idaho is $4,994 or 10% of total cost of project.

GUIDELINES FOR PREPARING RESEARCH PROPOSALS

for the

CONSORTIUM FOR THE STUDY OF MAN'S RELATIONSHIP WITH

THE GLOBAL ENVIRONMENT

Guidelines and a suggested format for preparing and submitting proposals for research grants are enclosed. They were developed under the direction of the Governing Committee of the Corsortium to assist scientists in organizing their proposals and to facilitate the review process.

Appended to the Guidelines are Objectives of the Consortium and of the MAB program; Mission statements of the USDA Forest Service; USDI Fish and Wildlife Service, National Park Service, and the Hertitage Conservation and Recreation Service. Goal statements of the participating MAB Directorates, Fish and Wildlife Service, National Park Service, Hertitage Conservation and Recreation Service, and a copy of the form to be used to evaluate research proposals. This backgound material should prove useful in focusing the research proposed most advantageously and in evaluating proposals equitably.

A calendar of Events with Deadline Dates for fiscal year 1980 also is included.

Funds Available -- Approximately $50,000 per research proposal. Workshops, Conferences, Symposia, Meetings, etc., will not be considered for funding.

Comment: Although no upper limit has been set on the size of the grant, those not exceeding $50,000 will receive the highest consideration.

Principal Investigators -- Principal investigators affiliated with other agencies of the Federal Government will receive transferred funds. Those at universities and with non-profit organizations will be issued grants. Office of Management and Budget (OMB) Circular A-110 shall be used to model financial aspects of research proposals from these sources. Principal investigators affilitated with State and local govenments shall follow the administrative requirements in OMB Circular A-102 as a model.

Type of Grant -- Grants to scientists at research institutions will be made under a reimbursable agreement unless there is a justifiable fiscal need for an advance of funds.

Comment: Regardless of how grants are made, fully 20 per cent will be withheld pending receipt and acceptance of all reports agreed upon in the contract. As a minimum, an interim progress report and a final report will be required, the latter within 2 months of the expiration of the grant.

Longevity of Research Grant -- 3-year maximum

Call for Proposals -- The Chairman of the Consortium will make an announcement calling for research proposals annually.

Comment: The announcement will be made as early in the new fiscal year as a realistic estimate can be made of agency funds available for MAB research and by January 1 at the latest.

Areas of Consideration -- Until such time that additional funds for MAB research become available, only proposals relating to Tropical Forests, Temperate Forests, and/or Biosphere Reserves will be considered. Objectives and Goals for the Consortium, participating agencies, MAB, and these Directorates are in the Appendix.

Submission of Proposals -- The original and 10 copies of each proposal, prepared in the format herein described, should be submitted to:

U.S. MAB Secretariat
U.S. Department of State
IO/UCS SA-2
Washington, DC 20520

so as to arrive at the Secretariat before the deadline set forth in the annual announcement by the President of the Consortium. Recipients of grants will be notified during August and grants will be awarded soon thereafter.

Format of a Proposal -- The format was developed by the Governing Committee of the Consortium to assist researchers in organizing their proposals and to facilitate the review process.

Sample of Cover --

RESEARCH PROPOSAL SUBMITTED TO THE
CONSORTIUM FOR THE STUDY OF MAN'S RELATIONSHIP
WITH THE GLOBAL ENVIRONMENT

Title of Proposal

Principal Investigators -- Names, addresses, phone numbers, affiliations

Institution or Agency

Proposed Starting Date

Estimated Completion Date -- Last day of month listed

Duration -- Months

Total Budget -- Estimate in U.S. dollars; total to include all overhead

Endorsements

Investigators Institutional Officials

-- (Signatures and Titles)--

Sample of Contents --

Abstract -- One page to include a brief statement of the problem, justifications, study objectives, scope and relationship of the study to the objectives of the Consortium.

Problem Statement -- Background and justification
-- Review of pertinent literature
-- Relationship to objectives of the Consortium and to goals of one or more U.S. MAB Directorates (at least one from the Consortium)
-- Anticipated benefits

Objective(s) and Scope --

Methods -- Study design including variables to be measured, sampling procedures, data collection
-- Method of analysis
-- Schedule of operations for field and/or laboratory

Reports and Manuscripts -- Schedule, plans, and suitability for publications (list media).

Literature Cited --

Principal Investigator(s) -- Vita including social security numbers, qualifications and available facilities to conduct and complete proposed research.

Budget Requirements --

	Dollars
1. Salary and Wages	
Principal Investigator	_____
Assistants	_____
Secretary - Typist	_____
Other	_____
Subtotal	_____

2. Staff (Fringe) Benefits
   _____% of Principal Investigators salary _____
   _____% of Assistants salary _____
   other _____
   Total Salary, Wages & Benefits _____

3. Expendable Materials and Supplies _____

4. Non-expendable Equipment (Itemize by unit, quantity, and price if more than $300 per unit 1/ _____

5. Travel and Per Diem
   Travel _____
   Per Diem _____
   Total _____

6. Computer Costs (Itemize) _____

7. Other direct costs (Itemize) _____
   _____
   _____
   Total Direct Costs (All of above) _____

8. Indirect (Non-recoverable) Costs
   _____% of Total direct costs _____

   Total Costs (Direct and Indirect) _____

1/ If equipment costs exceed $300 per unit, include justification statement with budget request. Disposition of equipment costing $300 or more must be negotiated before the grant is awarded.

APPENDIX

The Objectives of this Consortium are to operate harmoniously within the existing framework of the U.S. Man and the Biosphere Program; to encourage and support research that complements the mission of the participating agencies; to identify man-related problems of the environment; to initiate and carry out research programs directed toward a systematic resolution of these problems; to encourage publication and dissemination of meaningful research results; and to support and facilitate related activities furthering these purposes.

The Objective of the Man and the Biosphere Program is to develop the basis within the natural and social sciences for the rational use and conservation of the biosphere and for the improvement of the relationsip between man and the environment.

The Mission of the Forest Service is federal responsibility for national leadership in forestry; promotion and achievement of a pattern of natural resource use that will best meet the needs of people now and in the future; protection and improvement of the quality of air, water, soil, and natural beauty; protection and improvement of the quality of the open space environment in urban and community areas; generation of forestry opportunities to accelerate rural community growth; encouragement of the growth and development of forestry-based enterprises that readily respond to consumers' changing needs; encouragement of optimum forest land ownership patterns; improvement of the welfare of underpriviledged members of society; involvement of the public in forestry policy and program formulation; encouragement of the development of forestry throughout the world; expansion of public understanding of environmental conservation; and development and availability of a firm scientific base for the advancement of society.

The United States Fish and Wildlife Service provides leadership for the protection and improvement of land and water environments (habitat preservation), which directly benefits the living natural resources, and adds quality to human life; biological monitoring, through scientific research; surveillance of pesticides, heavy metals, and thermal pollution; studies of fish and wildlife populations; ecological studies; environmental impact assessment through river basin studies, including hydroelectric dams, nuclear powersites, stream channelization, dredge and fill permits; associated research; environmental impact statement review; area planning and preservation involving river basin, wildnerness areas,

and special studies, such as oil shale and geothermal energy. The Service is responsible for improving and maintaining fish and wildlife resources by proper management of migratory birds and other wildlife; control of population imbalances and fulfilling the public demand for recreation fishing while maintaining the Nations fisheries at a level and in a condition that will assure their continued survival.

The Service provides national and international leadership in the area of endangered fish and wildife from the standpoint of both restoration as well as preventive measures involving threatened species. This program includes development of species lists, recovery plans, conduct of status surveys, coordination of efforts nationally and internationally; research on propogation methods, distribution, genetics, and behavior; operation of wildlife refuges; law enforcement, foreign importation enforcement, and consultant services to foreign countries.

The Mission of the National Park Service is to administer the properties under its jurisdiction for the enjoyment and education of our citizens, to protect the natural environment of the areas, and to assist States, local governments, and citizens groups in the development of park areas, the protection of the natural environment, and the preservation of historic properties. The Service develops and implements park management plans and staffs the area under its administration; provides leadership in the preservation of representative natural areas; studies the natural environment as a means for improving the scientific basis for natural resource management through the promotion of inventories, baseline studies,and relationships of man-caused impacts in pristine natural areas.

The Heritage, Conservation and Recreation Service monitors and stimulates research relating to outdoor recreation, and cooperates with and provides technical assistance to other Federal departments and agencies. Certain rivers and trails are identified for possible study for inclusion in the National Wild and Scenic Rivers and Trails Systems. The possible adverse effects of transportation projects and programs on parks, recreation areas, and wildlife and waterfowl refuges are reviewed along with Federal actions having an impact on outdoor recreation. The Service sponsors programs to identify and recognize natural and historic landmarks, recovery of archeological remains, and records significant architectural and engineering works.

Criteria that the participating agencies will use in making their selections are: (a) compatibility with the missions of the agencies; (b) relatively short-term applied research involving both the natural and social sciences; (c) research aimed at an incremental and sequential achievement of Directorate objectives; and, (d) international involvement and/or applicability, especially with developing nations.

The Goal of the Tropical Forests Project is to stimulate, sponsor, and coordinate research, training, and application of research directed toward management of tropical and subtropical forest landscapes. Management may involve use of these landscapes for natural reserves, production forests, plantations, agriculture, and urban activities. Man is considered as part of the forest ecosystem.

The Goals of the Temperate Forests Project are, internationally, to study the ecological and socio-economic effects of alternative uses and managerial practices in boreal, temperate, and mediterranean regions having forests or the characteristic natual cover, and domestically, to research the following problems and problem areas: (1) environmental impacts of wildfire and fuel management policies; (2) effects on forests of energy development technologies, specifically, utilization of forest products for energy; (3) information and analytical techniques applicable to forest land use planning with emphasis on environmental benefit/cost of regional forest lands development and on regional ecological effects; (4) the ecological and socio-economic effects of intensive forest management practices and particularly the impacts on- and off-site of alternative methods of site preparation on the soils, water, and nutrient status of forest ecosystems, and the implications for future productivity of the land; and, (5) accumulate, analyze, and transfer information about forests.

The Goals of the Biosphere Reserve Project are (1) to promote the conservation of natural and man-modified areas representative of the world's major ecosystem, as a strategy for safeguarding the genetic diversity of the biota of these areas on which their continuing evolution depends; (2) to provide for research on the structure, functioning, and dynamics of ecosystems in order to enhance our understanding of natural processes and of man's impact upon them, to be applied toward better management policies, and, (3) to make available facilities for education and training in natural resource studies and management.

Abbs

The nine preliminary elements of the 1978-1982 operational plan for Biosphere Reserves are: (1) completion of the world coverage of biosphere reserves; (2) full implementation and demonstration of the biosphere reserve concept; (3) implementation of ecological research in biosphere reserves and establishment of effective links with other MAB project areas; (4) develop means and ways for effective ecosystem and species conservation in biosphere reserves; (5) identify future monitoring functions of biosphere reserves and implement monitoring schemes on a pilot basis; (6) establish education and training programs on the reserves; (7) establish a computerized information system to improve the flow of information concerning biosphere reserves; (8) provide for proper legal protection of biosphere reserves; and (9) link biosphere reserves with other protected areas.

CALENDAR OF EVENTS

Fiscal Year 1980

Deadline Date	Event
1979	
December 21	Estimate of funds to be made available by participating agencies received at the U.S. MAB Secretariat.
December 21	Chairman of the Governing Committee of the Consortium makes annual announcement calling for proposals.
1980	
March 10	Proposals must be postmarked by February 25 and received by the U.S. MAB Secretariat by March 10.
March 10	Proposals distributed for review by representative(s) of participating agencies and by the Executive Director of the U.S. MAB Secretariat for conformance to Agency Missions and to objectives of the MAB Program and the Consortium.
March 31	Reviews completed. Proposals with comments and evaluations received by the Secretariat on this date.
April 14	Proposals distributed to chairmen of participating directorates for peer review, evaluation, and comment.

May 12	Proposals returned to chairmen of participating directorates.
May 19	Meeting of Governing Committee to consider alterations in proposals suggested by peers. Return proposals to Principal Investigators, if needed.
June 16	Proposals postmarked by this date and received at the U.S. MAB Secretariat by June 30.
June 30	Meeting of Governing Committee to select and recommend proposals for funding.
July 14	Notification of acceptance of proposals as one to be negotiated by agencies (fiscal and technical negotiations).
August 15	Grant awarded.

PROPOSAL REVIEW FORM

Provide a rank for each of the criteria listed below. The ranks are:

0 = unacceptable or not present
1 = poor or low
2 = marginally adequate
3 = adequate, OK, medium
4 = good
5 = excellent or high

Generate the score by multiplying each rank by its factor (f)

CRITERIA

---

1. Research problem relates to Directorate No. _____. _____ yes _____ no
   Comment:

		Rank		F		Product
2.	Priority or urgency of research.	( )	x	2	=	( )
3.	To what degree will results of this research be needed by practioners	( )	x	1	=	( )
4.	What is the likelihood of immediate and extensive adoption of results assuming technology transfer routes are available?	( )	x	1	=	( )
5.	Degree to which proposal reflects Principal Investigator's knowledge of field (does the Principal Investigator know what he/she is doing?) Explain:	( )	x	2	=	( )

6. Overall quality of proposal. Is it well written? Are objectives clear, procedures described well, etc.? ( ) x 1 = ( )
Explain:

7. Are the procedures to be used adequate?
a. Experimental design _____ ( ) x 1 = ( )
b. Experimental methods _____ ( ) x 1 = ( )
c. Data reduction _____ ( ) x 1 = ( )
Comments:

8. BUDGET. Do you feel the budget is:

( ) Too low to adequately carry out work. Why?

( ) About right

( ) Too high for project as described. Why?

TOTAL SCORE _____

Reviewer: _____
Sign and Date

PROPOSAL REVIEW FORM

Reviewer_____ Date_____

Title of Proposal_____

Principal Investigators_____

Institution_____

==========

SUMMARY SCORE_____

( ) Accept proposal as written

( ) Accept proposal if changes noted below can be made.

( ) Reject proposal because:

( ) Inadequate proposal (comment below)

( ) Duplicates ongoing work (note below)

( ) Not within the scope of the mission of MAB, Consortium, Directorate nor of the participating agencies (explain below)

( ) Has some merit but needs major changes in proposal--the proposal must be completely rewritten (explain below)

Comments, Notes, and Explanations: _____

_____

_____

_____

_____

_____

_____

_____

To: Dr. Ables, Forestry

From: Nancy Weller, IRF

Subject:

University of Idaho
Inter-Office Memorandum

Date: 1-24-80

Dr. Stark forwarded this information to me, and I don't know if he also showed it to you. Dr. Laurence said that you would be particularly interested in page 8 - The Goals of the Biosphere Reserve Project. I am also sending a copy to Dr. Hatch.

Nancy Weller

TO: E. Ables
FROM: Molly Stock
SUBJECT: Genetic Resources of Wilderness Areas

12 December 1979

Here are some notes I made after our brief talk yesterday. I would very much like to discuss the subject more with you as I think Idaho wilderness areas represent a large potential for fruitful studies along the lines indicated below:

Natural populations of plants and animals (i.e., minimally affected by human activities) are a valuable genetic resource. Modern methods of genetic analysis provide a means whereby the genetic resources of wilderness areas can be measured and used as a basic comparative index in studies aimed at increasing our understanding of the effects of human activities upon these living systems.

Background. Early ideas on the genetic composition of populations followed a fairly strict Darwinian interpretation. That is, when a mutant gene form appeared, it was either disadvantageous and was selected out of the population or it was advantageous and, over time, became more and more common until the entire population was 100% fixed for that new gene type. Thus polymorphism (the existence of multiple forms of genes) was considered a transitory phenomenon. However, recent work with electrophoresis has shown us that natural populations contain high levels of genetic polymorphism which are, in most cases, relatively stable attributes of these populations over time.

The first population study using electrophoresis was published in 1966. That and more recent studies have shown that in many organisms populations are polymorphic at 25-50% of their loci and individuals are on the average heterozygous at 5-15% of their loci. The evolutionary significance of these high levels of variation is a subject of debate among geneticists today. Some believe that polymorphism results from the accumulation of 'neutral' genes (i.e., the different forms of the gene are equally fit). However, there is considerable evidence that variation is maintained by selection and represents a reservoir of adaptive flexibility (i.e., to permit survival when environmental conditions fluctuate) within these organisms. Thus, the optimum genetic condition under natural conditions is apparently one with high levels of inherent diversity.

Wilderness areas. Wilderness areas provide a unique opportunity to examine unmanaged (by humans) populations of plants and animals where the natural genetic resources have not been altered by specific management strategies. Such areas also provide a basis for comparing the effects of management practices and human-imposed environmental alterations upon such areas. Information on the genetic makeup of populations in wilderness areas could be used for such purposes as:

1) Studies to identify the specific evolutionary and genetic effects of conditions imposed by humans or by the natural environment (e.g., fire, insect damage, thinning). By contrasting the genetic makeup of populations before and after (or with an without) such conditions, one can identify those genetic types that would respond in a desirable way (e.g., resistant to diseases or pests) and deliberately select for such characteristics. Electro-

phoretic studies provide a useful alternative means of identifying such characteristics.

2) Studies to determine how best to preserve the high levels of genetic variation for future generations in managed situations. Human manipulation of forested areas can result in an irreversible loss of genetic material that is comparable to loss of endangered species. Genetic variation is reduced when a sample of the natural populations is taken and used to propagate a laboratory colony (i.e., insects), to establish a population in a new area (e.g., deer), or to establish tree plantations or seed banks. If the number of organisms used to initiate the cultured group is small, genetic variation may be further reduced in subsequent generations by inbreeding. Reduced genetic variation is manifested as an increased proportion of homozygous individuals and a concomitant reduction in individual heterozygosity and overall population polymorphism. Such changes can be simply and accurately estimated with electrophoretic techniques. Methods to minimize this reduction in genetic resources can then be implemented.
