1959

# Biotic Succession in a Douglas Fir Forest on Saddleback Mountain (Oregon Coast Range)

Jane Claire Dirks-Edmunds

ENVIRONMENTAL BIOLOGY

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| INSTITUTION | LINFIELD RESEARCH INSTITUTE<br>McMinnville<br>Oregon |
| Principal Investigator | Jane C. Dirks-Edmunds |
| PROJECT | BIOTIC SUCCESSION IN A DOUGLAS FIR FOREST ON SADDLEBACK MOUNTAIN (OREGON COAST RANGE) |
| Period | Two Years |
| Starting Date | June 1959 |
| Grant Requested | $15,570.05 |
| Approved | Signed by: |

_____

W. P. Dyke
Director
LINFIELD RESEARCH INSTITUTE

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Jane C. Dirks-Edmunds
Principal Investigator

Just extended to 12/61
Then to 6/62

## Abstract of Proposed Research

It is proposed to make an extensive ecological study of a young Douglas fir forest community at an elevation of approximately 1400 feet on the north slope of Saddleback Mountain in the Oregon Coast Range. Both quantitative and qualitative sampling of the biota will be carried out at weekly intervals through a two-year period which will cover approximately the twentieth and twenty-first years of succession after logging of the original virgin forest. Meteorological data will be obtained concurrently to determine some of the effects of these physical factors upon the biota and in turn modifications of these factors by the biota. Less extensive periodic observations have been made during the first eighteen years of the seral stages of succession.

Data are available from a similar five-year synecological study which terminated approximately two years before the mature Douglas fir community which formerly occupied this same site was logged.

A thorough comparison and analysis will be made of the data from the two studies.

## Historical Background and Relation to Present State of Knowledge in the Field and Comparable Work Elsewhere

According to the most recent statistics available, in 1953 the forests of the Pacific Northwest (Douglas-fir subregion) contained about 30 percent of the entire live sawtimber in the United States, and, of this, Douglas fir constituted 57 percent (Moravets, 1959). In the lumber industry of the country Douglas fir occupies a prominent position forming, in 1954, 28 percent of the total lumber cut in the United States, and in the Pacific Northwest it is the most important tree of the industry, comprising about 65 percent of the total lumber production (op. cit.). In spite of the importance of Douglas fir in the nation's economy, a search of the literature reveals that a single comprehensive ecological study has been made of a mature Douglas fir forest, involving instrumentation to determine the weather conditions in the area and extensive observations and collections of both plants and animals as a basis for an understanding of the entire biota of the forest community.

The investigation referred to was conducted by Dr. James A. Macnab, then at Linfield College, from the fall of 1932 to the spring of 1938 on Saddleback Mountain in Northeastern Lincoln County (Oregon Coast Range). Dr. Jane C. Dirks-Edmunds, at that time an undergraduate student at Linfield College, was an assistant in the project from December 1933 through the summer of 1937 and studied the area independently in the summer of 1938. For five years, from the spring of 1933 until the close of the investigation, approximately weekly observational and collecting trips were made to the research area which was situated in a primitive Douglas fir forest at an elevation of about 1420 feet on the north side of Saddleback Mountain nearly four miles southwestward from Boyer on the Salmon River Highway (Oregon 18) (Fig. 1.). Data assembled from weather-recording instruments (including a Friez hygrothermograph, rain gages,

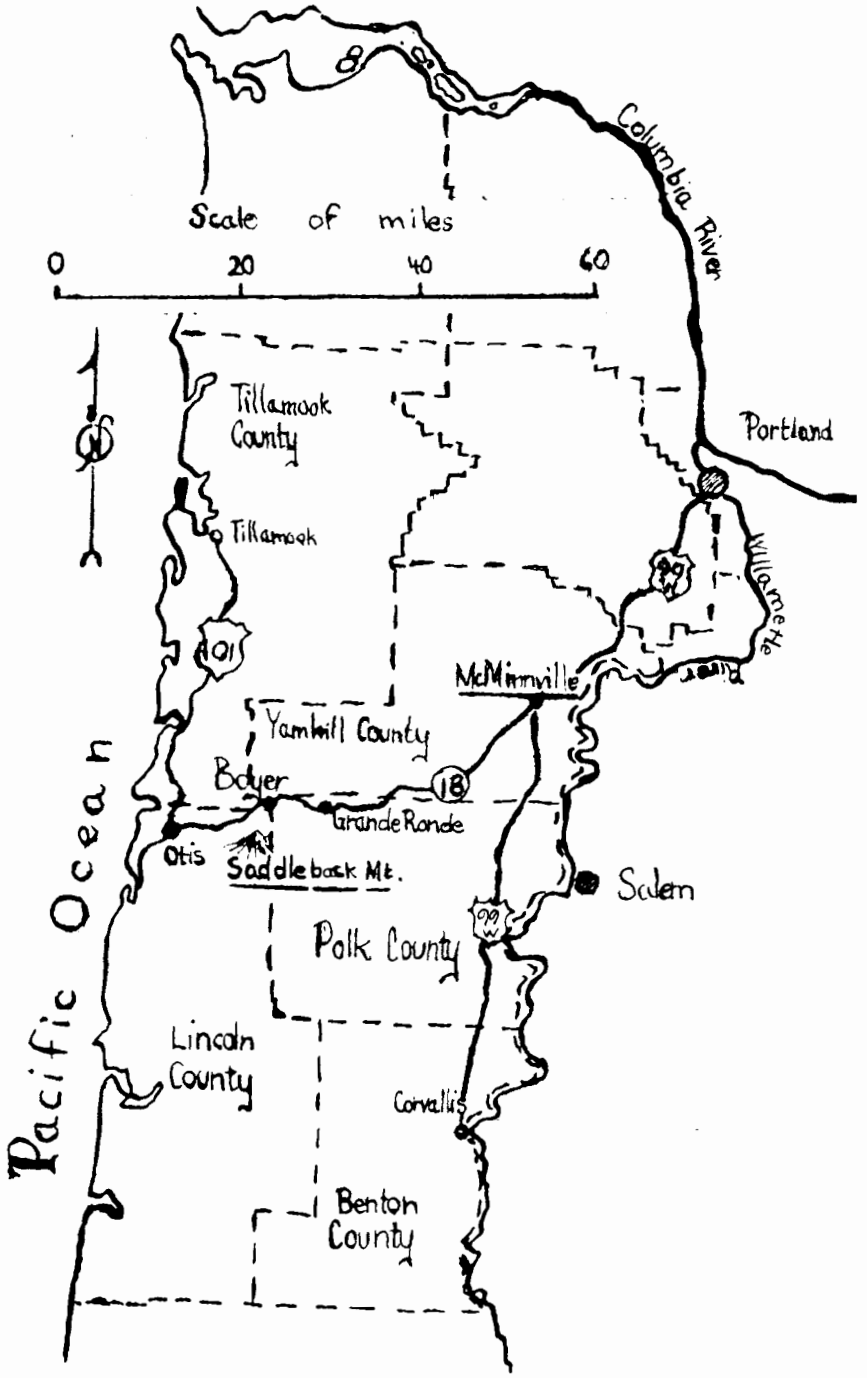


Fig1. Outline map of Northwestern Oregon showing location of McMinnville (Linfield College) and Saddle back Mountain (research area)

an anemometer, atmometers, and maximum-minimum thermometers), insect and other small animal collections, and notes on observations on all forms of life detected in the area constitute a voluminous assemblage of information about this forest community. The director of the research, Dr. Macnab, was unable to use this entire mass of information in his doctoral dissertation and, as a result, chose to select for this purpose the environmental, floral and faunal data which best delineated the changes from season to season. This he published under the title, Biotic Aspection in the Coast Range Mountains of Northwestern Oregon (1958). Because of her contribution to the research program, Dr. Macnab permitted Dr. Dirks-Edmunds to make use of data collected largely during the summers from 1934 through 1937, which she supplemented with her study in the summer of 1938, and used as part of her doctoral thesis (Dirks, 1941), a portion of which has been published as A Comparison of Biotic Communities of the Cedar-Hemlock and Oak-Hickory Associations (Dirks-Edmunds, 1947). From the study on Saddleback Mountain there still remains unpublished and available for use a very large volume of valuable information relative to conditions in this primitive, relatively undisturbed, mature Douglas fir forest community.

Published accounts of two additional studies in the Oregon Coast Range can be found in the ecological literature, but both are limited to a consideration of plants. The first of these was An Analysis of the Plant Communities of Mary's Peak, Western Oregon (Merkle, 1951) which dealt with data collected during the summer of 1947 and was, in the author's words an attempt "to test the application of the several phytosociological concepts concerned in the analysis and description of plant communities". The second study, entitled Forest and Adjacent Burn in the Tillamook Burn Area of Northwestern Oregon (Neiland, 1958), consisted of a comparison of plant quadrats in four sample areas in unburned forest with similar quadrats in two sample areas of the adjacent 1945 burn during the summer of 1956; limited environmental data were also recorded.

Another study which should be mentioned was published by Munger (1940) under the title, The Cycle From Douglas Fir to Hemlock. Its thesis is that the Douglas fir, though the predominant tree in southern British Columbia, western Washington and Oregon, is not the climax species but, in the absence of fire or clear-cut logging, ultimately will be supplanted by western hemlock and other shade-tolerant trees. Munger's paper is limited to a consideration of the tree species in the various forest areas described.

In the summer of 1940 logging operations removed the Douglas fir forest from the research area on Saddleback Mountain, but Dr. Dirks-Edmunds' interest in the area continued since she saw in this an opportunity to pursue a new phase of ecological research, and in the summer of 1941 she began a note and photographic record of the succession occurring there. This record, supplemented by three periods of small-mammal trapping, has been continued through the ensuing years as time has permitted and has been the subject of two reports at scientific meetings (Dirks-Edmunds, 1954 and 1959).

The Saddleback research area, for which so much information is available from the five-year investigation of the mature community prior to logging, affords a unique opportunity for study of the processes and factors involved in succession from logging back to the mature community.

No one knows what the original volume of Douglas fir timber was at the time the Pacific Northwest was settled by the white man, but it has been estimated that before logging began, old-growth Douglas fir timber covered about 14 million acres. By 1940 this area had decreased to 6.9 million acres, three-fourths of which was in western Oregon (Andrews and Cowlin, 1940). Also, at that time the harvesting of mature timber was so active that regrowth was not able to keep pace and the sawtimber volume of the Douglas-fir region was being depleted about four times as fast as it was being replaced by growth. The annual depletion of sawtimber from all causes then was estimated to approximate 8.3 billion board feet (op. cit.). In 1952 rate of depletion

(due to cutting and mortality) of the sawtimber volume in the Douglas-fir subregion was about 2.4 times the estimated rate of growth in sawtimber stands or about 11.2 billion board feet (Moravets, 1959).

Rapid depletion of the Douglas fir timber resources between World Wars I and II spurred the U. S. Forest Service and the Oregon State Board of Forestry to study mature stands of Douglas fir and the climax forests of the region (Hanzlik, 1928; Munger, 1940) and to begin an active research program with especial emphasis on forest management, selective cutting, reproduction, and growth of Douglas fir (Munger, 1927; McArdle and Meyer, 1930; Isaac, 1935; Moore, 1940; Andrews and Cowlin, 1940; Kangur, 1954; Lavender, 1954; Lavender and Engstrom, 1956). While these studies are important contributions to the knowledge of forestry and contain valuable information of an ecological nature relative to Douglas fir succession, they are either purely descriptive with little quantitative basis, or they are, at best, autecological, dealing with a single species or a limited group of species without considering the effects of the entire community-complex (all of the species interacting with one another and their environment).

Isaac and Meagher (1935), Isaac (1938, 1940 and 1943), Reid, Isaac and Pickford (1938), Ruth (1956), and Morris (1958) have presented some outstanding work of special significance in the reproduction and early succession of Douglas fir following logging and fire, but even these publications do not present the physical and biotic factors of the community as an integrated whole. A search of the literature has failed to produce a single publication which conveys an integrated picture showing the interrelationships of climate, plants, and animals in the succession back to a mature Douglas fir community.

## Objective

It is felt that the Saddleback research area with its unusual history offers a site which can tell admirably the story of Douglas fir succession following logging. In 1960, twenty years will have been concluded in this successional progression, and it seems desirable to compile for publication as complete a set of data as possible concerning this interval, patterned after the original investigation but so designed as to strengthen many points.

Such a study should have value in the field of applied biology as well as in the realm of pure science.

Each point listed in the procedure, which follows, is a specific objective.

## Plan of Procedure

To accomplish the over-all objective, the following plan of procedure is proposed:

1. Reestablishment of Hectare 17. One of the most significant aspects of the proposed study is the possibility of accurately reestablishing the boundaries of Hectare 17 which was the center of concentration for instrumentation, collection, and observation for the original study. Hectare 17 consisted of 100 meters, squared, and was subdivided into a grid of 25ths, each one having an area of 20 $M^2$. Dr. Dirks-Edmunds constructed a detailed map of the vegetation in this area during the original research period which will facilitate relocating the boundaries of the hectare and its subdivisions, so that this area can be used again as the center of research activities.

All who are familiar with the proposed research enthusiastically advocate remapping this hectare and concur in the idea that such a direct comparison of the vegetation of an area of this extent twenty years after logging with the

original forest vegetation would, by itself, constitute an outstanding and unique contribution to the literature.

2. Floral analysis. Once permanently located, Hectare 17 would provide transects, quadrats, etc., which could be used for floral analyses not only for this interval in the succession but also for years to come.

Trees will be counted, their age and size determined, and selected ones will be marked for continuing study. (Some trees were so selected and marked in 1954.) Stumps and logs of old trees will be studied and plotted into the map. Shrubs will be identified, and their abundance and extent recorded. Herbs also will be identified, their abundance and extent recorded, and their seasonal occurrence noted. The moss cover, also, will be studied.

3. Faunal analysis. It is desirable to ascertain as completely as possible every species of animal in the forest community, its abundance and role in the life of the community. Hectare 17 will serve as the center for this portion of the study which will be implemented by the use of various techniques, including the following:

a. Collection of insects, spiders, etc., at weekly intervals with sweep-net, beat square (for trees), and humus and soil samples. The humus and soil samples will be processed by using Berlese funnels. The regular collections will be supplemented by the use of a motorized collecting device and light traps at intervals during the spring and summer months. At these times collecting will probably be done on several consecutive days as well as throughout the night.

b. Spring and fall trapping of small mammals in cooperation with the North American Census of Small Mammals; this involves the use of a trap-line for three consecutive days in each trapping period.

c. Observations relative to all animal activity, but with special emphasis upon bird activities and mammal tracks and sign, will be recorded on every trip.

5. Photographic record. This record of vegetative succession and growth, which was started the year after logging, will be continued and supplemented both in color and in black and white. Most of the pictures which have been taken in the past are black and white.

## Personnel

Experienced personnel for supervision of the work outlined is available in the persons of the principal investigator, Dr. Dirks-Edmunds, and her graduate assistant, Mrs. Frances W. Daniels, both of whom participated actively in the original ecological study on Saddleback Mountain. The husbands of the senior investigators (M. R. Edmunds, B. S. in Forestry, Oregon State College, and H. C. Daniels, Deputy County Surveyor) are both very much interested in the project, since they also helped to some extent with the original investigation, and will assist as needed. Both men have had surveying experience which will aid materially in the relocation of Hectare 17. Also, both are experienced photographers.

In addition much time will be required of undergraduate assistants in aiding with invertebrate collections--sorting, labeling and pinning insects; trapping small mammals; compiling and tabulating meteorological and plant data, etc. Students in the Biology Department of Linfield College--chiefly seniors and juniors--will be available for training for assistance in these capacities.

Secretarial help will be needed for correspondence with specialists in various entomological, and other, specialties and for preparation of manuscript(s) for publication. Drafting assistance will be required in preparation of graphs for publication.

Technical consultants. It is a happy coincidence that Mr. Kenneth M. Fender and Mrs. Dorothy McKey-Fender live in McMinnville and have consented to be available for consultation and assistance with identifications of

insects, earthworms, and other biota of their specialties. Dr. James A. Macnab, the director of the original study, is enthusiastic about having the study continued. He is at Portland State College only forty miles away, has already been of assistance in the preparation of this application, and will make data from the original study readily available for reference and incorporation into publications if that is desired.

## Biographical Sketches

Principal Investigator: JANE CLAIRE DIRKS-EDMUNDS; b. Haney, Arkansas, June 9, 1912; d. Peter B. and Lydia Gates Dirks; m. Milton R. Edmunds, August 11, 1944.

Undergrad. Research Asst. Biol. Dept. Linfield College, 1934-37; A. B. (Magna cum laude) Linfield Coll., 1937; Grad. Asst. (Zool.) U. of Ill., 1937-41; Ph. D. (Zool.) U. of Ill., 1941; Instr. Biol. and Asst. to Registrar, Linfield Coll., 1941-44; Prof. Biol. and Head of Dept., Whitworth Coll., 1944-45; Linfield Coll.-Bonneville Power Adm. Ozone Proj., 1945-46; Exec. Sec.-Treas. Linfield Coll. Alumni Assn., 1946-49; Asst. Prof. Biol., Linfield Coll., 1946-48; Assoc. Prof. Biol., Linfield Coll., 1948-60; Prof. Biol., Linfield College, 1960- .

Charter Mem. Ore. Acad. Sci. (Mem. Conservation Com., 1954-44), Mem. Pac. Nw. Bird and Mammal Soc. (V. P. for Ore. 1953-54), Ore. Ent. Soc., Ecol. Soc. Amer., Amer. Soc. Mammal., A. A. A. S., The Nature Conservancy (Regional Mem. Com. Stud. Plant and Animal Communities, 1952-53), Cooper Ornith. Soc., Grasslands Research Found., Ore. Marine Biol. Soc., Sigma Xi, Phi Sigma, Pi Gamma Mu.

Ed. Linfield College Alumni Directory, 1947.

Research interests: Forest succession in northwestern Oregon, including coastal sand dune studies; marine ecology; small mammal populations. Cooperator N. Amer. Census of Small Mammals, 1948- .

Graduate Assistant: FRANCES WESTALL DANIELS; b. Silver Lake, Washington, Oct. 29, 1915; d. Albert A. and Nellie Moore Westall; m. Howard C. Daniels, July 5, 1939; daughter, Wanda Jane.

Undergrad. Research Asst. Biol. Dept. Linfield College, 1937-38; A. B. Linfield Coll., 1939; Student Biol. Dept. Gen Extension Div., Ore. State System Higher Educ., 1954 (part time).

Mem. Ore. Ent. Soc., ~~The Nature Conservancy, McMinnville Camera Club (affiliate of Amer. Photographic Soc.)~~.

Research interests: Flora of the Pacific Northwest, including an extensive series of kodachrome transparencies taken by her and her husband, some of which have been published in two western publications; northwestern Coleoptera; Ornithology of Pacific Northwest; natural history of the region.

Secretary, First Baptist Church of McMinnville, 1958-59; Special Instr. Biol., Linfield Coll., 1959- .

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## Publications of Principal Investigator

Dirks, J. C. 1940. Comparison of an Oregon Douglas fir-hemlock community with an Illinois oak-hickory community. Bull. Ecol. Soc. Amer., 21:34. (Abstract of paper presented before Ecol. Soc. Amer., Dec. 1940.)

Macnab, J. A. and J. C. Dirks. 1941. The California red-backed mouse in the Oregon Coast Range. Jour. Mammal., 22:174-180.

Dirks, J. C. 1941. Comparison of Douglas fir-hemlock and oak-hickory biotic communities. Urbana, Illinois. (Abstract of thesis.)

_____. 1949. Dynamics of forest ecology. Proc. Ore. Acad. Sci., 1:23-24. (Abstract of paper read before Ore. Acad. Sci., Jan. 1944.)

Dirks-Edmunds, J. C. 1947. A comparison of biotic communities of the cedar-hemlock and oak-hickory associations. Ecol. Monog., 17:235-260.

_____. 1954. Forest succession following logging in the Oregon Coast Range Mountains. Bull. Ecol. Soc. Amer., 35:89. (Abstract of paper read before Ecol. Soc. of Amer., Dec. 1954.)

_____. 1959. Forest succession following logging on Saddle Mountain in northeastern Lincoln County Oregon. Proc. Ore. Acad. Sci., 4:- . (In preparation for publication.) (Abstract of paper presented before the 1955 meeting of Ore. Acad. Sci.)

_____. 1960. Succession in a Douglas fir community on Saddleback Mountain of the Oregon Coast Range. A progress report. Bull. Ecol. Soc. Amer., 41: 55. (Abstract of paper presented before meeting of Western Section of Ecol. Soc. of Amer., June 1960.)

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## Pertinent Literature Citations


Andrews, H. J., and R. W. Cowlin. 1940. Forest resources of the Douglas-fir region. U. S. Dept. Agr. Misc. Publ. 389.

Dirks, J. C. 1941. Comparison of Douglas fir-hemlock and oak-hickory biotic communities. Unpublished thesis. University of Illinois.

Dirks-Edmunds, J. C. 1947. A comparison of biotic communities of the cedar-hemlock and oak-hickory associations. Ecol. Monog., 17:235-260.

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Hanzlik, E. J. 1928. Trees and forests of Western United States. Portland, Ore.: Dunham Printing Co.

Isaac, L. A. 1935. Life of Douglas fir seed in the forest floor. Jour. Forestry, 33:61-66.

_____. 1938. Factors affecting establishment of Douglas fir seedlings. U. S. Dept. Agr. Circ. 486.

_____. 1940. Vegetative succession following logging in the Douglas fir region with special reference to fire. Jour. Forestry, 38:716-721.

_____. 1943. Reproductive habits of Douglas-fir. Washington: Chas. Lathrop Pack Forestry Found.

Isaac, L. A., and G. S. Meagher. 1938. Natural reproduction on the Tillamook burn four years after the fire. Portland, Ore.: Pac. Nw. Forest Exp. Sta. (Mimeographed.)

Kangur, Rudolph. 1954. Shrews as tree seed eaters in the Douglas fir region. Ore. St. Bd. For. Res. Note 17.

Lavender, D. P. 1954. Douglas fir seed germination after exposure to varying temperatures and humidities. Ore. St. Bd. For. Res. Note 18.

Lavender, D. P., and W. H. Engstrom. 1956. Viability of seeds from squirrel-cut Douglas fir cones. Ore. St. Bd. For. Res. Note 27.

McArdle, R. E., and W. H. Meyer. 1930. The yield of Douglas fir in the Pacific Northwest. U. S. Dept. Agr. Tech. Bull. 201.

Macnab, J. A. 1958. Biotic aspection in the Coast Range Mountains of northwestern Oregon. Ecol. Monog., 28:21-54.


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Merkle, J. 1951. An analysis of the plant communities of Mary's Peak, western Oregon. Ecology, 32:618-640.

Moore, A. W. 1940. Wild animal damage to seed and seedlings on cut-over Douglas fir lands of Oregon and Washington. U. S. Dept. Agr. Tech. Bull. 706.

Moravets, F. L., Chief, Division of Forest Economics Research, Pac. Nw. Forest and Range Exp. Sta., Portland, Ore. Jan. 8, 1959. Personal communication.

Morris, W. G. 1958. Influence of slash burning on regeneration, other plant cover, and fire hazard in the Douglas-fir region. Pac. Nw. Forest and Range Exp. Sta. Res. Paper 29.

Munger, T. T. 1927. Timber growing and logging practice in the Douglas fir region. U. S. Dept. Agr, Bull. 1493.

_____. 1940. The cycle from Douglas fir to hemlock. Ecology, 21:451-459.

Neiland, B. J. 1958. Forest and adjacent burn in the Tillamook Burn Area of Northwestern Oregon. Ecology, 39:660-671.

Reid, E. H., L. A. Isaac, and G. D. Pickford. 1938. Plant succession on a cut-over, burned, and grazed Douglas fir area. Pac. Nw. Forest and Range Exp. Sta. Forest Res. Notes 26.

Ruth, R. H. 1956. Plantation survival and growth in two brush-threat areas in coastal Oregon. Pac. Nw. Forest and Range Exp. Sta. Res. Paper 17.

(See also Publications of the Principal Investigator.)

# Budget

## Salaries

| | First Year | Second Year | Total |
|---|---|---|---|
| Principal investigator<br>Jane C. Dirks-Edmunds | | | |
| ¼ salary (Sept.-May) | $1,600.00 | $1,600.00 | |
| ½ salary (June-Aug.) | 1,000.00 | 1,000.00 | |
| Total | $2,600.00 | $2,600.00 | $5,200.00 |
| Graduate Assistant<br>Frances W. Daniels | | | |
| ¼ salary, 12 mo. @$116.67 | 1,400.00 | 1,400.00 | 2,800.00 |
| Other Graduate Assistants<br>(mapping, etc.,) | | | |
| 80 hours @ $2.50 | 200.00 | | 200.00 |
| Undergraduate (Student)<br>Assistants, 1000 hrs. | | | |
| per year @ $1.00 | 1,000.00 | 1,000.00 | 2,000.00 |
| Secretarial, drafting, etc. | | 200.00 | 200.00 |
| Total | $5,200.00 | $5,200.00 | $10,400.00 |

## Travel

| | | | |
|---|---|---|---|
| 52 trips per year McMinnville to Saddleback Mt. for checking instruments and collecting; 6 extra trips per yr. for small mammal trapping. Total, 58 trips @ 70 miles — 4060 miles @ 7¢ per mi. | 284.20 | 284.20 | 568.40 |

## Permanent Equipment

| | | | |
|---|---|---|---|
| Binocular scope and light | 355.00 | | |
| Berlese funnels, 3 @ $10.00 | 30.00 | | |
| ✓Hygrothermograph, Friez recording | 236.25 | | |
| ✓Tempscribe, 2 @ $45.50 | 91.00 | -1 ordered | |
| ✓Distance Thermograph, Friez recording | 327.60 | | |
| ✓Maximum-Minimum Thermometers, 3 6 @ $10.00 | 60.00 | | |
| Soil Thermometer | 6.00 | | |
| Sling Psychrometer | 13.50 | | |
| Soil Moisture Blocks, 25 @ $3.20 | 80.00 | | |
| 1 - Rain and Snow Gages, 2 @ $46.50 | 93.00 | 1@ 33.00 (8") | |
| ✓Sunlight Illumination Meter | 334.50 | | |
| Increment borer | 21.10 | | |
| Tree caliper | 15.00 | | |
| Mechanized collector, estimate | 50.00 | | |
| Total | $1,712.95 | | $1,712.95 |

| | First Year | Second Year | Total |
|---|---|---|---|
| **Expendable Equipment and Supplies** | | | |
| Relative humidity-Temp. Charts, 2 sets of 100 @ $5.50 | | 11.00 | |
| Tools--forceps, trowels, soil samplers, etc. | 20.00 | | |
| Misc. collecting equipment--field bags, killing jars, vials, insect pins, preservative, labels, etc. | 100.00 | 75.00 | |
| Pinning forceps @ 6.50 | 16.00 | | |
| Photographic supplies | 100.00 | 100.00 | |
| Insect nets, 4 @ $3.40 | 13.60 | | |
| Traps: 11 doz. small mammal @ $2.25 (estimate); also live traps | 40.00 | | |
| Soil reaction set, LaMotte | 11.20 | | |
| Lights for light traps, estimate | 15.00 | | |
| Steel tape, 20 M. | 6.90 | | |
| Insect storage boxes, 25 @ $4.00 | 50.00 | 50.00 | |
| Total | $372.70 | $236.00 | $608.70 |
| **Other Direct Costs** | | | |
| Reprints (publication costs) | | 50.00 | |
| Insurance, express, postage, etc. | 100.00 | 100.00 | |
| Total | $100.00 | $150.00 | $250.00 |
| **Overhead** | | | |
| 15% of costs | 1,150.00 | 880.00 | 2,030.00 ~~1,560.00~~ |
| TOTAL | $8,819.85 | $6,750.20 | $15,570.05 |