

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
CRATER LAKE NATIONAL PARK
MEDFORD, OREGON

Dec. 23, 1947

**The Director
National Park Service
Washington, D. C.**

Dear Mr. Director: **Attention: Assistant Director**
 H. C. Bryant

In reply to your memorandum of November 22, we are enclosing an Outline of Research Activities in Crater Lake, Oregon
Saves, and Lava Beds.

Sincerely yours,

E. P. Levitt
Superintendent

By John M. Doerr, Jr.
Assoc. Park Naturalist

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cc: Reg. IV
Eupt. Levitt
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OUTLINE OF RESEARCH ACTIVITIES

in

**Crater Lake National Park
Lava Beds National Monument
Oregon Caves National Monument**

Contents

Introduction

Recent (1936-1937) Research Activities

Geological Research

Geology of Crater Lake
Geology of Hillman Peak and Union Peak
Discovery and Identification of Cristobalite,
Union Peak
Field Study and Mapping of the Dikes in the
Crater Wall
Geology of Lilo Rock
Mapping of the Glacial Striations in the Rim Area,
Field Study of Varved Clays in the Crater Wall
General Geological Exploration of the Park
Sounding Crater Lake
Field Studies of the Geology of the Lava Beds
National Monument

Botanical Research

Plants of Crater Lake National Park, Lava Beds
National Monument, and Oregon Caves
National Monument
The Ecology of the Plants of Wizard Island

Zoological Research

Percussive Trapping in Crater Lake National Park,
1937
Corrections and Additions to the Check List of Birds
of Crater Lake National Park
Additions to the Check List of Mammals of Crater
Lake National Park
The Mammals of Wizard Island
Bird Banding in Crater Lake National Park
Limnological Studies of Crater Lake

Historical Research

A History of the Modoc War
Field Studies on the Battlefield at The Stronghold,
Lava Beds National Monument

Aesthetic Research

Introduction

Scientific research started in Crater Lake in 1883, many years before the area was established as a national park. Early scientists contributed to our knowledge of the natural features of the area. Much of the information in use today is the result of scientific research done in the area during the three to four decades following the beginning of scientific study in 1883. It is no discredit to the scientists working during those years to say that the knowledge they acquired is not adequate for the park of today. Progress in all fields of endeavor has created a demand for a more thorough knowledge of the park. The area is an outlet for an increasing number of people with an increasing amount of leisure time. If we are to continue to help people profit from leisure time, and if the people are to receive the greatest values from the park, we must carry on an adequate program of research.

Since the establishment of the park in 1902, and more particularly since the establishment of naturalist activities in the park, the staff has, through research, contributed much to our knowledge of the area, and the interpretation of its values. In considering research activities in Crater Lake, it should be understood that during much of the time since a naturalist program was started in 1926 the park had no permanent naturalist, and that temporary acting park naturalists changed from year to year. Such a situation has not been conducive to accomplishments which would no doubt have resulted had it been possible to carry on a carefully planned research program. Regardless of past situations, research activity in Crater Lake has made progress and been productive. Some of the contributions are reports filed for reference in the park files; others have been given publicity in Crater Lake Nature Notes; and still others have received attention in various scientific journals.

In the three areas under the administration of the Crater Lake staff, research has been carried on and is in progress in geology, zoology, botany, history, and aesthetics.

Recent research accomplished and in progress has been and is being done by the naturalist staff, consisting of a permanent naturalist and seven temporary naturalists employed during the summer months; a wildlife ranger; various technicians of the National Park Service; and Dr. Howell Williams of the University of California. The research activities have been almost entirely of a field nature, there being no facilities for laboratory work other than mere office equipment, and some laboratory apparatus borrowed from various institutions. A number of the men carrying on summer field work have had during winter months the use of laboratories and other facilities at various universities and institutions, thus they have been and are continuing to carry on laboratory work in connection with problems at Crater Lake. Following is a list of the institutions and organizations which have recently cooperated in research problems at Crater Lake:

University of California
Stanford University (Dudley Herbarium)
University of Oregon
State College of Washington
San Jose State College
University of Wisconsin
University of Minnesota
Carnegie Institution
U. S. National Museum
U. S. Reclamation Service
U. S. Geological Survey
U. S. Bureau of Fisheries
Wisconsin Geological and Natural History Survey

While this report deals with research activities carried on since 1935, the more important research accomplishments of the staff before 1935 are here listed. Such a list should serve as a background for visualizing future research activities.

Geological Research

The Discovery of Fumaroles at the Pinnacles in Wheeler Creek Canyon, Smith, W. D., Nature Notes from Crater Lake, Vol. VIII, No. 3, pp. 1-3, Sept. '35.

Discovery of carbonized wood, Libbey, D. S., refer to Nature Notes from Crater Lake, Vol. IV, Nos. 1 and 2, 1931; Vol. VI, No. 3, pp. 3-6, Aug. '33; and Smith, W. D., Vol. VII, No. 3, p. 11, Sept. '34.

Structures in the Dacite Flows at Crater Lake; Allen, J. E., Jour. of Geol., Vol. XLIV, No. 6, Aug.-Sept., 1936.

Coralloidal Opal; Swartslow, C. R., Jour. of Geol., Vol. XLV, No. 1, Jan.-Feb., 1937.

Mount Mazama: Explosion versus Collapse; Smith, W. D., and Swartslow, C. R., Bull. G.S.A., Vol. 47, pp. 1609-1630, Dec. 1936.

The Glacial History of an Extinct Volcano, Crater Lake National Park; Atwood, Jr., W. W., Jour. of Geol., Vol. XLIII, No. 2, Feb.-March, 1935.

Zoological Research

Check List of Birds of Crater Lake National Park. Between 1926 and 1935 various members of the staff contributed to a check list of birds. Refer to zoological research during 1937.

Botanical Research

The Flora of Crater Lake National Park; Wynd, F. Lyle, The American Midland Naturalist, Vol. 17, No. 6, pp. 881-947, Nov. '36.

Check Lists of Plants. Previous to 1935 various members of the staff prepared lists of plants for various areas in the park. These lists appear in Nature Notes and in Manuals of Information and Operation. In 1934 Elmer I. Applegate started a systematic study of the plants of Crater Lake, Oregon Caves, and Lava Beds. This work is in progress.

Life Zones of Crater Lake National Park; Wynd, F. Lyle, paper prepared in partial fulfillment of the requirement for the degree of Master of Science, Univ. of Oregon, 1930.

The Floral Wealth of Crater Lake, Wynd, F. Lyle, Nat. Hist., Vol. XL, No. 1, pp. 419-427, June 1937.

Aesthetic Research

Blue Interval, Moll, E. G., Metropolitan Press, Portland, Oregon, 1935. This book of poems is of great value in the interpretation of aesthetic values.

Historical Research

Between 1885 and 1934, William Gladstone Steel, second superintendent and U. S. Commissioner, did much research in the history of Crater Lake. Refer to "Steel Points".

Following is a list of the outstanding research accomplished before 1936 by other than members of the park staff:

Geology and Petrology of Crater Lake National Park, Diller, J. S., and Patton, H. B., U.S.G.S. Prof. Paper 3, 1902.

On the Color of Crater Lake Water, Pettit, Edison, Proc. Nat. Acad. Sciences, Vol. 22, No. 2, pp. 139-146, Feb., 1936.

Crater Lake, A Study in Appreciation of Nature, Merriam, John C., Amer. Mag. of Art, August 1936.

Report of Survey of Crater Lake National Park, Ryder, Worth, Dept. of Art, Univ. of Calif., August 1932.

Suggestions Relating to Purpose and Educational Program of Crater Lake National Park, 1929, Merriam, John C., Rep. of Comm. on Educ. Prob. in Nat'l Parks, 1929.

Preliminary Report on the Crater Lake Project, Leighton, R. W., Univ. of Ore., May, 1934. A study of appreciation of nature beauty.

Crater Lake and Yosemite Through the Ages, Atwood, Jr., W. W., and Kingman, Eugene, Nat. Geog. Mag., Vol. LXXI, No. 3, pp. 327-343, March 1937.

Field Studies in Biology by Field Naturalist Joseph S. Dixon and Dr. R. M. Bond.

RECENT (1936-1937) RESEARCH ACTIVITIES

Geological Research

Geology of Crater Lake

This project is in progress, having been started in the summer of 1936 with funds made available through the Carnegie Institution and the National Research Council. The project is being carried on by Dr. Howell Williams of the University of California. To date Dr. Williams has been assisted in field work by permanent and temporary members of the park staff, including CCC student enrollees and technicians. The park has provided office space for Dr. Williams while in the field, and meals and quarters at regular government rates. This project is a re-study of the geology of the region, the objective being to answer the question of the origin of the crater.

Geology of Hillman Peak and Union Peak

The study of the geology of these two peaks in the park was carried on and completed by Temporary Ranger Naturalist Carl E. Dutton during the summer of 1936. In the field work Dr. Dutton was assisted by temporary Ranger Naturalist Wayne E. Karchner. The results of Dr. Dutton's field studies appear in Crater Lake Nature Notes as follows:

Hillman Peak, Nature Notes, vol. IX, no. 1, pp. 5-6, July 1936.
The Geology of Union Peak, Nature Notes, vol. X, no. 2, pp. 17-18, July 1936.

This project is particularly significant in view of the recent work of Dr. Howell Williams.

Field Study of Varved Clays in the Crater Wall

This project was carried on and completed during the summer of 1937 by Student Technician Randall E. Brown. The clays were discovered early in the summer of 1937 by Ranger Breynton R. Finch. Mr. Brown's study of the clays, and his report which appears in Nature Notes, vol. I, no. 3, pp. 37-38, Aug. 1937, is a worthwhile contribution to the glacial geology of the mountain.

General Geological Exploration of the Park

During the past two summers temporary Ranger Naturalist Wayne E. Kartchner has carried on an extensive exploration of the various cinder cones in the park. As a result of his explorations he has supplied for exhibit a number of excellent examples of volcanic bombs. On one of his exploring trips he discovered a deep throat in a cone. Previous to his discovery no report had ever been made of the feature. The throat is over 150 feet deep, averaging 60 feet in diameter. On making a second visit to the feature, in September 1937, Mr. Kartchner, accompanied by the writer, discovered an accumulation of over 25 feet of snow in the bottom of the throat. Examination of the exposed section of the snow showed four distinct seasons' snowfall. Plans are to obtain a core of the accumulated snow and determine the depth of the throat.

Sounding Crater Lake

Field work on this project will start just as soon as the lake is accessible in 1938. At the present time part of the necessary equipment has been assembled; additional equipment will arrive on or before June 1, 1938. In planning this project a study has been made of possible methods of sounding. Soundings will be made with lead and line, operating from a boat, accurate location of which will be from control points on the crater rim as well as compass readings from the boat. Plans do not call for any definite number of soundings. Preliminary soundings will be made along lines between established points. To date 186 soundings have been made in Crater Lake, an area of over 20 square miles. From that number of soundings it is impossible to draw accurate conclusions as to the features of the submerged portion of the crater wall and the crater floor. There are areas as large as one square mile in which there are no recorded depths. Relatively few soundings have been made within $1/2$ to $3/4$ of a mile of the shore line.

Judging from the number of significant features on the walls and floors of other volcanic craters, it is quite possible that a detailed sounding of Crater Lake will reveal features significant to the Crater Lake problem. In this report no attempt is made to list geological features which may exist below the water. The existence or non-existence of benches on the crater wall, block faults, individual cones or line of cones and pits on the crater floor will be significant to the problem.

The writer plans to carry on this project. Assisting him will be other members of the naturalist staff, and rangers stationed at lookout points on the rim. In view of the fact that Dr. Howel Williams is interested in the results of this investigation, his full cooperation will no doubt be given. The United States Geological Survey has agreed to loan some sounding equipment. Part of the field work on this project will be carried on at the same time limnological research is being done.

Field Studies of the Geology of Lava Beds National Monument

During the past two years the writer has carried on field studies of various geological features of the Lava Beds. Two projects are in progress, (1) the structure of Juniper Butte, (2) geology of Petroglyph Point-Peninsula. A preliminary report on the second project has been made in connection with proposed extensions to the Lava Beds National Monument. Also in connection with proposed extensions, the writer has made field studies of the Big Glass Mountain proposed extension area, and the Black Lava Flow proposed extension.

Botanical Research

Plants of Crater Lake, Lava Beds, and Oregon Caves

During the past two summers temporary Ranger Naturalist Elmer I. Applegate continued systematic study of the plants of the three areas. To date he has over 500 specimens in the herbarium files for Crater Lake, and over 200 specimens for each of the monuments. Plans call for completing the herbarium specimens for each area, the preparation of riker mounts of many of the plants, and the preparation of a check list of the plants of each area. The check list of plants of the Lava Beds has been completed and submitted to the Washington office for publication. Due to lack of funds it was impossible to publish the check list. Mr. Applegate is making an effort to publish the check list through the Dudley Herbarium at Stanford University. If he is not successful, plans call for preparing mimeographed copies of the list. In his study of the plants of the three areas, Mr. Applegate has had the cooperation of a number of botanists and institutions in the country. During the four seasons that Mr. Applegate has served as a temporary ranger naturalist he has produced several articles which appear in Crater Lake Nature Notes as follows:

The Flora of Wizard Island, vol. VII, no. 1, pp. 7-8, July 1934.
Applegate's Paint-Brush on Applegate Peak, vol. VII, no. 3,
pp. 10, Sept. 1934.

Monkey-Flowers of Crater Lake, vol. VIII, no. 1, pp. 9-10,
July 1935.

Latest Flowering Plants in Crater Lake National Park, vol. VIII,
no. 2, pp. 9-10, Aug. 1935.

Corrections and Additions to the Check List of the Birds of Crater Lake National Park

During the past summer Dr. R. R. Huestis, temporary Ranger Naturalist, assisted by Ranger W. T. Frost and Student Technician Elmer C. Aldrich, made corrections and additions to a check list of birds of Crater Lake submitted by Field Naturalist Joseph S. Dixon. The check list, returned to Mr. Dixon, represents the most complete check list of the birds of the park that has heretofore been prepared.

In connection with work on the check list of birds, Dr. Huestis prepared a paper, "Species Censuses in Crater Lake National Park", in which he has listed birds found in specific areas of the park. This paper will appear in the forthcoming spring issue of Nature Notes.

Additions to the Check List of the Mammals of Crater Lake National Park

This project is in progress. During the past summer temporary Ranger Naturalist R. R. Huestis, Ranger W. T. Frost, and Student Technician Elmer C. Aldrich made numerous observations and prepared study specimens of a number of species. Ranger Frost is carrying on observations of the winter mammals of the park this winter. Plans are to prepare during the coming summer a check list of the mammals of the park.

The Mammals of Wizard Island

During the summer of 1937 temporary Ranger Naturalist R. R. Huestis made a field study of the mammals of Wizard Island. The report of his observations appear in Crater Lake Nature Notes, vol. I, no. 3, pp. 36-38, Aug. 1937. Assisting Dr. Huestis in the field work on this project were Dr. R. M. Bond and Student Technician Elmer C. Aldrich.

Bird Banding in Crater Lake National Park

During the summer of 1936 temporary Ranger Naturalist Chas. W. Quaintance banded 17 Clark's Nutcrackers and one Oregon Jay. The birds were trapped, banded, and released on the rim of the lake. Each bird was banded with three molded celluloid bands and the U. S. B. S. aluminum band. All equipment for this project was furnished by Mr. Quaintance. Observations of the return of these banded birds are in progress.

Limnological Studies of Crater Lake

Introduction - The possibilities for research in the biology of Crater Lake are almost unlimited. Had fish never been introduced into the lake, biological studies of the lake would no doubt be limited to a study of organisms which reached the lake without the help of man. Devoid of fish, biological studies of Crater Lake would have little or no recreational

significance. Needless to say, fish have been planted and Crater Lake's reputation for good fishing is spreading. From the standpoint of fish the lake is unique, being high in elevation, deep, having neither an inlet nor an outlet, practically no shallow waters, and apparently no appreciable seasonal temperature changes. These features are barriers to the natural introduction and growth of organisms, which might be detrimental to certain aesthetic values, and which might or might not be beneficial to fishing as a recreation. In many respects Crater Lake is an ideal situation for research leading to a sound policy which will assure good fishing as a recreation. Natural barriers eliminate certain factors which would otherwise complicate the problem. Those same barriers serve to define the problem of the biology of the lake, and yet it is entirely possible that location and isolation have produced a delicate balance between poor and good fishing, or between poorer and better fishing.

In a recent article in the American Forester, "Planted Fish", Hayden A. Carter describes a situation applicable to Crater Lake. One question asked in the article, namely, "What became of my fish after they were planted?", can not exactly be answered for Crater Lake; neither can numerous other questions relative to fish and fishing in Crater Lake.

Biological research before 1937 -- Previous to the summer of 1937, temporary Ranger Naturalist J. S. Brode spent part of several summers doing field work on the biology of the lake. His studies had to do particularly with light penetration, and to some extent with fish food and the contents of fish stomachs.

Biological research started in the summer of 1937 -- During the summer just past, temporary Ranger Naturalist Arthur D. Hasler prepared an outline of the biological studies that should be made of Crater Lake. He did field work on such phases of the problem as were possible with limited equipment and time. At the end of the summer Dr. Hasler submitted progress reports on his field studies under the following titles:

Temperatures of Crater Lake During the summer of 1937

Equipment permitted reading temperatures to a depth of 120 meters.

Preliminary Report on Bottom Flora and Fauna of Crater Lake

With equipment loaned by the University of Wisconsin, samples were obtained down to a depth of 375 feet.

Preliminary Report on the Fish Food of Crater Lake

Observations indicate that the lake is not unfertile for perhaps a limited number of fish

Preliminary Report on Project to Determine Rate Growth of Trout in Crater Lake

Scale samples, weight, length, sex, species and general condition were obtained for over 400 fish returned by anglers. Assisting Dr. Hasler in obtaining this information was a CCC enrollee. Student Technicians Brown and Aldrich assisted in mounting the scales. The scale slides are being studied at the University of Wisconsin during the winter, the age to be correlated with length and sex to show rate growth. With data obtained by examining the fish returned by anglers, along with information relative to the use of boats supplied by the Lodge, Dr. Hasler has produced a report on, "Statistics on Fish Catches from Crater Lake." The data of this report appears in the July and August issues of Nature Notes, Vol. I, nos. 2 and 3, 1937.

Plans are to continue field research on the biology of the lake along the lines outlined by Dr. Hasler. Since the close of the summer season, additional equipment for biological research has been received; hence, it will be possible to carry on a much more extensive program of research without having to depend entirely on borrowed equipment. A detailed report on the progress of biological research of Crater Lake carried on during the past summer by Dr. Hasler will be forthcoming.

Dr. Hasler has had the cooperation of the U. S. Bureau of Fisheries and the staff of the Biology Department of the University of Wisconsin.

Historical Research

A History of the Modoc War

During the past two years Assistant Chief Ranger Don C. Fisher has spent considerable time in the preparation of A History of the Modoc War. During the past winter Mr. Fisher and the writer devoted practically a month in revising Mr. Fisher's history after which the revised copy was submitted to Washington for criticism. While making revisions we prepared an Outline of Events in the History of the Modoc War. This outline appears in Crater Lake Nature Notes, vol. I, nos. 1, 2, and 3, 1937.

Field Studies of the Battlefield at The Stronghold

In the fall of 1937 the writer spent practically an entire month mapping and studying the features of the battlefield at The Stronghold in the Lava Beds National Monument. The field studies were the basis for laying out and constructing a system of trails in The Stronghold. The trails are so constructed as to make all the significant features of the