

During the first month Ladd cooperated with Hoffmeister in Tonga and the work on Eua and Tongatabu was completed. In addition a trip was made to Falcon Island, a recently emerged volcanic cone which lies fifty miles north-northwest of Tongatabu. A landing was made under difficult conditions. The island is two miles in diameter and is composed entirely of pyroclastic materials, chiefly scoria and ash. The crater is located on the southeastern side and is occupied by a boiling lake whose waters rise and fall with the tide. Large quantities of steam and sulphurous gases arise from the crater. The crater walls are highest to leeward where they reach an elevation of 365 feet.

Ladd returned to Fiji to continue his study of Vitilevu, while Hoffmeister spent the next two months in the Vavau group at the northern end of Tonga. During the fourth month Hoffmeister joined Ladd on Vitilevu and the survey of this island was completed.

The island of Vavau is made entirely of limestone. Coral limestone predominates along the whole border of the island with the exception of the southern side. The rocks of the latter side and also of the interior seem to be made mainly of foraminifera. This side is characterized by long, deep arms of the sea which run inland in a general north-south direction and which are separated by narrow strips of land. These deep bays were formed by solution of the soft, porous limestone at the time the island stood considerably higher than it does at present. At this time they took the shape of enormous sink holes. Following this, submergence took place so that all but the highest parts of the island were covered by water. Since then elevation has progressed in stages to form clearly defined terraces. During all this time the sea, aided by the strong trade winds, had been cutting deeply into the limestone on the south and southeastern sides. In some places the southern rims of the sink holes were cut through and the latter were turned into bays. Although no detailed study of the rocks has been made it seems very probable that Vavau is considerably younger than the island of Eua. The latter has been found to contain some Eocene rocks and is beyond much doubt the oldest island of Tonga.

A large part of the 1928 field season was devoted to a study of the structural geology of Vitilevu. It seems clear that faulting has played a very important rôle in the history of the island. It is responsible for numerous topographic features, has determined the main drainage lines and is believed to be the mechanism by which Vitilevu was severed from a much larger land mass that extended to the west. Rarely do the rocks of Vitilevu exhibit folding. High dips are local and usually are definitely related to fault lines.

The more important steps in the geological history of Vitilevu seem to be as follows:

- (1) The formation of a series of ancient volcanics and sediments.
- (2) Mountain building and the intrusion of plutonics. This event occurred at least as early as Cretaceous time.
- (3) Prolonged erosion which removed most of the older rock and exposed the plutonics over wide areas.
- (4) Submergence, probably by faulting, at the beginning of the Miocene. It was at this time that Fiji's continental connection was lost. Apparently very little of Vitilevu showed above water.
- (5) Extrusive vulcanism—tuffs, marls and flows. Lower Miocene.
- (6) Cessation of vulcanism and widespread deposition of foraminiferal limestone to depth of several hundred feet. Lower Miocene.
- (7) Uplift by block faulting with the extrusion of volcanic materials along major fault planes. The older volcanics and the limestone were much fractured by this faulting. Some of the fault blocks were elevated three thousand feet. Most of the volcanic material was ejected as agglomerate, which was reworked to form tuffs, marls and conglomerates. Locally small amounts of foraminiferal or coralliferous limestone were formed. Miocene to near Recent.
- (8) Development of present topography and modern reef building. Minor faulting.

H. S. LADD

UNIVERSITY OF VIRGINIA

J. E. HOFFMEISTER

UNIVERSITY OF ROCHESTER

SCIENTIFIC BOOKS

Our Federal Lands. By ROBERT STERLING YARD, Executive Secretary, National Parks Association. Illustrated. New York. Charles Scribner's Sons. \$5.00.

"We are admittedly the richest, most powerful nation in the world and we took this power of wealth out of the ground. Now, we must invoice our resources and determine how we should proceed from here. For a nation begins but once," writes Dr. Hubert Work, secretary of the interior, in closing a brief and striking foreword to this remarkable book. Remarkable truly since no one heretofore has ever essayed the task of describing and inventorying the extensive and varied territory which the author has brought together under the new and inclusive term of "Our Federal Lands." No one who scans even superficially the pages of this work can fail to be impressed that in these lands the United States has

an "empire of famous history, vast size, colossal wealth, unbelievable opportunity, intricate problems, and physical beauty and diversity beyond imagination."

Each of the ten chapters deals with a particular type of the national area, recounting its history, origin, development, magnitude, utilization, political and social exploitation and pointing out its future significance in the upbuilding of the nation. Not a problem in conservation but finds its past and its future inseparably connected with some area of the federal lands and the policies for their control and utilization.

The first chapter on "Our National Estate" sketches in rapid outline the extent and diversity of these possessions, their value in the early years of national history as a source of revenue, and the origin of national movements which have grown out of them. Last and greatest of these movements is that embodied in the National Conference on Outdoor Recreation, called by President Coolidge four years ago and destined to be an outstanding contribution of his administration to the social invigoration of the American people through perpetuation of the contact with nature which had played such a signal part in molding the spirit of the pioneers.

The story of the public domain which follows, portrays the building of the nation, the rapid outflow of population under the enticement of free homesteads, the building of the railroads, the differentiation of mineral lands, timber lands, water-power lands and reclamation areas, with the complex legal and administration problems growing out of them. While in a real sense Roosevelt established for us the policy of the conservation of natural resources, yet, as Yard points out, the principle was recognized in royal charters of the colonies. It was Roosevelt who led the public revolt against wide-spread looting of national property by local and private interests. An interesting section here deals with the era of the automobile and the profound changes it has wrought in the problems of the federal lands.

The story of "Our National Forests" which constitutes the third chapter begins with a vivid description of the primitive conditions and traces the transformation of vast forested areas into rich, well-populated agricultural lands. From 1870 on came an orgy of forest destruction that transferred immense wealth to speculators and land grabbers and forced upon public attention the absolute necessity of forest conservation. To be sure isolated warnings had been uttered by individuals, and in 1873 the American Association for the Advancement of Science memorialized Congress and state legislatures for forest protection. This dates the start of the popular move-

ment; yet it was 1891 before the Forest Reserve Act was adopted and then only as a rider on a conference bill. When ten years later Theodore Roosevelt became president he put his full power behind the weak and inadequately manned Bureau of Forestry with generally recognized and conspicuous success. Roosevelt also established our water-power policy. The recreational use of national forests, the popular demand for wilderness areas and the preservation of wild life were natural outgrowths of the forest policy of Roosevelt and his successors.

A similarly intriguing chapter is that on reclaiming the desert. The story is followed out in historical sequence. It started with the National Irrigation Congress in 1901 and the Reclamation Act signed by President Roosevelt in 1902. To-day despite reverses and local setbacks this looms larger as a national enterprise than it did twenty-seven years ago. Akin to the irrigation of arid areas in the west is the reclamation of half a billion acres depleted by wasteful farming in the east. Valuable and extensive technical data are presented in tables, thus obviating breaks in the story itself and lightening the text to a large extent at least of a forbidding load of figures.

Water-power in the United States, estimated at fifty million horse-power of which only thirty million is commercially available and about twelve million is already developed, occupies a conspicuous place to-day in public attention. Federal control over it rests in considerable degree on its source in federal lands. Unfortunately the development of hydroelectric plants in some places threatens the existence of valuable fish resources and in other regions at times increases the pollution menace. Time and proper attention will solve these difficulties. In a few instances and at the hands of selfish promoters water-power development has threatened the national parks, those unique areas consecrated for all times to the people and as such to be zealously guarded.

The chapter on "Our Indian Wards" will be full of surprises to the reader. This is not a dying race but a people rapidly increasing in numbers and probably prosperous enough to be rated the richest nation on the face of the globe. As the data have come from government sources and the text has been revised by government officials the story told here is undoubtedly conservative, but it is not creditable to a great and rich nation and will be a surprise to some of our fellow citizens. Land hunger in earlier days has been followed by land grabbing with deceit and theft that has diverted areas of great value from those legally recognized as the lawful owners. Important problems in conservation are handled in this connection and in a calm, concise and clear manner that will appeal to the thoughtful reader.

Those who know Mr. Yard's able services as secretary of the National Parks Association and his valuable books on national parks will look to the chapter on that topic for the last word on the subject and will not be disappointed. It presents the best and most complete picture of the situation yet given. The standards, history, uses and development of national parks, the attacks upon the system and its public value are discussed with a frankness and breadth of view that make the account of special value just at this time when so many proposals for new projects mostly of local worth are being insistently urged upon the attention of Congress and the American people.

The chapter on "National Monuments" brings up another type of land area not clearly defined in the public mind and points out the need of study to formulate a proper system for the development of all such areas and a plan for the protection of each type so that its fundamental purpose may be most fully realized. Certain areas now labeled national parks certainly do not meet appropriate standards as such. National monuments have clearly a different character and purpose. And there are some areas not possessing the qualities of either group that are undoubtedly worth setting apart for the use of the people as recreational areas in which far greater freedom of action may be allowed the public without endangering their value than is possible in national parks or national monuments. National parks are discussed under Merriam's apt designation as a super-university of nature; national monuments constitute a lesser outdoor national museum; recreational areas provide the nation's playground. The account sets forth well the part played by different agencies, including the American Association for the Advancement of Science together with various other organizations, in formulating and establishing these standards first enunciated by distinguished leaders in public life. Despite what has been done, the system is still imperfect, and conflicting views between different government bureaus and departments need definite and early adjustment in the public interest. The reading of Mr. Yard's book shows clearly the heterogeneous character of the areas grouped under these headings and the dangers impending in the near future if readjustments are not made.

Another and pressing aspect of the situation is brought out vividly in the chapter on the "Depletion and Rescue of Our Amazing Heritage of Wild Life." The formation of refuges, which must be extended greatly in the immediate future, introduces a type of wilderness area demanding new methods of selection and maintenance. The movement for such refuges is very new but its influence has grown powerful within

a brief period. It can not be overlooked in the necessary and impending coordination of government areas and the development of conservation policies.

In the last chapter on "Half a Century of Nature Conservation," the author has brought out the essential character of the movement which led to the National Conference on Outdoor Recreation, called by President Coolidge in 1924, and the new era which was ushered in thereby. Roosevelt laid the foundations of the conservation movement; Coolidge built the first story. It remains for the future to complete the structure. Yard points out here with vividness lines of future growth and future danger.

The book has covered a large and unbroken field with success. It is readable and dependable despite the inclusion of a few errors. It is well printed and beautifully illustrated by fifty well-chosen full-page plates. Another edition will devote more space to wild life and its protection, a topic which, left to the end, was cut off somewhat abruptly in comparison with other chapters.

There is especial reason to read the book now when shrewd politicians and promoters are bombarding Congress with schemes for "utilizing" national resources, creating a dozen new national parks mostly as amusement resorts for local gain, and consenting sacrificially to use parts of old parks for the good of the people, or their part of it. Remember that these lands are "Our Federal Lands," and should be preserved both from expropriation and from despoliation. This can not be done unless the problem is understood and the work carried out intelligently. Mr. Yard has done the nation a great service in his long and exhaustive study of the situation and in his clear and effective presentation of the facts in this volume. To keep these lands for the people is the problem of to-day.

HENRY B. WARD

UNIVERSITY OF ILLINOIS

Pflanzensoziologie; Grundzüge der Vegetationskunde.
By DR. J. BRAUN-BLANQUET. Mit 168 Abbildungen und 330 Seiten. Biologische Studienbücher VII. Herausgegeben von Walther Schoenichen, Berlin. 1928.

THE author, who is connected with the botanical institute of the University of Montpellier in southern France, has had unusual experience in the study of vegetation from the modern ecological standpoint. He puts together in attractive and readable form the results of his own work, as well as those of his ecological colleagues the world over. The book shows that the author has kept intimately in touch with the advances made in the particular field of botany covered by the text.