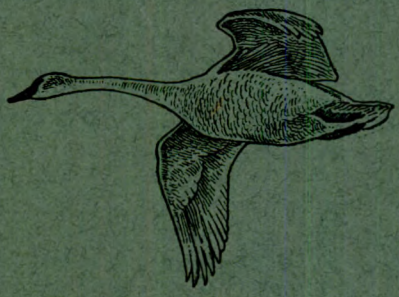
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FAUNA

OF THE NATIONAL PARKS

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UNITED STATES



FAUNA SERIES NO. 2

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ARNO B. CAMMERER, *Director*

FAUNA

OF THE NATIONAL PARKS

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UNITED STATES

WILDLIFE MANAGEMENT IN THE NATIONAL PARKS

By
GEORGE M. WRIGHT
AND
BEN H. THOMPSON

CONTRIBUTION OF WILDLIFE DIVISION
FAUNA SERIES NO. 2 - JULY 1934

UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1935

For sale by the Superintendent of Documents, Washington, D. C. - - - - - - - Price 20 cents

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FOREWORD

The national parks of the United States have come to play a unique and major role in wildlife conservation, that of perpetuating representative examples of the primitive American wilderness. In discharge of this function, service is rendered both in the whole field of natural science and to that ever-increasing body of American and foreign travelers who wish to see the Nation's out-of-doors in an unspoiled state.

The extreme difficulty of preserving these precious wildlife remnants as to the completeness of species, numbers of each kind, and naturalness of environments, in the face of a mushrooming growth in park travel and an alarming depletion of wildlife resources throughout the land, caused former Director Horace M. Albright to order a national parks wildlife survey. The results of this investigation were published by the National Park Service in Fauna Series No. 1, A Preliminary Survey of Faunal Relations in National Parks.

Under the title, Wildlife Management in the National Parks, the present volume develops the idea of wilderness-use technique which was suggested in the first survey, and reports on the actual progress which has been made in wildlife administration since the establishment of the Wildlife Division. The purpose in publishing this compendium of papers is twofold. First, it will serve as a guide to the park administrator in his effort to accomplish the purposes for which the national parks system was established. Secondly, this volume, like its predecessor and others to follow in the fauna series, is offered in the hope that the contents, dealing as they do with a subject on which there is insufficient published literature, may prove helpful to other persons or organizations interested in the development of similar programs.

ARNO B. CAMMERER,
Director, National Park Service.

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INTRODUCTION

Since the first volume of Fauna of the National Parks of the United States appeared, much has transpired in the administration of wildlife resources of the national parks. It seems appropriate, therefore, to lay before the people of our country, who watch with analytical interest the administration of their national parks, the circumstances which have brought about certain proposals and measures affecting the wildlife of our national parks and the nature of these proposals and measures. It is the aim of this second volume in the fauna series to present the developments in this field which have come about since publication of A Preliminary Survey of Faunal Relations in National Parks.

It is contemplated that this fauna series not only shall consist of the presentation of new life-history data and the results of pure scientific research conducted within the national parks and monuments, but that it shall serve as a medium for the exposition of a developing wilderness-use technique as it affects the biological aspects of the national parks. Such a technique must be further developed if we are to preserve the wilderness character of our national parks and still utilize them.

National parks technique is developing along a wide front of activities, involving engineering, landscaping, sanitation, architecture, education, recreation, publicity, and all the other activities of the Service. But one of the significant factors in this development is that sooner or later, directly or indirectly, every one of these activities affects the wildlife of the parks (see p. 109). In other words, these activities are all interactive.

As a logical sequence, therefore, part I of this volume is devoted to some of the phases and possibilities of national parks wilderness-use as they affect wildlife. Each of the five papers comprising part I of the volume has been written separately, each being a more or less complete article in itself. But, even at the risk of some repetition, it seems desirable to bring together in one body these various papers relating to the wildlife management phase of wilderness use.

Three of these papers [1] have been published previously in The Condor, a magazine of western ornithology. For permission to use them here, we are sincerely grateful to its editors.

[1] Men and Birds in Joint Occupation of National Parks, by George M. Wright. The Condor, vol. XXXV, November 1933, pp. 213–218. The Primitive Persists in Bird Life of Yellowstone Park, by George M. Wright. The Condor, vol. XXXVI, July 1934, pp. 145–153. A Wilderness-Use Technique, by Ben H. Thompson. The Condor, vol. XXXVI, July 1934, pp. 153–157.

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Part II of the volume presents a brief summary of the present status of national parks mammals and a restoration program, with supporting and accompanying data. Part II is the treatment of specific problems according to the principles laid down in part I. To be sure, the present results are not always ideal, but neither is the physical set-up of the parks.

No attempt is made in part II to give a complete account of all wildlife problems and the known or proposed remedies for all of the national parks, even if that were possible. The material selected for presentation has been chosen because it is representative of the type of wildlife management being developed in the national parks and not because of any preference for any particular parks or monuments.

Viewing the volume as a whole, it is evident that it deals with wildlife management and makes no pretense of presenting new facts in the form of pure zoology. When the United States Government created national parks and a National Park Service, it definitely embarked upon a venture involving the so-called intangible phases of wilderness utilization. To attempt wildlife management of the national parks on the basis of pure zoological research, apart from any consideration of the values involved and the ends sought, would be next to useless. Therefore we submit that a treatise with the nature of this volume has a legitimate and necessary place in the national parks fauna series.

It is contemplated that subsequent to this volume the next three volumes of the series shall be devoted to more purely zoological accounts—stressing life history—of the faunal resources of Mount McKinley, Sequoia, and Yellowstone National Parks. Studies and manuscripts pertaining to Mount McKinley and Sequoia, under the attention of Joseph S. Dixon of the Wildlife Division, are now nearing completion.

We take pleasure in acknowledging the assistance and guidance in many matters generously given by Dr. Joseph Grinnell, Director Museum of Vertebrate Zoology, University of California. For the assistance and friendly cooperation extended by fellow members of the National Park Service we are sincerely grateful. In particular we should like to acknowledge the thoughtful guidance of Dr. Harold C. Bryant, Assistant Director, National Park Service, and the debt we owe to Mr. Roger W. Toll, Superintendent of Yellowstone National Park, who through administrative aid and by sympathetic analysis has given lasting impetus to this work.

GEORGE M. WRIGHT.
BEN H. THOMPSON.

JUNE 26, 1934.

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PART I

PERPETUATION AND UTILIZATION OF PRIMITIVE WILDLIFE VALUES

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MEN AND BIRDS IN JOINT OCCUPATION OF NATIONAL PARKS

By GEORGE M. WRIGHT

How shall man and beast be reconciled in the conflicts and disturbances which inevitably arise when both occupy the same general area concurrently? As man is at once poser of the question, arbiter in the arguments, and, above all, himself the executioner, his verdict will be determined directly by the use or uses he wants to make of any particular area and the order in importance to him of those uses.

Whatever the designated use of an area, the desired relationships between human and animal occupants are difficult to establish. I believe from observations to date that it is justifiable to state the general proposition that the more man desires to preserve the native biota, the more complex become his problems in joint occupancy.

The opposite extremes would appear at first thought to be exemplified in the business district of a large city and a site that is set aside as a primitive reserve. In the crowded downtown district, nearly all vertebrate wildlife disappears. If one of the surviving species causes inconvenience to any ponderable group of the inhabitants, the prime objective of land use for that site automatically dictates that this species, too, must go.

In the instance of a true primitive area, man's estimate of the greatest values to be obtained from the sum total of resources on that area—and by that I mean values for himself, of course, there being no other standard—dictates that he shall impose such restraint upon himself as to shun the area entirely or almost entirely. Because man here, in choosing to forego his share in joint tenancy of the land, side-steps the problem entirely, this is not an adequate example.

Turning to the national parks, we find ideally exemplified the extreme case for which we are seeking, for here the law specifying land use permits neither the impairment of primitive wildlife nor the restriction of human occupancy. At one bold stroke, man has assumed the whole difficult problem in its most complex form, not really as a problem at all, but as a thing accomplished—and all this by high governmental decree.

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Section I of the act of August 25, 1916, to establish a National Park Service says, in part:

> The Service thus established shall promote and regulate the use of the Federal areas known as national parks, monuments, and reservations, hereinafter specified, by such means and measures as conform to the fundamental purposes of the said parks, monuments, and reservations, which purpose is to conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.

Countless times it has been pointed out that here was an inconsistency in a first premise; that a lion and a fawn were being asked to share the same bed in amnesty; that ice and fire were expected to consort together without change of complexion; in short, that the vast American public should be brought to the parks for a vacation without disturbance of the pristine loveliness of these sacred areas. A modern Portia, this lawgiver:

> Therefore prepare thee to cut off the flesh. Shed thou no blood; nor cut thou no less, nor more, but just a pound of flesh.

The National Park Service, springing into being with a thousand exigencies to meet and no time to gaze at the mountain and resolve paradoxes, accepted its charge in the spirit of a Casabianca ready to die for an impossible order. Latterly, however, it has lifted a determined hand to shape a course that will accomplish the seemingly impossible. For, after all, the history of civilization all along the way has been a record of that done today which seemed improbable yesterday, impossible the day before, and not even to be imagined in fools' dreams the day before that.

And so now we find man and animal in joint occupation of the national parks, each armed with his full guarantee of rights. How shall both be reconciled in the resulting conflicts? Where mammals are concerned, the relationships are so ramified and complex as to give pause to the most optimistic worker. Relations between men and birds in a national park, however, are so much simpler that this aspect of the picture is really bright with promise. Some idea of what the problems of birds and men in competition in the national parks are—what is being done to meet them, and what the ornithologist may hope for the future in these last stands of the primitive American wilderness—may be gleaned from the following short accounts of problems that have already developed or are anticipated.

First may be mentioned those situations in which birds are offenders. To date these are few and they should never be numerous or difficult of solution. The reveilles of California woodpeckers have at times rudely awakened guests of the Ahwahnee Hotel in Yosemite, and the resulting complaints were once sufficient occasion

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for the death sentence. Needless to say, this practice soon stopped. Again in Yosemite, campers' fare left on tables is frequently eaten or spoiled by western tanagers or Steller jays. It may tax the reader's patience to have such trivial matters classed as problems at all, yet it is amazing how many persons will come to sob on a ranger's shoulder begging for justice in the name of omnipotent "Uncle Sam" and the National Park Service, to wreak stern vengeance on some small feathered "nuisance".

There is one type of complaint against birds in the role of adversaries to man's interests that merits serious consideration. This occurs wherever birds are predatory upon game fish. In Yellowstone, a colony of white pelicans numbering approximately 300 birds live upon the spotted trout of Yellowstone Lake and adjacent waters during the breeding season. In many parks, notably Glacier, Yellowstone, and even Sequoia, American or red-breasted mergansers have been objects of condemnation. In Yosemite, kingfishers have raided the fish hatchery. There are other instances and certainly many more species of birds, including the beloved water ouzel, that take a toll of game fish, but the ones mentioned seem to be chosen targets for the shafts of the fishing fraternity. The reason why, in the opinion of some persons, fish predators as a group stand alone in being inimical to man's interests is obviously that fish constitute the only crop which man harvests in a national park.

The fair principle of give and take shows the way to a satisfactory solution to problems of this type. In return for the special privilege which is his in being permitted to take fish in park waters when the hunter is denied, and even the flower lover must not touch, and also in compensation for robbing the fish eaters of their normal food supply, the fisherman must be content to restock the stream for the benefit of all. This general policy has been adopted by the Service. In cases of unusually heavy losses, such as occur where a bird or family of birds systematically raids a rearing pond, special protective measures can be devised, or, as a last resort, the individual offender killed, still without altering the status of that species within the park.

In a second category among the conflicting interests of occupation are those in which the park residents and visitors exert an adverse influence upon the bird life. Here we find a more imposing list of disturbances already occurring, with the possibility of others to come. Man with good cause finds it essential to his enjoyment of certain of the parks to employ mosquito-abatement measures. The only effective yet economical method so far developed is to spread crude oil over stagnant waters. In Yosemite, a considerable annual toll of

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bird lives, notably robins and blackbirds, is the price paid, not to mention possible loss of habitats important to some species, and impairment of aesthetic values. The loss of bird life could conceivably reach serious proportions in some of the newer park projects, should either draining or crude oil application be the methods used. When the Florida Everglades project is realized, either the vistor will have to bear the discomfort of mosquitoes or leave the swamps to the birds. Elsewhere the birds must pay the price, unless some innocuous and practicable method of mosquito abatement is invented.

In Yosemite, in 1928, several band-tailed pigeons died from taking poisoned grain set out for rock squirrels around the Government barns. This type of difficulty already has been eliminated for all time, since the use of poison is now definitely prohibited within all parks, barring some emergency such as a rodent-carried epidemic of human disease.

Destruction of birds by moving vehicles fortunately occurs but in small degree, though occasionally owls and nighthawks meet death in this way, and at least one golden eagle in Yosemite was doomed as the result of striking a car radiator when frightened from the carcass of a deer which itself was an earlier victim of a highway accident. It may develop in the future that some rare and slow-moving bird will have its status definitely impaired by losses occurring in this way. In the mammal world there is the striking example of the gray squirrel colony near the foot of El Capitan. This was apparently the only remaining colony in Yosemite Valley after the great epidemic of 1920, and for a number of years practically all of the potential increase was accounted for as automobile fatalities. Then there is always the possibility of birds flying into wires. No specific instances where this has occurred within a national park to the detriment of any one species comes to mind, but under certain conditions such a complication may arise.

In desert parks, such as the new Death Valley Monument, where the water from a single spring may be vital to a part of the bird life of many square miles, and where developments to accommodate the influx of thousands of tourists may either preempt or obstruct the original availability of such water, the avian as well as the mammalian fauna will suffer. A little forethought in conserving the water to make it available at places removed from too much disturbance should successfully preserve values which might otherwise be lost.

There are two classes of birds which are unable to tolerate man's presence, at least insofar as joint occupancy of their breeding grounds is concerned. These are colony-nesting birds and large ground-nesting birds. The white pelican is a striking example of the former. Trespass on a breeding island, if permitted to any extent,

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may have any one of the following effects: Driving the birds off in the heat of the day may result in the cooking of the eggs. Prolonged absence from the nests during cold weather or at night will allow chilling of the eggs, with consequent destruction of the em-



FIGURE 1.—While the parent birds are off . . . (Photographed by George F. Baggley, Molly Islands, Yellowstone National Park, June 4, 1932.)



FIGURE 2.— . . . gulls may eat the eggs. (Photographed by George F. Baggley, Molly Islands, Yellowstone National Park, June 4, 1932.)

bryos. While the parent birds are off, gulls may eat the eggs. Young pelicans congregate in pods; if frightened they trample each other in the rush to escape, with many resultant deaths and injuries. If the nesting island is disturbed too frequently, the colony may desert and never return.

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FIGURE 3.—Driving the pelicans off in the heat of the day may result in the "cooking" of the eggs or of the fuzzless youngsters. (Photograph taken July 13, 1932, at Molly Island, Yellowstone. Wildlife Division No. 2456.)

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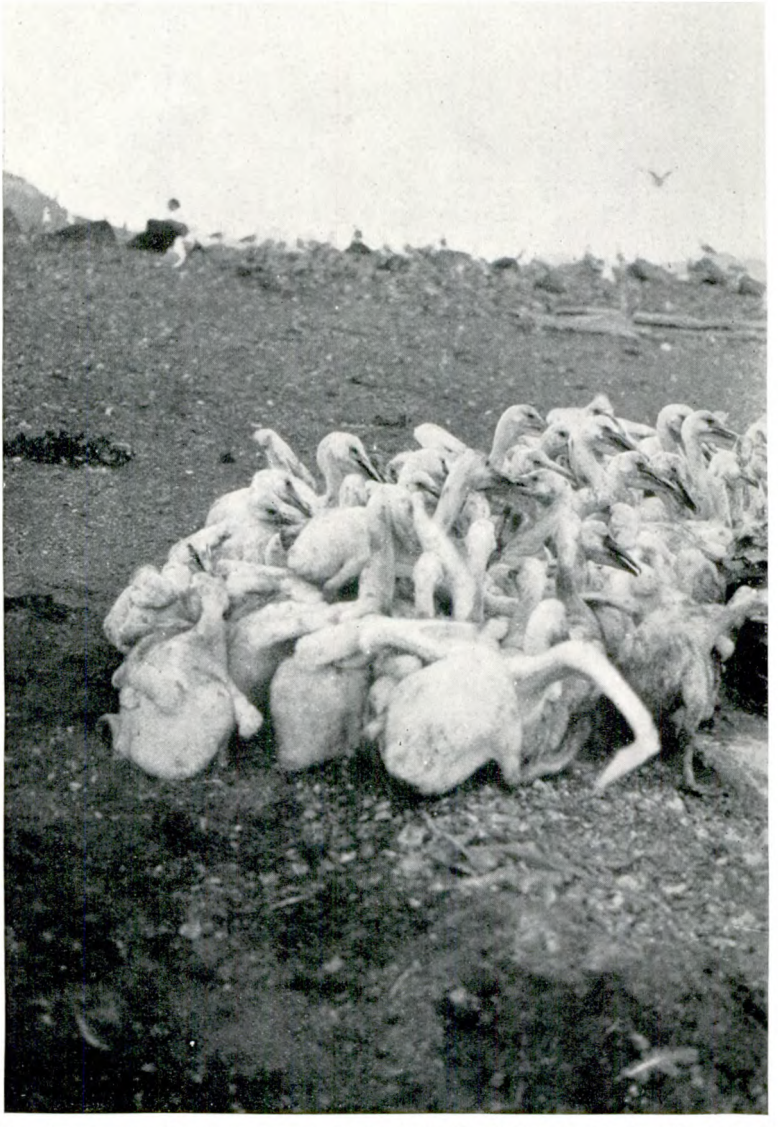


FIGURE 4.—Young pelicans congregate in "pods"; if frightened they trample each other in the rush to escape, with many resultant deaths and injuries. (Photograph taken July 13, 1932, at Molly Island, Yellowstone. Wildlife Division No. 2459.

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The sandhill crane is an example among large ground-nesting birds. These birds are so shy that the constant presence of people, such as fishermen tramping back and forth, often causes them to abandon the locality or fail to bring off their young. Only two eggs are laid, and even the sudden rising of the brooding bird when frightened may cause an egg to be kicked out of the nest.

How the difficult relationships involved between park visitors and birds of the two classes mentioned above are being resolved in the minds of students of park wildlife problems is seen in the following excerpts from the report of Frederick Law Olmstead and William P. Wharton on the Florida Everglades proposed park:

> It is essential that the rookeries be protected from intrusion, be made inviolate sanctuaries for the birds; but experience along the trial has demonstrated that with prevention of shooting and with entirely practicable regulation of public behavior, great numbers of people can be given opportunity to enjoy the sight of amazing throngs of birds at some of their great feeding grounds, and we believe that it will be safely practicable to admit large numbers of people to observation places so related to the rookeries that the still more amazing concentrated flights of homing birds at sunset will pass over them as they return from the feeding grounds.
>
> Where these observation places can best be located and how arranged, how people can best approach them, in what cases by automobile and in what cases by boat, and in general how it can be made possible for large numbers of park visitors to get these and other enjoyments offered by this region, and peculiar to it, without serious defacement of the landscape by artificial elements and also (what is here even more important) without upsetting the extraordinarily intricate and unstable ecological adjustments upon which the whole character of the region depends, is a problem that requires prolonged and intensive study from many points of view by the most competent people—botanists, zoologists, and geologists, as well as engineers and landscape architects. We are satisfied that it can be solved, and well solved; but we cannot too strongly urge caution, thorough study, and patience in the formulating of comprehensive and far-seeing plans before any physical changes, however innocent in seeming, are undertaken.

A third category of problems in securing the desired values from joint occupancy comprises the numerous situations in which man's presence operates inimically to his own enjoyment of wildlife values. The relationship sought is one in which the greatest amount of native bird life will be readily accessible to the largest number of visitors over a maximum period of their stay. It becomes evident that birds around development centers and along roads and trails have a much higher use value than those located in spots remote and inaccessible. Thus, while the totality of bird life within the park may not be affected thereby, the clean-up practiced around centers of human occupation and along roads and as recommended for trails as well, will tend to remove certain species from the very localities where there are the maximum opportunities to see them.

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Standing trees that are decrepit may have the dead wood pruned or be felled, and dead trees are commonly removed from the vicinities of buildings, camps, parking areas, and roads, partly in the interests of safety as they are potential windthrows, partly as a preventive fire potection measure, partly, perhaps, to augment firewood supply, and very largely, it may be suspected, to satisfy a psychological craving. Tidying up is so personally gratifying, and a tidy park labels an efficient administration. In justice, too, to the one who earnestly tries to please his public, the sensibilities of the city dweller, educated to the concept that a park laid out in the city style is the ultimate in park perfection, must be mentioned as a potent influence.

Yet one standing snag may be worth more than ten or a hundred living trees in supplying the peculiar habitat requirements of certain bird species. In the national parks of California, screech owls, sawwhet owls, pygmy owls, hairy woodpeckers, willow woodpeckers, white-headed woodpeckers, pileated woodpeckers, California woodpeckers, red-shafted flickers, tree and violet-green swallows, red-breasted nuthatches, western and mountain bluebirds, and mountain chickadees are some of the birds that may be affected by this loss of nesting sites and food supply. Crowns bare of foliage are veritable baits for the slower hawks, vultures, band-tailed pigeons, and other birds. If the concentration of these birds becomes less along the beaten paths, it is of little avail that they may be more common in the far places. Even the most energetic hikers perforce spend much of their time in camp, and by far the majority of total visitors checked in at the entrance gates never leave the highways and the places where they stop at night.

Nor is this all. There could be recounted an even longer list of birds, this time among the ground- and bush-inhabiting forms, which become increasingly scarce in the very places where people are most apt to see them, in proportion to the effectiveness of clean-up of downed and rotten logs and of brush piles and litter. Whereas lack of facilities to carry clean-up along roadsides to a logical finish has operated to the benefit of the fauna in the past and hence to the benefit of man in the enjoyment of the park, the future may tell a very different story.

Drying up of reservoirs for bird life not only occurs as a by-product of clean-up work. The trampling by thousands of human feet in congested areas destroys the habitat of grassland birds; and so the adverse influences multiply. It will be argued that development areas may, on the other hand, favor an increase of bird life. With many important reservations, this is true, particularly of the public camps. Yet the species favored are usually those aggressive

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forms so well represented by the members of the jay tribe, whose presence in unusual numbers will, in turn, cause smaller birds to seek a more peaceful life elsewhere.

But this leads out of the field of direct influences of human and bird populations upon one another into the multifold complexities of indirect influences. Research has as yet uncovered next to nothing in this virgin exploring ground, and we cannot even guess what trends in wildlife administration for national parks will be indicated when at last the factual basis shall be spread before us.

In review of the foregoing facts and postulations, it is the writer's opinion that the first two categories of problems arising out of joint occupancy (namely, those in which man affects the birds adversely and those in which this order is reversed) include but a few maladjustments and that these will be resolved successfully. The third category, covering those relationships in which man's presence operates to the detriment of man's use of the wildlife values, presents many more difficult problems; but their solution is by no means hopeless. A widespread appreciation that the problem exists is the first and most important step. This is already being realized, and the foundations of approach and practice, too, are in the mixer.

Can it be done? As indicated earlier in this paper, in all other fields of science nearly every triumph has been attained in the face of downright opposition. The way must be found to reconcile the conflicts arising from joint occupation of the national parks by men and animals without impairment of any major park value.

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MEN AND MAMMALS IN JOINT OCCUPATION OF NATIONAL PARKS

By GEORGE M. WRIGHT

Joint occupation of national parks by animal and human populations is prescribed by the organic laws which define national parks. Maintenance of wildlife in the primitive state is also inherent in the national-park concept. The conclusion is undeniable that failure to maintain the natural status of national parks fauna in spite of the presence of large numbers of visitors would also be failure of the whole national parks idea.

Further, since the feasibility of preserving the aggregate of primitive wildlife on unit areas anywhere in the United States has become the center of debate between constructive idealists and vociferous defeatists, the national parks, because they represent the problem in its most complex form, have become the test case.

Today, when so much attention centers on conservation based on land classification and the development of management practices designed to restore each class of land to its fullest wildlife productivity, it will be worth while to review the problems which have developed in maintaining the fauna of the national parks in a primitive state, with particular reference to those that are peculiar to them as against other kinds of wilderness reservations.

Though no categorical distinctions can be made between types of problems since there are interactions throughout and indirect influences hardly guessed at as yet, still it is evident that park faunal problems arise from one or more of three basic causes. These are: First, adverse early influences which operated unchecked in the pre-park period, and continued into the early formative period; second, the failure of parks as independent biotic units by virtue of boundary and size limitations; and, third, the injection of man and his activities into the native animal environments.

The first two are common to all areas wherein it is desired to maintain the primitive. Moreover, they have this in common, that we may look forward hopefully to the correction in large measure of the problems which they developed. Consider, for example, some of the type problems under these two causes. As the results of adverse earlier influences, there are problems in the reintroduction of extirpated species, restoration of species reduced to the danger

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point, rehabilitation of depleted habitats, and management of species become abnormally abundant because of removal of their normal controls. As the results of the failure of the parks to be self-contained, self-walled biological units, typical maladjustments are lack of winter range, ebb-flow of animals that are blacklisted outside the park areas, invasion by exotics, dilution of native species through hybridization, and exposure of natives to the diseases and influences of alien faunas. All the problems mentioned and others referable to the same two causes are recognizable as being common to primitive areas generally. Ideally one can hope that actual cures will be effected as these problems are analyzed and effective treatment evolved and applied.

The third class of problems, however—those arising out of joint occupation of the areas by men and mammals—has the dubious distinction of being the incurable. In the instance of adverse earlier influences the cause of disorder was removed when the area became effectively a national park. It only remains to undo now the damage that was done before. Where the park is an adequate biotic unit, addition of the proper areas and revamping of boundaries to follow natural faunal barriers will bring permanent removal of the basic difficulty. Progress on this front has been slow, but the adoption of a sound Nation-wide wildlife restoration plan based on planned land use should give it a great impetus.

The presence of people, and in fact of as many people as wish to come to the park, is a condition which cannot be altered; therefore the problems arising therefrom are to be dealt with as something permanent. They demand the development of a compensation technique in wildlife administration which will be put into effect and act continuously. Moreover, as park travel is steadily increasing, the problems are being constantly intensified, and it logically follows that the palliative measures including the restrictions willingly imposed on man by himself must also increase.

Though white man is in one sense part of the whole natural environment, one in the aggregate of faunal and floral species constituting the biota of the park, just as are the Indians who came via the Aleutians, and the grasses whose seeds were borne across the ocean, there are two things which set him apart even from other recent arrivals. White man's impact upon his environment is tremendous as compared to that of all other living forms. He is as much like them as cancerous growth is like normal growth and as destructive in effect. The second thing which sets him apart and which is antidote to the first, is his unique ability to appreciate his effect on his environment. He thus becomes capable of self-imposed restrictions to preserve other species against himself. Admittedly,

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his object is a selfish one, just as it is when he chooses to destroy other species to use them for food, but it is a higher, more altruistic, selfishness. It is selfishness for the benefit of all individuals of his own kind and their descendants after them. And incidentally it is a selfishness which reacts beneficially upon the animals over which he holds power of destruction.

The whole national park idea is a manifestation of this second attribute of man, dependent upon his utilization of his environment to his own advantage but in contradistinction to his instinctively normal utilization of land. Within the national parks, man's estimate of the greatest values to be obtained for himself from the sum total of their native resources, dictates that he shall occupy them in such a way as to cause the minimum of modification from the aspect they presented when he first saw them.

Man, like any other exotic, cannot intrude upon an area without causing some displacement and modification of the preexistent or primitive state, but the degree of change which he causes may be very great or relatively little. If a scientific study is made to determine how to keep the disturbances to a minimum, satisfactory results will be secured.

Let us examine those problems already known to be traceable to joint occupancy and indicate still others which may be expected. What has been done to study them and provide for their solution and what is planned by the National Park Service for the future?

First come those problems rooted in conflict between the more fundamental needs of men and animals in the parks. They are essentially by-products of occupation of common habitats.

In the early park period, the livestock concept of wildlife administration prevailed. Predators were controlled, and rangers were permitted to trap fur bearers in winter to eke out inadequate salaries. This is not to be condemned either, for it was consistent with the national parks concept in that early stage of its development. Moreover, at that time, many of the grazing animals were so depleted that first attention had to be given to saving the small breeding remnants. Some of them, such as buffalo, elk, and antelope, were so close to extinction that any action to save them was justifiable. Now that these forms are out of immediate danger with many nuclei established, it is easy to forget that this was not always so. Then, one spoke of campaigning against carnivores as though they were something devilish, just as one did of Huns in the World War and with as little reason. In fact, it was only a few years ago that the principle of equal protection for all species was established.

Even from their incipiency the parks recognized that the animal life would have to be protected against certain normal aggressions

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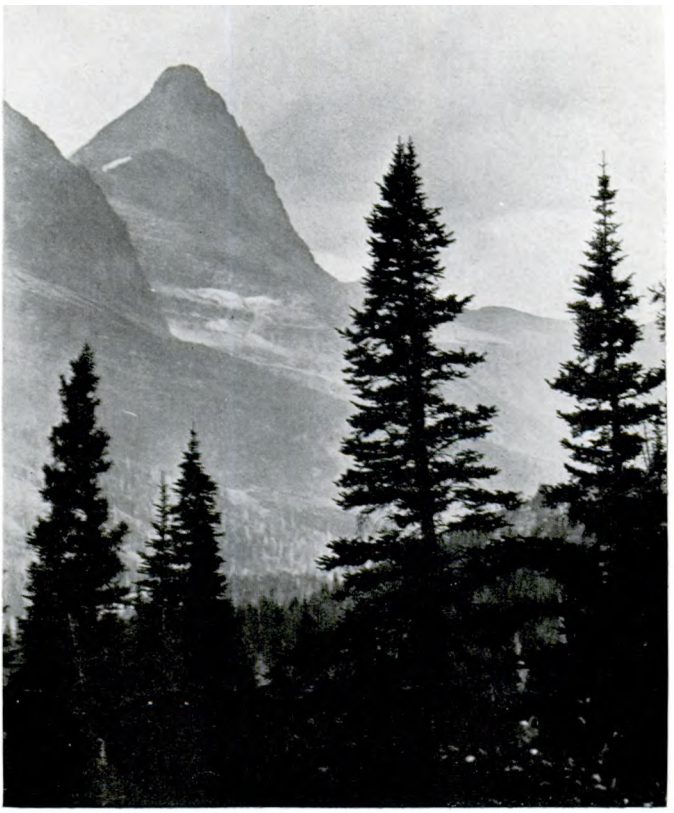


FIGURE 5.—The whole national park idea is a manifestation of . . . man, dependent upon his utilization of his environment to his own advantage but in contra-distinction to . . . (Photograph taken September 2, 1931, at Iceberg Lake, Glacier. Wildlife Division No. 1875.)



FIGURE 6.— . . . his instinctively normal utilization of land. (Photograph taken April 22, 1934, Olympic Peninsula, Washington. Wildlife Division.)

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of civilization. Visitors must not molest the animals. Visitors must not bring dogs or, at the very least, they must be kept on leash. Domestic stock must not be pastured in the park by residents, though this was never considered to apply to riding horses.

Such simple precautions seemed enough when parks travel was light and we still labored under the illusion that there were great hidden wildernesses in the West. Later the almost complete decimation of primitive wildlife elsewhere greatly enhanced the importance of the parks as last refuges at the same time that the influx of thousands of visitors raised the question as to whether the park wildlife could stand the pressure. For the first time we began to glimpse the multitude of ways in which the animal and human elements conflicted.

Realization of the problem meant the elimination of the needless harm to animal life which was attendant upon poisoning around barns, burning of meadows, and so on. Maladjustments of this type which are in the accidental class are now corrected as fast as apprehended. They are not the permanent problems in joint occupation.

Once all species are given full protection insofar as the right to live their life cycles unmolested is concerned, and park visitors are at the same time enjoined against taking any step as individuals to protect themselves against the animals, problems in animal harmfulness to man arise. Few species are actually dangerous to human life, but some are injurious to property, others to man's special interest in certain natural features of the park, while still others are inimical to his comfort and esthetic senses.

The rattlesnake is, of course, a traditional enemy but, nevertheless, a greatly overestimated one. The proper practice is to destroy rattlesnakes when encountered at human concentration points but to permit them to go unmolested elsewhere.

Coyotes, rabbits, and squirrels may act as carriers of diseases communicable to man. Epidemic outbreaks of such diseases constitute emergencies abrogating all regular rules and regulations and calling for heroic but temporary and specifically applied local treatment.

Among mammals, the various species of bears can be considered as being physically dangerous. Because visitors cannot carry firearms, this danger is real, and if the park administration protects the bears against the visitors it must protect the visitors against the bears. For this reason, individual bears of bad character are destroyed. But the bear problem is due very nearly 100 percent to the abnormally intimate contacts which human beings have sought to establish with the bears and not to the innate ferocity in bear nature.

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The subject, therefore, is properly referable to that category of problems involved in the manner of presentation of the visitors to the wildlife and will be treated later.

Mammal damage to property is of small significance. Since the offenders are not to be destroyed, recourse must be had to isolating the property from the animals. The real difficulty here comes in inculcating the basic administrative policies so deeply that recourse to this kind of treatment will always be first thought, replacing the instinctive reaction to kill. For example, in Mount McKinley National Park considerable damage is sustained from the porcupine gnawing on buildings. The immediate proposal was local control by shooting. But such an objectionable course was unnecessary. Moreover, since the porcupines of this region migrate locally, serious reduction of the park porcupine population could result from prolonged application of such treatment. At present, the offending porcupines are trapped and moved elsewhere. In all likelihood, a permanent solution to this problem will be found through cooperation with the Branch of Plans and Design of the National Park Service in development of an acceptable porcupine-proofing. This then will become standard for all structures where such damage occurs.

Cases in which animals prejudice the comfort of the visitor or abuse his esthetic senses demand the development of similar technique. Where skunks insisted on sharing man's houses with him, they were once trapped and drowned. Now they are trapped and removed to remote sections. It is a safe prediction that skunk-proof basements will be standard in the future.

Where animals prejudice man's special interests in the natural features of the parks, the involvements are greater. The scene of man's special interests is out in the park proper and more often than not in the most sacred areas, whereas the troubles discussed above are usually limited to the development areas, which are exceptions from the remainder of the park area in nearly every way.

If a park has been created for the express purpose of preserving an outstanding archeological object, the welfare of that object, including both protection against destruction and presentation in a primitive setting, transcends all other administrative obligations, including that of wildlife protection. Thus, if a hard-hoofed species is hastening the destruction of a ruin, or a rodent is destroying vegetation which is an important part of the ruin picture, there can be no question of tolerating the damage, and the offender must be extirpated from the immediate locality if no other and less objectionable solution can be found. Fencing, for example, would in-

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trude an artificial element in the ruin scene and therefore would be eliminated as a possibility.

The inroad of fish-eating mammals upon game fish is detrimental to the special interests of one group of visitors. Nor can we be oblivious to the perfectly understandable hostility of the fish culturist whose business it is to keep the park streams well-stocked. But the logic of the arguments that the fisherman is a privileged character in a national park wherein nothing else but fish can be taken; that, in so doing, he is depriving the fish-eaters of their food supply; and that he must restore fish to the streams and lakes for the benefit of these creatures as well as himself, has been so forcefully demonstrated, that there is no longer any question of controlling species predatory upon fish. For purposes of practical administration, exceptions have to be made in the case of individual animals doing unusual damage around rearing ponds or hatcheries.

Finally, since man is superior, and endowed with every advantage, it would be miserable admission of defeat if he could not find ways of solving these simple problems of animal injury to man without resorting to campaigns of destruction which ruin the primitive and impoverish the aggregate of natural phenomena which, in reality, is the park.

In turning to a consideration of maladjustments of the reverse order, those involved in the repercussions of civilization upon the wild mammals both by direct effect and indirectly by disturbance of environments, we come to grips with the key problems in national parks administration.

Consider first the unavoidable factor of actual physical displacement. All construction projects today must conform to the master plans which specifically limit developments to certain excepted areas. The guiding principle is that all the roads and buildings necessary to the accommodation of both permanent employees and transients shall be compacted into the smallest possible space. Though this technique is in its infancy, rapid progress is being made. Approved practice today often calls for erection of apartment-type dwellings to secure economy of ground space.

For better control and to accord with the most advanced scientific thought on the subject, the research reserves program developed by the Ecological Society of America has been adapted to national parks use under a plan proposed by the Wildlife Division of the National Park Service. Under this scheme the whole of the park becomes a primitive area with the exception of certain fixed and well-defined areas to which developments must be limited. The excepted areas include right-of-way for roads and site for camps, hotels, and utility

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groups. The primitive area, which is the park proper, must remain untouched except for fish culture, trail development, and insect and fire control practices. For scientific study and to serve as control experiments, specific areas within the primitive area may be set aside as permanent or temporary research areas. In these, fish planting is prohibited. To make this program satisfactorily effective, the park should be surrounded by a buffer strip of the maximum width possible, in order to isolate it from external influences. Success of this measure must depend on whether adjacent lands are in public or private ownership and on the degree of cooperation which can be secured.

Adoption of this plan will mean reduction of the displacement factor to the practical minimum. In order that neither enjoyment and use of the park nor the primitive status of its wildlife shall be jeopardized, men must live on less and less ground and do more and more journeying forth to see the wildlife. There is ever-increasing restriction on the camping privilege. Before long, no one will camp in the park except in a developed camp site in which the location of car stall, fireplace, table, and tent have all been predetermined by the Branch of Plans and Design. Though such a degree of seeming restriction upon freedom is naturally abhorrent, the parks are our most precious bits of wilderness and must be safeguarded. The vast areas outside the parks provide ample space for those who would camp as they please.

In addition to the impingement by large numbers of people upon the faunal habitats, causing a contraction in the total animal populations, there are certain corollary maladjustments which develop. In all of the national parks every bit of available range forage is needed for native game. Both company and Government saddle horses have been given the range needed by the park wild animals for so long that the practice is rooted in tradition and is hard to change. Nor can it ever be eliminated entirely. Nevertheless, a great improvement has been effected by maintaining careful jurisdiction and exercising good range management. Riding horses maintained in the park for visitor use are not brought in until the season starts and are taken out of the park as soon as it is over. Numbers are limited to the demand. And what is more beneficial than anything else, the horses are herded high upon the summer range instead of being allowed to impoverish the critical winter game range.

A few species of mammals which thrive on civilization, notably coyote and ground squirrel, tend to increase and spread in the wake of development and, by very virtue of their aggressive characteris-

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tics, to impinge upon native forms whose niches they preempt. In such cases, control is clearly indicated. In parks such as Glacier and Yellowstone, however, the coyote, while it is undoubtedly more abundant than formerly, may perform a useful function as a salutary control on herbivorous forms in place of the mountain lion and wolf, which formerly filled that role.

Finally, among the problems of joint occupation, there is the large and complex category of problems involved in the manner of presentation of wildlife to the visitor. That there are such problems



FIGURE 7.—As it should *not* be—animals disjoined from their natural habits and drawn out of their natural haunts to be presented spectacularly . . . (Photograph taken November 2, 1929, at Yosemite. Wildlife Division No. 935.)

is due indeed to the very perversion of what should be the relationship between the animals and the visitors. The visitor, instead of seeing animals disjoined from their natural habits and drawn out of their natural haunts to be presented spectacularly to him on as intimate terms as possible and with the minimum expenditure of energy on his part, should in fact be presented to the animals, so as to see them at home behaving primitively in their primitive environments.

Probably the most typical and certainly the best known problem resulting from the manner of presentation is that of bears in Yellowstone. To show how this problem was analyzed and what progress has been made toward its solution, the following excerpts are quoted

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from Fauna of the National Parks of the United States, Volume I, published in May 1932, by the National Park Service:

The manner of presentation of bears in this and other parks has been to feed large quantities of garbage in arenas, there being one or more of these according to the distribution of human population centers. This has brought about unprecedented concentration of bears in small areas in Yellowstone. What are some of the adverse or possible adverse effects upon the bears resulting from this manner of presentation?

(*a*) The intimate association of many bears at one time on the feeding grounds must facilitate the spread of diseases or parasites which may be endemic in bears in Yellowstone, or of any diseases which may be introduced among them.

(*b*) The garbage itself, including the remains of domesticated animals, may introduce parasites.

(*c*) The rich concentrates in the garbage are an unnatural food for bears; and if feeding of them is continued for many bear generations, injurious physiological changes in the make-up of the bears are exceedingly likely to occur.

(*d*) The garbage season is coincident with the tourist season and not with the bear requirements. As a result of this uneven distribution of food, there is likely to be a scarcity of feed at the critical times. If it is true that because of this unnatural condition the females go into hibernation in a poor condition, there is a genuine possibility that the cubs born in the winter months will suffer until eventually degeneration of the race will take place as a result.

(*e*) Inasmuch as the garbage is concentrated in areas a few yards square, the old bears are able to dominate the situation at the expense of the younger animals. It is possible, on the other hand, that the young animals learn only the feeding habits of their elders; and not being trained to rustle their natural foods, become the small, scrawny, hold-up bears so common on the Yellowstone roads.

(*f*) The garbage pits must cause a desertion of the niche formerly occupied by the bears in the summer time, thus further disturbing normal biotic relationships in the park.

(*g*) Garbage feeding attracts the bears to the vicinities of the food stores of campers and encourages a lack of fear of man. The bears offend man, who has the whip hand, so that the bears are bound to be the sufferers in the end.

(*h*) Bears appear at their worst on the garbage platform, so that their characters, in the minds of the visitors, suffer as well as does very probably their physical well-being from this manner of presentation.

To conclude, it might be said that this manner of presentation of bears is very likely to be to the ultimate detriment of the bears. Certainly it is responsible for much of the injury to man.

In the two seasons which have elapsed since this analysis of the Yellowstone bear problem, certain corrective steps have been taken, and there is measurable improvement. Garbage feeding has been eliminated except for the Canyon and Old Faithful bear shows. Back-door feeding of bears and feeding of bears by visitors has been greatly reduced and eventually will be completely eliminated. Approximately 100 troublesome black bears and a very few bad-actor

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grizzlies have been destroyed. The number of bear complaints reported in the 1933 season was about 60 percent less than for the preceding year. For 1934 an allotment for bear-proof refuse containers and food safes has been secured for one campground. If this experiment proves successful, all campgrounds will be bear-proofed as fast as funds can be made available.

Not only with bears in Yellowstone but wherever any animal has been garbage-fed, hand-fed, petted, and tamed, the results have been detrimental both to the animal and to man in the park. Moreover, such practices have no national parks value, since the city zoo can satisfy this sort of human craving far more successfully. If we do not present park animals wild and in their natural background, we do not present a wildlife picture of national parks significance.

In arranging for the presentation of the visitor to wildlife it must be remembered that birds and mammals in the immediate vicinities of roads and development areas are of relatively greater value because they are the ones which are most apt to be seen. Roadside clean-up tends to make the part of the park seen by visitors sterile of wildlife. Therefore it should be kept to the absolute minimum. Office orders urging caution to preserve wildlife values in conduct of Emergency Conservation programs have been issued, and close supervision is exercised. Still it is difficult successfully to combat human zeal in making the woods as tidy as possible.

The general recommendations calculated to secure the best values to the visitor from park wildlife and at the same time to avoid destruction of the primitive status of that wildlife are that the wilderness be permitted to come up as close as possible to human concentration areas, that park animals be not pauperized or tamed, and that ingenuity be exercised to introduce visitors to the animals' environments without their presence having adverse effects.

RECAPITULATION

This country has now been explored and occupied from coast to coast and from Canadian to Mexican boundaries. The haphazard development and cropping of natural resources has proved so enormously wasteful and unproductive of benefit to our citizenry that the future national welfare in this respect has been seriously threatened.

Under a reclassification of lands to secure the maximum benefit from each type, wildlife will find some place everywhere. The percentage value accorded to wildlife may be very small in some cases, but it will be considerable for most lands and on some, such as marsh, desert, and rugged mountain types, wildlife values will outrank all others.

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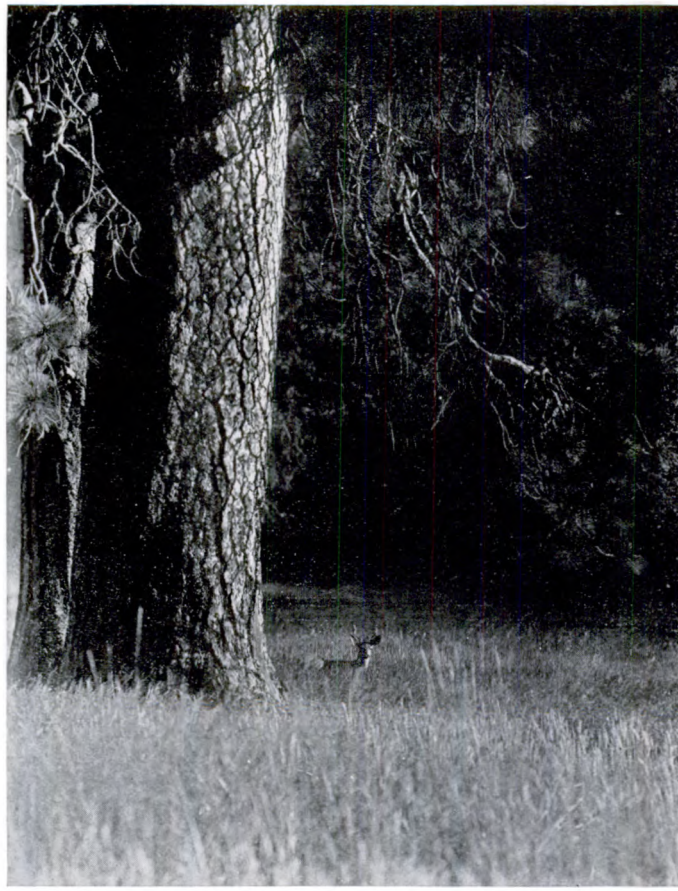


FIGURE 8.—If we do not present park animals wild and in their natural background . . . (Photograph taken July 13, 1929, Yosemite. Wildlife Division No. 67.)



FIGURE 9.— . . . we do not present a wildlife picture of national parks significance. (Photograph taken April 27, 1932, Mammoth Hot Springs, Yellowstone. Wildlife Division No. 2519.)

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Conservation thus is seen to be not an end in itself or a creed over which men fight according to personal prejudice, but a means for securing the maximum cropping of natural resources without destruction of the productive capital. The forms of cropping include the realization of sporting, economic, esthetic, and scientific values.

Certain areas in public ownership will always be dedicated to the preservation of wildlife in the wilderness condition. Because the modifying influences exerted by human populations would ordinarily prevent the realization of this objective, administrative practices must be developed to correct and prevent modification of the original natural conditions.

The national parks are one among the various types of areas which are designated for the preservation of the primitive. Because the parks are set aside both for preservation of natural conditions and for use by the people at large, they have not only to cope with problems resulting from adverse influences and problems of adverse external influences, but they are confronted also with the problems resulting from joint occupation.

These problems are of such magnitude that some observers have concluded that only the childish idealist, pathetically blind to the practical obstacles, would attempt to accomplish the thing. There are others who believe the effort is warranted. Much of man's genuine progress is dependent upon the degree to which he is capable of this sort of control. If we destroy nature blindly, it is a boomerang which will be our undoing.

Consecration to the task of adjusting ourselves to natural environment so that we secure the best values from nature without destroying it is not useless idealism; it is good hygiene for civilization.

In this lies the true portent of this national parks effort. Fifty years from now we shall still be wrestling with the problems of joint occupation of national parks by men and mammals, but it is reasonable to predict that we shall have mastered some of the simplest maladjustments. It is far better to pursue such a course though success be but partial than to relax in despair and allow the destructive forces to operate unchecked.

(Read May 8, 1934, at the Sixteenth Annual Meeting of the American Society of Mammalogists, American Museum of Natural History, New York City.)

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THE PRIMITIVE PERSISTS IN BIRD LIFE OF YELLOWSTONE PARK

By George M. Wright

Days with the birds in Yellowstone are tonic to him whose spirit is bruised by reiteration of the lament that wilderness is a dying gladiator. Too frequent exposure to a belief born of despair is not good for any man. To conservation, it is a poison the more deadly because the injurious effects remain unnoticed until a lethal quantity has accumulated in the system.

There is an obvious prevalence of the conviction that perpetuation of primitive wildlife anywhere on this continent is impossible in face of the expansion and intensification of European-type civilization. Neither is it to be denied that this particular defeatism has been a boon to the greedy one who would justify his seizure of the last egg or his eating of the last duck.

Honest recognition of all factors operating to destroy the wilderness and of the amount and rate of such destruction is nothing to decry. Propaganda from this source is salutary if accompanied by proper advertisement of the facts, and providing that it is presented as diagnosis with prescription for treatment and not intoned as a funeral oration.

The national parks and national monuments and certain designated areas within national forests have constituted the strong line of defense in the conscious determination to preserve representative examples of the primitive wildlife of America. In the beginning we were blithely unaware of the complexities involved in this undertaking, unaware that acts of Congress and ranger patrols were but preambles to the real task of keeping nature natural. The first sharp pain of awakening inducted a sore travail, the taking of inventory to determine the adverse influences, their causes and their effects. From this labor a new principle was born. Henceforth, scientific, planned management would be used to perpetuate and restore primitive wildlife conditions. The earlier protect-and-hands-off policy had abundantly shown it could not accomplish this objective alone and unaided.

Even before the birth a spectral wolf haunted the scene. Ever bolder, his howls now make the night one long anxiety, for he shouts to heaven that the baby lives in vain. Small wonder if the nurses

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whose duty it is to appreciate every hazard over which their charge must triumph and to prepare him for it, now and then grow discouraged. Their heavy task becomes quite unbearable with that added tribulation, the defeatist headshaking of the spectral wolf.

Often it is but a small unnoticed shade of change which transforms the pleasant task into burdensome duty. I do not know when the change occurred, but there came a day when the elk bull standing on a much-too-near horizon was no longer the embodiment of wild beauty, no longer a wild animal at all to me, but just next winter's great big problem, a dejected dumb brute leaning on the feed ground, its gums aflame with foxtails and suffering from necrotic stomatitis.

It was the fear of fixation in this jaundiced outlook which first suggested a changed diet through study of the healthy elements in the picture instead of so much concentration on the bad spots. The refreshing mental exercise of analyzing observed incidents for their faithfulness to primitive life brought me to these reminiscences of a few among the many hours spent watching the lives of birds in Yellowstone.

The Yellowstone-Teton area, roughly speaking, a plateau some one hundred and twenty miles long by sixty wide, of altitude varying from six to eight thousand feet, and encircled by mountains rising from three to six thousand feet above its plain, was one of the wildernesses late in yielding to man's violation. Though the three largest rivers of the country, first roads of exploration, clawed thirstingly at the flanks of the Gallatins, Absarokas, Wind Rivers, Hobacks, and Tetons, the ruggedness of these ranges and their long lingering snows discouraged all but the hardiest scouts like John Colter and Jim Bridger.

In the course of time even this land was called upon to yield much from its rich stores of game and fur. The trappers who went in came out laden, yet they told little, as it was not their way incautiously to brag about the best trapping grounds. The game beyond the mountains was nearly annihilated, and much of this was the same game that had summered in luxury on the abundant grasses of the plateau. Then the dude explorers and hunters—"Muggses" they were called in their day—came to take a share. Protection was only a name in the first years after the park was set aside, and very probably less than that insofar as the game was concerned. Finally, the automobiles, shrieking over fast roads, brought thousands of well-meaning but thoughtless visitors whose very presence would seem paradoxical to the concept of wilderness.

In spite of all these vicissitudes, each one of them a fearful impact on the primitive, today the beavers are back by the hundreds,

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content in the freedom to pursue their inherent way of life, without ever a lurking fear that they might be born to ride to the Paris opera astride some dandy's eyebrows as did their beaver forefathers not so many beaver generations gone by. Down in the Bechler swamps, the lone loon is as solitary as the poet's version would be pleased to have it. Shiras moose thresh the willows in Willow Park, their behavior so naturally easy that the wide-eyed tourist might well wonder if it is not himself who is exotic in these surroundings and therefore the curious object. While watching a marten in the woods of Heart River, a coyote amongst the ghost trees of Middle Geyser Basin, a badger on the boulder-strewn hills of Lamar Valley, I have sometimes felt almost offended by the suspiciously elaborate disregard of my presence manifest in their behavior.

But it is the birds of the water, beautifully wild birds by the thousand, that are encouragement and inspiration to the man who prays for conviction that the wilderness still lives, will always live. The shimmering silver sweep of the many lakes large and small, and the calm yellow-brown expanse of the broad, warm rivers harbor a varied and abundant bird populace. Trumpeter swan, sandhill crane, white pelican, Canada goose, American merganser, mallard, Barrow golden-eye, California gull, and osprey are outstanding in the picture, some because they are large birds, others because there are so many of them. In the case of the Canada goose it is both. Cormorant, Caspian tern, loon, Harlequin duck, willet, avocet, solitary sandpiper, shoveller, sora rail, great blue heron, and others earn distinction on a day's list because they are either rare or rarely seen. And the red-letter, wood-ibis day may not repeat itself in one person's experience. Other birds of more usual occurrence are coot (myriads of these), ruddy duck, pintail, green-winged teal, blue-winged teal, scaup, eared grebe, pied-billed grebe, buffle-head, red-winged blackbird, yellow-headed blackbird, belted kingfisher, western yellow-throat, tule wren, Wilson snipe, Wilson phalarope, and the inland waters' constant companions, dipper, killdeer, and spotted sandpiper; and beyond all these, fully again as many more.

The concentration of so many waterfowl so high in the mountains is in itself an amazing thing. The readily apparent cause of this unusual spectacle is the abundance of warm shallow waters in both the streams and lakes which favor production of the preferred foods.

Sometimes while I am watching these birds on the water, the illusion of the untouchability of this wilderness becomes so strong that it is stronger than reality, and the polished roadway becomes

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the illusion, the mirage that has no substance. The impression of the persistence of the primitive is strongest in those exciting minutes when the birds are observed struggling to outwit their natural enemies or in a competition against one another, themselves oblivious to all but the primeval urge of the moment.

The notebook records many interesting incidents in the natural lives of Yellowstone birds, some of them particularly suggestive of the theory that animals hew closely to the way of life peculiar to

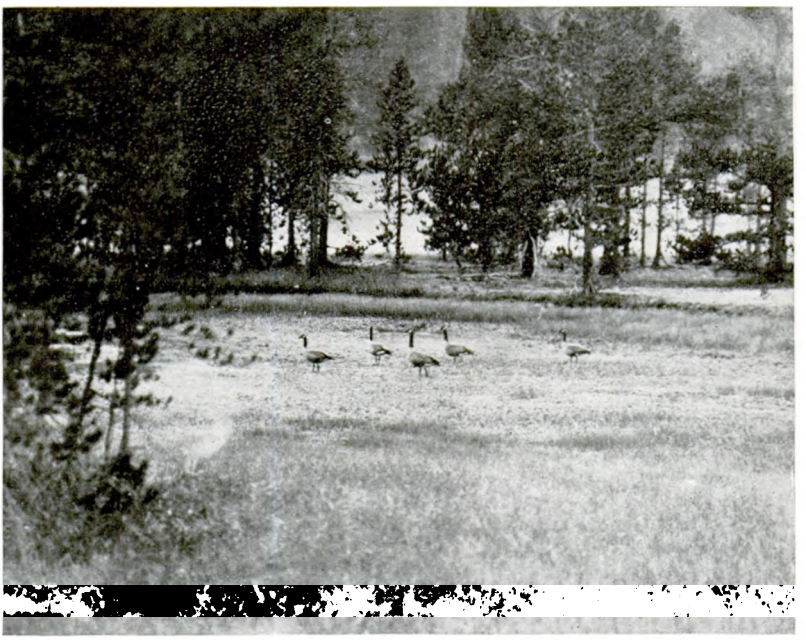


FIGURE 10.—Canada geese frequent the roadside meadows—often as if no road were there. (Photograph taken September 10, 1929, at Twin Lakes, Yellowstone. Wildlife Division No. 387.)

their species, ignoring man-made changes in their environment so long as these do not constitute insuperable obstacles demanding deflection of habit.

Among Yellowstone birds, the sandhill crane is reputedly the wariest. Its bearing is always patrician. For all that the swan is a tradition of grace and dignity, still the familiarity that breeds contempt brings a day when one is close to confessing this bird's kinship to certain inmates of Si Farmer's duckpond. The sandhill crane never gives a chance for familiarity. In its aloofness there seems to be more than fear. A first acquaintance made in 1930 left an impression that subsequent events have failed to erase. It seemed as if the cranes eschewed close association of any sort with the whites

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who had come to trespass upon their chosen solitude. Only with the dire need to protect their young did the barrier break down.

In early June 1931 we stood on the edge of a lost, lily pad lake in the Bechler River district. The gleam of sunlight on a rusty red head pressed closely down revealed a sitting crane. Though we halted in our tracks and made no movement, she could not endure our presence for more than a couple of minutes. I could not tell afterwards how she rose from the nest, but there she went, crossing the lake with slow, sweeping steady wingbeats, uttering that strange unearthly call which is the very embodiment of all wildernesses. Slowly she lifted, gaining just enough altitude by the time she reached the lake's far shore to clear the lodgepoles and disappear from our view. There were two eggs well advanced in incubation on the flat raft of tule stems.

In 1932, this time on the last day of July, while we were riding across a wet meadow near Tern Lake, two sandhill cranes permitted us to come much closer than usual. The explanation was right under foot. Our horses jumped aside as a half-grown baby exploded from the young lodgepoles and went careening out across the uneven ground. We tried to run down this grayish-pink fledgling, but our horses were at a disadvantage, and once it reached the forest on the other side our quarry disappeared like magic. The one parent that remained on the scene flew from one hillock to another in silence. In alighting it would come in on a long slant, lightly touch its feet to earth in twelve to fifteen giant paces, and finally come to rest with wings folded.

We had always maintained that this was one bird which would never consent to abide with man, but the summer of 1933 proved us wrong. All through the season two pairs of cranes, each with a single young, fed unperturbedly in the meadows north of Fountain Geyser in full view of the constant procession of cars. On September 13, when last observed, the youngsters equaled their parents for size, though readily distinguishable by the reddish-brown streakiness of their bodies and the lack of color in the head markings. That same day we located a third family with two juveniles not more than a mile airline from the other two. It was a gala day indeed, for we felt that it marked Yellowstone's high achievement in perpetuating the primitive in the presence of man.

An early morning in June found us driving from Canyon to Lake, a route which is always interesting because it never fails to reveal a fascinating wildlife panorama. Where the road closely parallels the Yellowstone River, two American mergansers were acting strangely. Both wore the gaudy trappings that proclaimed their maleness to the whole world. The foreparts of one merganser

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were thrust under water. Its tail was elevated, and the wings were slightly spread as with some extraordinary effort. The other merganser fussed alongside. Presently the struggles of the first ceased, and both of them began to circle excitedly around and around over the spot. A California gull came out of the nowhere, swooping past with a ghoulish cry. Back again it swung, then most unexpectedly departed in screaming, precipitate retreat. Before we could cogitate the unorthodoxy of such an ungull-like act, the mergansers, too, were lost to sight under the spread of a white fan-tail and the beating of broad dark wings. From a sparkle of spray, a bald eagle rose with one 10-inch native trout. And now the story was plain. The mergansers had tackled a trout too big to be managed. The gull foraging up the river sensed the possibility of a steal, only a few seconds before the swift approach of the eagle changed lust to fear. There we were, all of us, too much startled by the sudden dive of the great bird to do much of anything at all. With measured strokes the monarch winged away toward the distant wooded bench where, it is rumored, it occupies the same nest from year to year.

A pair of Harlequin ducks dropping down through the fast water below the Cascades was the second touch of the unexpected. In the bright morning light the rich red side of the male was the conspicuous identifying mark, the more bizarre paintings on head and neck not being revealed at a distance.

In a marshy expanse of the river not far from Mud Volcano, a pair of trumpeter swans were quietly feeding, and when we returned that way late in the afternoon they were still there, a picture of perfect repose in the soft caress of the setting sun. Though we never left the car in making these observations, what we saw was all wilderness life.

The story of the white pelican is a sorry one the country over. California, for instance, which once had at least nine colonies and 2 years ago could still boast one, failed to produce any young in the summer of 1933 because of drought. But the wilderness of the Yellowstone fights to protect its own.

The presence of white pelicans on Yellowstone Lake has been continuously recorded for over 50 years, and it is safe to assume that they have bred there for a long, long time. Rumors, probably well founded, since the antipathy of fishermen against all the fish-eating birds and mammals is well known, tell of numerous raids on the breeding islands, and the control experiments which were officially sanctioned are a matter of record. Today the fish predators in national parks have equal rights with all other classes of animals.

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There is written into the Park Service code for wildlife the following policy:

> Species predatory upon fish shall be allowed to continue in normal numbers and to share normally in the benefits of fish culture.

In spite of the pressure to destroy the primitive which was brought to bear before this permanent peace was signed, the colony seems to have maintained a fairly constant status throughout. Each year has revealed the same sort of domestic activity down on the island nursery.

The general sequence of events, together with species noted and the numbers of each, have all been so constant for each of the trips we have made that the chronicle of any one of these excursions will do as a pattern of the rest. This particular trip took place on June 4, 1932.

The Bureau of Fisheries' boat makes a broad furrow for 18 miles up the lake before the tiny Molly Islands at the head of the southeast arm are sighted. A hazy cloud of gulls first marks the spot for us. Then a half hundred pelicans rise up among them. For a few minutes they whirl about in disorder, then organize the flying march which takes them over to a sandspit on the mainland where they alight and remain, still in the order of march, at rest but watchful. While the boat is still a hundred yards off shore, two cormorants shoot out across the water straight and low like two torpedoes leaving a destroyer. At the same instant the calls of startled Canada geese come to us from the far side of the islands. Later someone spies the geese heading for the marshes at the river mouth.

While we are coming to anchor and casting off the rowboat, the cloud of gulls thickens and their protests shatter the calm. Among them are two Caspian terns, but they are not so fearless as the gulls, and soon are lost from the picture. Not until our boat scrapes on the pebbles do the sitting pelicans decide to abandon their nests to the enemy. We scramble to high ground in time to see the last reluctant three take to the air.

The Caspian terns are presumed to be breeders, but this year as before we fail to find their nest among the 564 which we count as belonging to the California gulls. We find the single cormorant nest with 3 eggs. The cormorant population seems to remain constant at 1 pair. The 9 goose nests on the 2 islands contain a total of 19 eggs, 5 being the largest number in 1 nest. There are 126 occupied pelican nests, and 232 eggs. Three nests contain 4 eggs each. Two western willets, a few Wilson phalaropes, and the usual complement of spotted sandpipers complete the Molly Island census for the day. We hunt in vain for a blue-winged teal nest, remembering well the one we found on Pelican Island in 1930.

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The year 1932 marked a milestone in the Yellowstone white pelican saga. That year, respect for the pelicans reached the point where the superintendent of the park issued an order prohibiting all boats from even passing close to the Molly Islands during the nesting season, the only exceptions to be two or three ranger-conducted surveys for census purposes. Persistence of the primitive in the face of much interference has won its reward, another victory for wilderness.

There is an aura of wildness about the cluster of lakes deep in the wooded heart of Mirror Plateau which stills the voice and quickens the senses. From the first, our experiences in this territory



FIGURE 11.—Far down in the southeast arm of Yellowstone Lake the two tiny pelican islands lie. Not until our boat scrapes on the island pebbles do the sitting pelicans decide to abandon their nests. (Photograph taken June 4, 1932, at Yellowstone Lake, Yellowstone. Wildlife Division No. 2466.)

taught us to watch for the unexpected. The trip of June 1932 yielded no particular excitement until the moment of our departure on the morning of the 25th. We walked up the crest of the hill on the west side of Tern Lake where we could get a good, though somewhat distant, view of the trumpeter swan nest that we had been studying. Both parent birds were out of sight, so we started on. At the last opening in the trees we hesitated for the fateful last look.

A black object loomed by the swan nest. With field glasses glued to our eyes, we saw that it was an otter stretching its full length upward to peer down into the nest. From one side it reached out toward the center and pushed aside the material covering the eggs.

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Then the commotion started. With rapt interest, the otter rooted around in the dry nest material, heaving up here and digging in there, until it was more haystack than nest. Then the otter started to roll, around and around, over and over. This went on for a number of minutes. At frequent intervals its long neck was craned upward, and the serpentlike head rotated around to discover (we supposed) if the swans were returning. At last the otter seemed too weary of this play. It climbed from the nest to the outer edge, then slid off into the water. Swimming along the edge of the marsh grass, it was the undulating silver demon of the water world. Once it dove and several times detoured into channels through the grass, only to come right out again and continue on. It never turned back, and was finally lost to sight.

Where were the swans all the while we had been praying for their return? We well remembered that time 2 years ago when they came flying in from a far corner of the lake to drive off a raven which had already broken one egg. Careful search with the glasses revealed the parents, all that we could see being the water-stained heads and black bills protruding from the marsh grass. One was about 600 feet from the nest, the other not more than 240 feet. Yet both birds gave no evidence of concern. Seeing that the damage was already done, and another year's potential swan crop for the Mirror Plateau lost irrevocably, we saw no further reason for caution. So we stripped off our clothes and waded out across the shallows. We were amazed to find all five eggs intact. There they were, all together, rolled to one side, but perfectly whole. So much for the circumstantial evidence. Had we gone on, Mr. Otter would have had one order of scrambled trumpeter swan eggs charged on his bill.

We covered the eggs and hurried away in confusion as huge hailstones pelted our bodies. We hoped that the parents would return to protect the eggs from chill. The storm obscured the scene, obliterating the next chapter in the story. Later we learned from the ranger reports that no cygnets were raised on Tern Lake that year. Which meddler should shoulder the blame, the otter or the scientist?

Mirror Plateau has been made a research reserve. The only trails leading in are elk trails. No developed trails will ever find a place there, and of course no roads. Since no trout are ever to be planted in these lakes, there is every reason to hope that here again the fugitive wilderness has found another safe retreat.

The Mirror Plateau, however, like Molly Islands, is a special case. Here man has shut himself out to protect the wilderness. We seek to retell those occurrences when it seems that the wilderness has persisted in its primitive characteristic in spite of artificial developments.

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We stood on the road the cold morning of November 10, 1932, watching the sun lift the veil of mist from the meadows at the head of the Madison. Wild fowl floated on the river with that economy of movement so characteristic of wild creatures in cold weather. Men stamp their feet and blow in their hands, but the animals and birds seem to conserve their body warmth to best advantage by staying very still.

The bald eagle usually present in this section in winter made its rounds and disappeared in the direction of the Firehole. A coyote sat out in full view in the middle of the snow-white meadow with a cocky mien which seemed to say that it had done enough mischief of a serious sort during the night and now awaited something to arouse its curiosity. Of course no good scientist would be guilty of even toying with the fancy that a coyote could be suspected of thinking at all. Oblivious to such insult, the coyote presently came trotting toward the river bank and proceeded to go on a still hunt for birds. He worked downstream, keeping back out of sight except where a break in the bank or some protective cover permitted him to come down to the water's edge. When five Canada geese near the opposite shore caught sight of the enemy they kicked into the air and flew off calling loudly. They broke the sweet silent spell. Mallards and American mergansers seemed aware that their position was impregnable and paid no attention. Nine mallards swam downstream right past the coyote, which by now was openly eying them from the bank. The coyote turned its attention to hunting small rodents in the meadow, and we started up the road. A single Clark nutcracker crossed in front of us.

The road up to Old Faithful closely parallels Firehole River. Numbers of dippers breed here in summer, but in winter there is a much greater concentration on this and the other warm streams. But where were the dippers this morning? Finally we found them. We had been searching their accustomed rocks, but these were ice-covered now, and the birds had therefore abandoned them for the winter to stand quietly on the submerged rocks, their legs warmed by the friendly river.

The elk, too, take advantage of the thermal heat. We saw many of them in the upper Geyser Basin and knew that some would remain there for the winter, loafing on the warm ground which is always free enough of snow to provide some forage. At that, they fare better than the bulk of their fellows who join the migration. It is generally recognized today that the elk wintering up on the plateau usually come through in good condition, whereas those on dole at the feed grounds are emaciated by spring. Wild game prospers more if permitted to remain primitive. The mere presence of man is

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not so injurious. It is when he attempts to have the animals live his way and die his way that ruin follows.

Canyon, for example, is one of the human concentration points in the park. Before visitors came to this place, it was a concentration point for ospreys, and there is no evidence that civilization has diminished their numbers. Throughout the summers of many centuries they have raised their young on pinnacle nests in Yellowstone



FIGURE 12.—Osprey nest beside the highway. The ospreys of Yellowstone are evidence that even a very highly specialized and localized form can persist in the full vigor of the primitive in very close contact with man. (Photograph taken July 13, 1931, near Marys Bay, Yellowstone. Wildlife Division No. 2139.)

Canyon. Crowds of eager-eyed tourists on the parapets, which in some instances are almost directly over the nests, do not disturb the sitting birds.

Notes taken on the mild, cloudy day of May 20, 1932, read as follows:

Osprey.—From the lookout point at the end of the Canyon Drive on the north rim, we were able to count seven nests on which ospreys were sitting. Ospreys wheeled in the higher air and floated in the canyon. Ospreys sat on their nests and called, like giant young chicks, when their mates came near. Ospreys came in with their catches of trout. Yellowstone Canyon belongs to the ospreys. People build roads back of the rim, railings over the steep points, and trails down to the river, but the canyon really belongs to the ospreys. They alone are equipped to be at home in this rugged brilliant gorge.

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A raven, too, has its nest just under the rim of the south wall, but its life is made miserable. An osprey chased the thievish raven for a quarter of a mile down the canyon while we lunched and meditated upon a wonderful nature.

The ospreys of Yellowstone Falls are evidence that even a very highly specialized and localized form can persist in the full vigor of the primitive in very close contact with man. Lately the sandhill crane has shown ability to do the same thing. The white pelican has done it, as have the beaver and the moose, the Canada goose, and many others. When I see how many of the wild creatures can reassert their wild way of life upon the exercise of a very little restraint on man's part, I am encouraged to laugh once more at the defeatists and tackle afresh the problems of wildlife restoration.

Though these reminiscences of field days were encouraged for the purposes of strengthening a slightly damaged optimism personally, and rebutting the despair chorus generally, they have engendered a new line of thought. This is that a useful technique for solving wildlife problems may develop from a study of the inherent tendencies in all species to remain primitive. Since their primitive living pattern must represent the most beneficial one for them, we may hope through analysis and understanding of its method to improve management practice. More of the wild animal background should enter into wildlife administration to the exclusion of ideas rooted in centuries of association with domestic livestock.

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A WILDERNESS-USE TECHNIQUE

By Ben H. Thompson

In northwestern Wyoming is a land guarded by mountains. It is a wilderness of forest, swamps, and lakes, broken by cliffs and lofty granite spires, and chiseled by crackling ice and the sunny dripping of water. Long river tentacles reach up to this high plateau from different oceans. In winter it is a land of heavy snow and sweeping sleet, and sometimes the night is whiter than day. Then the elk herds drift down from the sage and aspen valleys where the rivers go to warmer levels. The weasels turn white with little black tips, and the snowshoe rabbits have black-edged ears above muffed feet. Sometimes a great gray owl comes softly out of a wet sky. In spring it is a land of mist-blue forests and sparkling lakes. Then summer haze begins to rise from the forest and makes the great mountains look like bluer shadows in a blue sky. Ocean birds come sailing in to nest in unseen swamps. There is the mute whistle of ducks, the call of geese, and the "weer" cry of gulls. The marsh grass grows in seeping ground and the forest blooms; the pond lilies push their soft yellow lamps above water, and sage and lupine bask in the sun.

Into this land people go for the love of it and to learn its ways. To save this wilderness just as it was "for the benefit and enjoyment of the people", a portion of it was established as Yellowstone National Park.

Here is a thing so glorious that it threatens to be impossible. How can the secret beauty of wilderness be opened to the people and remain unspoiled? This is the greatest question we have to meet if we are to save this and every other national park as truly primitive areas. At once we are faced with the thing so aptly expressed by Leopold:[1]

> The salient geographic character of out-door recreation, to my mind, is that recreational use is self-destructive. The more people are concentrated on a given area, the less is the chance of their finding what they seek.

It seems that what we most need is the technique of using a wilderness without spoiling it. Roads and living accommodations have been constructed in these wilderness places to make them habitable

[1] Conservation Economics, by Aldo Leopold, Journal of Forestry, vol. XXXII, no. 5, 1934, pp. 537–544.

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for man. Roads have cut through forests and hills, have bridged rivers and marshes, have clean-cut the feathery margins of lakes. Buildings, erupting from the age-blended scene, have been set up in the midst of sacred areas. All this was perceived years ago, and a remarkable technique has since been developing to blend buildings, roads, and bridges with the scene and to save sacred areas from all development. But the main problem still confronts us—to preserve the wilderness character of humanly utilized wilderness.

A step so simple as to be almost overlooked, yet perhaps far-reaching in its implications, has been made.

An old road in Yellowstone is to be improved and partly relocated. Near the brink of the Lamar River in northeastern Yellowstone, in the direct route of the new road, a small lake spreads between low glacial mounds. At evening, the mirrored hills and sky take on a shining luster within the margin of the lake. The picture looks so quiet, but from the tules around its edge comes a medley of squalls, chucks, squeaks, and ratchety sounds. From time to time the chorus rises, as two waterfowl with slapping feet and wings run across the water, shattering its picture into a thousand disconnected pieces. Then small dusky creatures bob again back to the tules, and the picture draws its shining self together once more.

The lake is not spectacular nor famed for its beauty. It is simply one of many lakes in the region where wild fowl nest and wild animals come timidly to drink. But the question arose—and this is perhaps the germ of a new technique—whether the proposed road should girdle the lake or stay entirely away from it to avoid disturbance of the nesting waterfowl. In other words, was the wildlife of this lake important enough to man, for aesthetic recreation, to induce him to change the course of a proposed highway? The question naturally hinged on the extent and variety of waterfowl utilization of the lake. Observations made at the lake over a period of years have disclosed the following:

Pied-billed grebes, not known in the park before, in recent years have been found nesting among the tules in this lake. Here they glean the mud-gray tule stems from the lake bottom and construct their barely floating nests. Each nest is hardly more discernible than a shadow on the water and can be easily mistaken for a tiny mass of half sunken débris. But neatly hidden beneath a few wet-clinging tule stems, rest the several roundish white eggs, sheltered from the sun and possible enemies while the nesting bird feeds out in the lake. One swampy afternoon a sharp and sudden hailstorm broke over the lake, pelted its glossy surface into bobbing chessmen and wilted the bird songs in the tules. With the first great drops of the shower, the silent snake-like head of the grebe

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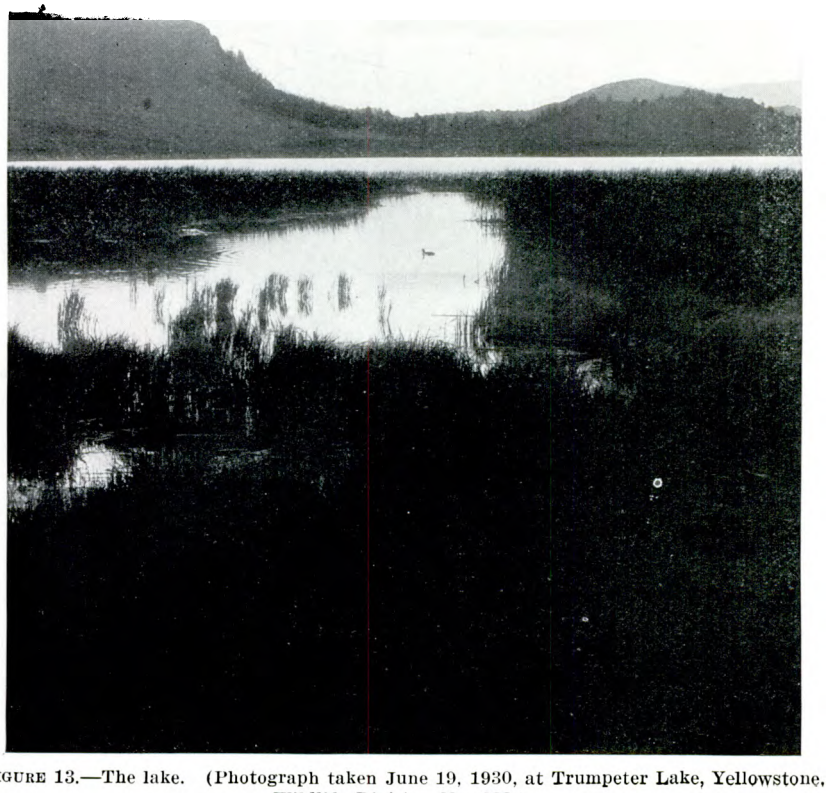


FIGURE 13.—The lake. (Photograph taken June 19, 1930, at Trumpeter Lake, Yellowstone, Wildlife Division No. 888.)

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suddenly rose in the water, the bird crawled onto her nest, carefully nosed the covering back and settled herself on the eggs while the hail drops rolled from her back.

Some days later two little downy grebes were found swimming among the tules. They were captured, photographed, released. No sooner than the intruders' departure, four loudly cawing ravens swooped on the lake, flew away with one of the baby grebes, and the other one was never seen again. So much for the good intentions of man in the grebe's precarious haunt!



FIGURE 14.—Two little, downy pied-billed grebes were found swimming among the tules. (Photograph taken June 30, 1930, at Trumpeter Lake, Yellowstone. Wildlife Division No. 1363.)

Almost certainly, these timid, elusive birds would not frequent the lake if the road were built by its brink.

Year after year a pair of trumpeter swans returns with the lengthening days of April to rebuild their huge half-floating nest of dry tules stems. More like a haycock it looks as it lies nakedly on the lake in early spring. By the time the downy white cygnets hatch, after 40 days of hazardous incubation, green tules screen the nest and birds from the lake shore. So wary are these great white birds that they are easily frightened from the nest. At such times—in other nests—ravens have been known to break the eggs, and an otter has been watched as it rolled in the nest and tore it to

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pieces. In spite of such vicissitudes, this pair of trumpeter swans has raised six young swans during the last 3 years. There are probably fewer than a hundred trumpeter swans left in the United States. This little lake is of vital importance to the species.

Common Canada geese frequent the lake, although no nests have been found. Common mallards nest at the lake each year and usually may be seen with their shuttling ducklings, foraging somewhere in the tules. Pintails, scaups, and Barrow golden-eyes glean the marshes day after day, and ruddy ducks court and fight like pirates.



FIGURE 15.— . . . and ruddy ducks court and fight like pirates. (Photograph taken June 12, 1931, at Trumpeter Lake, Yellowstone. Wildlife Division No. 2316.)

Each year, after long search, the shadowy form of the little sora is seen as it creeps through the whispering marsh tangle. At least three pairs of Wilson phalaropes have nested at the lake in 1 year. They are the most evasive of all the lake inhabitants. Now and then a solitary sandpiper proclaims its presence by a flying flash of its tail, but more often the spotted sandpiper flickers from bank to bank to lead you from its nest. Two killdeers nest near the muskrat's house, their plaintive cries convincing you that two fuzzy babies are crouched near you—perhaps in a buffalo track. The inexorable coots fight and squawk day and night. Their clumsy nests, built like fire houses, with driveway from nest floor to water, encircle the lake. Prolific, they people the marsh with innumerable black babies.

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Yellow-headed blackbirds outnumber them all. Like a yellow-vested orchestra, they maintain the din and the clatter. Forty-three of their nests were found at the lake one summer. Of these, 33 were empty. Of the remainder, only 3 contained 4 eggs each when the census was taken. Their rate of reproduction at this particular lake cannot be great. Three pairs of red-winged blackbirds nested at the lake the same year. Their nests were destroyed by some unknown factor before the eggs hatched. But each year the red-wings return. Nevada Savannah sparrows and Lincoln sparrows nest in the grass by the lake shore. Rock wrens and yellow-throats sing from the surrounding hillsides.



FIGURE 16.—The red-winged blackbird's nest was destroyed by some unknown factor before the eggs hatched, but each year the red-wings return. (Photograph taken June 16, 1930, at Trumpeter Lake, Yellowstone. Wildlife Division No. 657.)

A total of 73 nests was found at the lake one year. This may seem an amazing number for so small a community but it is probably representative of many similar marsh-lakes in the park.

There seems to be a neat signal code between birds and mammals of the lake region. No matter how stealthily the lake is stalked, one's secret approach is usually heralded by the snort of an antelope, the whistle of a marmot, the squeak of a ground squirrel. After much foolish labor one peers cautiously over the last hillcrest to find every bird in the lake alert for danger. What the effect would be of highway traffic thrust into such a delicately poised protective system can only be conjectured, but it would probably deaden its efficiency.

Thus we briefly sketch the lake's bluebook. Only the birds which are most confined to the lake habitat have been mentioned. A host

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of others is wrapped in the lake's ecologic community. They, too, add to the recreational values but are not directly connected with the problem under consideration.

Since the lake is neither spectacular nor uncommon—is not one of the outstanding manifestations of primitive nature—should so much consideration be given to it? Why not follow the already surveyed course of the proposed road?

National parks are created where the outstanding examples of primitive nature are to be found. Roads and accommodations are constructed in them to make them available to the people—so far, so good. But when we come to make the wilderness itself available to the people, we must first arrive at some idea of that which we seek, then develop the technique for accomplishing our goal. As far as wildlife in the wilderness is concerned, perhaps the greatest spectacle is not a flock of thousands of birds on a baited sanctuary, but the one mother grebe covering her nest while the hail drops roll from her back. We cannot build highways to see these things. We can build highways to bring people near enough that they can see these things by exerting a moderate amount of their own individual energy and ingenuity.

Applying this thought to the lake and proposed highway, we would be more apt to attain the thing we seek if we kept this little lake away from the road, where those may go who care to and observe the birds which live there. There is no need to make it available to any others.

Birds are seen constantly along roadsides in the park, as portrayed in the preceding article by Wright. Furthermore, as he has suggested, wildlife tends to cleave as closely as possible to its natural mode of living where the innovations of man do not actually force it out of its normal habitat. Even such disruptive events as the construction and utilization of modern highways in Yellowstone leave the major portion of the native bird life apparently undisturbed. In other words, the wilderness is persistent.

It may be that the disrupting effect of a modern highway in a wilderness is more psychological than zoological. If such is the case, that it is worth considering, too. But in the particular case of this little lake and the proposed highway, there is grave doubt that a lake-shore highway would be of any benefit to either the nesting swans or grebes, and might result in the loss of several other species at the lake, even though there would still be enough birds left to present an interesting, primitive spectacle from the road.

These factors were considered, primarily as affecting the trumpeter swans but also as affecting some of the other nesting birds of th[illegible]. An order was issued that the road should not follow the [illegible]

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This perhaps seems like "much ado". Nevertheless, it is an advancement in the technique of utilizing the wilderness and still preserving it. What will the future of such a technique be? I am tempted to speculate.

It will depend in great measure upon the things we learn about wilderness as an organism. Based upon these findings, accommodations for human convenience must be so constructed that they will exert a minimum of intrusion. Otherwise, man loses the things he seeks. It will depend upon the effects of roadways, trails, sanitation, roadside clean up, and other developments, as they affect plant and animal communities, soil, water percolation, etc. It will depend upon the effect of man's presence in large numbers in the wilderness. The accumulation of such knowledge may result in the restoration of much larger tracts of untouched wilderness than we have now. It may result in a greater concentration of development areas than we now have, with perhaps certain lines of development abandoned. Undoubtedly the future generations will be more adept in the art of this technique than the present, and they will be grateful for large tracts of wilderness wherein they may develop new values which our present limited technique has left untouched.

From the psychological angle we have equally as much to learn. It is enough to suggest that perhaps a certain minimum area of undeveloped wilderness may be found necessary for the aesthetic recreation of the individual; that a certain width and type of road may not be exceeded without suffering definite loss of wilderness character along its course; that beyond a certain degree in refinement of roads and living accommodations we are as effectively removed from being in the wilderness as though a glass enclosed us; that guided trips and excursions must be limited to certain numbers of participants, beyond which we face the law of diminishing returns in wilderness enjoyment.

At any rate, the decision at the lake was an indication of the growth of a wilderness-use technique in the national parks—an attempt to keep these places as they were when the fur trappers first explored them, and yet to open their treasures to all people.

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NATIONAL PARKS AND WILDERNESS USE

By Ben H. Thompson

In the summer of 1913 Colonel Theodore Roosevelt, accompanied by two of his sons, went cougar hunting in the Kaibab Forest on the north rim of the Grand Canyon. There he met Uncle Jim Owen, who guided the party on its 2-weeks' cougar hunt. Uncle Jim has killed more than 600 cougars in the Grand Canyon and the Kaibab.

In the October 4 issue of the Outlook and Independent[1] of that same year, Mr. Roosevelt recounted the big adventures of the trip and, true to his sportsmanship, gave a generous account of his guide, Uncle Jim Owen.

> Uncle Jim was a Texan, born at San Antonio, and raised in the Panhandle, on the Goodnight ranch. In his youth he had seen the thronging myriads of bison, and taken part in the rough life of the border, the life of the cowmen, the buffalo hunters, and the Indian fighters. He was by instinct a man of the right kind in all relations; and he early hailed with delight the growth of the movement among our people to put a stop to the senseless and wanton destruction of our wildlife. Together with his—and my—friend Buffalo Jones, he had worked for the preservation of the scattered bands of bison; he was keenly interested not only in the preservation of the forests but in the preservation of the game. He had been 2 years buffalo warden in the Yellowstone National Park. Then he had come to the Colorado National Forest Reserve [Kaibab] and the game reserve, where he had been game warden for over 6 years at the time of our trip * * *. One important feature of his work is to keep down the larger beasts and birds of prey, the arch enemies of the deer, mountain sheep, and grouse; and the most formidable among these foes of the harmless wildlife are the cougars. At the time of our visit he owned five hounds, which he had trained especially, as far as his manifold duties gave him the time, to the chase of cougars and bobcats. Coyotes were plentiful, and he shot these wherever the chance offered; but coyotes are best kept down by poison, and poison cannot be used where any man is keeping the hounds with which alone it is possible effectively to handle the cougars.

In this brief account of Uncle Jim Owen, Roosevelt personifies the growth of the wilderness-use idea as it arose naturally, out of the vanishing frontier—from buffalo hunter to cattle man, to game keeper and predatory-animal hunter on a Government game refuge. But to continue with the adventures of the Roosevelt hunting party, after a few days with Uncle Jim's hounds, a cougar was struck. Hounds and men trailed him over the brink of the canyon and "treed" him in a yellow pine on the edge of the red cliffs.

[1] A Cougar Hunt on the Rim of the Grand Canyon, by Theodore Roosevelt. Outlook, Oct. 4, 1913, pp. 259–266.

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Here the Colonel speaks for himself,[2]

> It was a wild sight. The maddened hounds bayed at the foot of the pine. Above them, in the lower branches, stood the big horse-killing cat, the destroyer of the deer, the lord of stealthy murder, facing his doom with a heart both craven and cruel. Almost beneath him the vermilion cliffs fell sheer a thousand feet without a break. Behind him lay the Grand Canyon in its awful and desolate majesty.
>
> The boy shot true. With his neck broken, the cougar fell from the tree * * *.

This episode is brought back because it portrays that vivid American ideal which stopped the senseless slaughter of our game and which at the same time contained the seeds of inevitable developments that later so nearly defeated its purpose. There is no thought here to discredit Mr. Roosevelt's work—surely, he would have been the last one to say that nothing more could be learned about wildlife after his time. But unfortunately there are many today whose ideas on wilderness use have not budged an inch since 1913, who are still shooting into the tree where "stood the big horse-killing cat, the destroyer of the deer, the lord of stealthy murder, facing his doom with a heart both craven and cruel." So, let's go on with the story.

Nearly all of the Kaibab cougars have been killed. At present it is thought by lion hunters familiar with this rough country that perhaps four or five cougars may still remain—hardly sufficient even for breeding stock. It is true that cougars eat deer, as Colonel Roosevelt said. It is also true, as he did not say in his article, that when things which eat deer are removed, deer increase like guinea pigs.

By 1919, deer of the forest had increased until they were beginning to consume more forage than the range could produce. The Forest Service reported the situation, but the Kaibab was so far away that no one could believe it. Deer kept increasing, forage kept diminishing, cattle and sheep were reduced to alleviate range pressure, the forest officials called loudly, the stock owners called just as loudly; a few people in the country pricked up their ears and said "There is nothing to it." By 1924, deer had increased until more than seventeen hundred were counted in one meadow in one evening. Winter came, deer died, and those that lived ate every leaf and twig till the whole country looked as though a swarm of locusts had swept through it, leaving the range (except for the taller shrubs and trees) torn, gray, stripped, and dying. Conservationists of the country at large heard the noise of the fray and got in a first-class tangle which effectively prohibited anything from being done. Cattle and sheep contributed materially to the destruction; the combined factors has-

[2] *Loc. cit.*

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tened and augmented the catastrophe. Finally, the area was thrown open to hunting, and by 1930 the deer had been greatly reduced. By 1934, parts of the winter range still look almost as they did 10 years ago, and it will probably take 50 years of careful management completely to cover the scars of the fiasco. It was a conservation fiasco and it opened our eyes to the necessity of wildlife (not game) management.

It is not being maintained here that the killing of cougars was the sole factor which brought about the Kaibab disaster. Other factors entered into the problem, such as overstocking the range with domestic stock. Then too, coyotes, bobcats, and eagles were killed



FIGURE 17.—By 1934, parts of the winter range still look almost as they did 10 years ago, and it will probably take 50 years of careful management to completely cover the scars. . . . (Photograph taken March 10, 1934, Kaibab Plateau. Wildlife Division No. 3738.)

as well as cougars. But it is thought that the cougar-deer relationship traced here was the main factor in the whole complex problem.

This paper started with the title, "National Parks and Wilderness Use". Where do the national parks come into the picture as portrayed thus far? It comes about in this way:

Wild animals know nothing about the arbitrary boundaries which man draws on maps to indicate areas set aside for his different types of wilderness use. Animals wander back and forth, as seasons and quest for food dictate, across refuge or hunting ground, park or forest, as the case may be. What affects the deer or cougars in the environs will also affect them in the game sanctuary itself.

Grand Canyon National Park adjoins the Kaibab National Forest. When cougars were killed and deer consumed the range in the Kaibab, cougars became scarce in the adjacent national park and

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deer destroyed large areas of forage there, too. When national parks were set aside as inviolate wildlife sanctuaries, to preserve representative portions of the American frontier heritage, it was assumed that the wildlife of these parks would find suitable refuge within them regardless of what happened outside. But when deer were shot in the Kaibab National Forest, there were fewer deer to return each spring to Grand Canyon National Park.

It became evident that in order to make our national parks effective wildlife refuges we must cope with the conditions which affect wildlife outside of the parks as well as within them.

Particularly was this true at Grand Canyon, because hunting is not permissible in national parks. An appropriate aside here is that the necessity of complete protection for all forms of wildlife within the national parks is evident, if we are to preserve these relatively small areas of American wilderness in front of a steam-roller civilization. Therefore hunting to reduce the abnormal population of deer on the Kaibab had to be done outside of Grand Canyon National Park.

For several years the recovery program at the Kaibab has been under way. Its objective is to determine the carrying capacity of the range in its present impoverished condition, to reduce the deer herd to within this range-carrying capacity—domestic stock has already been reduced to 1,800 head of cattle and 2,400 head of sheep—and to keep the deer herd commensurate with range production until the range can once more attain normal production. In other words, the deer herd will increase in size as forage production increases.

Toward this end a cooperative range reconnaissance and deer census is made in February and March annually, with members of the Forest Service, National Park Service, and State game commission participating. Forage conditions of the winter range are noted carefully as day after day we ride the ridges and valleys of this frontier. All deer seen are counted by the parties interspersed in the field at such distances as to avoid duplication of count. As the range recovers the census may become impossible, but under the present overbrowsed condition deer can be seen readily. The census is only a working figure; inspection of the range is the important factor.

A second and more scientific method is the construction of fenced range quadrates. This is really simple. In its barest form, a representative plot of range is selected and fenced against deer and stock. The plants inside the fence cannot be eaten; consequently they have a normal growth. Each year the new growth inside the fence is measured and compared with the measured remnants of

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new growth left on plants outside the fence. And thus we learn just what percentage of plant utilization the range is receiving and whether the range is deteriorating or improving. Of course, this type of study has more complex ramifications but the case just given illustrates the method.

This method is also being employed in national parks where elk and deer winter ranges are endangered.

The inevitable train of events now has brought us to the place where we can look back critically upon the cougar hunt of 1913. It was done then with the idea that proper wilderness utilization would consist of killing the bloodthirsty animals so that people could enjoy the gentle ones. But we have seen what happened to the gentle deer of the Kaibab and Grand Canyon. Unfortunately, the Kaibab was only the type case; the same thing has happened in many places throughout the West in both national parks and national forests where deer and elk have been protected and their enemies destroyed. The whole difficulty arises because we have learned to appreciate only a few wilderness aspects.

By now you are ready to say that the whole Kaibab fiasco would never have happened if we had hunted both cougars and deer moderately. I am willing to say that that would have been infinitely better wilderness utilization than we got, but I suspect that "moderate hunting" at that time would have meant 50 deer, 50 cougars. Undeniably, cougar hunting had as much justification as deer hunting. It is real sport. After reading Roosevelt's account of his 1913 cougar hunt, no one can doubt that the Colonel, Uncle Jim, and the boys had a whale of a good time. Furthermore, cougar hunting—like deer hunting—is an economic asset to the community. It is reported that one lion hunter who guided parties into the Kaibab during 1928 and 1929, when his parties bagged nearly 50 cougars, reaped some $9,000 from his hunting in those 2 years. It looks as though the remaining four or five cougars of the region will have to grow a lot of kittens before another $9,000 can be harvested.

Deer and cougar lived together for countless thousands of years before white man came along to protect the helpless deer. How much part the cougar played in developing the deer into an animal with its particular type of fleetness, grace, alertness, and cunning—the very characteristics which make the deer a deer and not a cow and hence desirable for recreation and game—we can only conjecture. We do know this, however, that in areas where deer have had the predatory menace entirely removed, they have largely lost both the game and the aesthetic values. Now, if any hunter or game expert thinks he can step into the cougar's role and supply all of the evolutionary factors which we suspect the cougar has supplied, he is

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welcome to do so, but I would rather not see him do it in or near a national park, where we should like to maintain a semblance of the primitive.

Slowly permeating through the maze of events at the Kaibab was this concept of the organic character of the wilderness. That is, things could not be done in the Kaibab without affecting Grand Canyon, and vice versa; cougars could not be killed without directly affecting the character, habits, and numbers of deer and indirectly affecting range; range plants could not disappear without affecting ground-dwelling birds and small mammals, and so on.

It is this very thing, the organic character of wilderness life, which makes it impossible for any national park or other wildlife refuge to stand alone, unharmed by factors outside of it.

To put my case briefly, I want to see a sustained yield of all forms of native wildlife and of wilderness recreation, particularly in the regions surrounding the national parks. Not only do I believe that such wilderness use is the inevitable solution of the Kaibab type of difficulty, but further, that it is the only possible utilization of the wilderness areas surrounding the national parks which can make it possible for us to preserve the wilderness aspects of the national parks themselves.

In view of the organic character of the wilderness, it now becomes evident that to attempt to compute the recreational or game value of a wild animal on the basis of the number of times it may be seen by visitors, or upon the number of its kind which may be viewed or shot, is a childish and futile approach. The wilderness is much too complicated to be dealt with in any such crude butter-and-eggs way. And the psychology of recreation is equally much too complicated for any such rule-of-thumb hedonics.

To put it another way, we cannot stress the value of one animal at the expense of another, for if we do our lopsided vision is reflected in poor management which wrecks the whole organic wilderness. Moreover, acquaintance with, or utilization of, the infinite variety of wilderness processes and creatures has far greater recreational potentialities than any sentimental addiction to a few, obviously harmless, pretty creatures. And equally important is this business of numbers. Perhaps the greatest deer spectacle on earth is not the seventeen hundred deer eating up the meadow in the Kaibab but one perfectly healthy buck bounding through the forest.

Had these principles been applied in managing the Kaibab from the time it was first made a national forest, I believe that the fiasco would never have occurred. This is not an attempt to say that all wilderness areas should be managed according to national parks' principles—most certainly not. There are and should be many dif-

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ferent types of wilderness utilization, and the purposes of one type do not need to coincide with the purposes of another type. For example, Grand Canyon National Park was set aside for its scenic beauty, for its recreational and educational possibilities, and for scientific study. Immediately north of Grand Canyon National Park lies the Kaibab National Forest, a great hunting ground and one-time cattle range. Immediately to the south of Grand Canyon lies the Tusayan National Forest, wherein there is lumbering and stock grazing. And south of that lies the public domain with its

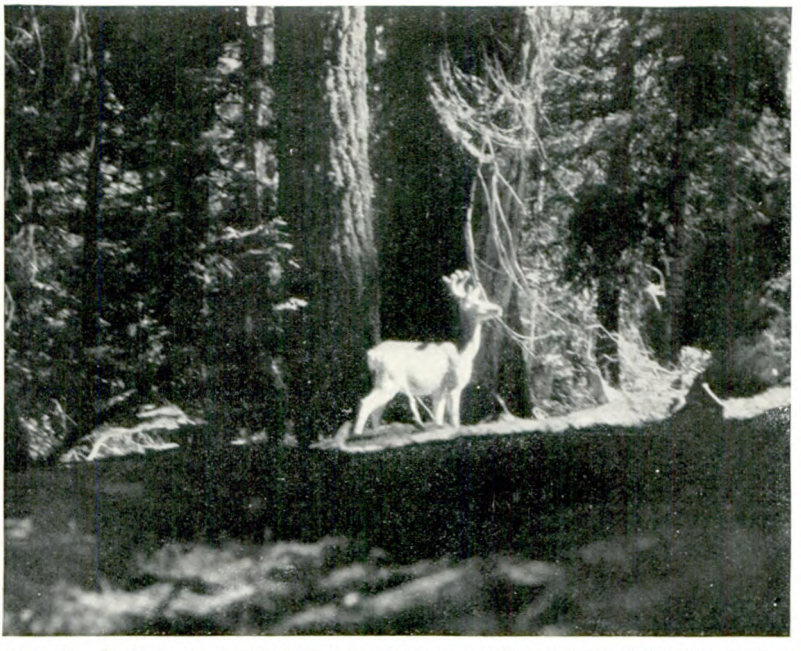


FIGURE 18.—Perhaps the greatest deer spectacle on earth is not the 1,700 deer eating up the meadow in the Kaibab but one perfectly healthy buck . . . (Photograph taken June 16, 1933, Crescent Meadow, Sequoia. Wildlife Division No. 3349.)

unfortunate everything. Here then is a typical example of the dovetailing of our various wilderness-use purposes. But the point is that there are certain biological principles which all wilderness administrations will have to adopt or else none can be successful.

From the wildlife management angle, an attempt has been made here to state fairly some of these inescapable principles by tracing briefly the salient events of the Kaibab and analyzing them. Let us go on now to a consideration of the function of national parks in our scheme of wilderness use generally.

In view of the fact that there are many varieties of wilderness use, as just outlined above, most of which are practices that for one

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reason or another definitely and permanently modify most of our remaining wilderness heritage, it becomes evident that the national parks have a very definite function to perform in maintaining primitive conditions. This is a thing which the public generally does not understand. There is a constant flow of proposals to the National Park Service to introduce this or that exotic, such as pheasants, Hungarian partridges, even large foreign mammals; to kill predators; to make zoos; to throw the parks open to grazing and lumbering; to provide artificial amusements; and in general to make of the parks just another string of fashionable resorts. These things which can be done better elsewhere should be done elsewhere. Because certain amusement contraptions have been successful at Coney Island, or certain types of exotic game have produced sport on somebody's shooting preserve, is no reason why these things should be transferred to our national parks. As Mr. Frederick Law Olmstead points out, there is need to clarify our concept of that type of recreation which is sought in the wilderness and not introduce the things which could operate much more satisfactorily elsewhere; for instance the amusement contraptions of Coney Island. Conversely, we should determine what attributes are peculiar to each park or wilderness itself and make our developments conducive to the enjoyment of these. We must see the particular function which national parks have in wilderness use generally, then develop our technique of administering them accordingly. And to this technique some of the principles developed earlier in this paper have been found to be essential.

In respect to our Nation's wildlife, the national parks play a quantitative part as well as a qualitative. Many times in the recent past, national parks have operated as reservoirs to replenish sections of the country where game animals had become extinct, for instance, the 3,000 elk transplanted from Yellowstone to various parts of our country and Canada. But above even this function of restocking the country with game animals is the function of pure wildlife conservation. The national parks have already provided sanctuaries and in the future, even more, must provide sanctuaries for many forms of wildlife which can exist nowhere else in the country—for example, grizzly, wolf, wolverine.

As corollary to the above, another function of the national parks is their obligation to forge the way by a unique educational technique toward a more widespread appreciation of all forms of wildlife and all aspects of the wilderness. Often elsewhere in game management there has been the tendency to follow the pleasant road of the "good fellow"; to provide as much as possible of the things to which people were most accustomed, because the accustomed

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things are the most comfortable; that is, to sentimentalize over the helpless deer, to ascribe deeds of honor and human intelligence to hounds, to transplant the familiar things far and wide and, above all, to produce quantity. These luxuries are quite all right in their place, but if they become the sole mode of recreational wilderness use, I'm afraid there would be a nauseating monotony about it all. Moreover, such practices lead definitely to destruction of many phases of nature, as at the Kaibab.

Thousands of people go to the national parks because they want the things which are peculiar to the primeval wilderness and, what is more, peculiar to a particular wilderness—such as Glacier or Yellowstone or Grand Canyon or some other one. To make possible the great joy to be found in the infinite variety of the wilderness—not to thwart the desire to discover more and more of its ways—and the moral obligation to leave it unimpaired for new discoveries tomorrow, these are functions of the national parks in our general scheme of wilderness use. Our national parks are a great philosophical venture in which we are attempting to pry open for ourselves the intricate and delicately balanced system of wilderness values essential to full and intelligent enjoyment of the wilderness. The success of the venture is going to hinge largely upon our understanding of the values at stake, our knowledge of recreational psychology, and our ability to meet the biological requirements of wilderness management.

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PART II

PRESENT STATUS OF NATIONAL PARKS WILDLIFE AND THE RESTORATION PROGRAM

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REPORT ON THE CURRENT STATUS OF LARGE MAMMALS IN THE NATIONAL PARKS

By GEORGE M. WRIGHT and BEN H. THOMPSON

Given herewith is a brief report on the current status of national parks' mammals, with particular emphasis on restoration plans for those forms concerning which some apprehension is felt, either in the parks or in the country at large.

BISON

Bison always have held a unique position among the park animals because of the intensive management necessary to prevent their extermination. Now that their perpetuation is assured, radical changes will be made in the buffalo program.

In 1900, when a census was taken of the Yellowstone Park herd, 29 were counted and 10 more were estimated, or about a total of 40. In 1902, Congress appropriated $15,000 to provide for the development of a Yellowstone bison herd. A semidomesticated herd was started with 3 bulls from the Goodnight herd of Texas, and 18 cows obtained from Conrad Allard in western Montana. It is thought that the wild and tame herds have become one. According to Figgins' speciation, we conclude that the present Yellowstone bison is probably a hybrid of *Bison bison bison* from Texas, *Bison bison septemtrionalis* from Montana, and *Bison bison haningtoni*, possibly the mountain form.

The original nucleus of 21 introduced, in addition to the remaining natives, has produced a total of 2,279 since 1902. Two hundred and ninety-seven have been shipped alive. Six hundred and eighty-two have been slaughtered for meat. Forty-eight outlaws and cripples have been destroyed, and there have been 124 recorded losses from disease.

Disease loss has been due to hemorrhagic septicemia. Outbreaks of this disease caused a loss of 22 buffalo in 1911; 53 in 1919, and 49 in 1923. Treatment is by vaccination with bacterin provided by the United States Bureau of Animal Industry. A supply is kept on hand in case of further outbreaks and hemorrhagic septicemia is no longer feared. It is estimated that Bang's disease (contagious abortion) affects from 38 to 43 percent of mature animals in the herd. Studies are being conducted to learn more about this disease and its

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possible effects on the herd. During the 1934 round-up, 84 cows and 4 bulls were tested and branded for identification. Sixty-five percent of the cows and all 4 bulls reacted positively to the test. The same individuals will be observed next winter to determine prevalence and progress of infection, effect on reproduction, period required to attain individual immunity, if any, and probable general effect on the future of the herd.

There are now 1,128 bison in Yellowstone. It is proposed to reduce the herd to 1,000 owing to the declining carrying capacity of the range with ultimate intent to stabilize it at a number commensurate with normal range production. This situation is complicated because of utilization of this range jointly by wapiti, moose, deer, mountain sheep, pronghorn, and beaver.

Today the bison of Yellowstone enter upon the third, and it is hoped the final period. In the first period, the bison was practically exterminated. The second period, extending from 1902 to 1929, was devoted to building up a new herd by every means at human command. The third period, which now becomes possible because the park has an adequate herd and the bison has been saved from danger of extinction generally, will be devoted to the task of returning the Yellowstone herd to the wild state insofar as the inherent limitations of the park will permit.

To this end, castration of bull calves will be discontinued and the existing steers culled out as rapidly as possible. Calves will be permitted to run with the cows through the winter instead of being corralled and fed as formerly. Instead of there being a fall and a spring round-up only one will be held in the future. Gradual reestablishment of the normal sex ratio of 1 to 1 will be sought. This will limit artificial management of the herd to a single round-up which will be necessary so long as there is a surplus to slaughter, to winter feeding at the Buffalo Ranch which will be necessary so long as the herd must be held within present park boundaries, and, to disease prevention and cure. When these things are accomplished there will be once again a wild herd of bison in the United States.

In conservation of bison, Yellowstone will always be the most important national park in the United States. Glacier might rank second if the proposal to establish a herd which will summer in the park and winter on the Blackfeet Indian Reservation can be realized. A nucleus, including individuals of both sexes and all ages, would be held in a fenced enclosure of approximately one township on tribal lands in the vicinity of Boulder Creek. They would be held there for a period of 1 year to fix them in the habit of homing in this vicinity and then would be released. The Indians would be owners

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of the buffalo, responsible for their care, and would be entitled to the surplus. The Indian council, suspicious that the real purpose is to deprive them of more of their lands in order to extend Glacier Park, has been unwilling to accept the plan as yet.

The only other bison to be found in the national parks consist of small exhibits at Wind Cave (maintained by the Biological Survey), at Colorado National Monument, and at Platt. All of these are under fence. They serve a useful purpose in affording to local visitors, who might not otherwise have this experience, the opportunity of seeing bison. They are also additional safety nuceli in case of disaster to the large herds. Under the President's emergency pro-

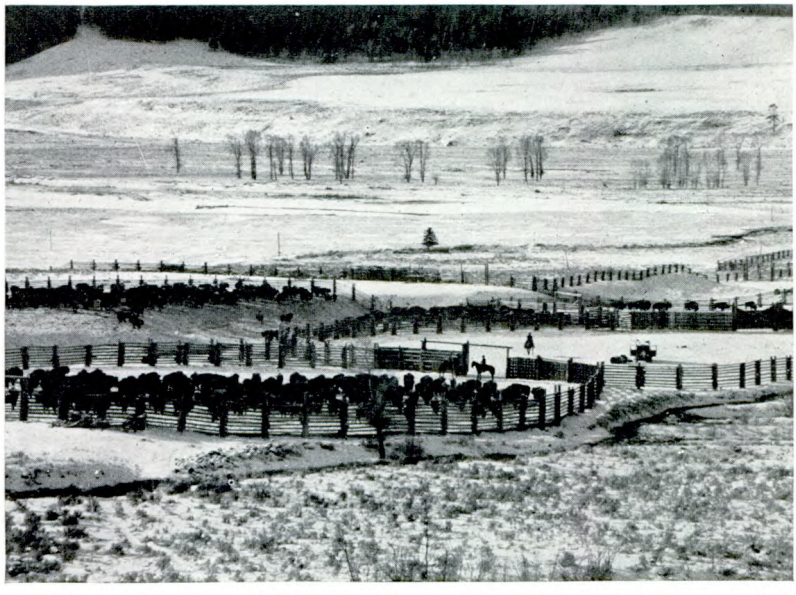


FIGURE 19.—Buffalo round-up, Yellowstone National Park. Instead of there being a fall and spring round-up, only one will be held in the future. (Photograph taken December 6, 1932, at Buffalo Ranch. Wildlife Division No. 2889.)

gram the paddock at Platt has been moved to a new location and increased in size so that the herd can be increased from the 5 formerly accommodated to a maximum of 30.

WAPITI

The national parks have played an important role in the conservation of three forms of elk native to the United States. The other varieties once found within our borders, including the Arizona wapiti (*Cervus merriami*) and whatever species originally inhabited the territory east of the Mississippi, became extinct without benefit of national parks protection. While the National Park Ser-

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vice does not feel that elk in any of the parks are in immediate danger of being exterminated at present, there are many acute problems involving not only the elk themselves but seriously threatening many other animals as well.

The American wapiti (*Cervus canadensis canadensis*) is native to the three parks in the Rocky Mountains—Glacier, Yellowstone, and Rocky Mountain. It is further represented by small bands maintained under fence for exhibition purposes in Wind Cave and Platt National Parks and Colorado National Monument.

Since 1913, 3,007 elk have been shipped from Yellowstone to 24 States for transplanting purposes. An additional 307 have gone to Canada. Yellowstone elk fall into two main divisions, the northern herd wintering on the Yellowstone River drainage both in and out of the park, which is estimated to number 12,000 at present, and the southern herd of approximately 20,000 elk which winters in Jackson Hole under the care of the Biological Survey. The Yellowstone Plateau is the most important summer range of both herds.

The southern elk herd problem is too well known to warrant discussion here. Summer range on the Yellowstone Plateau is adequate for all the elk which utilize it at present, and more.

The northern elk herd today faces the most serious crisis in its history. Because of adverse conditions on the normal wintering grounds at lower elevations outside the park which are now utilized by sheep, cattle, and horses, and because hunting under the present system drives the elk back, almost the entire herd winters inside the park in the Lamar and Gardiner River districts. This has necessitated resort to artificial feeding, which has proved so much more harmful than beneficial that it must be discontinued as soon as possible.

It should be remembered that approximately 10,000 elk, 1,000 bison, 800 mule deer, 600 antelope, 125 bighorn, and numerous other game animals now pass all of the year except the short summer season on what, under natural conditions, was only a transient spring and fall range.

Let it be emphasized that the Yellowstone winter range must be protected. If this is done, three other important species—mule deer, antelope, and bighorn—can be saved, a fourth, the western white-tailed deer, might be reintroduced, and others, including bison and beaver, will be greatly benefited. All these and others have been more or less sacrificed to the maintenance of the elk herd.

The Rocky Mountain Park elk story is typical of what may be expected wherever elk are reestablished in areas that are limited by lack of winter habitat. Before market hunting days, elk were very

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abundant in this section of the Rockies. It is believed they were completely exterminated prior to 1900. In 1913 a band of 20 cows and 5 bulls from the Yellowstone elk herd was brought to Estes Park. There are now between 350 and 400 elk in the national park area, and more than 2,000 deer. The beginnings of a range problem are evident. Aspen trees on the winter range have been stripped of their bark and reproduction killed. Purshia is being killed out. Sagebrush and ribes are now being taken. Foxtail (*Hordeum*) is invading. At present the range is being kept under close observation. Fenced quadrates are being constructed to facilitate range

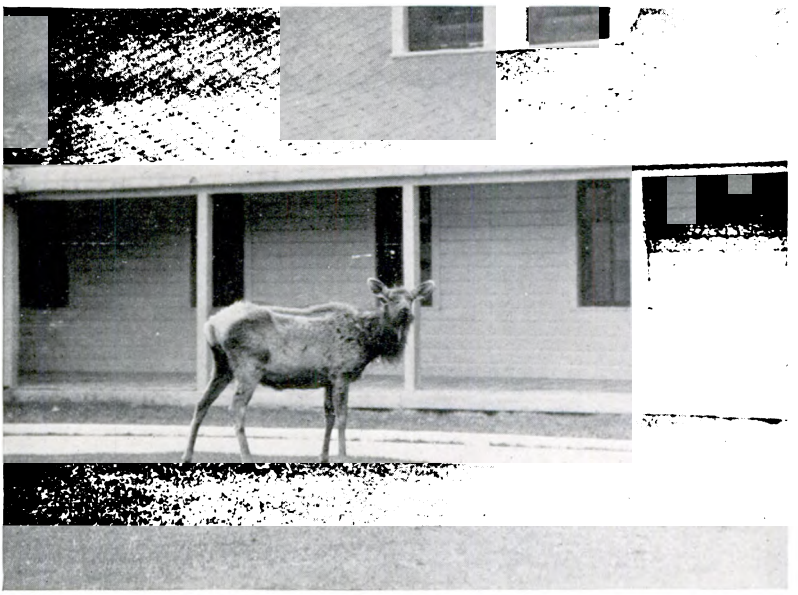


FIGURE 20.—Product of artificial feeding . . . so much more harmful than beneficial that it must be discontinued . . . (Photograph taken May 16, 1932, at Mammoth Hot Springs, Yellowstone. Wildlife Division No. 2137.)

study. Last summer Emergency Conservation workers were assigned to the task of pulling up foxtail in an effort to check this exotic in the incipient stages. Some desirable meadow land in Morraine, Horseshoe, and Beaver Brook parks has been added to the park, but there is a very definite limit to what can be done in this direction. When the carrying capacity of the range has been determined, the herd will have to be kept within the indicated limits.

Glacier Park has approximately 1,000 elk, the census for 1933 being 1,290. Thirty-one head were brought in from Yellowstone in 1912. Their condition is constantly precarious because hard winters force them down to their natural wintering ground on the In-

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dian Reservation. The Indians are not bound by any restrictions on hunting. A slaughter occurred a few years ago and may be repeated at any time. Superintendent Scoyen has assiduously devoted himself to the task of interesting the Indians in wildlife preservation in the hope that they will see the advantages of open and closed seasons. A judicious use of game surplus by the Indians of the reservation would be welcomed.

The Roosevelt wapiti (*Cervus canadensis occidentalis*) is represented in Mount Olympus National Monument by the Olympic herd, which is said to number around 6,000 head at present. Most of the elk summer in the monument. In the 1933 hunting season, the first in 30 years, 157 were taken by hunters. No penalties for poaching were provided until 1927 and enforcement was negligible then. Poaching undoubtedly has been a controlling factor, although the herd has increased in numbers. There is an important winter-range problem. The limited lowland valleys cut off by the sea are occupied by submarginal farms. Therefore, the elk tend to remain higher and in greater concentration upon certain sections of the winter range, a fact which is leading to range deterioration in these areas. In 1932, cougars were hunted and about 30 were killed by the Biological Survey and others. A cougar population may be a necessary adjunct to a healthy elk herd.

The monument was under Forest Service jurisdiction until this year when it was transferred to the National Park Service. This action, as well as the submarginal agricultural lands retirement program and the opening of a hunting season, have all combined to focus attention on the case of the Olympic elk. Several field investigations of this problem are under way, notably, by Mr. O. J. Murie, for the Biological Survey and the National Forest Service, by Mr. M. P. Skinner, representing the Boone and Crocket Club, and by the National Park Service. The Elk Commission has adopted the Olympic elk problem as a major activity. It is expected that satisfactory results in the perpetuation of the Roosevelt elk will be forthcoming.

Yosemite has discharged its duty to help save the dwarf wapiti (*Cervus nannodes*) from extinction. This small elk was native to the river bottoms in the central valleys of California. It came just about as close to the brink of extinction without going over as any wild species possibly could. The California Academy of Sciences was instrumental in placing a small band in Yosemite Valley in 1921, where these elk were maintained in a paddock and cared for and fed for 12 years at an annual cost to the park of more than $400. On October 20, 1933, the Yosemite herd numbering 27 animals was liberated in Owens Valley, which is part of the watershed controlled

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by the Water Board of Los Angeles. This is believed to provide an abundant and ideal habitat for the species. There have been no losses so far, and the animals seem entirely at home in their new surroundings.

MOOSE

Moose are hardy. They do not have the herding habit, nor do they migrate to the lowlands in winter. Yellowstone is their present stronghold, with an estimated population of 700 Shiras moose (*Alces americana shirasi*). Moose studies have been conducted by rangers



FIGURE 21.—Moose in Yellowstone National Park. Here moose can be seen every day in the tourist season by passing motorists . . . (Photograph taken May 20, 1932, at Norris Junction, Yellowstone. Wildlife Division No. 2171.)

for several winters. One of the finest wildlife exhibits anywhere in the parks system is the moose show at Willow Park. Here moose can be seen every day in the tourist season by passing motorists and sometimes as many as 10 are in sight at one time.

Grand Teton National Park estimates approximately 125 moose within its boundaries.

There are some 150 American moose (*Alces americana americana*) in Glacier. Recent ranger reports have emphasized the fact of their increase, particularly as evidenced by their appearance in hitherto unfrequented valleys. Losses from poaching can never be entirely eliminated until the private ranches of the west side are purchased.

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The Alaska moose (*Alces gigas*) just recently has become a resident member of the Mount McKinley Park fauna. In 1926 moose were casual visitors on the basis of a few that wandered up in the summer from the timbered lowlands. Factors which may have contributed to this change are the recent addition of lands of lower altitude to the park, the cumulative effects of protection, and possibly persecution which may have led them to adopt this high refuge even though living conditions are less favorable.

CARIBOU

Caribou do not find complete sanctuary in any national park.

The barren ground caribou (*Rangifer arcticus*) continues to be present in Mount McKinley in abundance, the current estimate being 15,000. Since the park caribou take part in the great annual run in central Alaska, which takes them far beyond the park boundaries, their future is bound up with general protective measures for the species. They continue to be threatened as to purity of stock by the presence of the inferior but aggressive imported reindeer.

We have no caribou data for Katmai, where one of the barren ground forms undoubtedly occurs.

Mountain caribou (*Rangifer montanus*) have a potential status in Glacier, which is located in the southern fringe of their range. Very rarely stragglers into the northwest corner of the park are reported. An investigation was made 2 years ago which resulted in the conclusion that little could be done to make this rare wanderer a secure member of the Glacier fauna.

Isle Royale once had a band of caribou, but it disappeared many years ago.

DEER

Deer are so well represented in the national parks, both as to species and as to numbers, and are generally so secure, that discussion here is limited to a few scattered observations.

If the Big Bend of the Rio Grande proposed park area comes into the national parks system, the Mexican mule deer (*Odocoileus hemionus canus*), Arizona white-tailed deer (*Odocoileus couesi*), and fan-tailed deer (*Odocoileus texanus*) will be added to the parks' fauna. Everglades would bring in the Florida white-tail (*Odocoileus osceola*). Some individuals of *Odocoileus virginianus virginianus* were recently transferred from Mount Vernon to Shenandoah. Under protection, this species can be well cared for in Great Smokies. Columbian black-tailed deer are found in all the parks of the Pacific coast, and mule deer in the 15 parks within their native range. The western white-tailed deer is found only in Glacier, where there are

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approximately 2,000. White-tailed were formerly found in Yellowstone and may be reintroduced there when sufficient range has been procured. In a number of instances there are deer problems involving the adjustment of numbers to the carrying capacity of winter ranges. The National Park Service favors the policy of managing the Kaibab deer herd to permit its gradual increase as the range is brought back to normal productiveness. On the South Rim of the Grand Canyon, water holes for deer are being constructed, and about 60 square miles of range have been fenced to exclude domestic stock. In furtherance of game range studies, fenced quadrates are being constructed in Yosemite, Sequoia, Grand Canyon, Zion, and Mesa Verde, and have already been constructed in Rocky Mountain and Yellowstone.

BIGHORN

The present status of mountain sheep is generally far from satisfactory. Practically nothing is known concerning the factors affecting its status. Intimate studies must be made before there can be a constructive program.

The Dall sheep (*Ovis dalli dalli*) of Mount McKinley seems to be at a low ebb in cyclical abundance. Previous peaks were in 1906–07, and in 1929. In the latter year, 15,000 were estimated in the park, and there were certainly more than 10,000. The 1933 census gives an estimate of 3,500. Whereas there were many lambs in every band of ewes in 1926, the total lamb count for 1932 was only 357. Obvious factors responsible for this decline in reproduction were bad weather and molestation by wolves and coyotes. Though these cycles of abundance are in themselves a natural phenomenon, man has added so many more hazards that it is easily possible the time may come when recovery is impossible. The only help which can be administered at present is increased protection for the sheep outside the park and control of their natural enemies inside. Coyotes will be eradicated if possible, and permission for a very limited wolf control was given in 1933.

A remnant of the Sierra Nevada bighorn (*Ovis canadensis sierrae*) persists in the Mount Whitney region of California. If this small nucleus increases, there is hope that its reestablishment in Sequoia and Yosemite can be secured, either by a natural reinvasion or by transplanting.

The Rocky Mountain bighorn (*Ovis canadensis canadensis*) is now found in Glacier, Yellowstone, Grand Teton, and Rocky Mountain National Parks, the 1933 censuses being 313, 150, 45, and 360, respectively. In Glacier they suffer from poaching and from coyote depredations as a result of feeding to hold them in the park. In

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Yellowstone they are slowly declining in numbers, and those that remain appear in poor condition. Their resistance to lungworm, scab, and disease in general appears to be low. Unfavorable forage conditions centering in the elk problem are thought to be a main cause. In Rocky Mountain they are thought to be decreasing, and probably will fail to improve unless boundaries are extended to give them better protection from man and domestic sheep.

Little is known concerning the sheep within the rim of Grand Canyon. They are seldom seen. An arbitrary estimate of 200 is given, but there has been no observable increase or decrease in recent years. The recent removal of more than a thousand feral burros may react favorably upon the sheep.

Inclusion of the proposed Big Bend of the Rio Grande and Guadalupe Mountains areas would extend protection to *Ovis mexicana* and *Ovis canadensis texiana*, respectively.

PRONGHORN

The American pronghorn, in spite of its importance among large game species, and its great spectacular value, is rather poorly represented in the national parks system. The proposal has been made that a park or monument should be established with antelope as an outstanding feature.

There are between 600 and 700 pronghorn on the overcrowded northern game range of Yellowstone. Although this area can hardly be considered as being within their optimum range, and they are crowded down to the vicinity of Gardiner in winter on an extremely depleted area, they prosper nevertheless. The recent addition to the park below Gardiner will benefit the pronghorn more than any other species concerned.

Petrified Forest National Monument has recently fenced an area of approximately 40 square miles for the express purpose of excluding domestic stock and thereby permitting range improvement for antelope within the monument. It is planned to develop one or two watering places in the monument as further inducement to bring antelope within its protection.

A herd of 25 is artificially maintained under unfavorable conditions in the Indian Gardens down in Grand Canyon. It is expected that this experiment will be discontinued as soon as suitable range can be procured in Grand Canyon National Monument, where preparations are being made for the reintroduction of this species. There a fence to exclude domestic stock from the antelope range already has been constructed, but the range will require several years to recover from its overgrazed condition.

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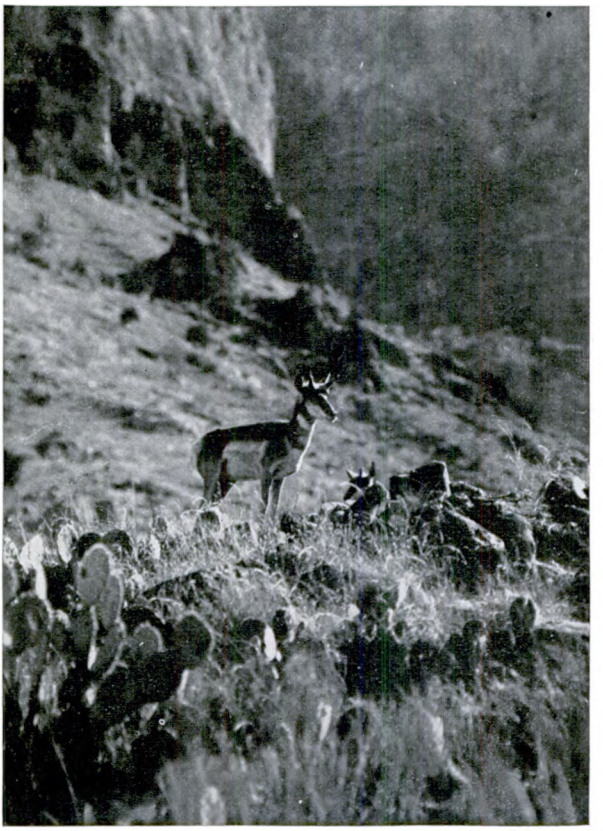


FIGURE 22.—A herd of antelope is artificially maintained . . . in the Indian Gardens down in Grand Canyon . . . (Photograph taken October 31, 1930, Indian Gardens, Grand Canyon. Wildlife Division No. 1905.)



FIGURE 23.— . . . under unfavorable conditions, i. e., feeding troughs. (Photograph taken June 1, 1933, Indian Gardens, Grand Canyon. Wildlife Division No. 3298.)

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MOUNTAIN GOAT

The mountain goat can be dismissed with brief comment because its status is satisfactory from every standpoint.

The Montana mountain goat (*Oreamnos americanus missoulae*) is found in Glacier Park. There are more than 800 and the number is increasing. They do not leave the park at any season and are benefited further by the protection afforded by Waterton Lakes Park in Canada, which adjoins on the north. Goats frequent the higher chalets—particularly Sperry Chalet, where they are the major attraction—and are frequently seen by motorists crossing Logan Pass.

Four hundred cascade mountain goats (*Oreamnos americanus americanus*) are safe within the boundaries of Mount Rainier. All reports agree that they are increasing.

The Columbian mountain goat (*Oreamnos americanus columbiae*) occurs in Glacier Bay National Monument. The proposed increase of this area to approximately double the present size would provide for their permanent protection.

Mountain goats do well because they remain within the protecting park boundaries the year round, because their chosen terrain is so rugged as to be protected against the influences of civilization within the park, and because they are adapted to survive under the most rigorous climatic conditions.

BLACK BEAR

Since the black-bear problem is no longer one of saving the bears but of establishing a mutually satisfactory relationship between bears and humans in the parks, they may be dismissed briefly here. There are about 2,000 black bears in 13 parks, the majority of them in Glacier, Mount Rainier, Rocky Mountain, Sequoia, Yellowstone, and Yosemite

GRIZZLY AND BROWN BEARS

The national parks hold out the last hope for the grizzly bear in the United States proper. It is entirely gone in the parks of the Pacific coast and southwest regions, and from Rocky Mountain National Park. The 1933 big game census gives 112 grizzlies for Glacier and 260 for Yellowstone. Unless present conditions radically change, grizzly bears will survive indefinitely in these two parks.

The national parks play a minor part in the conservation of brown and grizzly bears in Alaska. Now that prospecting is prohibited in Mount McKinley, bears are increasing. Joseph S. Dixon observed 29 Toklat grizzlies (*Ursus toklat*) in 1932, as against 3 in 1926. The tundra brown bear (*Ursus kidderi tundrensis*) also is present.

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There should be extensive areas in Alaska devoted to the complete protection of the brown bear, largest of all living carnivores. Enlargement of Glacier Bay National Monument would be of material assistance to the brown bear.

COUGAR

Cougars have almost disappeared. Their absence is responsible for many of our game problems. There is encouragement in the fact that in recent years they have been given complete protection within the national parks. However, they range widely and are persecuted so persistently outside the parks that their future status, even within the parks, is decidedly questionable.

WOLF

There are probably no wolves today in the national parks of the United States outside of Alaska. The loss is lamentable and there is little likelihood that it can be remedied.

The Mount McKinley timber wolf (*Canis pambasileus*) has been increasing during the past few years. Its value is thoroughly appreciated by the National Park Service, even though the necessity of some control during 1933 was admitted on the basis that the mountain sheep of the park were in need of relief.

COYOTE

In the national parks, as everywhere else, mere mention of the coyote is sufficient to start an argument. Coyotes are present in all western parks and recently have become established in Mount McKinley. In all probability they have extended their altitudinal range in many areas. Indications lead us to believe that they are becoming more abundant than formerly in places where wolves have been exterminated.

Coyotes are given equal protection with other species except in Mount McKinley, where they are plainly exotic and hence are condemned, and in Yellowstone, where they are controlled by shooting in limited numbers over certain areas. In summer they are a common sight along the loop highway and yield to no other animal in visitor appeal. The National Park Service policy is that judicious control of coyotes by proper selective methods may be exercised in any park where it is demonstrated to the satisfaction of the Director and the Wildlife Division that coyotes are endangering the survival of some other species.

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MUSTELIDS

Most members of this group are secure in the national parks. There are two exceptions.

Both fisher and wolverine are in desperate straits generally, although the Mount McKinley wolverine (*Gulo hylaeus*) is more abundant today than it was 10 years ago. Even though the mountain sheep population of Mount McKinley is at a low ebb—and evidence seems to indicate that wolverines prey upon them—no control of the wolverines has been permitted. Mount Rainier still harbors a few common wolverines (*Gulo luscus*), and Yosemite and Sequoia have each a small number of the southern wolverine (*Gulo luteus*). Wolverines are gone from the Rocky Mountain parks.

Though fisher are credited to Glacier, Yellowstone, Mount Olympus, Mount Rainier, and Yosemite, definite evidence of their presence today is lacking except in Sequoia and Mount Olympus.

Little can be done for wolverine and fisher, and the other fur bearers as well, unless park boundaries can be extended in critical areas or unless "buffer areas" in which no trapping is permitted can be established around the parks.

RODENTS

For as much value as there may be in any sweeping statement, it may be said that park rodents are prospering. It would be impossible to go into detail in this brief survey.

Beaver have increased encouragingly in recent years. Rocky Mountain and Yellowstone are their strongholds. In both parks their range is endangered through the destruction of aspen and willow on the overbrowsed elk winter ranges.

The gray squirrel population is slowly building up in Yosemite and Sequoia.

Kaibab and Abert squirrels at Grand Canyon are in excellent condition. The placing of White Sands, Great Sand Dunes, and Death Valley on national-monument status adds many rare, specialized small rodents to the protected list.

CONCLUSION

The National Park Service believes that its wildlife resources are sounder today than at any time since its establishment. Large-game species, with the important exception of mountain sheep, have made marked improvement. Predators at last have attained equal protection with other forms. The outlook for some small fur bearers, however, is not promising.

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The restoration program includes:

1. Reintroduction of extirpated species, namely, Mexican bighorn (*Ovis mexicana*) in Mesa Verde National Park, Sierra Nevada bighorn (*Ovis canadensis sierrae*) in Yosemite National Park, plains white-tailed deer (*Odocoileus virginianus macrourus*) in Yellowstone National Park, plains white-tailed deer (*Odocoileus virginianus macrourus*) in Shenandoah, bison in Glacier National Park, Oregon antelope (*Antilocapra americana oregona*) in Grand Canyon National Monument, Merriam turkey (*Meleagris gallopavo merriami*) in Mesa Verde National Park, and a number of others when suitable range has been procured.

2. Range management to restore depleted habitats in Yellowstone, Rocky Mountain National Park, Bandelier National Monument, Petrified Forest National Monument, Grand Canyon National Park, Grand Canyon National Monument, Sequoia National Park, and Yosemite National Park.

3. Assistance, through special protection of one kind or another, to rare species, namely:

(*a*) The fur bearers in all the national parks, demanding boundary extensions and surrounding buffer areas in which there should be no trapping or predatory animal control except as permitted by the National Park Service;

(*b*) Bighorn in Glacier National Park, Grand Canyon National Monument, Yellowstone National Park, Grand Teton National Park, Rocky Mountain National Park, Zion National Park, Death Valley National Monument, and Sequoia National Park;

(*c*) Pronghorn in Yellowstone and Grand Canyon National Parks and the environs of Petrified Forest National Monument:

(*d*) Trumpeter swan and sandhill crane in Yellowstone National Park and vicinity; and

(*e*) Various species of grouse in several of the national parks.

4. Complete eradication of poaching.

5. Protection of wildlife against the harmful effects of civilization within the national parks. The ramifications of this problem are too endless to detail here.

6. Studies of diseases and parasites, particularly as affecting the ungulates of Yellowstone National Park; life history and food habit studies in all parks.

7. Attempted eradication of exotic species, such as the coyote in Mount McKinley National Park and the opossum in Sequoia National Park.

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8. Numerous other management measures necessary to preserve primitive or wilderness conditions within the national parks and monuments.

The chief needs may be summarized as follows:

1. Strengthening of the internal system of wildlife administration in the parks in order that the maximum benefits from wildlife management can be secured.

2. Rounding out of the national parks system to include outstanding biotic association not now represented.

3. Regulation of transplanting and restocking practices throughout the nation to protect the purity of each strain in its native territory.

4. Revision of boundaries to follow natural faunal barriers, and inclusion within the parks of critical seasonal ranges which are necessary to the welfare of park game.

(Read May 8, 1934, at the Sixteenth Annual Meeting of the American Society of Mammalogists, American Museum of Natural History, New York City.)

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REPORTS CONCERNING WILDLIFE RESTORATION

Because of various proposals involving reduction of buffalo, elk, deer, and other species, as outlined in the foregoing report on the Current Status of Large Mammals in the National Parks, it is felt that an explanation of these contemplated actions is due. It is believed that the explanation most satisfactory and economical of time and energy is to be found in the reports submitted by the Wildlife Division from time to time, which portray conditions as we have found them. Therefore, a representative list of such reports is given herewith.

Throughout, the reports are submitted practically verbatim, with only such slight changes in text as would be conducive to greater clarity, or in matters involving personnel or administrative routine which would have no place here. In no case has the meaning or purpose of any report been changed.

It should be noted that the first series of reports deals with restoration measures. The second series of reports deals with the administrative phase of wildlife management. Only such reports are included as are necessary to indicate and explain the national parks wildlife restoration and administrative program.

REPORT UPON WINTER RANGE OF THE NORTHERN YELLOWSTONE ELK HERD AND A SUGGESTED PROGRAM FOR ITS RESTORATION

Submitted to the Director of the National Park Service, February 28, 1934

It is felt that the following pictures portray the precarious status of the Yellowstone elk winter range far more adequately and briefly than would a written description of these conditions. Therefore no written account of the range is submitted in this report.

It may be said, however, that the recent acquisition of some 7,000 acres of additional winter range near Gardiner will not alleviate materially the present situation because much of that territory comes to the park in an already overgrazed condition. It has been the sustenance of domestic stock for many years prior to its acquisition by the park.

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FIGURE 24.—East slope of Blacktail Deer Creek Valley as it was on September 17, 1933. There is not enough grass to cover the stones. This is typical of a large part of the elk winter range in northern Yellowstone. (Photograph taken September 17, 1933, Yellowstone. Wildlife Division No. 3347)

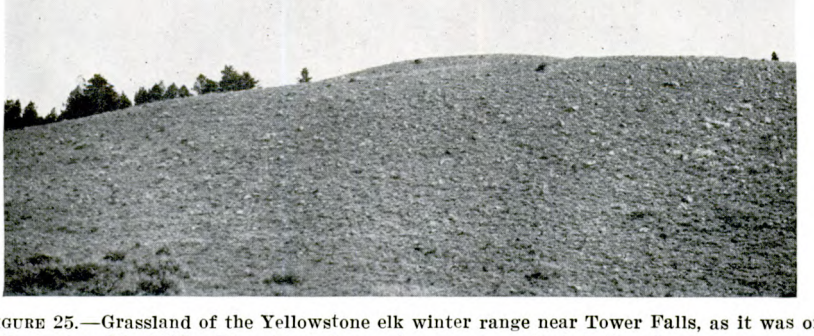


FIGURE 25.—Grassland of the Yellowstone elk winter range near Tower Falls, as it was on September 17, 1933. Drought and grasshoppers accentuated the already overgrazed range, but these factors must be calculated in arriving at the carrying capacity of the range. (Photograph taken September 17, 1933, Yellowstone. Wildlife Division No. 3273.)

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FIGURE 26.—End of the range. The right side of the picture shows elk winter range within Yellowstone National Park. The fence is the boundary. The left side of the picture shows rank growth of sagebrush just outside the park. Here we can compare the original and the present state of the range. There can be no doubt of what has happened. (Photograph taken June 1, 1932, near Gardiner. Wildlife Division No. 2501.)

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FIGURE 27.—Sagebrush graveyard. Sagebrush killed by overbrowsing. Characteristic of much of the Yellowstone elk winter range. (Photograph taken September 17, 1933, near Black Tail Deer Creek, Yellowstone. Wildlife Division No. 3275.)



FIGURE 28.—Overbrowsed chrysothamnos. When the less palatable species which come in as a result of overgrazing suffer to this extent, no additional danger signal is necessary. (Photograph taken May 23, 1932, at Gardiner River, Yellowstone. Wildlife Division No. 2036.)

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FIGURE 29.—Willow thickets killed along the Gardiner River by overbrowsing. This is characteristic of the plight of willows over the elk winter range generally. (Photographs taken May 23, 1932, Yellowstone. Wildlife Division No. 2473.)



FIGURE 30.—Another characteristic view of the elk winter range. Every available form of browse is reduced to a small percentage of its normal productive capacity. (Photograph taken May 23, 1932, Mount Everts, Yellowstone. Wildlife Division No. 2039.)

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FIGURE 31.—Juniper, piñon, and all other available browse stripped as high as the elk can reach. Where is the next crop of browse to come from— (Photograph taken June 8, 1932, near Mammoth Hot Springs, Yellowstone. Wildlife Division No. 2543.)



FIGURE 32.—Elk-browsed Douglas fir. It is over 7 feet from the ground to the lowest foliage. What becomes of the Douglas fir saplings less than 7 feet tall? The tall grass is the unpalatable rye grass. (Photograph taken May 19, 1932, Mammoth Hot Springs, Yellowstone. Wildlife Division No. 2530.)

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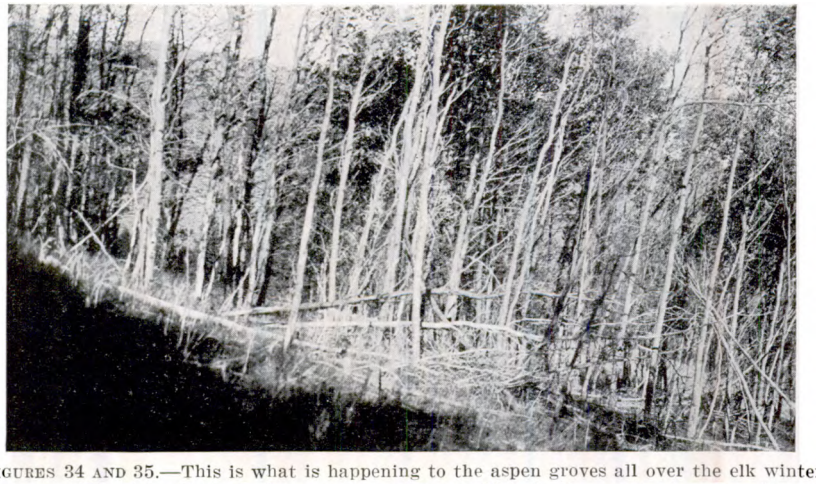


FIGURE 33.—Elk-browsed juniper. Food is scarce when elk take juniper to this extent. Like most browse, juniper can be so cropped only once. After that a new stand must provide the next forage. But here the seedlings are taken before they get a start. (Photograph taken April 29, 1932, at Gardiner River, junction of Lava Creek, Yellowstone. Wildlife Division No. 2020.)

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FIGURE 34.



FIGURES 34 AND 35.—This is what is happening to the aspen groves all over the elk winter range. Elk strip the bark from mature aspens, which is the apparent cause of early death of these trees. Note the dead and down timber. Note also that all the young aspen reproduction is a mass of bare sticks, in most cases dead. If the present elk pressure is maintained, aspen groves will disappear within a few years from the Yellowstone elk winter range. This means hard times for beavers also. (Photographs taken September 17, 1933, on Tower Falls Road, Yellowstone. Wildlife Division Nos. 3281 and 3282.)

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FIGURE 36.—Overbrowsed by elk. This is what is meant by loss of food and habitat of ground-dwelling birds and small mammals. Note, also, what has become of winter range for antelope, deer, and mountain sheep. Overabundance of elk truly is driving these other forms of life out of the park. (Photograph taken June 8, 1932, near Mammoth Hot Springs, Yellowstone. Wildlife Division No. 2542.)

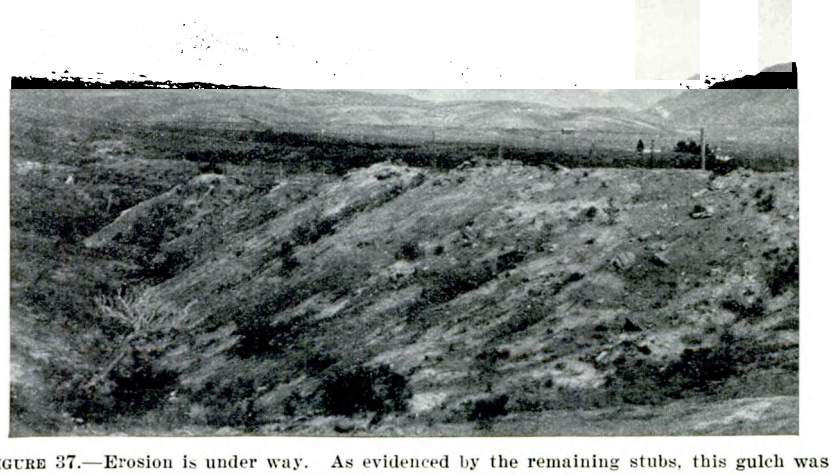


FIGURE 37.—Erosion is under way. As evidenced by the remaining stubs, this gulch was once well protected by grass and shrubby growth. It is now stripped naked, and the fertile top soil is washing away. Erosion is hard to stop once it starts. (Photograph taken June 9, 1932, west of Gardiner, Yellowstone. Wildlife Division No. 2437.)

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FIGURE 38.—Hillside trails are a certain sign of overgrazing. Such a network covers the Yellowstone elk winter range. (Photograph taken May 19, 1932, at Mammoth Hot Springs, Yellowstone. Wildlife Division No. 2258.)

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The range condition portrayed in these pictures is not a merely transient one nor is it of purely recent occurrence. The pictures have been secured in Yellowstone National Park by members of the Wildlife Division over a period of 4 years. The range was in deplorable condition when we first saw it, and its deterioration has been progressing steadily since then. It is noticeably worse now than it was in 1929.

Something must be done to establish a safe relationship between the number of elk and the available forage before another winter is encountered and further damage done. In considering a program to accomplish this purpose there are two particularly significant points to consider.

First, there is more certainty for the perpetuation of the elk herd if it is composed of 6,000 healthy animals on a good range than if it numbers 12,000 starving animals whose resistance to cold and disease is gone.

Second, a herd of elk reduced to the carrying capacity of the range will mean that three other important game species of this park can be saved and a fourth reintroduced. These are Rocky Mountain bighorn, Rocky Mountain mule deer, American pronghorn, and plains white-tailed deer, respectively. Many others, including bison and beaver, will be greatly benefited.

All observers who have been studying this problem are agreed that the northern elk herd is hovering on the brink of disaster. The first hard winter will bring hideous starvation and wastage. The longer the hard winter is deferred, the greater will be the catastrophe. Mild winters mean that less forage is produced, that the elk utilize it to greater extent, and that larger calf crops are produced.

There is little justification for our depriving the elk of their winter range, concentrating them for three-fourths of the year on what would normally be their spring and fall range, and then permitting the herd to increase until that range is exhausted, with starvation inevitable in the end. It would be an inhuman thing to do in the face of our knowledge of the incontrovertible facts.

There are but two approaches to a solution of this problem.

One is to acquire more winter range. Every effort should be made to do this as soon as possible. The only ultimate solution of this problem is to provide adequate and suitable winter range. But even this will not bring immediate relief, because most of the territory which might come into the park as winter range is already overgrazed. It would take several years of reduced grazing pressure to restore the land to its normal productivity.

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The other method is to reduce the size of the herd. It is the only way which will be immediately applicable and effective to save the range, the elk, and the other animals.

Therefore, it is proposed that a plan to reduce the northern elk herd be adopted now, so that all will be in readiness to act this coming winter.

It is suggested that 3,000 elk be taken, each winter, until the herd can be supported by the range. Of course, the number could be modified after the first year either to decrease or increase the number removed according to the results that were being obtained. At the rate indicated here, it would take 3 or 4 years or more to bring the herd to proper proportions, since there is an estimated yearly increase at present in the neighborhood of 2,000.

There are two ways to accomplish this, and they are discussed here in the order of attention which they should receive:

1. Increase hunting adjacent to the park with the objective of disposing by this means of as large a proportion as possible of the number set for reduction each year.

2. Slaughter and distribute to the Indians the balance between what the hunters take and the total number it is desired to weed out.

Montana is aware that the National Park Service is favorable to a larger kill. The plan is to secure an understanding with the State that the season will be closed when the kill reaches the desired total. This now is possible. But there are obstacles. The legislature there will not meet again to make any changes in the game laws effective before 1936. It then should be possible to increase the take by raising the bag limit, lengthening the season, further developing the system of open and closed periods so as to encourage the elk to come out of the park, advertising of the hunting, etc.

However, even this will not accomplish the results desired. In mild winters the elk simply do not come out in sufficient numbers.

Until the problem is solved permanently, Yellowstone must be prepared each season to slaughter elk as it does buffalo. Preparation, of course, would have to be made in advance and the work undertaken before the season becomes so advanced that the animals are too poor to be fit for consumption. January would be the month.

There is nothing in this proposed program that is not feasible. Its essence is (1) to decide each fall how many elk should be taken from the herd, (2) to notify the game commission of Montana so it may plan to get as many of this number as possible for the hunters, (3) to perfect the plan for killing and distributing as many elk as are left in the year's allotment when the hunters are through.

In closing this report, these things should be emphasized:

1. Yellowstone is our greatest big game refuge.

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2. The most important game herds in that park depend upon the narrow strip of land between the Yellowstone Plateau and the north boundary of the park.

3. The prolonged abuse of this strip of land by the elk is the one great danger to the existence of the elk themselves and the other species as well.

4. This danger can be averted at present only by reducing the elk to about half their present number.

5. This cannot be accomplished unless hunting is supplemented by regulation of numbers within the park.

REPORT CONCERNING WILDLIFE MANAGEMENT IN GRAND CANYON NATIONAL PARK

Submitted to the Director of the National Park Service April 18, 1934

Before Grand Canyon became a national park there was extensive cattle grazing up to the south rim of the canyon. Both browse and grass were abundant. Water was present in sufficient amount to provide for game, but was insufficient to provide for domestic stock. Therefore, ponds, or earth tanks, were constructed at various localities over the range, mostly outside of what is now the park. The water impounded in these tanks was utilized by cattle, sheep, horses, burros, and wild game.

During this period of utilization, hunting and range depletion caused a reduction in the number of deer inhabiting the region. When the boundaries of Grand Canyon National Park were drawn, they provided only a narrow strip of protected territory along the south rim of the canyon. Outside of this narrow protected strip, deer are still hunted, the range is still utilized by domestic stock, water is caught and retained in the tanks, and salt is provided for domestic stock.

It becomes evident that in order to provide for deer in the park, south of the canyon, compensating measures must be undertaken to restore the wildlife of this limited region to its former independence.

The steps undertaken are these:

1. A 5-wire fence has been constructed along a considerable portion of the south park boundary. The lowest wire averages about 24 inches from the ground—this to exclude unpermitted cattle from the park range and to allow the free passage of deer. It is contemplated that the protection here afforded the range will allow normal range recovery and forage production. It will soon provide better browse for deer within the park than can be found outside.

2. Water holes, or tanks, are being constructed within the park to catch and retain water for deer and other forms of wildlife. It is

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felt that this is necessary in order that game will not be forced out of the park in the search for water. Eight such tanks have been constructed during the winter of 1933–34 by Civil Works Administration labor, and it is hoped that about 8 more may be finished. The limestone formation of this region is porous; run-off is slight, and precipitation is erratic. It is improbable that these tanks will all contain water at the same time, but it is thought that if a sufficient number is constructed there will be certainty of available water for deer and other wildlife within the park. Moreover, these will become places where there is greater probability of park visitors' seeing and becoming acquainted with the wildlife of the park.

3. No hunting is allowed within the park.

Such a program has been devised by the administration of Grand Canyon National Park to counteract the encroachment of civilization and to maintain wildlife of the area in its primitive independence.

Additional features of the Grand Canyon wildlife restoration plan are given in the following report.

SUGGESTED WILDLIFE MANAGEMENT PLAN FOR GRAND CANYON NATIONAL PARK

In accordance with your request for a definite plan of Wildlife Division procedure, a wildlife management plan for Grand Canyon is submitted. This plan is the result of field reconnaissance of Grand Canyon National Park and conferences which Mr. Thompson held with Superintendent Tillotson and Chief Ranger Brooks.

In submitting this report it was understood that only such points should be included as met the approval of all members of the conferences * * *.

This report is not in the form of a formal 5-year program, but if accepted by you will be used as a basis upon which such a 5-year program will be constructed for Grand Canyon.

SOUTH RIM

1. To sustain a normal herd of wild deer.

(*a*) By completion of the water-hole system now being developed.

(*b*) By improvement of the range. (NOTE.—A large portion of the South Rim deer range is now enclosed within the fence being built to exclude domestic stock and to allow free passage of deer, but the range as a whole has been overbrowsed and overgrazed generally.)

An essential step in range restoration is: (1) to construct perhaps 15 fenced range study quadrates, with an equal number of unfenced

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check plots, to be distributed along the South Rim at desirable places.

(*c*) By no further introduction of deer from elsewhere.

(*d*) By allowing the native predatory animals equal protection with other forms of the park's wildlife.

(*e*) By continuing the practice of hunting immediately adjacent to the south boundary.

(*f*) By discontinuing, as soon as possible, all artificial feeding of deer and allowing the tame herd to go wild.

NORTH RIM

1. To restore the overbrowsed deer range.

(*a*) By cooperative agreement with the Forest Service to the end that the deer population of the whole North Rim-Kaibab area may be kept low enough, by hunting, to permit range recovery.

2. To restore the deer herd to normal status when the range is recovered.

(*a*) By cooperative agreement with the Forest Service in the regulation of hunting.

3. To allow the normal predatory animals equal protection with other forms of the park's wildlife.

4. To practice no artificial feeding of the native animals, except the Kaibab squirrel, other rodents, and nongame birds which are sometimes fed by visitors.

5. To reintroduce and maintain a herd of native antelope in Toroweep Valley, with no other means of artificial sustenance or protection than will be necessary to establish the herd and to provide water. It is thought that the antelope range (some 25 square miles lying south of the stockproof fence) should be given 2 or 3 years to recover before antelope are placed there.

GENERAL

1. To assign a wildlife ranger, a portion of whose duties will be the study and investigation of local wildlife problems and wildlife administration.

Suggested course of action:

(*a*) To elicit observations and information from the entire force.

(*b*) To carry on specific investigations over a period of years, for example:

(1) A winter investigation of porcupine habits and food.

(2) A study of the food, habits, and abundance of bobcats, and their relation to other forms of life in the canyon.

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(3) A study of the rate of recovery and condition of range, using the quadrates and all other field and printed material available.

REPORT ON WILDLIFE OF GRAND CANYON NATIONAL MONUMENT

Submitted to the Director of the National Park Service May 8, 1933

NOTE.—Since the status of pronghorn is unsatisfactory generally, the Grand Canyon National Monument report has been included in the series to indicate activities of the National Park Service in providing for pronghorn in the Southwest. It should be noted here that the Petrified Forest National Monument range for pronghorn—some 40 square miles—has already been fenced against cattle, and the Grand Canyon National Monument fence and water development program (see report) is under way.

GRAZING AND HOMESTEADS

The grazing and agricultural utilization of the area is treated in detail in the report of Superintendent Tillotson. These factors are, however, important from the standpoint of wildlife administration and will be briefly discussed here.

In Tuweep [1] Valley, homesteads extend from the upper portion to within about six miles of the lower end of the valley. Cattle and sheep graze in the Mount Trumbull section of the monument and perhaps 40,000 head of sheep winter on the plateau section between Tuweep Valley and Kanab Creek. The entire area covered in the three and a half days of reconnaissance showed varying degrees of overgrazing. In the plateau area, growth of the sparse grasses is encouraged by removal of sheep as soon as the snow disappears. The region then is untouched until snowfall late in the year. This practice has been developed because of the lack of water in the area. Thus a system of deferred grazing is actually in effect. Browse plants, however, receive little benefit from this practice because they can be overbrowsed during the winter months, a condition illustrated by the Kaibab winter deer range. Grass and such shrubs as *Atriplex* and the browse plants listed for the Sandrock area could be improved in Tuweep Valley and the Sandrocks by further protection. Superintendent Tillotson's suggestion that the south line of W. A. Kent's homestead be the deadline for grazing in the valley and that all of the valley south of Kent's place and north of the river be preserved for American pronghorn range, should result in improved conditions in this portion of the valley. It is Mr. Tillotson's plan to prohibit grazing in the Sandrock area also.

[1] Tuweep *same as* Toroweep.

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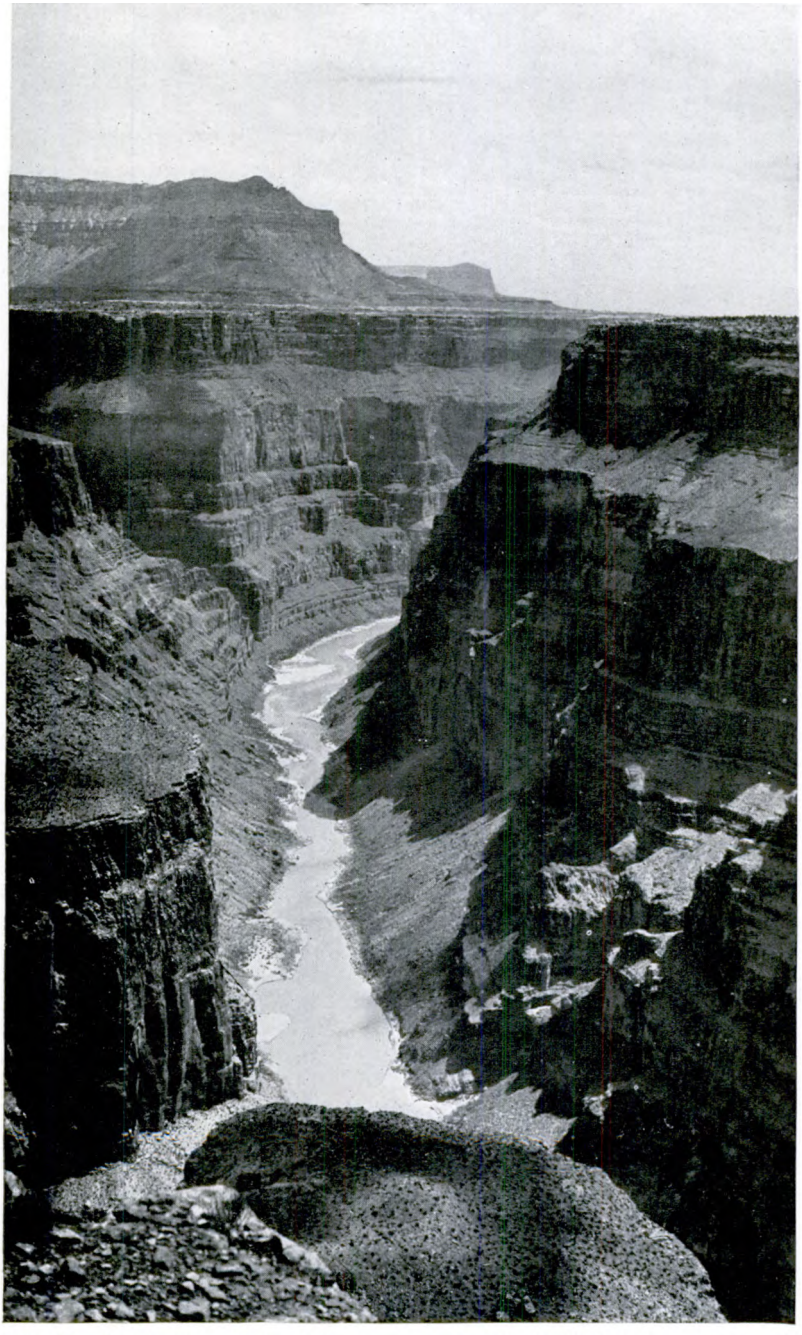


FIGURE 39.—Inner gorge of the Colorado, approximately 3,000 feet deep, as seen from Toroweep Point, lower end of Toroweep Valley, Grand Canyon National Monument. (Photograph taken May 3, 1933, Grand Canyon National Monument. Wildlife Division No. 3240.)

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The southern portion of the Trumbulls shows no over-grazing, but the northern portion of the mountains within the monument is over grazed, principally by cattle. The homesteaded land is, of course, at present largely useless for wildlife considerations.

Since the abolition or severe restriction of grazing in the monument area would impose an undue hardship upon ranchers who live there, no such course seems justified at present. However, an advised restriction of the number of stock allowed to use the range throughout the monument—other than the southern portion of Tuweep Valley, which should be entirely closed to grazing—will be necessary to keep the range from further deterioration. With the granting of no new grazing or homestead privileges the region should become available for wildlife and for national-park purposes in the future, at which time full development of the native wildlife resources will be possible. For the present, the possibilities of wildlife reinstatement are few.

AMERICAN PRONGHORN

It is reported by W. A. Kent, who first came into the region in 1914, that American pronghorn (probably *Antilocapra americana oregona*) were then plentiful in Tuweep Valley and in the region in general. (The pronghorn at Indian Gardens are probably of this species.) A band of six roamed just west of the Trumbulls until about 5 years ago, but Kent does not know of their having been seen since.

The proposed pronghorn range in the southern portion of Tuweep Valley comprises an estimated area of 25 square miles. This is sufficient territory to support perhaps several hundred animals when the range is in normal condition. The herd would be a natural and important attraction along the road to Toroweep Point. In that the range would be restricted to this relatively small area, however, the set-up would not be entirely natural, for it is highly probable that the pronghorns in former times roamed widely over the entire area from the Vermilion Cliffs to the river.

The question of water in this proposed refuge will have to be considered. A small seep is found at the base of the eastern cliff of Tuweep about midway along the pronghorn range. The water flow is small and is limited to about 3 months of the year. This would be insufficient. If the animals were allowed to roam the entire region as they did formerly, they could find enough water to subsist and any artificial water supply would be unnecessary. But since their restriction to the lower end of the Tuweep Valley is necessary at present, an artificial water supply to meet the demands imposed by an artificial limitation would seem to be justifiable.

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It seems likely that this demand could be met at comparatively small cost. An old lake bed, perhaps a quarter section in area, lies just north of Vulcan's Throne at the south end of the pronghorn range. This has been used by the stockmen of the vicinity, who have thrown a small dirt dam across the spillway to impound water. With a more durable type of construction, water probably could be impounded the year round. The experiment seems worth making.



FIGURE 40.—The proposed pronghorn range in the southern portion of Toroweep Valley comprises approximately 25 square miles. (Photograph taken May 3, 1933, southern portion of Toroweep Valley, Grand Canyon National Monument. Wildlife Division No. 2998.)

MULE DEER

A State deer refuge borders the entire west line of the monument. This refuge was created in 1930 because of the unwarranted killing of deer in the Trumbull Mountains. It was reported that one man had killed 30 deer to be fed to his chickens. Such chickens seem to be voracious, but the story is taken for what it is worth. Last fall Kent saw a band of 35 deer on the north side of the Trumbulls. Deer, however, are not numerous in the mountains. During 1 day's ride from the floor of the valley to the crest of the mountain, along the crest to the south end, and return, we saw no deer and few deer tracks. In the plateau portion of the monument deer are reported present, especially along the points near the river, but are not numerous. We saw no deer the day we rode over the plateau.

It is not probable that deer were ever abundant in the monument area because of its aridity, but it is certain that they were more numerous in former times than at present. Deer forage is plentiful in the Trumbull section and is sufficient to meet all normal needs in the plateau section and down on the Sandrocks where deer winter.

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If given protection these animals should increase perceptibly in the next few years, although protection will be difficult with the presence of sheep herders in the areas.



FIGURE 41.—Old earth dam across the lake outlet. (Photograph taken May 3, 1933, foot of Vulcan's Throne, Grand Canyon National Monument. Wildlife Division No. 2997.)



FIGURE 42.—Dry lake bed at the foot of Vulcan's Throne. (Photograph taken May 3, 1933, Grand Canyon National Monument. Wildlife Division No. 2996.)

DESERT BIGHORN

Mr. Kent reported seeing two Desert bighorns along the cliffs east of Tuweep Valley the week before we arrived. He reports them common along the cliffs north of the Sandrocks, also. Prohibition of grazing in the Sandrock area should give the bighorns needed

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protection. Since they are scarce in Grand Canyon National Park, their presence in the monument is a valuable asset to the limited game resources.

OTHER ANIMALS OF THE REGION

These may be treated briefly. Ringtail, spotted skunk, badger, gray fox, kit fox, coyote, and bobcat are reported present. There is some winter trapping practiced in the vicinity, and the foregoing are reported caught. Cougars at one time were plentiful in the Trumbulls but have been hunted so persistently that they now are very



FIGURE 43.—Vegetation of the Sandrock area along the brink of the inner gorge. This is valuable winter range for deer and mountain sheep. (Photograph taken May 3, 1933. Sandrock area, Grand Canyon National Monument. Wildlife Division No. 2992.)

scarce. Prairie dogs are not found north of the canyon although they are present south of it. Jack rabbits and cottontails are numerous, but they are reported to have decreased suddenly about 3 years ago. Before that time they were so numerous as to be considered a pest. One porcupine was seen, and a few porcupine scars on small yellow pines, but the damage is so slight in the area as to be negligible. The little cinnamon ground squirrel (*Ammospermophilus leucurus cinnamomeus*) was seen from the Sandrocks to the yellow pines of the mountain.

CONCLUSIONS

1. Excepting the possibility of reintroduced American pronghorn, the fauna of the monument probably never will be spectacular, because of the aridity of the region.

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2. Grazing should be eliminated from the proposed pronghorn range and the Sandrocks.

3. It seems desirable to attempt the reintroduction of the American pronghorn (*Antilocapra americana oregona*).

4. The production of an artificial water supply for pronghorn appears necessary and justifiable to counteract the unnatural restriction of the animals to the refuge. If in the future sufficient range were available to support them, the artificial water supply might not be necessary.

5. Restricted grazing throughout the remainder of the monument seems to be the only justifiable course for the present. But, owing to the overgrazed character of most of the range, restriction of the number of stock grazed will be necessary to prevent further deterioration. The actual number of stock which the range can support must be determined by further study.

REPORT CONCERNING A PROPOSED EXTENSION OF MESA VERDE NATIONAL PARK

Submitted to the Director of the National Park Service October 24, 1933

NOTE: The opportunity to do something constructive for Merriam turkey and Mexican bighorn seems to be gradually shaping itself at Mesa Verde. But several obstacles must first be removed. They are indicated in the excerpts from the October 24, 1933, report. In the May 11, 1934, Wildlife Restoration Plan for Mesa Verde, these same difficulties are presented with what steps have been taken toward solution. Also, wildlife possibilities for the Mesa are indicated.

July 5–7, 1933, I accompanied Supt. C. Marshall Finnan on a pack trip up the Mancos Canyon from Ute to Stevens Canyon, exploring several of the intervening side canyons en route, and covering the Big Mesa portion of the Ute Indian Reservation lying between the southeast corner of Mesa Verde National Park and the Mancos Canyon. The present report is to recommend the acquisition by the National Park Service of that portion of the Ute Reservation bounded by Mancos Canyon, Navajo Canyon, and the present southeast boundary of the park. If such were accomplished, Mesa Verde National Park would comprise the whole of the Mesa Verde Plateau north of the Mancos River, with the exception of the more arid western section, which is now outside the park.

In order to give the perspective which makes the acquisition of this Ute territory desirable, it is necessary to give the faunal possibilities of an enlarged Mesa Verde National Park.

MEXICAN BIGHORN were probably native to the Mesa at one time. Nordenskiold called one of the branches of the Navajo Canyon "Sheep Canyon", and early explorers of the Mesa found mountain

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sheep horns. There are no sheep there now, but forage is abundant and conditions suitable for their reintroduction, except that the territory is too limited. Under the present set-up they would be exposed constantly to poaching. It probably would be impossible to have mountain sheep in the park with the present boundaries. But if the proposed boundary extension were consummated it would be desirable to reintroduce this species.

ROCKY MOUNTAIN MULE DEER are present within the park in limited numbers. Last fall deer were reported plentiful in migration, from the La Platas and from the northern part of the Mesa, moving southward toward the lower reaches of the Mesa along the Mancos Canyon. During the winter various observers reported fresh buckskins seen at Ute camps. While the Navajos do not kill deer themselves, they are willing to barter with the Utes for the buckskins—a double reason for the annual toll of deer. Few deer were reported during the spring migration. I saw very few deer tracks anywhere on the Mesa and saw only one deer during the 3 days of the pack trip. This is a very unfortunate circumstance in that nowhere in the West have we seen finer or more abundant deer forage than is to be found on the Mesa Verde. It is a unique haven for deer, yet deer are noticeably scarce. In fall and winter when they move down into the Ute Reservation they are unprotected. This is also the "happy hunting ground" for other inhabitants of the region, whose activities are not strictly limited to the legal seasons. If these hazards could be removed, and this choice winter range acquired, Mesa Verde might have its natural component of deer.

FUR BEARERS.—The present area of the park is too small to protect the roving fur-bearing animals. Five cougars are reported killed in the immediate vicinity of the park within the last 2 years—probable result, a porcupine problem still exists within the park. Two years ago fox and coyote tracks were numerous over the Mesa; at present they are scarce—probable result, an abnormal increase of prairie dogs is noticeable. Beaver workings are numerous along the Mancos River. The beaver-cut logs and stumps range in age from those almost obliterated to last year's workings. The record portrayed in these cuttings seems to be that of repeated invasions by the beavers, a brief occupancy, and repeated disappearances. With beavers unprotected in the Mancos Canyon it is improbable that a permanent beaver population can be maintained.

WILD TURKEYS were kept by the cliff dwellers. This custom is prevalent among the Indian Pueblos of the Southwest today. However, the record is sufficiently indefinite to make it impossible to ascertain whether wild turkeys were at one time native to the Mesa. In various of the canyons Ponderosa Pine is present to a limited degree.

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Mr. J. Stokley Ligon says that he has never found turkeys away from this pine. I think, however, that there is sufficient pine in the Mesa canyons and sufficient turkey food to provide suitable range for the Merriam turkey in Mesa Verde. Water holes would have to be developed on the Mesa for these birds, as well as for the other forms of wildlife, to augment the springs found in the canyons. The development of such water holes seems reasonable because the cliff dwellers built small reservoirs at various places on the Mesa. The wildlife undoubtedly profited by this added supply of water. Since the wild turkey played such an important part in the life of the cliff dwellers, its reintroduction is very desirable. But the present territory of the park is too limited to maintain turkeys.

The DUSKY GROUSE, at present fairly abundant on the Mesa, probably would thrive by the added protection of increased territory and water supply. If the Ute section of the Mesa is ever developed by the building of a road up the Mancos Canyon and the introduction of domestic sheep on the Mesa, grouse, as well as all other forms of life within the present park, probably will suffer heavily. * * *

VEGETATION OF THE AREA UNDER CONSIDERATION.—Although some sheep grazing occurs in the Ute Reservation immediately southeast of the park, the vegetation is still in a fairly normal condition. Wheat grass still is present and bunch grasses are widespread. It is notable that the grasses still grow under the juniper and piñon forest, as all early explorers have reported, which condition is rarely found in the Southwest today. Wild flowers are abundant; this section of the Mesa is really green. Large clumps of Gambel Oak, an excellent browse plant, are numerous in the section nearest the park. *Cercocarpus*, *Amelanchier*, *Fendlera*, and *Purshia* are unusually abundant. Much of the area was burned, perhaps 50 to 60 years ago. In this portion, browse and grasses have returned, almost to the exclusion of the juniper and piñon. This is some of the finest deer winter range I have ever seen. It is equally valuable for domestic sheep, but is unsuited to their continued utilization. If it is turned into sheep range, this excellent forage will be destroyed, and the area then will be useless for either grazing or wildlife purposes. The area is not large enough to be of great value to the reservation, but it is the critical area from the park point of view.

Grazing has been practiced in the Mancos Canyon for years and exactly what is predicted here for the Mesa has happened on the floor of the canyon. Grass is gone; we scraped the soil in a few places where there was no visible sign of grass and found old grass root stubs. All desirable browse is cropped close to the ground: Gamble Oak, *Artemisia*, and *Atriplex*, the most palatable plants, are heavily browsed and reproduction is scarce. Indians have burned

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patches of willows and arrow-weed to open the ground for grass. These burned areas are practically barren.

ADMINISTRATIVE DIFFICULTIES.—The Mancos River is the logical boundary for the park on the south and east. It has the advantage of definiteness and forms a more natural faunal unit by segregating the section of the Mesa north of it from everything else of similar altitude and biotic character. It virtually is impossible to keep sheep grazing and poaching out of the park with the present arbitrary boundary skirting this Ute segment of the plateau. Sheep watering tanks were found on the Mesa so near the park boundary that it was impossible to tell whether they were inside or outside of the park. And numerous signs of sheep grazing were evident within the park.

CONCLUSION

Mesa Verde National Park needs the natural faunal picture to supplement the archeological story presented. The wildlife of the Mesa at the time of the cliff dwellers was as much a part of their civilzation as the artifacts and buildings. Without the wildlife there could have been no Mesa Verde culture. It is important that this phase of the picture be preserved and presented today. Such a course is impossible with the present boundary, and will be even more remote if the Ute section of the Mesa is turned into domestic sheep pasture. Mountain sheep, deer, all the fur bearers, turkeys, grouse, and all the other forms of native wildlife of the Mesa should be there today. We have not yet begun to realize the wildlife possibilities of this park.

REPORT REGARDING WILDLIFE RESTORATION PLAN FOR MESA VERDE NATIONAL PARK

Submitted to the Director May 11, 1934

On the morning of March 24, 1934, a conference on wildlife restoration possibilities in Mesa Verde National Park was held by Superintendent Leavitt, Park Naturalist Franke, Ranger Markley, and Thompson, of the Wildlife Division. Every aspect of the problem evident to us at this time was discussed, ideas pooled, and the following suggested program developed for your consideration:

1. *Boundary adjustments.*—Every phase of wildlife preservation and restoration in Mesa Verde is contingent upon the securing of an adequate biological unit for the park, as outlined in Wildlife Division report of October 24, 1933. Response to the boundary adjustment proposal of this report has come from Mr. D. H. Wattson,

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superintendent of the Consolidated Ute Agency, under date of December 21, 1933. Superintendent Wattson states:

> I expressed to Mr. Finnan my belief that the Indians would raise no serious objection to a transfer to the park of these lands, providing in lieu lands of equal value for grazing were available and that in such an event I would be glad to recommend an exchange, but that an act of Congress prohibits any change in the areas of Indian reservations.

It is the feeling of those at Mesa Verde that the area under consideration is of such vital importance to the integrity of the park that the matter should be further pursued. Therefore, Superintendent Leavitt proposes, as a first step, to ascertain which lands, if any, are open to and suitable for transfer, in the hope that a specific proposition may be worked out to submit to you and to the Commissioner of Indian Affairs.

As has been stated previously, Mesa Verde National Park must some day include the whole of Mesa Verde north of the Mancos Canyon if its game feature is ever to be anything but a skeleton.

2. *Eradication of private holdings within the park.*—A second vital contingency of wildlife restoration is the eradication of private holdings within the park. (Refer to memoranda on private holdings, Sept. 15, 1931, of Mrs. Phoebe H. E. Stevens and Mr. Clarence Teague.) The holdings of Mrs. Stevens (160 acres in Morfield Canyon and 320 acres in Prater Canyon) include the territory and water supply most suitable for wild turkeys. The upper valleys of these canyons could provide excellent grass and brush cover suitable to game birds, but because of cattle grazing these areas are kept relatively bare. Cattle must cross a portion of the park to reach this range.

Government funds for the purchase of these private holdings are impounded because they cannot be matched by private funds. These private holdings should be secured and added to the park as soon as possible.

3. *Confinement of horses.*—The horses belonging to a guide and horse concessioner in the park have grazed along the approach road in the vicinity of Far View junction throughout the winter. This local concentration and the range utilization have been augmented by the present mild winter. Unfortunately, the horses have remained in the locality most preferred by deer. Hereafter, according to Superintendent Leavitt, the horses are to be removed to the mesa between Spruce and Navajo Canyons, and a fence constructed to confine them there. This measure will liberate a local deer range from too heavy utilization.

4. *Water supply.*—Old surface wells exist in the following canyons: One each in Navajo, Soda, Moccasin, Morfield, White, and School Section; three wells in Prater. It is proposed to develop

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water for game at various places on the mesa, either by repair and installation of windmills or by construction of surface reservoirs. The windmills probably would provide a more constant supply of fresh water. They would not be visible from the entrance road.

Unfortunately, the most desirable wells are in Morfield and Prater Canyons on private holdings.

5. *Ponderosa pine.*—Ponderosa pine is considered essential for wild turkeys. This pine is limited to a few groves and isolated trees on the mesa. Young pines have been cut and used in the past for construction of cabins. Pine reproduction in Morfield Canyon has been seriously retarded and impaired by stock grazing. To combat this situation, Park Naturalist Franke suggests an experimental planting of ponderosa pine seedlings in the Morfield-Prater vicinity.

6. *Introduction of the Merriam turkey.*—Since the wild turkey played such an important role in the life of the cliff dwellers, it is proposed that wild turkeys be planted in at least two places on the mesa. It is thought that the ponderosa pine grove, near water at the head of Morfield Canyon, is the most favorable spot for turkeys. Superintendent Leavitt and Park Naturalist Franke suggest that a second planting be made near headquarters, where the turkeys may be cared for and seen by the public until they establish themselves in the region.

In this connection the following is quoted from Mr. J. Stokley Ligon's letter of April 14, 1934:

> From what you and Mr. Wright told me, I believe the Merriam wild turkey will do well in Mesa Verde Park. It is probable that I will be in northwestern New Mexico before fall, selecting locations for releasing sage hens. If I am, I might be able to spare the time to go to Mesa Verde and look over the proposition. I could then advise more intelligently regarding turkeys. If you have ample evidence that the Merriam turkey formerly occurred there, this should be sufficient proof that it will thrive. If the water supply and timber growth are the same as formerly when turkeys were there, they surely could be restored. You are entirely correct in your opinion that only wild stock should be liberated; these birds could no doubt be secured at some convenient point in New Mexico next winter when we are trapping and moving turkeys. The cost would not be excessive. I would be only too glad to assist in any way that I could in this regard.

7. *Introduction of Mexican bighorn.*—Since mountain sheep were probably native on the mesa until recent years, it is proposed that they be reintroduced, provided the above-mentioned boundary adjustment is made.

Again quoting Mr. Ligon's letter of April 14, 1934·

> You mention the matter of mountain sheep for Mesa Verde. The Mexican bighorn from the Big Hatchet Mountains of southwestern New Mexico would probably be best suited for the experiment. While I have not had experience in trapping and transplanting sheep, the past winter I put in a trap in the

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Big Hatchet Mountains for the game department and prospects are promising for getting some of the animals. We plan to move some to other mountains of the State formerly inhabited by this sheep. Old horns of mountain sheep secured by me near Grants, N. Mex., and from Cuba, southeast of Aztec, by others, have been classified as the Mexican bighorn; and I would assume that Mesa Verde is somewhat of the same semidesert type. I do not believe that sheep from the upper Rocky Mountain area would be suitable, and I doubt if they would stay if released there.

8. *Porcupines.*—Due to the fact that there is no apparent porcupine damage this winter, it is proposed that porcupine control be discontinued until such time as (and if) it should become necessary.

9. *Predatory animal control.*—Because of the very small area of the park, no predatory animal control is deemed necessary or desirable.

10. It is understood that the proposals given herewith constitute a restoration program, and that no attempt is made to domesticate or semidomesticate any forms of the park's wildlife, or to exhibit them in any artificial manner. The object of this program is to restore the wildlife of Mesa Verde and to maintain it under natural conditions.

REPORT CONCERNING PROPOSED GUADALUPE EXTENSION OF THE CARLSBAD CAVERNS NATIONAL PARK

Submitted to the Director of the National Park Service April 19, 1934

NOTE.—An encouraging progress has been made by the National Park Service in pursuing the extension of Carlsbad Caverns National Park with the ultimate goal to include a portion of the Guadalupe Mountains. Wildlife possibilities for the proposed Guadalupe extension were discussed in the previous volume of *Fauna.*[1] It is to be remembered that American Wapiti (*Cervus canadensis canadensis*) have been introduced into the Guadalupes within recent years to replace the extinct Arizona Wapiti (*Cervus merriami*). This project was investigated by the Wildlife Division in March 1934. The following report is given to indicate the unfortunate results of this type of exotic transplant.

April 1 to 4, inclusive, I spent at Carlsbad Caverns National Park. Two trips were made in company with Ranger Perry Convis into the Guadalupe Mountains. On April 2 we drove and hiked over the Queen's Mesa, which lies mainly northwest of the caverns. On April 3 we went into McKittrick Canyon in the Guadalupes south of the caverns.

Inasmuch as a report has been sent from this office under date of October 30, 1931, outlining characteristic wildlife of the region and its possibilities as a national park, no detailed report of fauna and

[1] Fauna of the National Parks of the United States, by George M. Wright, Joseph S. Dixon, and Ben H. Thompson. Contribution of Wildlife Survey, Fauna Series No. 1, Government Printing Office, 1932, pp. 87–91.

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flora is submitted herewith. In general, however, my recommendations are these:

(1) It still seems desirable to add to Carlsbad Caverns National Park the eastern portion of the Guadalupe Mountains, extending from the caverns and Rattlesnake Canyon south to and including El Capitan, the southernmost peak of the range in Texas. Perhaps Dark Canyon drainage could form the western extension of the proposed addition.

The territory lying northwest of the area just bounded is utilized extensively for grazing purposes and is hardly suitable for national-park purposes. The eastern boundary should follow close to the foot of the mountains, in order to escape competition with local grazing which extends practically to the east foot of the escarpment.

(2) McKittrick Canyon, in Texas, is the most scenic of the canyons, cutting into the eastern face of the Guadalupes. Its vegetation cover, ranging from the *Agave* types of the Lower Sonoran zone to the Douglas fir and yellow pine of the Transition zone, presents a splendid variety of habitat for native wildlife. Most of these canyons, but notably McKittrick, contain ample water for wildlife. McKittrick has a running stream of clear, cold, mountain water well stocked with rainbow trout. It is thought that the hiking and camping features which could be developed in these canyons would be a great inducement to visitors to the Carlsbad region. Moreover, the mountains present possibilities for an unusual wildlife preserve.

(3) A few years ago Canadian elk were introduced into McKittrick Canyon; they now number approximately 60. It was thought at the time that their introduction would be desirable to fill the place left vacant by the extermination of the Merriam elk. It becomes evident, however, that this more northern species of elk is as truly exotic as any transplant might well be. It tends to inhabit the slopes of the canyon nearest the stream bed to the destruction of the native and extremely picturesque vegetation. Because of this maladjustment and the destruction of the choicest section of the canyon—which seems inevitable with further increase of elk—it is recommended that the elk be either greatly reduced or extirpated entirely, if this area becomes a national park.

REPORT CONCERNING TRUMPETER SWANS IN YELLOWSTONE NATIONAL PARK

Submitted to the Director of the National Park Service May 2, 1934

There is no record of the abundance of breeding swans within the Yellowstone Park area in the early historical accounts, though we do know that trumpeter swans were once abundant in this general

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region of the United States and that many swan skins were taken at Red Rock Lake. Early superintendents' reports have mentioned the presence of swans in the park. Reports of witnesses indicate that trumpeter swans continuously have occupied Red Rock Lakes near Yellowstone, but we have not been able to ascertain whether there was a period of interruption when the birds did not breed in the park at all, or whether they simply became so scarce as to be generally overlooked. The latter is probably the case.

It is a fact that in recent years there has been an increase in the number of trumpeter swans breeding in the park. To a degree this increase may be more apparent than real, inasmuch as more attention has been focused on the swans than before and, nesting stations recently reported may have been previously overlooked.

Prior to 1929 a pair of trumpeter swans had been known to make unsuccessful nesting attempts at Trumpeter Lake in the Lamar Valley. Swans with a family of young also had been reported from Bridger Lake and the pond near Lewis Lake.

The Wildlife Survey began an investigation of the trumpeter swans in 1929 which was carried on without interruption by the Wildlife Division. In September 1929 Mr. Dixon observed a pair of swans at Trumpeter Lake and also photographed a pair on Alum Creek. In 1930 the survey party made studies at the Trumpeter Lake, Tern Lake, and Jackson Lake Lily Pond breeding stations.

* * *

Since that date censuses have been taken annually and submitted to you.

Please note that no proper comparisons can be made between the censuses in this period. In the first place certain important nesting stations were not discovered by us in 1931. Red Rock Lakes, for instance, account for approximately half of the total number observed, and are included only in 1932 and 1933. It is practically impossible to secure a true census either on foot or by horseback, and that is why an airplane survey has been recommended for 1934.

To indicate what manner of program is projected for the perpetuation and increase of the trumpeter swans, I quote here a letter addressed to Superintendent Toll on May 1, 1934:

> Since we shall not be in the park until late in the summer, permit me to review for you the measures which are proposed for the 1934 continuation of the park's program to assist the swans.
>
> 1. Trumpeter Lake should again be protected against all visitors, at least until the eggs hatch and the cygnets are a couple of weeks old. Even after that, it is not advisable to encourage any visitor to come to the lake except when accompanied by a ranger. The decision to keep the Cooke City road location at least as far away from Trumpeter Lake as the present old road is excellent

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both as a protection to this particular nesting lake and in its recognition of the principle that developments must give proper consideration to wildlife values.

2. Riddle Lake is probably the most favorable nesting water for trumpeter swans in the park. It is proposed that this lake be closed to fishing at least until the end of July. It has been suggested that fishing should be encouraged because of an overabundance of trout in the lake. However, the reports of those who have taken trout at Riddle Lake indicate that the fish there are not good quality anyway, owing probably to the warmth and stagnancy of the water. Therefore, why not close this lake to fishing entirely so long as trumpeter swans nest there?



FIGURE 44.—Marshy reaches of Upper Red Rock Lake, Mont. The Red Rock Lakes comprise the most important single nesting ground of the trumpeter swan in the United States. (Photograph taken September 19, 1933, Upper Red Rock Lake, Mont. Wildlife Division No. 3348.)

3. It is urged that local coyote control be carried on at Trumpeter Lake, Swan Lake (if occupied by swans this year), White Lake, and any other of the nesting lakes which are so constituted as to expose cygnets to coyote damage. By this same token I do not consider that coyote control at Riddle Lake, Shoshone Lake, and Heart Lake would render any protective benefit to the swans.

4. It is proposed that the system devised by Ranger Arnold for preventing the trumpeter swans from making land crossings between lakes be used at both Tern Lake and Trumpeter Lake this year. This consists of setting out flags and placing certain other repellents.

5. The proposed plan to construct small nesting islands in those lakes which, while otherwise suitable to trumpeter swans, have no nesting sites, should be undertaken this year under Emergency Conservation Work or other emergency funds, if possible. Heart Lake and White Lake are suggested for this

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experiment. Of course, this work should not be done on any lake on which trumpeter swans are going to try to nest this year, until the nesting effort is seen to be a failure or late in the fall when the cygnets have departed.

6. Reconnaissance work should be continued by rangers in their respective districts throughout the season, as in former years. A check should be made of both proven and possible nesting lakes before the eggs hatch, in other words, prior to June 1. A second census should be taken in late July to determine the number of cygnets surviving at that time. Finally, it has been decided that the only way to make a complete and satisfactory census of trum-



FIGURE 45.—Photograph of the framed trumpeter swan picture with its caption, which has been posted in the gun clubs and appropriate public places in the Red Rock district. (Photograph by Dr. Frank R. Oastler, Red Rock Lakes, Mont., June 18, 1932.)

peter swans nesting in the Yellowstone region is by airplane survey. It is proposed that this survey be made in August when we reach the park. Jackson Hole, Henry's Lake, and Red Rock Lakes, all outside the park, should be included on this flight.

As reported to you from time to time, we are also conducting a program to improve conditions for the trumpeter swans in the areas adjacent to the park, by personal contact, letters, and supplying attractive framed enlargements of Dr. Oastler's trumpeter swan picture with explanatory legend. We have been successful in stimulating the interest of hunting clubs on Red Rock Lake to the point

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where they have taken up the matter of trumpeter swan protection with the Montana Fish and Game Commission. In response to their request for assistance, the commission posted a reward of $50 for the arrest and conviction of anyone found guilty of killing a trumpeter swan.

We now have proposed the following program:

1. Shooting licenses sold throughout Montana to be stamped with a warning to exercise care against accidental shooting of swans.

2. Large painted signs to be placed on all approach roads to the lakes.

3. Radio publicity to be arranged by the State game commission.

4. Newspaper publicity to be sent out by the game commission before the opening of the shooting season. We would be glad to furnish data and pictures for such newspaper articles.

5. Metal signs to be posted at intervals along the lake shore bearing a legend similar to the caption on the framed trumpeter swan picture, calling attention to the fact that birds of the year are gray rather than white and carrying notice of the reward offered by the State of Montana.

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REPORTS CONCERNING ADMINISTRATIVE PHASES OF WILDLIFE MANAGEMENT

The reports and data compiled in this brief section pertain to wildlife restoration ultimately, but more immediately to restoration through certain administrative arrangements.

The letter to Mr. Thomas C. Vint, Chief of the Branch of Plans and Design, National Park Service, indicates how closely wildlife management integrates with and transects the construction phase of national-park development, and incidentally, all other phases of national-park administrative activities.

The reports on buffer areas and research areas are an attempt to arrive at a comprehensive, long-time plan for developing national parks so that developments shall exert a minimum of malinfluence on the wilderness characteristics of the parks and outside influences shall be buffed down into compatible proportions. Buffer areas, in other words, would act as transformers to step-down the high, disruptive pressure against native forms coming from outside the parks. The research areas report is an attempt, specifically, to zone the parks, from the administrative point of view, toward securing the maximum preservation and utility of their wilderness sections for scientific purposes directly, and indirectly for the ultimate benefit of everybody.

The reports are, otherwise, self-explanatory.

REPORT CONCERNING OVERGRAZING AS A LANDSCAPE PROBLEM

Submitted to the Chief of the Branch of Plans and Design, National Park Service, May 28, 1934

Copy of Mr. Frank E. Mattson's memorandum to you, relative to overgrazing in northern Yellowstone as a landscape problem, has been received and read with much interest. I think that Mr. Mattson has described the situation just as it is and has drawn the only conclusion that can be drawn from such a circumstance, namely, that this overgrazed condition is not only a wildlife problem but a landscape and forestry problem as well.

EFFECT OF WILDLIFE UPON THE LANDSCAPE

There are several cases where overgrazing has seriously changed the landscape. A few pictures, depicting representative cases, are included here because they are much easier to take than long written descriptions of the cases would be.

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FIGURE 46.—Elk trails scarring the hillsides, about which Mattson spoke. (Photograph taken May 19, 1932, at Mammoth Hot Springs, Yellowstone. Wildlife Division No. 2258.)

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FIGURE 47.—Elk-browsed junipers and Douglas firs along the road between Mammoth and Gardiner. This is not only a landscape problem of today, but of the future, for practically no coniferous reproduction is succeeding. (Photograph taken June 8, 1932, near Mammoth Hot Springgs, Yellowstone. Wildlife Division No. 2542.)

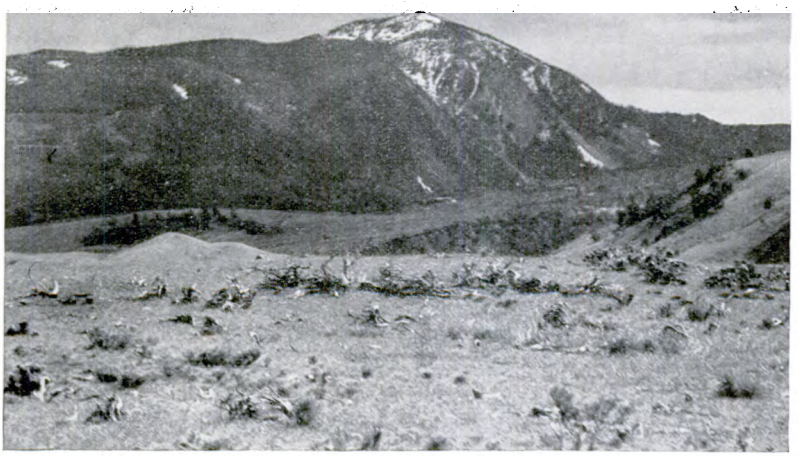


FIGURE 48.—Carcasses, but not of elk; just sagebrush remains of the once luxuriantly sage-covered hills of northern Yellowstone. (Photograph taken May 23, 1932, Mount Everts, Yellowstone. Wildlife Division No. 2037.)

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FIGURE 49.—Aspen trunks, smooth and white, as they normally grow. (Photograph taken May 29, 1933, Bright Angel Point, Grand Canyon. Wildlife Division No. 3685.)

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FIGURE 50.—Aspen trunks, scarred and black, after elk have stripped them of their bark. (Photograph taken July 29, 1931, Geode Creek, Yellowstone. Wildlife Division No. 2012.)

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FIGURE 51.—The final result: Old trees dying, reproduction a mass of dead sticks, and the aspen grove falling to pieces. This is characteristic of Yellowstone's and Rocky Mountain's overcrowded elk winter ranges. (Photograph taken September 17, 1933, on Tower Falls Road, Yellowstone. Wildlife Division No. 3281.)



FIGURE 52.—Erosion symphony—the beautiful meadows of Estes Park gutted out to the tune of thousands of tons of fertile soil annually. This particular gully is probably the result of overgrazing plus a misplaced road which at one time meandered up the natural drainage course of the meadow. But the scene is also characteristic of a number of parks and monuments in the Southwest. (Photograph taken June 22, 1931, Estes Park, Rocky Mountain. Wildlife Division No. 1991.)

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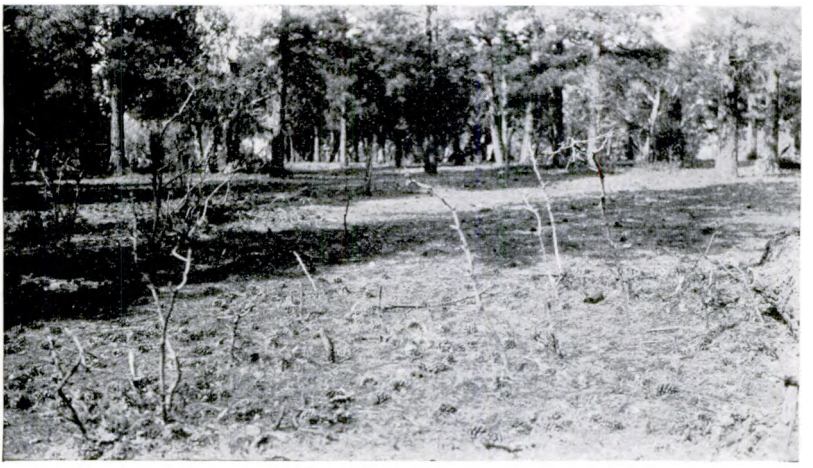


FIGURE 53.



FIGURES 53 AND 54.—Scenes along East Rim Drive in Grand Canyon—all that is left of dense growth of Gamble Oak and Cowania. Cattle grazing within the park is the explanation. (Photographs taken June 4, 1933, near Grand View, Grand Canyon. Wildlife Division Nos. 3299 and 3294.)

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FIGURE 55.—The deer-browsed manzanitas of Yosemite Valley. (Photograph taken March 29, 1930, Yosemite Valley. Wildlife Division No. 567.)

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FIGURE 56.—Strange little ponderosa pines as seen along roadsides in Rocky Mountain, Grand Canyon, Yosemite, and Sequoia. Cause: Elk and deer browsing. (Photograph taken March 30, 1930, Yosemite Valley. Wildlife Division No. 566.)

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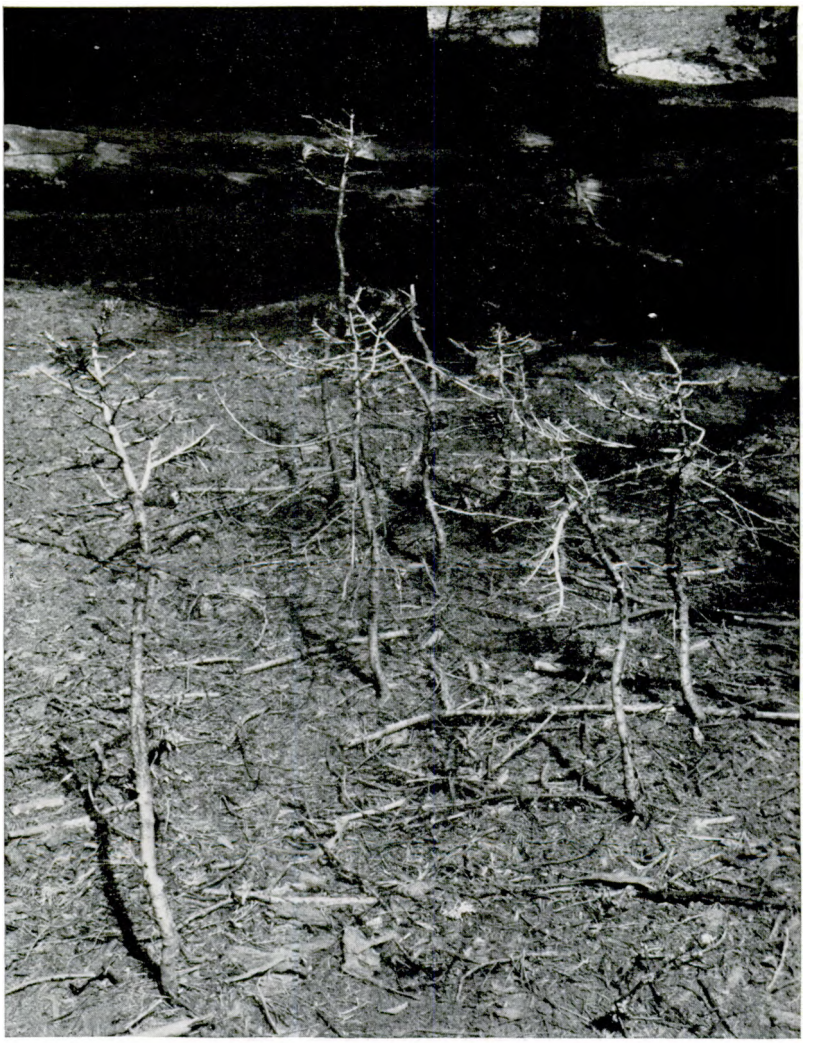


FIGURE 57.

See Figure 58. Wildlife Division No. 3118.

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FIGURES 57 AND 58.—The once lush growth within and about Giant Forest, Sequoia National Park. The cause is evident. (Photograph taken April 28, 1933, Giant Forest, and June 10, 1933, Round Meadow, Sequoia. Wildlife Division Nos. 2989 and 3118.)

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EFFECT OF LANDSCAPING DEVELOPMENTS UPON THE WILDLIFE

Another angle of the situation is just about the reverse of that shown in the pictures. That is, the pictures show where wildlife has damaged the landscape; the reverse order is where developments are detrimental to the wildlife. This is too long to go into, but the mere mention of a few cases is sufficient, namely, mosquito and swamp control around centers of habitation; roads and waterfowl nesting sites (see fig. 59); roads and wilderness areas; roads and mountain sheep range, as in the case of the Trail Ridge in Rocky Mountain; water utilization and fishing, as in the Never Summer Range in Rocky Mountain (see fig. 60); camp grounds, parking areas, industrial centers, and such, which take portions of winter range and are inimical to the presence of large game animals. Merely to mention these is to indicate how minutely the wildlife and landscape values dovetail.

Because of the same problem having at least these two aspects, each of which is handled by a separate branch of the Service, it is proposed that it would be advantageous if the Branch of Plans and Design should send to the Wildlife Division copies of reports and correspondence relative to overgrazing, erosion, and other cases where your men have noticed that animal life is destroying landscape values, and that there be a reverse exchange of data where situations warrant it. In this way it is felt that many problems which are tackled separately might find quicker and more satisfactory solution.

REPORT CONCERNING RESEARCH RESERVES IN NATIONAL PARKS

Submitted to the Director of the National Parks Service, February 23, 1934

Following receipt of your letter of June 6, 1933, making the Wildlife Division responsible for promotion of the research-reserves program in the national parks, I called a conference of our group for the purpose of developing a plan of action.

After careful study and deliberation we have concluded that some changes in the original research-reserve plan would have to be made to secure conformity with basic parks policies and to facilitate a locking into the administrative code. Unless this be done, the research-reserve plan could never get beyond the paper stage.

We believe that we have arrived at a plan which will satisfy the need.

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FIGURE 59.—High-Line Canal along the Never Summer Range in Rocky Mountain—a beautiful landscape scar and a fine robber of fishing streams, beaver ponds, and game range below. (Photograph taken June 27, 1931, Never Summer Mountains, Rocky Mountain. Wildlife Division No. 2303.)

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FIGURE 60.—The reverse of the story—waterfowl nesting site makes way for road in Zion. (Photograph taken May 27, 1931, Zion Canyon. Wildlife Division No. 1833.)

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RESEARCH RESERVES

To our knowledge, areas have been designated as research reserves in Grand Canyon, Lassen Volcanic, Sequoia, Yellowstone, and Yosemite National Parks. A formal survey in the form of an original inventory of biotic communities of the Yosemite Research Reserve has been started. Another area has been recommended as a research reserve in Rocky Mountain National Park. * * *

It is our opinion that, with the exception of the Yosemite Research Reserve, which is being studied by the Yosemite Field School, universities or other suitably equipped institutions should be induced to undertake the formal studies of research reserves within the national parks.

All available correspondence relative to research reserves has been carefully studied and discussed. Dr. Shelford's memorandum [1] on nature sanctuaries has been the basis for evolving a nomenclature and definition of terms in considering research reserves within the national parks.

Shelford's definitions of classes of nature sanctuaries are as follows:

1. First-class nature sanctuaries:

Any area of original vegetation, containing all the animal species historically known to have occurred in the area (except primitive man) and thought to be present in sufficient numbers to maintain themselves, is suitable for a first-class nature sanctuary.

2. Second-class nature sanctuaries:

A. Second-growth areas (of timber) approaching maturity, but conforming to the requirement of no. 1 in all other respects.

B. Areas of original vegetation from which not more than two important species of animal are missing.

3. Third-class nature sanctuaries:

Areas modified more than those described under no. 2.

This excellent classification is something toward which to work. There are several difficulties to be overcome, however, before research reserves within the national parks and monuments can attain the first-class nature sanctuary status which they should. It seems important to outline briefly these difficulties in order that a program of progressive restoration may be undertaken toward the setting up and maintenance of research reserves.

I. No first- or second-class nature sanctuaries are now to be found in any of our national parks under their present condition. The reasons are:

(*a*) No park is large enough in its entirety to provide protection and habitat unmodified by civilization for the large ungulates and

[1] Preservation of Natural Biotic Communities, by Victor E. Shelford, Ecology, vol. XIV, No. 2, April 1933, pp. 240–245.

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carnivores. To be specific, Yellowstone, the largest national park, cannot provide winter range for its buffalo, elk, deer, antelope, and mountain sheep. If a few wolves occasionally wander into the park during summer, as recently has been reported, they go to lower country in winter, which is outside the park. Moreover, it is probable that white-tailed deer, cougar, lynx, wolf, and possibly wolverine and fisher are gone from the Yellowstone fauna. Add the grizzly to this list, and you have the carnivore situation at Rocky Mountain. In Grand Canyon, feral burros have decimated every available bit of range within the canyon, and domestic stock have taken heavy toll from the narrow strip of South Rim Range. Cougars have been almost extirpated, and bighorn greatly reduced. The entire ground cover and food supply for ground-dwelling birds and small mammals has been changed by grazing. In Yosemite the bighorn and grizzly are gone and cougar almost gone. In Glacier the grizzly is scarce, the buffalo and trumpeter swan are gone, and game in general is seriously depleted because of inadequate boundaries. There is no need to repeat the story for the smaller parks. By definition, then, none of the larger parks can provide a first- or second-class nature sanctuary at present.

(*b*) The irregularity and arbitrary character of boundaries of existing national parks provides insufficient buffer areas to protect the research reserves, even if first-class nature sanctuaries were available as research reserves. A research reserve must be located somewhere near the center of a large national park, or else be protected by some adequate faunal barrier, in order to provide sufficient and adequate buffer area around it. Otherwise, the large carnivores and the fur bearers which are killed and trapped around the nearby boundary of the park will be drained from the normal fauna of the research reserve. This is exactly what has happened to the entirety of each of our large national parks. The results have just been listed above under (*a*).

This matter of external influence incessantly acting upon the faunal resources of a national park cannot be overestimated. The fate of the carnivores and fur bearers is too well known. The ungulates are robbed of their winter range and held within the park during winter, by virtue of hunting and civilization just outside the boundaries. This means artificial feeding of big game, congestion at feeding stations, and spread of disease, abnormal concentration of predators, and overgrazed range with all its succession of maladjustments, not the least of which is the loss of food and cover for ground-breeding and ground-dwelling birds and small mammals. Add to this the depletion of rare wild fowl outside the park, such as trumpeter swan, sandhill crane, some ducks and

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geese, etc., and it becomes evident that the attempt to handle the salvation of wildlife from within a sanctuary is a futile attack. The success of the sanctuary depends largely upon what is done outside the sanctuary to make it a real and adequate haven for wildlife.

(*c*) Let us look at some of the research reserves which have already been designated to see how the above-mentioned factors operate. There are four research reserves in Lassen Volcanic National Park. Lassen is approximately 10 by 16 miles square, enclosing the volcanic cone. The description of the research reserves is as follows:

Research Reserve No. 1.—"Approximately 2½ square miles at north boundary of park * * *."

Research Reserve No. 2.—"Approximately 1½ square miles in Lost Creek drainage at north park boundary * * *."

Research Reserve No. 3.—"Strip ¾ mile wide and approximately 5 miles long * * * ending at south boundary."

Research Reserve No. 4.—"Two plots totaling approximately 4 square miles in Hat Creek Valley. Area to be reserved in devastated region for study of succession. Area entirely denuded by 1915 eruptions, leaving loose rocky volcanic ash and rock covering."

No. 4 is valuable for floral succession study. But in the light of the above listed factors which work against the fauna of a national park at all times, of what value are nos. 1 to 3?

These samples, to be sure, are in a small national park. Are there none better in the larger parks? Grand Canyon seems promising. Here there are five research reserves. Three of these are such isolated temples rising out of the canyon that they cannot be developed for commercial or human utilization and therefore appear to be protected. The other two are on the North and South Rims and are so close to the boundaries of the park that their biotic character will always be affected by activities just outside the park.

Yellowstone might present even a better possibility for research reserves, but the depletion and modification of the Yellowstone fauna, already outlined, would affect any research reserves anywhere within the park so as to make them hardly more fruitful areas of study than any other area within the park.

Mount McKinley may have better possibilities for research reserves, but the great interior portion of the park is covered with glaciers, and any research reserve would have to be located on the lower fringe of the park, which is subject to the influences of immediately adjacent civilization. It may be said that civilization has already arrived at the gates of Mount McKinley.

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II. The constant flux of nature, which over vast areas throughout long periods of time strikes the so-called "balance", becomes an entirely different thing in the relatively small area of a national park with everything upset around it and many of its species of wildlife either gone or nearly gone from within it. To take a specific case: When the last nucleus of the trumpeter swan nests in the Yellowstone region; when the most valuable protected breeding ground for this bird is on the Mirror Plateau, which is a research reserve; when the swan's enemies (at least, coyote, raven, crow) have increased and profited by civilization so that the swan-predator abundance ratio is vastly more in favor of the predator than it was in primitive days; then to suggest allowing the normal flux of nature to take its course means to let the man-made flux of nature drive the trumpeter swan out of existence. It would mean to give up several rare species because we did not practice wildlife management to compensate for the adverse factors which civilization has brought up against these forms of wildlife.

Does all this mean that we should abandon the attempt to preserve primitive nature simply because its normal processes have been wrecked, and should turn to management of wildlife toward building up arbitrary and static faunal populations within the national parks? Most emphatically, no. It does mean wildlife management, but toward a specific end, and that end is the restoration of the primitive faunal condition. In other words, the primitive balance of nature is not discarded; it is made the goal of wildlife management within the national parks. To accomplish this there must be restoration of some species; there must be restoration of range by the control of certain of the ungulates in certain localities; there must be acquisition of winter ranges; there must be relief from trapping in the regions adjacent to the parks; there must be a long-time policy regarding the fixation of primitive areas within the parks, and many other management measures.

The purpose of the above discussion is to indicate that the establishment of research reserves within the national parks will necessitate a certain amount of restoration, involving a long-time program. We submit the following program toward the establishment of research areas.

1. A definition of terms (for use in a national park):

(*a*) *Primitive area.*—A primitive area is that portion of a national park or monument in which no roads nor public accommodations shall be constructed; in which trails and the necessary fire-protection devices may be constructed; and over which a wildlife progressive restoration program shall be exercised. The entire

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body of a national park or monument, aside from road and development areas, should be for all time a primitive area.

(*b*) *Research areas.*—(NOTE.—Inasmuch as insect infestations and fires might gain too much headway with a research reserve if they were not controlled, and since preparation for and the prosecution of such control has been prohibited in treatment prescribed for a

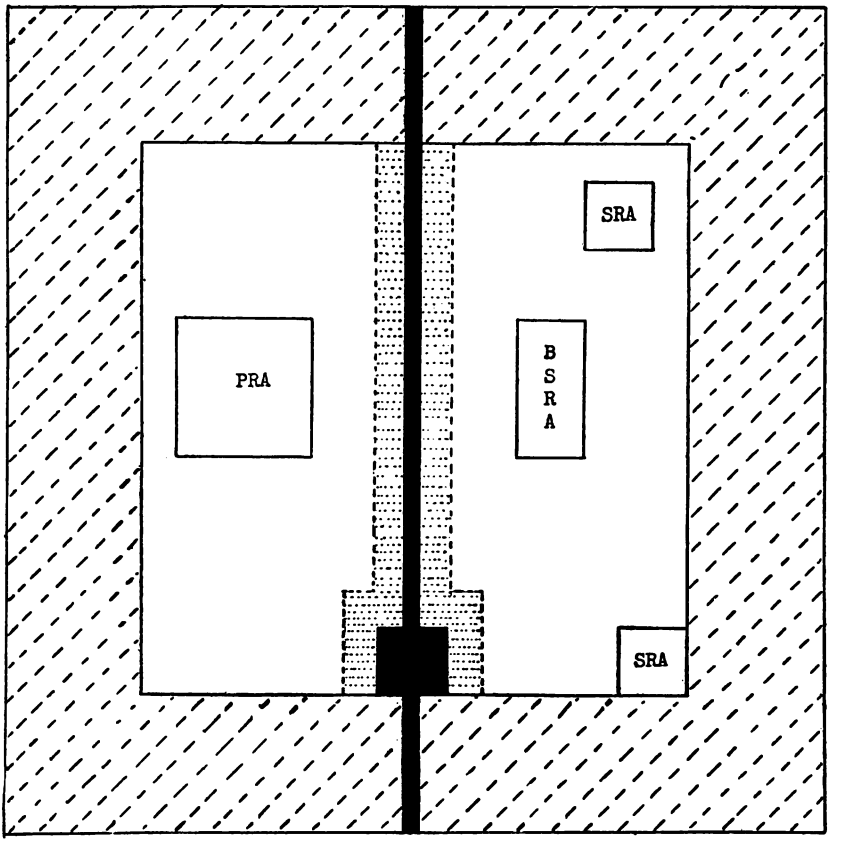


FIGURE 61

Black: Road and development area.
Dotted: Indefinite extent of human influence modifying wilderness conditions somewhat along roads and development center.
Hatched: Buffer area surrounding the park.
PRA: Permanent research area.
BSRA: Biotic succession research area.
SRA: Specific research area.
White: Primitive area—rest of the park.

research reserve, we suggest that the term "research reserves" be supplanted by the term "research areas", and that research areas shall be accorded a treatment differing somewhat from that previously prescribed for research reserves.)

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The character of a research area shall be identical with that of a primitive area, except that no fish culture shall be permitted within a permanent research area, or within waters which would affect or modify the aquatic life within the waters of a permanent research area.

Since research areas such as those in Lassen are valuable for various types of study but can make no pretense of conserving unmodified the larger game animals, we suggest that the single concept of "research areas" be further amplified to specify the purpose of each different type of research area, namely:

(1) *Primitive research area.*—An area which would be a first-class nature sanctuary (Shelford's terminology) to remain for all time inviolate and to be located permanently at one place within a primitive area.

Such primitive research areas might be located at such places as the Mirror Plateau and the Bechler River district in Yellowstone, and in other protected and adequate localities in the other large national parks, such as Mount McKinley, Glacier, Yosemite, and Katmai National Monument. Such a primitive research area has already proved valuable on the Mirror Plateau in Yellowstone by having prevented the planting of fish in that locality, thereby saving the nesting trumpeter swans from undue molestation.

(2) *Specific research area.*—An area set aside for the investigation of a particular species of animal or animals or of a specific problem. Such a designation might be permanent or might terminate when there was no longer need of it.

Such specific research areas might be established, say, near the Lower Geyser Basin in Yellowstone for a study of the requirements of the sandhill cranes nesting there. If the sandhill cranes, because of topographic, climatic, or some other cause of change in habitat, should go elsewhere in the park and not return to the Lower Geyser Basin sandhill crane research area, such designation might then be terminated and a new area so designated. Specific research areas might be utilized in nearly all of the national parks and monuments.

(3) *Biotic or floral succession research area.*—An area set aside for the protection and investigation of biotic or floral succession in a developing or recovering biotic community. Such designation might be permanent or temporary, for instance, the Lassen Research Reserve No. 4, established to protect the biotic succession in the wake of an eruption. Forest-fire areas, flood and insect devastated areas, etc., might well be designated as biotic or floral research areas.

(4) Other designations, if and when they should become desirable.

We further suggest:

2. That there be designated certain definite and limited development areas within the national parks and that these prescribed

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limitations be adhered to strictly in future developments within the parks and monuments. This designation of development areas should be made in order that the remaining portion of each national park and monument may be maintained always as a primitive area to be treated as indicated under definition of primitive areas just given above.

3. That members of the Wildlife Division undertake to designate and locate suitable research areas, of the different types listed above, within the national parks and monuments.

4. That, since the research-area concept is the apex of the effort to restore and maintain the perfection of each national park and monument, the program for establishment of research areas be linked with the whole move to restore and provide adequate native habitat for the fauna of the national parks and monuments. The reasons for this are two:

(*a*) As a protected laboratory, the research area can be no more effective than the protection of the park in which it is situated. This has been shown to be inadequate by the loss of faunal members and the deterioration of range and habitats.

(*b*) In order to establish adequate protection for research areas, the erection of buffer areas around the park and the readjustment of inadequate boundaries would be far more effective than withdrawing further and further within the park. This is the vital point of this entire discussion.

Overgrazed ranges, depleted and lost habitats, abnormal deer and elk populations, and decimated and lost faunal species must be restored to somewhere near normal status by wildlife management within the parks. Details of all these steps are too numerous to present here. But such procedure is necessary to make the research areas real. We further submit in order to vitalize the concept of research areas that great effort be made at this time to procure additional winter range adjacent to the parks and monuments by the purchase of submarginal farming lands and by reallocation of territory generally surrounding the parks and monuments. Readjustments of boundaries consistent with the requirements of faunal populations must be procured. Buffer areas in which there shall be no trapping of fur bearers or hunting of rare species should be erected outside of and surrounding the national parks and monuments so that research areas, and indeed the entire primitive areas of the national parks and monuments may be made real wildlife sanctuaries wherein the native fauna may be maintained in natural habitats.

It seems to us that such a program in its entirety should be our method of procedure in attacking the problem.

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REPORT CONCERNING THE CHARACTERISTICS OF BUFFER AREAS

Submitted to the Director of the National Park Service, May 28, 1934

The following characteristics of buffer areas are proposed:

1. Each buffer strip should be several miles in depth, varying of course to suit the requirements of fauna, terrain, pressure of civilization, and other conditions imposed by the environs of each park or monument. For instance, a buffer area along the east side of Yosemite should extend far enough down the east slope of the Sierra Nevada to protect the fur bearers of that side of the park from trapping, and to protect Sierra Nevada bighorn in winter, if and when they are reestablished on the park.

2. There should be no introduction of exotics within the buffer areas.

3. There should be no trapping of fur bearers within the buffer areas.

4. There should be no predatory animal control within the buffer areas, unless it is sanctioned by the National Park Service.

5. There should be no grazing of domestic sheep within buffer areas.

6. Hunting of game animals, such as elk and deer, should be permitted within the buffer areas, where and when the National Park Service deems that such action is justified. For instance, the hunting of elk around Yellowstone and deer around Yosemite are clearly justified and desirable.

It is believed that any such buffer-area program as proposed above would be of the greatest value in restoring and preserving the wilderness aspects of the parks and monuments and properly would hold a place in any comprehensive scheme of land utilization for conservation purposes.

WILDLIFE MANAGEMENT UNDER EMERGENCY CONSERVATION WORK

The last administrative phase of wildlife management to be treated here is in connection with the Emergency Conservation Work which is being carried on within the national parks.

Because of the extent of construction and clean-up activities suddenly made available in the parks—necessary activities which ordinarily would have taken many years to accomplish—it has been considered expedient and in full accord with national-parks purposes to place trained zoologists in the parks to assist in the supervision of all construction activities, with the objective of protecting

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faunal habitats and wilderness conditions, as much as possible, where construction activities are involved. These men are also expected to conduct wildlife research while in the parks, with the objective of better wildlife management.

It is felt that these measures will aid in insuring the safety of our wilderness parks and protect these valuable heritages while they are being improved for human comfort and human utilization.

Reports covering all the Emergency Conservation Work wildlife projects for the various national parks and monuments need not be given. But one typical outline is given as representative of the national parks Emergency Conservation Work wildlife projects.

DIRECTONS FOR FAUNAL RESEARCH IN THE GREAT SMOKY MOUNTAINS NATIONAL PARK ISSUED TO THE NATURALIST TECHNICIAN IN CHARGE

Submitted through the Director of the National Park Service, June 4, 1934

Given herewith are a few suggestions outlining necessary research in connection with the faunal problems in Great Smoky Mountains National Park, subjects about which we are very anxious to get specific data.

In your letter of appointment from Dr. Bryant, Assistant Director of the National Park Service, three fundamental points were outlined as indicating the desirable course of your activities. The suggestions given herewith are intended as further amplification of the three main points described by Dr. Bryant.

PROJECTS

1. Since most of the eastern national parks are still in the formative period and definite boundaries have not yet been determined in all cases, it is very essential that information be available in detailed and concise form indicating exactly what boundaries would be necessary for your park in order to provide for all-year habitat and complete and normal existence for the various forms of wildlife native to the park. Particular emphasis should be placed upon territory required as adequate deer winter range. As you are probably aware, most of the western parks now are faced with complex problems resulting from the fact that in practically every case no suitable quantity of winter range has been included within national-park boundaries to provide for deer, elk, mountain sheep, and other species. We are extremely anxious to avoid this difficulty in the establishment of the newer eastern parks, and now is the time when data pertinent to and descriptive of the necessary winter ranges should be available.

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2. An investigation should be made to determine which native species of animals are gone from Great Smoky Mountains National Park and the surrounding region, and which ones advantageously might be reintroduced. For example, if elk were at one time native to the Great Smokies, it is dubious whether or not they could be reintroduced and properly provided for in the face of the now limited territory available and the encroachment of civilization from every side. However, if after your study reintroduction of elk would in your judgment be desirable, we should like to have report upon such project, stating possibilities, requirements, possible conflicts, etc.

3. Determine which native species of wildlife have been abnormally depleted and work out a suggested program for improving their status. In particular, you should concentrate on the study of the abundance, factors affecting, life history, requirements for bear, deer, fur bearers, and wild turkeys, under the particular circumstances arising from the trapping of fur bearers, poaching, hunting in the environs of the park, and any other factors which might affect the welfare and permanent protection of these important species.

4. Make a careful study of the effects of roadside clean-up and other construction activities, as these possibly may be destructive of faunal habitats locally along roadsides and around camps and development centers, noting also the effect of such activities upon soil protection and humus formation, advising means for minimizing such maladjustments where possible. Where you have discovered undesirable effects resulting from necessary development activities, present your findings of the situation to the superintendent and suggest ways and means of avoiding the difficulty if possible. In all such cases, reports should be sent to the Washington office and to the Wildlife Division.

5. In a broad survey of Great Smoky Mountains National Park, determine which areas are "sacred", i.e., particularly valuable for wildlife and indispensable as faunal hinterlands for the park. Indicate these areas in reports to your superintendent, the Washington office, and this office, as being worthy of freedom from all development. In this same broad survey of the faunal possibilities of your park as being impinged upon by the necessary developments, try to determine just how the park could be developed most advantageously from the wildlife point of view, retaining as your objective meanwhile the preservation of the wilderness character of Great Smoky Mountains insofar as that is possible. May I cite an example:

In Yellowstone National Park in 1933 an old highway was to be relocated and improved. This proposed road followed the shore line of a small lake which was valuable as a nesting ground for various rare birds. A reconnaissance of the various species of birds

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dependent upon this lake was made and the results of the survey presented to the superintendent. After giving this consideration, he issued an order that the road should be relocated so that it would not go anywhere near the lake shore.

Also in Yellowstone there was a small lagoon not far from Yellowstone Lake which was equally important as a duck nesting ground during the breeding season and as a quiet water retreat for numerous waterfowl during migration. A new highway was scheduled to follow the shore of this lagoon and cut across a portion of one end of it. After the matter was considered from all angles by members of the administrative, engineering, and educational staffs, the Branch of Plans and Design, and the Wildlife Division, a route was worked out for the road whereby it might go near to the lagoon and still be hidden from view, by following the far side of a low ridge which shielded the proposed highway from the lagoon. In this manner a satisfactory solution was reached for a problem which at first appeared to be a complete tangle. This is the sort of thing to which I refer under no. 5 of this letter.

Significant of the outlook with which conservationists are viewing construction and clean-up activities in various parts of the country is the following quotation from an article entitled "Conservation Economics", by Aldo Leopold, in the Journal of Forestry, May 1934, p. 540:

> There was, for example, the road crew cutting a grade along a clay bank so as permanently to roil the troutstream which another crew was improving with dams and shelters; the silvicultural crew felling the "wolf trees" and border shrubbery needed for game food; the roadside-clean-up crew burning all the down oak fuel wood available to the fireplaces being built by the recreation-ground crew; the planting crew setting pines all over the only open clover-patch available to the deer and partridges; the fire-line crew burning up all the hollow snags on a wildlife refuge, or worse yet, felling the gnarled veterans which were about the only scenic thing along a "scenic road." In short, the ecological and esthetic limitations of "scientific" technology were revealed in all their nakedness.

Equally important to this whole problem is the fact so well expressed by Prof. Walter Mulford, of the Division of Forestry of the University of California:

> A forest is the most complex biological society, in both plant and animal life, with which man works in any phase of his land utilization enterprises.

6. Try to gather life-history data on all the important game species of your park. Even though such data may not seem pertinent at the time, it becomes increasingly valuable as it accumulates and is essential for the solution of administrative problems in the future.

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