NATIONAL PARKS *Magazine*

Relic of a Triassic forest: agatized log section in Petrified Forest National Park, northeastern Arizona

January 1966

Looking Forward

An Editorial

As a new year opens, hopeful and courageous planning for the parks and the natural country of America is in order.

This year could see the settlement of the controversy about dams at Bridge and Marble Canyons on the Colorado by agreement on building aqueducts and pumps to get water into Central Arizona, using power from coal-fired plants.

It could see the permanent protection of water supplies for Everglades National Park by suitable deep reservoirs and aqueducts tapping Lake Okeechobee's surpluses, now dumped into the sea.

Comprehensive plans for the Yellowstone and TVA-Smokies regions, and a score of other regions with a national park nucleus, could be developed in the Bureau of Outdoor Recreation, designed to protect the roadless areas of the parks and forests and yet provide abundant automobile recreation and other mass recreation on the periphery.

By this method, the National Park Service and the Forest Service would be afforded a fighting chance of giving genuine protection to actual wilderness, as contemplated by the Wilderness Act.

The Potomac River Basin could be established, in the light of the very broad consensus which already exists, as a model of beauty and conservation for the nation and the world; complete water purification would be substituted for the dilution of pollution; all of the sixteen major reservoirs proposed by the Army Engineers would be abandoned; the headwater storage system would provide flood and siltation control and excellent outdoor recreation.

The maximum acreage of coast redwoods recommended by conservationists could be set aside as a Redwood National Park, with additional surrounding redwood lands protected by ecological forestry easements, perhaps to be managed in a Redwood National Forest for both production and recreation.

A great new national park could be established in the North Cascades, with a heartland protected to park standards, large surrounding areas of roadless wilderness, and buffer zones beyond, where ecological forestry practices in Douglas fir could be employed on public lands.

Strong public sentiment is building up toward bringing the big highway programs under better policy guidance. More concern must be shown for the protection of ecological, historical, and other social values, as contrasted with raw development. A beginning could be made by interdepartmental consultation, motivated by broader human considerations.

With the establishment of the Water Resources Council and the Federal Water Pollution Control Administration, a fundamentally revised approach toward river basin management should get under way promptly, based on depollution, headwater storage, and well-planned recreational development by the States with Federal assistance under the Land and Water Conservation Fund Act.

Entrapped in super-cities which more and more stifle instead of enhancing the good life, the American people are pressing for the restoration of urban open space, and the reduction of traffic to a manageable flow. The new Department of Housing and Urban Development will be a fulcrum for creative programs in urban affairs.

The concept of natural beauty whose protection and enhancement is a goal of civilized life has been firmly established in a brief space of time as national policy. It should now be possible to insist firmly upon roadside beautification and also to bypass new highways around beautiful country which should be left undisturbed by traffic.

The protection of our wildlife resources, for their esthetic, scientific and recreational values, must not be neglected. Important as it may be to reduce needless governmental expenditures, the important national wildlife refuges should not be sacrificed to shortsighted and trivial economies. On the contrary, with the great new interest in conservation, the nation could embark on a wholehearted wildlife restoration program.

And there are many new areas which will doubtless be added in due course to the national park system; Cape Lookout and Oregon Dunes National Seashores, and Sleeping Bear, Pictured Rocks, and Indiana Dunes Lakeshores, among others. The Wild Rivers program has met with widespread approval, and will hopefully move ahead.

There is every indication that the President and his official family intend to pursue objectives of this kind vigorously, and to open great new pages in the history of environmental protection and enhancement. Conservationists everywhere will applaud such efforts and give them whole-hearted support. —*A.W.S.*

NATIONAL PARKS *Magazine*

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Front cover photograph by Moulton B. Smith

The stone "forest" of Arizona's Petrified Forest National Park is not actually unique; scattered here and there about the world are other such silent "forests," relics of one past geologic age or another. The Arizona "wood" *is* unique, so far as known presently, in the beauty and diversity of its coloration. Its locality had been remarked on a number of occasions by the earlier investigators of the American Southwest; under threat of complete destruction, the choicest part of the wood-bearing terrain was set aside as a national monument in late 1906 by President Theodore Roosevelt. In 1962 the monument was reclassified as a national park.

The Association and the Magazine

The National Parks Association is a completely independent, private, non-profit, public-service organization, educational and scientific in character, with over 32,000 members throughout the United States and abroad. It was established in 1919 by Stephen T. Mather, the first Director of the National Park Service. It publishes the monthly *National Parks Magazine*, received by all members.

The responsibilities of the Association relate primarily to the protection of the great national parks and monuments of America, in which it endeavors to cooperate with the Service, while functioning also as a constructive critic; and secondarily to the protection and restoration of the natural environment generally.

Dues are $6.50 annual, $10.50 supporting, $20 sustaining, $35 contributing, $200 life with no further dues, and $1000 patron with no further dues. Contributions and bequests are also needed. Dues in excess of $6.50 and contributions are deductible for Federal taxable income, and gifts and bequests are deductible for Federal gift and estate tax purposes. As an organization receiving such gifts, the Association is precluded by law and regulations from advocating or opposing legislation to any substantial extent; insofar as our authors may touch on legislation, they write as individuals.

Membership in the Association carries with it subscription to *National Parks Magazine*. School and library subscriptions are $5 a year; individual copies 50 cents. Letters and contributed manuscripts and photographs should be addressed to the Editor at Association headquarters. The Association is not responsible for loss or injury to manuscripts and photographs in transit. Return postage should accompany contributions.

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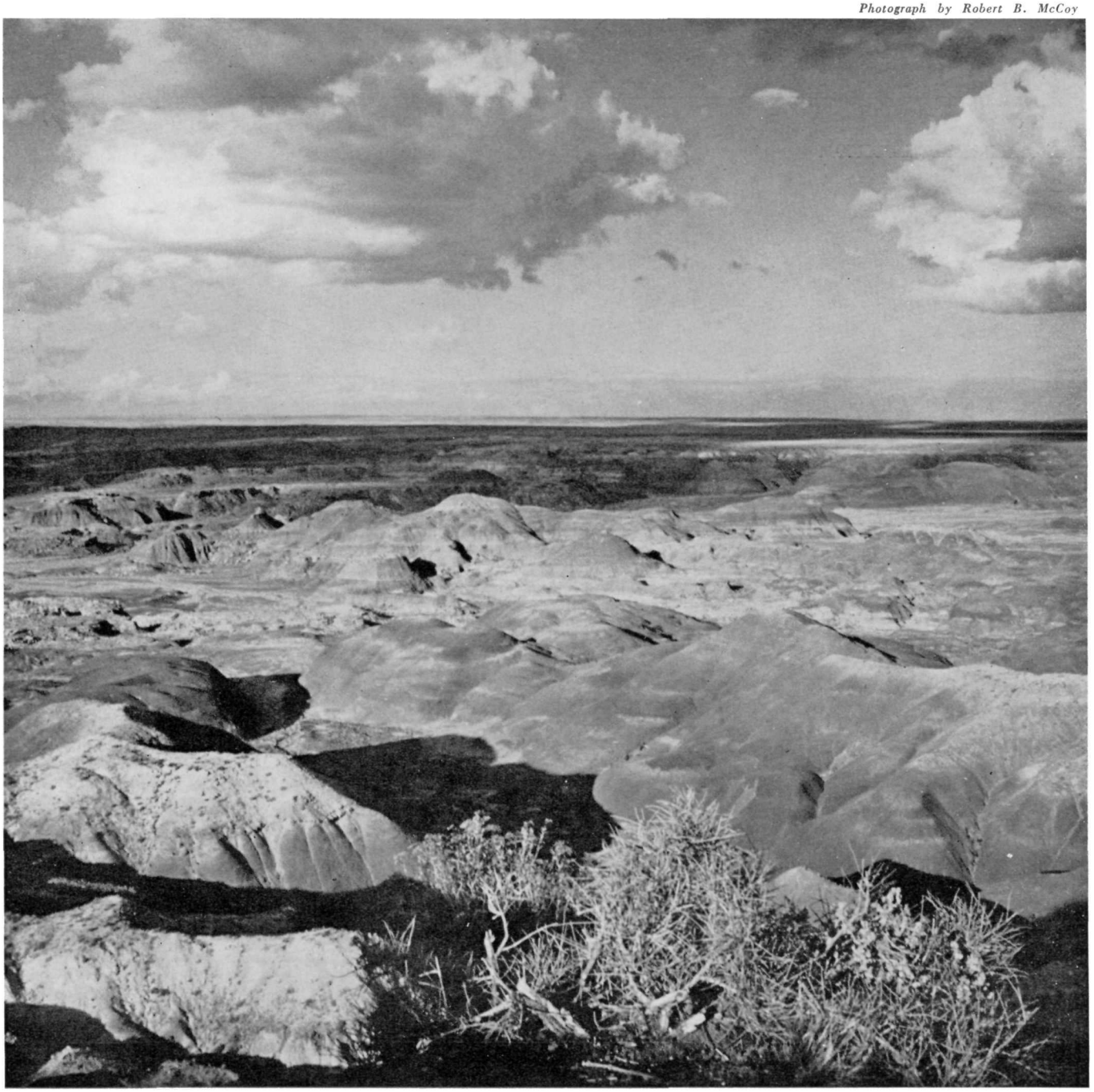
Petrified Forest National Park

The Painted Desert of northeastern Arizona, a vast expanse of clays and soft, easily-eroded sedimentary rocks, glows indescribably with pastel colors as the evening sun slants across ridge and pinnacle. A substantial segment of the Painted Desert is preserved for Americans in Petrified Forest National Park, along with the finest of the adjacent "stone forest."

Photograph by Robert B. McCoy



In June of 1860, the House of Representatives of the 36th Congress "laid upon the table and ordered to be printed" its Executive Document 90, the final report of Lieutenant Joseph Christmas Ives of the Corps of Topographical Engineers, an account of the Lieutenant's explorations on the lower Colorado River and adjacent terrain, published by the Government Printing Office about a year later under the general title *Report Upon the Colorado River of the West.*

Ives had been ordered by Congress to determine whether, or how far, the Colorado might be useful for navigation; and during his expedition of the years 1857 and 1858 he had worked his way up from the Colorado's mouth to the limit of useful navigation waters, beyond which he traversed a canyon that appeared, "in a scientific point of view, of the highest interest, and presenting natural features whose strange sublimity is perhaps unparalleled in the world."

Leaving the immense chasm of the Colorado, Ives had occasion to explore the region of northeastern Arizona Territory which was even then called the Painted Desert, a wild, desolate and brilliant chaos of erosion that "produced a picture as unlike those presented by most portions of the earth's surface as could well be imagined."

But it was something particular in this dry, multi-colored world that caught the Lieutenant's attention—something we now recognize as one of the world's great natural phenomena. It was a strange "forest," one cheered by neither the song of bird nor the rustle of insect; a forest whose trees were of stone colorful as the soft matrix from which they had weathered; the Petrified Forest of Arizona. Ives should be allowed to describe the ageless relics for himself, for they have never since been more adequately pictured, nor have his general observations as to their nature and history been seriously challenged in the light of the then-prevailing state of geological science.

"In the denudation of the marls [in the sense of easily eroded sediments] immense quantities of silicified wood have been brought to light. Fragments of all sizes are thickly strewed over the low lands, and have accumulated in piles of many hundred cords at the bottom of some of the slopes, where they have precisely the appearance of so much drift wood. The fossil trees are apparently all coniferous, though belonging to several species and probably representing more than one genus. From the difficulty of having specimens properly sliced for the microscope they have not yet been critically examined. They exhibit considerable variety in their mode of preservation, but frequently retain, in great beauty and perfection, the details of their anatomical structure. Some of the trunks are converted into red jasper, and look like huge masses of red sealingwax. Others are composed of agate or opalescent chalcedony, often showing a variety of

"After leaving Camp 5 some distance we passed the remains of a large petrified tree, the wood of which was agatized. It was broken in pieces, as if by a fall, and its root was uphill. It must have been upward of three feet in diameter."—Captain Lorenzo Sitgreaves, in "Report of an Expedition Down the Zuni and Colorado Rivers," 1853. It is considered quite possible that the tree mentioned by Captain Sitgreaves is that shown in the photograph below.

Photograph by Moulton B. Smith

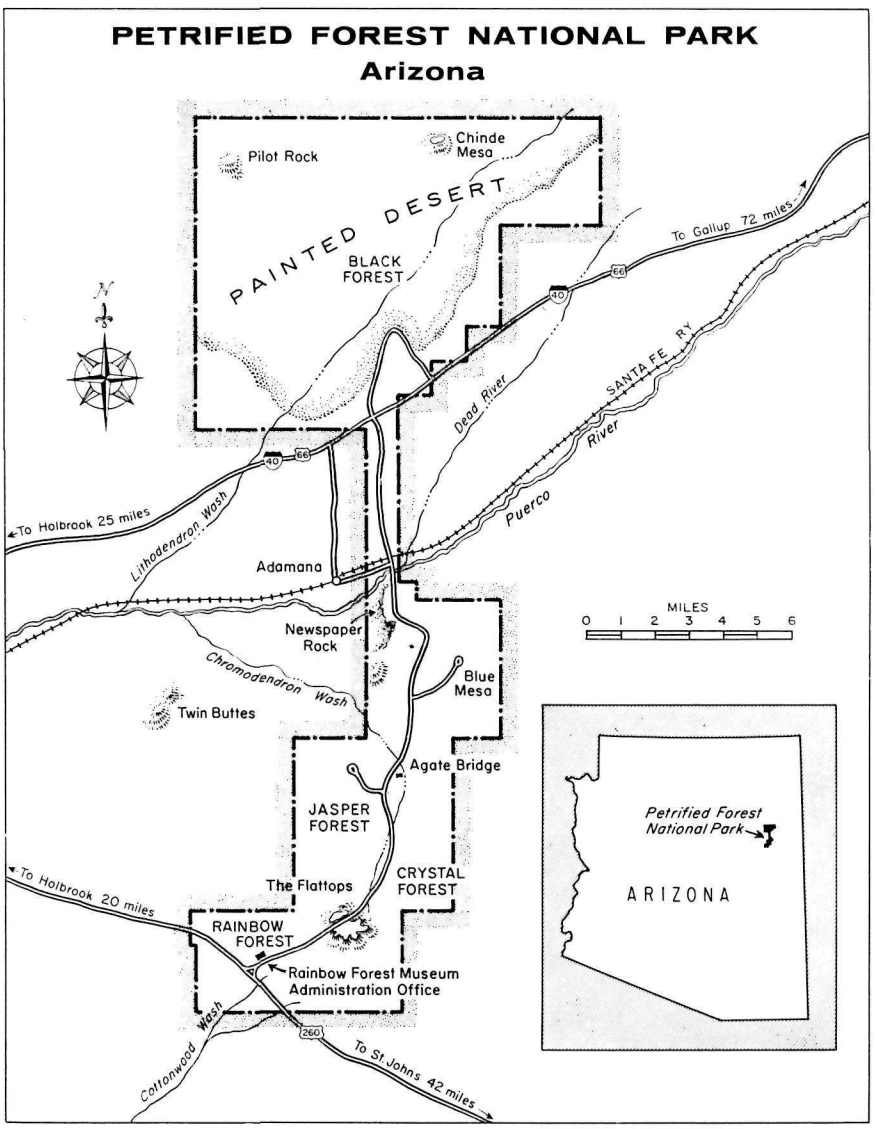
bright colors and forming beautiful specimens for the cabinet. As generally found, these silicified trunks are broken into pieces from one to six feet in length, as though they had been sawed through transversely. These pieces have usually been separated from their fellows and lie scattered about in the greatest confusion, but . . . I found a number of trunks of which the fragments were all in opposition, and the tree complete from root to summit.

"In all that came under my observation, I failed to find any evidence that they had grown in the vicinity. All the trunks were stripped of their branches and exhibit precisely the appearance of those transported to some distance by the agency of water."

It is very likely that Ives' account of the petrified trees had been read and perhaps edited for technical points by John Strong Newberry, one of the nation's prominent 19th century geologists, who was a member of the expedition. There are but few amendments that can be made to Ives' commentary in the light of later scientific work, a tribute to Ives and probably also to the scientific acumen of Newberry.

The vast majority of logs in the Petrified Forest is comprised of two conifers, one a long-extinct relative of the modern araucarias—the monkey-puzzle pine of South America and the Norfolk Island pine of Australasia—and the other a somewhat similar tree. A third species, found sparingly, is a tree about which paleobotany has not yet had much to say, *Schilderia adamanica*, a cross-section of which is shown on the back cover of this magazine. Also there have been found remnants of a number of other tree-sized plants, most of which are yet to be botanically described.

The rather regular transverse breakage pattern of the silicified trunks mentioned by Ives has since been attributed (largely for lack of a better explanation) to harmonic vibrations set up within the logs by earthquake shock-waves at a time when the already silicified logs were deeply entombed in their layers of sediments. Modern geology agrees that the tree-trunks, stripped for the most part of branches and roots, were brought to their burial site in the marshes of an ancient flood-plain by Triassic streams during times of high water, and that they were brought from no great distance. Further, as a result of some careful geological detective work, it is thought that the particular streams that carried the trunks headed in a series of low hills some miles west of present Petrified Forest National Park.



Map by Federal Graphics

Admire and Leave

There is one other observation which ought to be made concerning Lieutenant Ives' account of the Petrified Forest. His remarks concerning the colorful wood as "beautiful specimens for the cabinet" were valid enough: others, to come later, had far less esthetic regard for the marvelous stone forest. Today the unthinking or selfish visitor to the park is almost certain to leave the area with a citation rather than a cabinet specimen; as a Petrified Forest Park ranger once said, "It's my job . . . to see that there will always be this great natural display of petrified wood here where it was formed." The ranger meant what he said; a word to the wise has often been called sufficient, but every year a number of visitors to the park prove that for every rule there are some exceptions.

In the ordinary course of events a forest tree lives out its life and then slowly returns to the soil by way of oxidation and the attack of living organisms. Where petrified wood occurs, it is reasonable to suppose that a rather special set of geological circumstances must have at one time been in operation. In the case of Petrified

Forest, there must have been a fairly rapid (geologically speaking) downward movement of the earth's crust, at least locally, sufficient to progressively bury the logs as they were brought in, away from the oxygen of the air, and also to equal, nearly at least, the upward accumulation of plant remains and inward-bound river sediments.

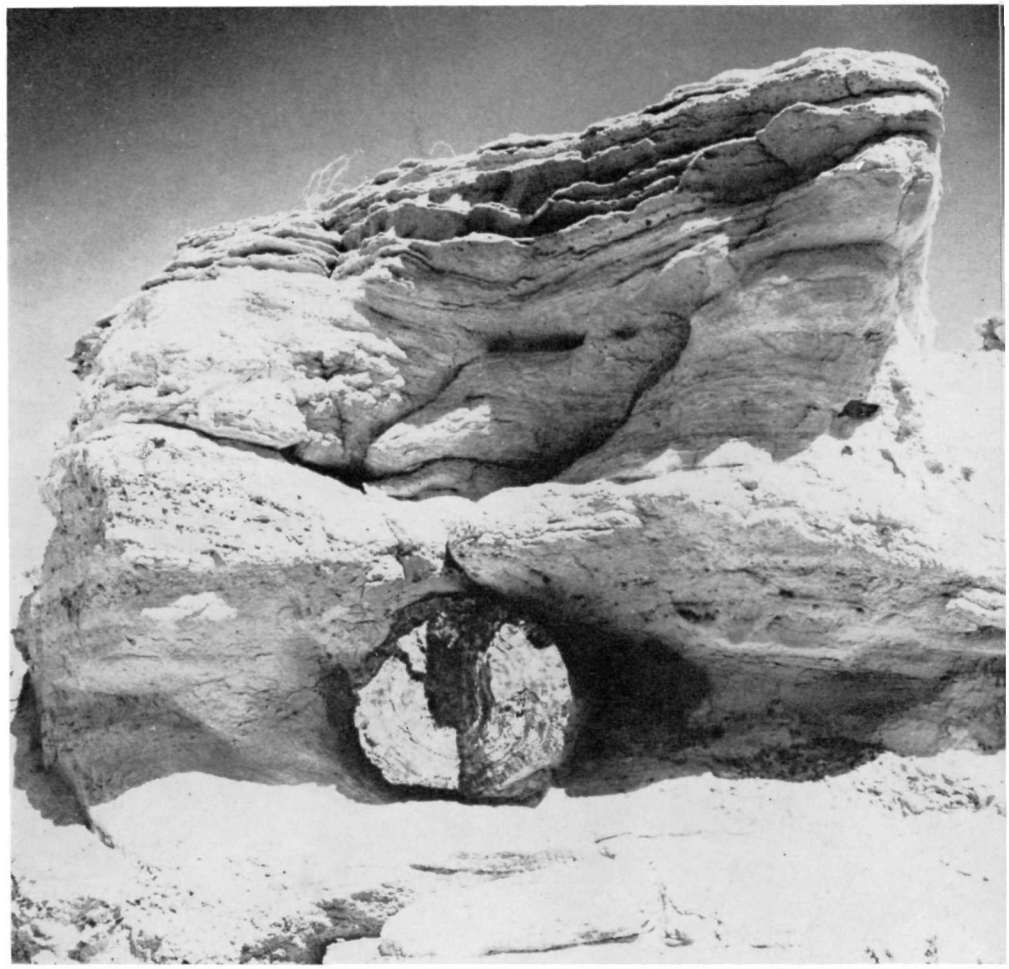
Subtle Natural Process

Once a fragment, or an entire tree-trunk, has been buried in sediments, away from oxygen and living scavengers, petrifaction may follow in the course of time; a subtle process, and one as yet not well understood. Mineral matter, usually but not necessarily silica, is exchanged for organic matter, atom by atom, in a transaction known rather formidably as metasomatosis, and the wood is usually at last converted to some variety of quartz such as chalcedony in one of its subvarieties—agate, opal, or jasper—retaining, as has fairly recently been determined, at least a little of the carbonized tissues. Where metallic or other oxides are incorporated into the stone along with the silica, bright patterns in yellow, red, buff, purple, and other color shades may be created, as in the Petrified Forest.

As the nation progressed westward Arizona's Petrified Forest became more widely known. People came to admire, to study, to carry away souvenirs large and small; others came to estimate the commercial potential of the agatized wood. A project got under way for a stamp-mill which would convert the hard logs into abrasives for sandpaper. The future of the strange forest began to look dim to the more thoughtful people of Arizona, and to their counterparts throughout the country, and the cudgels were taken up for some kind of protection for the Forest. Thus it was that, in the closing days of 1906, President Theodore Roosevelt issued a proclamation establishing the Petrified Forest National Monument for the protection and preservation of one of the world's most colorful and extensive concentrations of silicified wood.

The finest part of the stone forest and its colorful terrain, including a portion of the yet more colorful Painted Desert immediately to the north, continued in the status of national monument until 1962. During that year the monument achieved the title of national park through a maneuver over which park enthusiasts waxed somewhat less than enthusiastic—essentially, a horse-trade between Arizonans and the Interior Department that brought the preservation more land in return for the enhanced publicity generated by the magic phrase "national park."

But as either monument or park most people need little persuasion that the Petrified Forest, whose colorful logs were thought by the Navajos to be the bones of a monster destroyed by the sun, is one of the nation's outstanding scientific and scenic properties; a preservation whose bits and pieces seem to breathe life into the dim geological past and to make it, for them, a little less impersonal. ■



Photograph by Moulton B. Smith

The soft rocks and unconsolidated sediments of the Petrified Forest terrain have not as yet released their entire holdings of silicified Triassic logs. The photograph above shows a log-section still encased in its sandstone matrix. Below: petroglyphs on rock-faces of the region attest to the presence of prehistoric Indians, who also used the heavy blocks of petrified wood in the construction of their dwellings.

Photograph by Piet Van de Mark

Ski-Touring the National

Photograph courtesy National Park Service

The world of the cross-country ski-enthusiast is one of sun, sky and trackless snow, away from the crowds that throng about mechanical ski-lifts and the long lines of humanity waiting to be carried up the hill. The skier above tours the white solitude of Mount Rainier National Park in Washington State.

Parks and Forests

By Cecil M. Ouellette

SKI-TOURING, AS DISTINGUISHED FROM the more mechanical sport of ski-lifting, is practiced throughout the United States wherever snow cover and slopes allow, from the White Mountains and Adirondacks to the High Sierra and Cascades; and the great national parks and national forests offer some of the finest ski-touring terrain to be found anywhere. Already the parks and forests attract great numbers of recreational skiers; of these, a few more each year venture deeper into the "back country," away from the crowds and the lift-served slopes. For them, the lure is sun, sky and trackless snow —a world known only to the cross-country skier.

Stated simply, cross-country skiing is a method of traveling on foot over snow-covered terrain. As an outdoor sport in America it was slow in attaining the popularity it has enjoyed in most European countries; but recent years have seen a swift spread of its appeal in this country. Actually, ski-touring has become the newest big winter sports discovery in the United States. Paradoxically, it also happens to be the oldest organized snow sport, having fathered such modern-day offshoots as the downhill, slalom, and jumping competition. To an ever-increasing number of enthusiasts, cross-country is the most pleasurable form of skiing.

In terms of human experience, ski-touring can be enjoyed at a variety of levels; skill is not necessarily the determining factor in enjoyment. The beauty of forests and slopes wrapped in snow, the silence of the touring trail, and the satisfaction of achieving some summit, circuit or viewpoint appeals to the novice exactly as it does to the expert. Both young and old, skilled and unskilled, can take equal pleasure from a leisurely tour on skis through snow-covered countryside. And since skiers of widely diverse skills can thus enjoy the sport together, ski-touring is fast becoming a family sport, especially since man-made facilities are not a requirement for enjoyment. It can be practiced wherever there is a snow cover—over fields, woodlands, or back roads.

To the novice, touring on skis means simply sliding one ski ahead of the other. To the expert it means using either the "diagonal" or "double-pole" stride, either of which utilizes the gliding ability of the skis. The diagonal method employs a single-pole stride, which simply refers to the alternation of arms and legs at each stride. As the skier moves forward, he pushes off one ski and at the same time uses the opposite pole for added thrust to increase his glide over the snow.

Art of Double-Poling

To double-pole, the skier takes a short step, leans forward placing both poles out front, then pushes off into a glide on the opposite ski. Ski poles not only help with balance, but provide added thrust to help sustain the all-important glide of the tourer. Skiers have found that these trail maneuvers enable one to travel at an optimum pace—farthest and fastest with the least effort. Good touring technique makes ski travel a sport and a pleasurable outdoor experience.

As the cross-country skier approaches an uphill stretch, he does not look for the end of the queue to the rope tow or chair lift, for there is none. He does, however, look for the "fall line," then decides which method he will use in climbing. Depending on the steepness of the terrain, several methods can be used. The skier can sidestep, do the herringbone, use the traverse-sidestep combination, or ski straight up!

Skiing straight up a steep slope never ceases to attract the attention of onlookers. It is, however, the cross-country method for climbing hills. In order to get the necessary purchase, a skier literally reaches out with his lead ski and grabs the snow. Particular attention is given to every uphill step, and for the purpose a flat and well-set ski holds the best. A little wax and a pair of strong arms also help. "Skins," or climbers, are also used when the angle of climb is great. These are strips of canvas or sealskin strapped to the bottom of the ski. With skins attached, one can climb more directly and with less effort.

In cross-country it should be remembered that snow conditions and terrain may vary remarkably. In a downhill

National Park Service

Ideal cross-country ski terrain may be found in many of our national parks and forests; the scene above was taken in Sequoia National Park.

run of several thousand feet from a high peak or ridge, the skier may encounter deep powder, ice, breakable crust, wet snow, thin snow, and slush. Caution and conservative skiing is, therefore, required: the cross-country skier is far from the rescue crews of the ski patrol. This variety of natural conditions is not a curse. A handicap, yes. But there is fascination in learning how to cope with the vagaries of nature, and to like them. There is excitement and pleasure in making, with few falls, a descent over changing snow surfaces; to schuss steep slopes; or to run through dense woods. It is more than a satisfaction. It is a triumph. It is the skier's challenge.

The "step-turn" maneuver provides plenty of thrills in the downhill. The skier simply lifts a ski out of the track, points it in the desired direction, and pushes off with the other ski. This is a technique borrowed from skating, and is most useful in making rapid and accurate changes in direction. There is nothing quite like whizzing through dense woods, picking your way, and using quick little step-turns to negotiate obstacles. Step-turning requires good balance, and many skiers practice riding first one ski and then the other. Those who have mastered this new downhill technique usually resort to "tree-hugging" or "grasping for branches." Small trees will bend when hit; big ones are not as cooperative.

Touring with standard ski equipment is not advisable. Those who enjoy the sport use a special set of touring skis with hickory or steel edges, touring boots, and touring bindings. The touring binding permits the heel to rise off the ski, thus allowing the ski to glide over the snow without lifting. Better control in making turns and traverses is assured with steel edges, and special waxes are used in ski travel to cope with different snow conditions and to avoid snow sticking to the skis. Good waxing provides a fast glide on the level and a good grip for climbing. Broken ski tips are common in cross-country, so most skiers carry a spare tip made of metal for just such an emergency.

The greatest single danger in ski-touring the high mountain elevations comes in the form of tons of sliding snow—the dreaded avalanche. Good equipment and good judgment are two prerequisites to a safe and enjoyable high-altitude ski-trip.

Photograph by the author

Unlimited Opportunity

Localities frequently toured by skiers of this country include most of our well-known mountain ranges and heights. Beginning in the West, ski-touring enthusiasts use the upper terminals of ski lifts as departure points to ski off the beaten track and away from the crowded slopes. California's 14,000-foot Mount Shasta, Mount Hood in Oregon, Washington's Mount Rainier and Mount Baker are the big favorites. From the high Sierra up through the mighty Cascades to the rugged Rockies, there abound wonderful possibilities for cross-country skiing. Many a Western skier will strike out for a full day's jaunt in these snow-clad hinterlands, searching for unskied slopes of deep powder.

Crater Lake National Park in southern Oregon offers some quite pleasant ski-touring country. An all-winter road leads to the crater rim, which is the "skiing off" point for many scenic trips. The circuit around the lake is more than thirty miles, and means a trek of two or more days. Most ski-touring in the West is done during March, April, May, and in some places,

Photograph by the author

For the experienced cross-country skier, there is satisfaction in achieving a summit, a circuit, or a magnificent viewpoint, and excitement in making, with few falls, a descent over changing snow-surfaces.

even June. These are the best months. The snow has consolidated, days are longer, and the temperatures warmer.

Touring in the East is rapidly becoming a favorite outdoor sport. From the Appalachians on up through the Adirondacks and the Catskills there is a great variety of cross-country trails. New Hampshire's White Mountain National Forest provides some of the toughest touring terrain to be found anywhere in the country, while the Green Mountain National Forest of Vermont offers trails to match every degree of skill.

Cross-country skiing can be fun, stimulating, and healthful—and it can also be dangerous. The difference is often due to carelessness on the part of the skier; but the greatest single danger comes from nature alone in the form of tons of sliding snow—the dreaded avalanche. The tourer, however, can keep most of these hazards under control by the expert utilization of his equipment and by his good judgment. To tour safely and comfortably, the Ski Touring Council, whose headquarters is in New York, advises the following precautions, particularly on longer trips: Parties should consist of at least three; do not underestimate time required. Deep snow and windfalls can slow progress considerably; do not get overheated while climbing; carry along at least one extra upper garment, and a snack to eat; take along a map and compass if you are not thoroughly familiar with the country. A pocket altimeter is also useful. A flashlight and a whistle also may come in handy; before starting out and upon returning from a trip, advise the ski patrol, as well as your friends; and finally, if skins are to be used, be sure they fit, and adjust them before starting the cross-country trip.

In general, the sport of ski-touring makes its appeal to those who are fascinated by the recreational treasures of snow and slope; who are humbled by the beauty of sparkling white forests and vast expanses of snowfields; who thrill to long sweeping descents through snow down to green valleys; and who see a challenge beyond the snow-clad horizon. Indeed, outdoor adventure and challenges are the very essence of a winter sport that lures novice and expert alike. ■

THE BEAVER RETURNS TO MAINE

BY BILL GEAGAN

U. S. Fish and Wildlife Service: W. B. Campbell

The Maine beaver, Castor canadensis canadensis.

ONE CALM NIGHT IN NORTH-CENtral Maine, I pressed my canoe against a low wall of alder sticks, aquatic plants and bog mud, and rested from a day of beaver-watching. Suddenly I was startled by short, loud, slapping sounds; the canoe rocked gently as wave rings lapped at its sides. I realized that the wall-like barrier against which I rested was a beaver dam. I saw dome-like mounds which were beaver houses, and knew that the strange sounds exploding the forest twilight were beaver alarm signals. The animals were slapping their broad, flat tails on the surface, then plunging below it. The sounds grew more rapid. Members of the colony were coming out for a night of feasting on aquatic plants, teaching the young of the year, and perhaps felling and cutting a few trees for building or patching. They had sensed my presence, but were unable to locate me. Quietly I paddled away, happy with my discovery that the beaver, rising slowly but steadily from near-extinction, was back again in great numbers in Maine.

Only the beaver has been so closely associated with—and instrumental in—the development of New England. Its pelt was the unit of trade between the colonies and the Indians; colonists shipped thousands of beaver skins to England annually, for they were accepted instead of gold in payment of debts. To the Indians the beaver was the staff of life. They used its flesh for food, its fur for clothing, bed coverings, hangings in the wigwams and as gifts. Castoreum, a secretion from the beaver's specialized scent glands, was considered a remedy for earache, deafness, headache, loss of memory and insanity. The skins were a medium of exchange and the principal article of wealth.

Excessive killing of the animals caused scarcity, and although some efforts were made to protect the dwindling numbers of beaver in Maine as far back as 1866, law enforcement was not effective until 1928. Even then the beaver population remained dangerously low. Poaching and secret selling of the pelts prevented any noticeable rise in numbers. It was then generally feared that the species was headed for extinction in the State.

Commissioner of the Department of Inland Fisheries and Game George J. Stobie was the first to organize a full-time, uniformed and well-trained warden force to protect Maine's beavers. When the beaver population increased under his two-fisted protection, he planned, launched and supervised a long-range management program that continued after his retirement several years ago. Now the beaver is back in the State in numbers almost as great as those of pioneer days. The mammals add substantially to Maine's economy, but are so numerous that in many settled sections they have come to be re-

Maine Department of Inland Fisheries and Game

Sometimes beavers make home in streambank and build house above. Branches seen above water show winter feed-bed.

garded by some people as a "nuisance."

Beaver trapping is legal in Maine in January and February; in 1964 it was permitted state-wide. The rich brown-black pelts of the Maine beaver are always in demand because of their size, color and quality, and even on a low market beaver skin brings a good price. Very large skins, called "super blankets," bring at least $80 each.

Trees are, of course, the main "tool" of the beaver. Maine beavers use all available hardwoods, and at one time or another cut almost every species of softwood; white cedar, hemlock, black spruce, red spruce, white pine, pitch pine, balsam and tamarack. Poplar is the preferred wood, and the presence of this tree has much to do with the distribution and location of beaver colonies. Other trees occur in the beaver's diet in relation to their availability. The alder, always found near the water, is used in large amounts but mostly as material for construction of dams and houses. Although the leaves of the alder are eaten the bark is very seldom used. Aquatic plants are the principal summer food, and little tree-cutting is done until early fall, unless new houses or dams are constructed.

Non-Conforming Beavers

According to surveys, beavers limit their land travels for food to about 100 yards on either side of "their" streams. In one rare instance, however, I found a place where beavers had traveled some 250 yards over a sprawling open bog of tall swale grass, brush, and islands of alder and red maple. They were determined to cut red oak, poplar and even elm at the base of high land.

Beavers are efficient dam-builders; their creations vary in size from a small accumulation of sticks to a structure ten feet high and several hundred feet long. Unpeeled alder is invariably the principal building material, while whitewood (poplar gnawed clean of bark), aquatic plants, and mud and rocks—some up to ten pounds—are also used. Old dams are frequently strengthened by the alders that grow up through them, along with certain aquatic plants. One dam in the northern part of Maine, examined by a warden and a biologist of the Fish and Game Department, had a lumberjack's cant-hook wedged into it. On several occasions I have found canoe paddles, parts of old oars, and old axes in beaver dams.

Home is a hollowed-out mound of sticks and mud equipped with underwater entrances, a plunge platform, and a dry sleeping area. It may vary from the extreme size of forty feet in length and twenty feet in width to a structure measuring nine by six feet. The average house is eighteen by ten feet on the outside, at water level. Most houses are four or five feet high above the water, but some may tower as high as nine

feet. The winter food supply of tree branches is stored close to the base of the lodges and sometimes almost completely surrounds them. When ice forms on the flowages, or beaver-reservoirs, the green twigs can often be seen protruding above the surface.

Life of the Beaver

A colony of beavers is a definite family group. If unmolested for three years or more, the group usually consists of an adult male and female, the young of the previous year (yearlings) and the young of the current year (kits). There is another, less clearly defined group: the two-year olds. In the spring and summer when the female is about to produce a new litter, the male leads his yearlings and kits on a journey. He returns with only the kits. The yearlings, which have just become two-year olds, seek mates and build their own dams and houses in another location. The long breeding period of the Maine beaver begins in mid-February and the young are born after a gestation period of about three months. Litter sizes vary from two to seven; the usual size is four. There is no evidence that the beaver produces more than one litter a year.

Beaver predation is extremely light on both land and water, and the only real drain on population is made by human trappers. In "nuisance areas" where beavers are flooding roads and highways and plugging culverts with dams; flooding or felling wanted timber, or washing out cultivated land, wardens and game biologists live-trap and transport the animals unhurt to suitable remote wooded areas. Such distribution is part of the State's extensive management program, which includes a constant check on habitat carrying capacity.

Dynamiting nuisance dams and such experimental repellants as lighted lanterns, mothballs, and burning sulphur in pans placed on the ruins have no effect on the bold and busy animals. They push all contraptions overboard and the dams are quickly repaired tighter than ever, again and again; and the animals stubbornly remain as long as a substantial supply of food remains.

While in some areas considerable damage is done in valuable timber stands, much of the wood taken by beavers has little or no commercial value. Even timber companies—which own well over half of Maine's 17 million forested acres—feel that despite their tree-gnawing ways beavers are an important natural resource in the State and should be perpetuated. Beavers stabilize water levels on streams and rivers, thus conducting their own soil and water conservation programs. States without a natural supply of beaver live-trap the animals and parachute them into suitable habitat to conduct such "programs."

Maine timberland owners are particularly grateful to the beaver when, during long periods of drought when forest fires rage, beaver flowages often are the only sources of sorely needed water for the Indian pumps and hoses.

Farmers, whose fields are frequently enriched by the soil left on the land after flowages have been abandoned and drained, also are grateful.

Animal Interrelationships

The beaver is also beneficial to other species of wildlife. The thousands of flowages throughout the State provide excellent nesting and resting areas for Maine's most important species of waterfowl, the black duck. This is especially important in these days of numerous powerboats, which disturb the flocks and ruin much natural food on the lakes and ponds. Beaver flowages provide excellent protection for the ducks from all natural enemies—and to some extent from hunters—and an abundance of food. The flowages help maintain a relatively constant water level, important during the nesting period. Other species of ducks that make extensive use of the flowages in the fall as well as during spring and summer include ring-necks, wood ducks, teal, golden-eyes and hooded mergansers. Surveys have revealed that increases in waterfowl numbers coincide with beaver increases.

Beaver flowages also create desirable habitat for the muskrat. Older flowages provide considerable food for this furbearer, and the constant water-level prevents the little animals from being flooded out, or frozen in as the result of a sudden drop in water level during the winter. Muskrats get along very well with beavers, and even share houses with them.

Otters frequently use "dead" flowages in the winter if they hold sufficient water to prevent freezing to the bottom; live flowages are also used occasionally. The old story that otters kill beaver—especially kits—cannot be substantiated, so far as this writer has been able to ascertain.

The wandering mink finds many of his preferred foods in abundance at the flowages; so does the night-roving raccoon. Field mice and other small mammals are attracted by the grassy areas where water levels recede; these animals in turn attract the red fox. The snowshoe rabbit and ruffed grouse are also found at flowages, while the weasel and great horned owl are frequent visitors. Moose, now making a strong comeback in Maine, are often found at flowages feeding on the leaves and roots of aquatic plants and wading in to escape flies. Whitetail deer, black bear, and the migrant woodcock are also attracted to—and benefit from—beaver flowages.

Relations With the Trout

The controversial subject of beaver-trout relations needs more study. While some dams prevent passage of trout and salmon to cold-water lakes and ponds, the beaver still helps these fishes, especially trout. Beaver dams prevent passage of non-jumping fish species that prey upon young trout and salmon in the nursery areas. The great flowages also provide havens for trout when the streams are lowered by drought. Large amounts of food and favorable conditions at beaver flowages —even those well over ten years old—support populations of large, healthy trout. There seems to be no evidence to support the belief, held by some, that the presence of an old flowage causes a change in the water chemistry of a stream.

The beaver has finally come back to Maine in great numbers, and is proving its importance both in the ecology of the wild and in the economy of man. ■

Mr. Geagan, a resident of Bangor, Maine, has long been active in the field of conservation education. He is also a prolific writer on nature and the outdoor way of life.

Photograph by the author

Historic Fort Ross, on the California coast above San Francisco, a former Russian trading-post.

FORT ROSS

By Mary Castagna

NOT FAR FROM THE TOWN OF JENner, which is at the mouth of the Russian River on the California coast about two and a half hours by car north of San Francisco, stands Fort Ross, where Czarist Russia's dream of an American empire fizzled out about the middle of the nineteenth century. On August 18, 1962, the historic fort was declared eligible for registration by the National Park Service as a national historic landmark.

The August date was selected because it was believed to be the 150th anniversary of the original dedication of the fort in 1812 by Muscovite fur-hunters from Alaska. The Russians had hoped that the fort would provide the answer to the problem of supplying food to their starving "base of operations" at Sitka, Alaska. But, in defiance of the weak Spanish trade laws prohibiting Spanish Californians from doing business with any power other than Mexico and the mother country, Fort Ross also became a fur-trading center during its brief—and very successful—existence. Herds of sea otter were plentiful along the rocky shores north of the Golden Gate and the Russians, with the help of Aleut Indian experts, made rich hauls. Some of the pelts were traded for the foodstuffs needed so badly by comrades at Sitka.

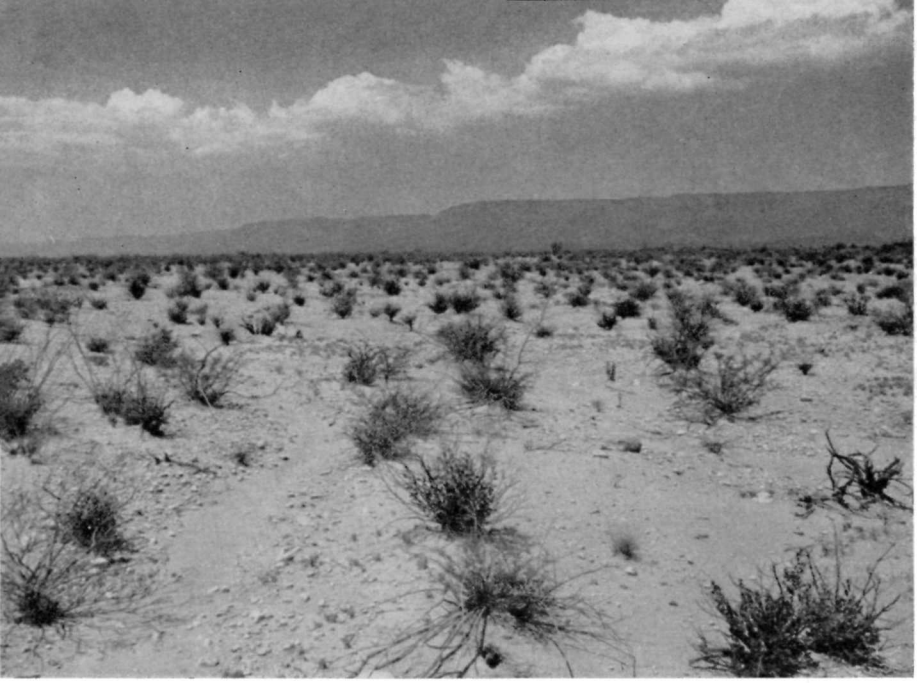
From Santa Rosa on U.S. 101 State Route 12 leads to the heart of the Russian River county in the southern section of the California coast redwood country. At Guerneville the sparkling river offers swimming, boating and fishing; and only two miles farther north is Armstrong Redwoods State Park, where dimly-lit trails lead one among the tall, silent sequoias and the beautiful ferns of the ground-cover.

The Fort lies to the northwest. Traveling west from Guerneville toward the windswept coastal town of Jenner the highway winds again, in and out, through more stands of majestic redwoods. From Jenner, where the Russian River empties into the Pacific, State Route 1 passes high above the irregular shoreline and finally reaches Fort Ross.

At one time this trading-post contained fifty-nine buildings, nine of which were inside the stockade. Now only a handful of these remain—but they are still worth a trip to see. The post was built in the form of a quadrangle about 300 feet square, enclosed by a redwood stockade with two blockhouses at opposite corners (formerly well-fortified with cannon.) In 1906, when the post became a State historical monument, the remaining structures were restored; stockade, Commandant's quarters (now a museum), and the Russian Greek Orthodox chapel, oldest of its kind in the United States outside of Alaska.

One might wonder why the Russians abandoned their claim, however ill-founded it might have been. But nature had suffered depletion. The great annual slaughter of fur-bearing animals had greatly reduced both numbers and catch; and finally the Russians withdrew to Alaska. John Sutter, of Mother Lode gold fame, helped the Russians to his own advantage by purchasing the fort's improvements and supplies. The terms of the bargain emphasized the desperate needs of the Russian Alaskan post. Sutter was to supply the Russians at Sitka with a shipload of food every year for four years; and each year the Russians sent a ship south.

After Sutter's death the post grounds fell into disrepair. But after acquisition by the State restoration commenced, and now as a national historic landmark, the site has become a permanent monument commemorating a little-known claim to California. ■



Shrub Desert Formation at the base of the Guadalupe Mountains near Carlsbad Caverns National Park, New Mexico. Tarbush and creosotebush are the principal species here; they are one to three feet tall. A small arroyo is beginning to form in center foreground.

Plant Formations in the Natural History Interpretation of Southwestern Desert Regions

By Frederick R. Gehlbach

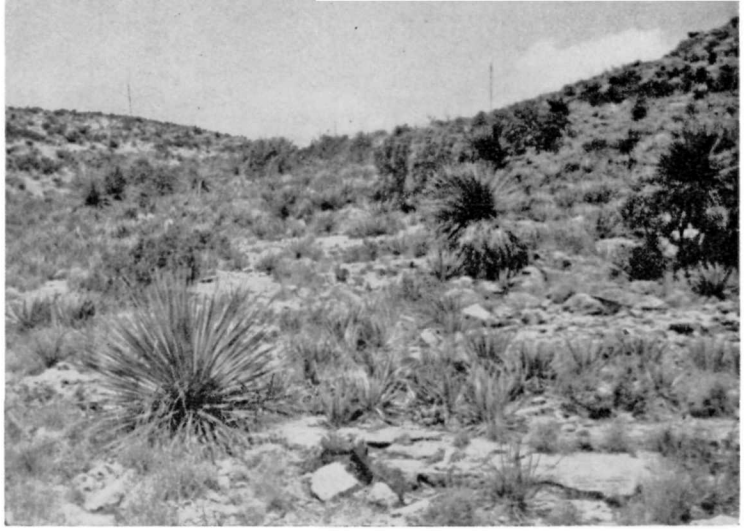
Recently a national park service biologist asked me about the nature of the Chihuahuan Desert. When I replied that it was neither a geographic region nor a life zone, or part of a life zone, he seemed amazed. I said that I believed this distinctive desert was a plant formation, or it could be called a biome if plants and animals are considered together. It is dominated by shrubby leaf-succulent or semi-succulent species like lechuguilla and narrowleaf sotol, and it occupies dry, rocky hillsides in western Texas, southern New Mexico, and northern Mexico. Furthermore, various other shrubs such as slimleaf goldeneye and oneseed juniper may occur within the Chihuahuan Desert Formation.

"This desert is certainly not a geographic region," I observed, "for one may see another, very different kind of desert dominated by small-leaved shrubs—for example, creosotebush and tarbush—in the lowlands of the same States and Mexico." Moreover, creosotebush and associated, non-succulent shrubs like bursage range westward through southern Arizona and California, whereas lechuguilla and narrowleaf sotol do not. Thus, the Chihuahuan Desert is confined to a small portion of the Southwest, while the small-leaf shrub assemblage or Shrub Desert Formation is more widespread. Equating a biota like the Chihuahuan Desert Formation with a geographic area has caused confusion in the past when, in reality, this biota lends distinctiveness to an area that also contains other desert vegetation.

A Concept Contradicted

"But what about the life-zone concept?" the Park Service biologist asked. He had just returned from the Bowl, a limber pine-Douglas fir forest in the proposed Guadalupe Mountains National Park, so I inquired what he had seen on the exposed slopes above the Bowl. He replied, "narrowleaf sotol, and similar desert plants—according to the life-zone concept, this just can't be!" Well, I could not blame him for being surprised, for I had thought the same thing when I first saw the desert shrubs, lechuguilla and slim-leaf goldeneye, blooming near Douglas fir, Arizona cypress, and similar large trees at 6500 feet in Boot Canyon in the Chisos Mountains of Big Bend National Park. And I knew what he would say about the Bowl area, for I had studied it, too.

"You see," I said, "while there is a general increase in moisture and a similar increase in plant size and the number of trees as one ascends a southwestern mountain, this overall picture is punctured by canyons, rock outcrops, southern exposures, and other environmental factors that destroy the 'layer cake' idea of life zones." Trees simply cannot grow successfully on steep, south-facing, bare rock slopes like those above the Bowl, because the general environment is dry, even though there is adequate precipitation. Snow melts and water quickly runs off or is evaporated by the strong mountain winds. The sun shines more intensively on south-facing slopes and ground temperatures are relatively high. Thus, the life-zone concept gives an erroneous impression of such a complex southwestern environment, whereas the plant formation concept



At left, Chihuahuan Desert Formation in Walnut Canyon, Carlsbad Caverns National Park, New Mexico, Narrowleaf sotol is the large shrub, about three feet tall; lechuguilla is the smaller shrub, about one foot in height in this area of limestone outcrops and steep slopes. At right, Evergreen Woodland formation in McKittrick Canyon of proposed Guadalupe Mountains National Park, Texas. Larger trees are alligator junipers, smaller ones primarily gray oaks in interior view showing the considerable open space and grass cover between dominant species.

does not, since the environmental positions of species are not predetermined for any natural area by plant formations. In other words, you cannot expect to find trees above desert shrubs in all situations, and there is no reason why you should!"

There are eleven different plant formations in "hot desert" regions of the Southwest (see accompanying outline, page 18.) I have mentioned one of the most unusual—the Chihuahuan Desert—but the Sonoran Desert is equally distinctive in characterizing a single geographic region. Its dominant species are trees like saguaro and foothill paloverde together with such shrubs as cholla and brittle-bush. Sonoran and Chihuahuan Deserts occupy similar environmental positions—foothill and bajada slopes—in their respective regions but are dominated by very different plant forms—stem-succulent cacti either of tree or shrub size on the one hand, and leaf-succulent or semi-succulent shrubs on the other. Whether a shrub or tree is succulent, evergreen, deciduous, small or large-leaved—indeed, whether trees and shrubs are dominant at all—makes the difference in describing plant formations. Formations are as easy to recognize as wildflowers, because their dominants are the largest, most numerous, and most widespread species within them.

Let us take a look at one specific area, the north side of the Chisos Mountains in Big Bend National Park, to better understand the dynamics of plant formations. As one drives from the Grapevine Hills through Green Gulch up into the Basin, he encounters two shrub-dominated desert formations and the tree-dominated Evergreen Woodland Formation. The landscape is a continuum of vegetation, however, not a clear replacement of one plant formation by another, because of the uniqueness of species. The observant traveler notes that individual plant species have distinctly different centers of abundance and different distributions. It is the degree of coincidence of a few abundant species of the same or similar structure in a given environment that determines the presence of a plant formation. (See accompanying table, page 17).

At the base of the Grapevine Hills, the Shrub Desert Formation occurs on lowland silty soil and is composed primarily of creosotebush and Christmas cactus. Whitethorn acacia and lechuguilla are present in considerable numbers. Near the Basin Junction lechuguilla, slimleaf goldeneye, and narrowleaf sotol become dominant; this is the Chihuahuan Desert Formation and the soil is much rockier here.

ABUNDANCE OF IMPORTANT PLANTS IN STUDY PLOTS ALONG THE ROAD BETWEEN THE GRAPEVINE HILLS AND BASIN IN BIG BEND NATIONAL PARK, TEXAS

	PLANT FORMATIONS					
	Desert Shrub 3200-3500 feet		Chihuahuan Desert 3800-4400 feet		Evergreen Woodland 5100-6200 feet	
Creosotebush	44	49	—	—	—	—
Christmas cactus	11	27	—	—	—	—
Whitethorn acacia	10	4	3	—	—	—
Long-spine pricklypear	3	1	2	3	—	—
Lechuguilla	14	15	43	35	—	—
Slimleaf goldeneye	—	2	19	18	14	—
Engelmann pricklypear	—	5	6	1	13	—
Narrowleaf sotol	—	—	13	19	6	—
Foothill basketgrass	—	—	—	3	8	—
Oneseed juniper	—	—	—	6	7	2
Mexican pinyon	—	—	—	—	30	21
Gray oak	—	—	—	—	10	5
Emory oak	—	—	—	—	2	4
Alligator juniper	—	—	—	—	—	19

A few Shrub Desert species are still found—long-spine pricklypear for example—and a few Evergreen Woodland species like foothill basketgrass appear. Then, near the head of Green Gulch, one enters typical Evergreen Woodland with its Mexican pinyon, gray and Emory oaks, and alligator juniper—even though slimleaf goldeneye and narrowleaf sotol continue to suggest the desert influence.

The trail from the Basin up to Emory Peak is through Evergreen Woodland, and one can see again how the internal composition of a plant formation changes along an environmental gradient. Mexican pinyon becomes increasingly abundant, while gray and Emory oaks decrease and are replaced by Graves oak, a deciduous species found sparingly around the Basin. The evergreen nature of the woodland is maintained, however, by the pinyons and alligator juniper as we arrive at Boot Canyon. Along Boot Canyon creek we find the Deciduous Woodland Formation in which Graves oak is the single most important species and big-tooth maple, another deciduous tree, is also dominant. Woodland—we can verify—is always dominated by trees in contrast to desert, always dominated by shrubs; but woodland has a distinctly different appearance when composed of large-leaf, deciduous species.

Arizona cypress, Douglas fir, and a few ponderosa pines are present in Boot Canyon but not in sufficient abundance to form the Coniferous Forest Formation. Perhaps coniferous forest was present at some time in the past, when the Big Bend climate was much wetter, but today Mexican pinyon and alligator juniper are increasing in numbers at the expense of the larger forest species. Around us in the canyon bottom and along the trail to Juniper Canyon seedling pinyons are everywhere. Young cypress and fir can be found, too, but not in such abundance as the pinyon or alligator juniper seedlings. Thus, we are drawn to the inescapable conclusion that plant formations and species distributions vary not only in space—as in the Chisos Mountains—but in time as well. ■

Plant Formations of Southwestern Desert Regions

Shrub Desert—a small-leaf, shrub dominated assemblage in which creosotebush is the most important species and tarbush or bursage are coindicators along with whitethorn acacia, mariola, etc.

Chihuahuan Desert—a leaf-succulent and semi-succulent, shrub-dominated assemblage limited to western Texas, southern New Mexico, and northern Mexico, east of the Continental Divide. Chief indicators are lechuguilla, narrowleaf sotol; but slim-leaf goldeneye, oneseed juniper and others are locally important.

Sonoran Desert—a stem-succulent, tree and shrub-dominated assemblage limited to southern Arizona, adjacent California and northern Mexico west of the Continental Divide. Chief indicators are saguaro and cholla cacti, foothill paloverde, and brittlebush.

Desert Grassland—a short bunchgrass-dominated assemblage in which the species are usually less than two feet in height. Tobosa, black grama, and fluffgrass are important indicators, and there is much open ground.

Plains Grassland—a short grass-dominated assemblage in which indicators such as galleta and blue grama may form a continuous, almost uninterrupted ground cover.

Mountain Grassland—a tall bunchgrass-dominated assemblage with species like bullgrass, mountain muhly, and pinyon ricegrass averaging more than 2 feet in height.

Chaparral—a large-leaf, evergreen, shrub-dominated assemblage that is thick and nearly impenetrable in places. Manzanita, buckbrush, mountain mahogany, and scrub oak are important indicators.

Evergreen Woodland—a small-leaf and large-leaf, evergreen, tree-dominated assemblage with species averaging less than 15 feet high and with an open canopy. Alligator juniper, Mexican pinyon, gray oak, and Emory oak are important indicators.

Deciduous Woodland—a large-leaf, deciduous, tree-dominated assemblage with an open or closed canopy of both tall and short species. Netleaf hackberry, velvet ash, southwestern sycamore, and various cottonwoods, walnuts, and willows are primary indicators, although there are many others.

Coniferous Forest—a small-leaf, evergreen, tree-dominated assemblage in which species average more than 15 feet tall and form a closed canopy. Ponderosa pine, Douglas fir, limber pine, and white fir are important indicators.

Alpine Tundra—a dwarf, meadow-dominated assemblage in which species are less than one foot tall. Found only at elevations greater than 11,000 feet and dominated by distinctive species of grasses, sedges, rushes, and herbs.

Common and Scientific Names of Southwestern Plants Mentioned in Text

Alligator juniper—*Juniperus deppeana*
Arizona cypress—*Cupressus arizonica*
Bigtooth maple—*Acer grandidentatum*
Black grama—*Bouteloua eriopoda*
Blue grama—*Bouteloua gracilis*
Brittlebush—*Encelia farinosa*
Buckbrush—*Ceanothus greggi*
Bullgrass—*Muhlenbergia emersleyi*
Bursage—*Franseria dumosa*
Cholla—*Opuntia bigelovi, O. fulgida*
Christmas cactus—*Opuntia leptocaulis*
Cottonwood—*Populus spp.*
Creosotebush—*Larrea tridentata*
Douglas fir—*Pseudotsuga menziesii*
Emory oak—*Quercus emoryi*
Engelmann pricklypear—*Opuntia engelmannii*
Fluffgrass—*Tridens pulchellus*
Foothill basketgrass—*Nolina erumpens*
Foothill paloverde—*Cercidium microphyllum*
Galleta—*Hilaria jamesii*
Grasses—*Festuca, Poa, Phleum, Trisetum spp.*
Graves oak—*Quercus gravesii*
Gray oak—*Quercus grisea*
Herbs—*Geum, Silene, Potentilla spp.*
Lechuguilla—*Agave lechuguilla*
Limber pine—*Pinus flexilis*
Long-spine pricklypear—*Opuntia macrocentra*
Manzanita—*Arctostaphylos spp.*
Mariola—*Parthenium incanum*
Mexican pinyon—*Pinus cembroides*
Mountain mahogany—*Cercocarpus montanus*
Mountain muhly—*Muhlenbergia montana*
Narrowleaf sotol—*Dasylirion leiophyllum*
Netleaf hackberry—*Celtis reticulata*
Oneseed juniper—*Juniperus monosperma*
Pinyon ricegrass—*Piptochaetium fimbriatum*
Ponderosa pine—*Pinus ponderosa*
Rushes—*Juncus, Luzula spp.*
Saguaro—*Carnegiea gigantea*
Scrub oak—*Quercus turbinella*
Sedges—*Carex spp.*
Slimleaf goldeneye—*Viguiera stenoloba*
Southwestern sycamore—*Plantanus wrightii*
Tarbush—*Flourensia cernua*
Tobosa—*Hilaria mutica*
Velvet ash—*Fraxinus velutina*
Walnuts—*Juglans spp.*
Whitethorn acacia—*Acacia constricta*
White fir—*Abies concolor*
Willows—*Salix spp.*

News and Commentary

Environmental Pollution

During the first week of December in the year just past the United States Government Printing Office made available to the public a 290-page volume titled *Restoring the Quality of Our Environment.* With perhaps a touch of the poetic in the title, the printed report of a President's Science Advisory Committee panel on environmental pollution, rendered after fifteen months of study, deals most unpoetically with one of the somber facets of twentieth-century life: the pollution in many ways—some obvious, some subtle—of our natural habitat.

For the most part Americans are becoming somewhat familiar with pollutants like smog, severe concentrations of pesticides, debauched rivers, and the more unpleasant or annoying like. Pollution of this kind is thoroughly examined in the report of the panel and its sub-panels. For it, there are known, though often politically or socially unpalatable, remedies. But: "Pollution is not a single simple problem; rather it is a compound of thousands of problems about which we know too little to plan and act as adequately as we should." Who, aside from the specializing few, has given much thought to the long-term effect of massive chemical injections into our envelope of air? For example, "carbon dioxide is being added to the earth's atmosphere by the burning of coal, oil, and natural gas at the rate of 6 million tons a year. By the year 2000 there will be about 25 percent more carbon dioxide in our atmosphere than at present. This will modify the heat balance of the atmosphere to such an extent that marked changes in climate, not controllable through local or even national efforts, could occur." Perhaps the physical scientist might be tempted to infer that changes *must* occur, under the given circumstances; but the job of this report is essentially to warn rather than alarm, and so there follows ". . . it may be very important to find means of preventing and counteracting the changes, or to change our source of energy to one that produces less carbon dioxide."

Regarding the attitude Americans take toward their rivers, streams and lakes—also, indeed, toward the oceans that border their continent—the panel has this to say:

"Water pollution control decisions should not be based entirely on health considerations. Present water treatment practices, if vigorously applied, appear adequate to permit our use of almost all waters for domestic purposes . . . Management of water pollution should, therefore, be based on other uses we wish to make of our waters. Polluted waters deny us important esthetic and recreational uses such as swimming, fishing, and boating; may result in bacterially or virus contaminated shellfish and ill-flavored fish; cause destruction of fish and other wildlife; may even lose their natural capacity to dispose of wastes . . ."

One of the generalized findings of the panel was, that no citizen, industry or municipality any longer has the "right" to pollute the environment, a finding that leads directly into a matter about which conservationists will surely hear more in future. Put crudely, it seems quite likely that environmental pollution could be made to diminish by tying it directly to the polluters' wallets. If one pollutes, one pays. ". . . We must rely upon economic incentives to make it natural for each pollutor and for each employee of a pollutor to work toward diminishing their pollution," says the panel. "Incentive systems in which all pollutors would be subject to 'effluent charges' . . . would . . . provide such incentives." These incentives, practically unknown in America, have worked very well in foreign lands; for an example, see the adjacent box.

Restoring the Quality of Our Environment is, indeed, a living document; better, perhaps, a document by which we shall have to live, come soon or late. It is a report that the interested conservationist might secure, lend to a friend, and that friend to another; it is not a volume that may safely be laid aside to gather dust.

The report may be obtained from the superintendent of Documents, Washington, D.C. 20240. It is priced at $1.25, postpaid.

Powerful Incentive

"One answer to pollution is a scheme that has proved successful in the Ruhr. Flowing through West Germany's most concentrated industrial region, the river remains clear enough for swimming and boating within the shadow of smokestacks—all because of the *Ruhrverband,* a cooperative society of 250 municipalities and 2,200 industries along the river. The society gets results with a simple principle: he who pollutes the waters must pay the cost of purification. Carefully calculated assessments have enabled the *Verband* to build 102 purification plants since 1948, and encourage members to clean up their own wastes. The Ruhr's steel industry has installed water-circulation systems in its plants to use the same water over and over again. As a result, the plants now draw only 2.6 cubic yards of water for the production of one ton of steel, compared with the 130 cubic yards they used in the past."

—From the article "Hydrology" in TIME *for October 1, 1965, Vol. 86, No. 14.*

Wilderness and the Condor

The first area in the United States to be recommended to Congress for inclusion in the national wilderness system authorized by the Wilderness Act of 1964 may well be the 74,900-acre San Rafael Primitive Area in the Los Padres National Forest of California, widely known as the home of the rare California condor. Present Forest Service plans look toward reclassification of the primitive area to wilderness area status, with an increase in size to 110,403 acres. Conservationists have heartily supported the Forest Service in its contemplated action. Carl W. Buchheister, president of the National Audubon Society, has suggested that enlargement of the proposed wilderness might go a step farther to include the entire upper watershed of the Sisquoc River as well as Big Pine Mountain in the Los Padres Forest to safeguard important flyway and roosting areas used by the California condor, a bird whose continued existence is currently fully as questionable as that of the better-known and better-publicized whooping crane.

"We would point out," said President

(Continued on page 20)

Word of Appreciation

Conservationists should be just as ready with praise for good work on the part of public agencies and public servants as they are with criticism for questionable acts or policies. Congratulations to the Forest Service and its Chief, Mr. Edward P. Cliff, seem quite in order in the matter of the Service's proposal to reclassify and enlarge the San Rafael Primitive Area into a San Rafael Wilderness Area. Readers wishing to express themselves may write Mr. Cliff, addressing him as Chief of the United States Forest Service, Department of Agriculture Building, Washington, D.C. 20240.

Buchheister at November, 1965, hearings on the reclassification matter, "that this larger area is but a part of the remaining Los Padres National Forest still in wilderness condition today, and potentially important to the California condor in the future as its numbers increase . . . our goal in condor conservation must be to increase the population of the bird *until it can be counted in the hundreds*; not merely to preserve the precarious status quo."

Thoughtful conservationists will feel, no doubt, that continuation of the California condor as a viable native animal species fits very well into the over-all concept of multiple-use of natural resources, and that the Forest Service should be given all possible encouragement to continue and expand its already praiseworthy efforts in behalf of the California condor in its sole remaining habitat—the Los Padres National Forest.

New Hawaiian Park?

Very recently released by the National Park Service is a report on a proposed *97,000-acre Kauai National Park on the* Island of Kauai in the Hawaiian Archipelago. The report, which NPA has not as of this date (late November) examined in detail, indicates enthusiasm for the area both on the part of the Park Service and the Secretary of the Interior, Mr. Udall. Park Service officials have stated that the proposed terrain, of great beauty, meets the highest standards for national park status; while the Interior Secretary had the following to say:

"I consider this one of the most important and significant areas proposed for addition to the national park system during the nearly five years that I have been Secretary of the Interior. It is one of the crown jewels of the Islands, and *would be a superb addition to the na*tional park system. It has been spectacularly endowed by nature with a magnificent coastline, hardly touched by civilization; strange swamplands in an unusually high location; two coral beaches, one arid and one endowed with lush vegetation; deep, colorful lava valleys; invaluable remnants of ancient Hawaiian civiliza-

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Inter-American Conference on Renewable Natural Resources

On October 18-22, a number of ministers and other persons concerned with conservation of natural resources, representing member states of the Organiza tion of American States, convened in Mar del Plata, Argentina, to consider the progress, or lack of progress, in the conservation of the Western Hemisphere's renewable natural resources; more specifically, the progress that has been made toward establishment of national parks and similar natural preservations in North and South America. Representing the United States were Interior Secretary Stewart L. Udall; Dr. Stanley A. Cain, Assistant Secretary of the Interior for Fish and Wildlife and Parks; Mr. Quentin R. Bates, Agricultural Attaché of the American Embassy in Buenos Aires; Mr. David Carley of Madison, Wisconsin; Mr. C. Gordon Fredine and Mr. Luis A. Gastellum of the National Park Service; Mr. Samuel E. Jorgensen of the Bureau of Sport Fisheries and Wildlife; Mr. Hamilton K. Pyles, Deputy Chief of the Forest Service; and Mr. George H. Thigpen of the Office of Inter-American Political Affairs, State Department.

After careful consideration of the problems relating to renewable natural resources in the Western Hemisphere, the Conference recommended seven principles for consideration by respective governments and the Organization of American States. These were:

In late October, 1965, representatives from member states of the Organization of American States gathered in Mar del Plata, Argentina, to consider the renewable natural resources of the Western Hemisphere and the progress that has been made in conserving them.

Photograph courtesy Information Service, Argentine Ministry of Agriculture

That the renewable natural resources of these nations are a fountain of social, economic, and spiritual strength that must not be wasted or impaired and should be steadfastly preserved and managed for the benefit of all men.

That many of the recommendations *approved at congresses, conferences and* numerous scientific meetings have not been carried out, even though there is an awareness of the importance of conserving renewable natural resources . . .

That it is well known that any manifestation of development affects the natural environment and therefore, it is necessary, in the planning stage, to evaluate—in their scientific and technological value—the scope of any changes that might take place.

The renewable natural resources form a bioecologic complex and, consequently, the utilization of any of the components or actions affecting them should take into consideration the aggregate of such resources even when dealing with the use of a single animal or plant species, in order to maintain a biological balance.

That in a constantly changing world it is the duty of mankind to preserve natural areas in the form of national parks or similar reserves, in order to facilitate the preparation of scientific and economic studies as well as for the spiritual enjoyment of the people.

That even though the financial aspect is indispensable for the application of a sound policy of development of renewable natural resources, it is possible to initiate most of these activities with the actually available means and with the collaboration of governments and users.

That the common goal of the member states of the Organization of American States is to unite their peoples in mutual understanding and in cooperative programs of joint and concerted action to accomplish these objectives.

tion; varied recreational opportunities; and species of birds and other wild creatures that can be found nowhere else."

The Secretary noted that the Park Service will have definite proposals for the park very soon. Of special interest to preservationists will be the recommendations of a group of citizen advisers, which have considered the problems of water rights, hunting, fishing, fruit and berry picking, military and space installations, grazing, existing parks, and mountain cabins. The Magazine will detail the proposed park more definitively in an early issue.

Marine Laboratory Dedicated

November, 1965, brought the dedication of the Bureau of Commercial Fisheries' new Tropical Atlantic Biological Laboratory on Rickenbacker Causeway in Biscayne Bay near Miami, Florida. Dedicated at the same time was the nearby Virginia Key Campus of the Institute of Marine Science, University of Miami. The Bureau has indicated that the new Laboratory is the culminating point of years of planning for establishment of a laboratory devoted to study of fishery-oceanography in the tropical Atlantic.

Outdoor Recreation Grants

First grants to States under the Land and Water Conservation Fund will go to Connecticut, Missouri, Nebraska, New Hampshire, New York, Oregon and Rhode Island for 22 separate outdoor recreational projects, the Bureau of Outdoor Recreation says. Total amount involved is more than one and a quarter million dollars. Included among the projects are Atlantic and Pacific coast seashore areas; overnight camping facilities; boating, swimming and fishing projects; and, city-wise, day-use areas for bicycling, hiking, picnicking, sports activities and nature study. As of November 15, twenty-two States had submitted statewide outdoor recreation plans to the Bureau for approval; all State plans were due to be in the hands of the Bureau by the end of 1965.

Advisory Board Recommends

Early October brought forth four recommendations for new national park system areas from the Advisory Board on National Parks, Historic Sites, Buildings and Monuments at a regular meeting in Washington, D.C., and Harpers Ferry, West Virginia. These were: a Voyageurs National Park of some 166,000 acres in northern Minnesota (including about 60,000 acres of lakes); the Saint Croix National Scenic Riverway on the Saint Croix River, which forms the boundary between Minnesota and Wisconsin for many miles, and for which a controversial power project was scheduled not many months ago; the George Rogers Clark National Historical Park, in Vincennes, Indiana, to include the State's present George Rogers Clark Memorial and a number of other historic sites in the vicinity; and finally, the Board expressed concurrence in the designation of the Pennsylvania Avenue National Historic Site in Washington, D.C., by Interior Secretary Udall, with the approval of the President.

Assateague Gets Superintendent

Mr. Bertram C. Roberts, most recently superintendent of the Castillo de San Marcos in Saint Augustine, Florida, has been named as superintendent of newly created Assateague Island National Seashore off the Delmarva Peninsula of Maryland and Virginia. Temporary headquarters for the new seashore will be at Snow Hill, Maryland. Park Service Director George B. Hartzog, Jr., has indicated that a realty officer will also be named soon to assist in getting on with the job of land acquisition on Assateague Island.

Reprieve for Redwoods Parks

NPA has learned that the California State Highway Commission recently passed a resolution which will eliminate plans for freeway construction through Prairie Creek Redwoods State Park in northern Humboldt County on the California coast. The resolution will also place afoot a study of an alternative route to the one officially adopted two years ago for freeway construction through a mile of the National Tribute Grove of redwoods in Jedediah Smith Redwoods State Park, in adjacent Del Norte County. While Governor Edmund G. Brown of California has not possessed legal authority to bring about such a change in Highway Commission thinking, many conservationists feel that his powers of persuasion may have been exerted to the fullest extent in the matter, and that much credit is due the Governor for his intense interest in the redwoods parks freeway construction problem.

Jedediah Smith Park road construction plans were moving into the land-acquisition stage as early as last September (see article, page 21, *National Parks Magazine* for September, 1965) and actual construction had been tentatively scheduled for the summer of 1966.

African Wildlife Management

Interior Secretary Stewart L. Udall has announced that two conservation experts from his Department are to leave for Mweka, Tanzania, to join the faculty of the College of African Wildlife Management, the first persons from the United States to be selected for such an assignment. The instructors are W. Leslie Robinette of Westminster, Colorado, representing the Fish and Wildlife Service, and Vernon C. Gilbert, Jr., of Arlington, Virginia, an employee of the National Park Service. The two will remain at Mweka for at least 2 years.

Located on the slopes of Mont Kilimanjaro, the College of African Wildlife Management reflects efforts by several nations and conservation groups to assure preservation of East Africa's valuable animals and their habitat. Students are wildlife managers and park employees of East African nations. The college buildings and much of the land were provided by the Tanzanian Government. Supporting the college are the African Wildlife Leadership Foundation, the Frankfurt Zoological Society, the West German Government, Great Britain, the Rockfeller Foundation, the Old Dominion Foundation, the World Wildlife Fund, the Ford Foundation, and the United States through the Agency for International Development.

Endangered Species Report

Two native animals which have teetered on the verge of extinction show an encouraging increase in numbers, according to recent Bureau of Sport Fisheries and Wildlife surveys. Whooping cranes returning to the Arkansas National Wildlife Refuge on the Texas coast this fall number 44, two more than last year at about the same time, while total numbers of the trumpeter swan are now in the neighborhood of a thousand. The trumpeter's population was once less than a hundred birds—much less, according to some accounts. Now, thanks to valiant work at several Western wildlife refuges—in particular, the vast Red Rock Lakes Refuge in southwestern Montana's Centennial Range—the Fish and Wildlife Service has been able to remove the bird from its list of endangered native animal species. Largest of the world's waterfowl, the trumpeter swan attains weights of from 20 to 30 pounds, and an adult may have a wingspread of more than seven feet. The Bureau of Sport Fisheries and Wildlife points out that the primary breeding range of the trumpeter lies within a 60-mile radius of West Yellowstone, Montana. The Red Rock Lakes-Yellowstone population winters near the breeding grounds; principal winter range is the North Fork of the Snake River and its tributaries in northeast Idaho. Red Rock Lakes and Yellowstone National

(Continued on page 22)

Park also provide wintering habitat where warm springs keep waters open and food available in winter.

NPS Personnel Notes

In mid-November National Park Service Director George B. Hartzog, Jr., announced the retirement of Ronald F. Lee, director of the Service's Northeast Region, and the appointment of Lemuel A. Garrison to succeed him in the post. Mr. Lee's career with the Park Service has been a long and distinguished one, commencing in 1933 with his appointment as field historian at Shiloh National Military Park in Tennessee and including over the years the positions of chief historian for the National Park Service and assistant director of the Service. His many honors have included the 1952 Cornelius Amory Pugsley Medal for conservation activities; the Interior Department's Distinguished Service Award, in 1957; and the George McAneny Medal, in 1961, "for a preeminent career devoted to the furthering of conservation and historic preservation without stint of personal sacrifice."

Mr. Lee will have an able replacement in Mr. Garrison, more familiarly known to conservation folk both in and out of the Park Service as "Lon" Garrison, possessor of a long and distinguished career both in the field and in NPS Washington headquarters. Mr. Garrison was most recently director of the Midwest Region, after having been superintendent of Yellowstone National Park for ten years of thorny park policy decisions.

Pests and Pesticides

A public symposium on scientific aspects of pest control will be held in the State Department auditorium in Washington, D.C., January 31 to February 3, 1966, to review advances in pest control and in the understanding of its consequences for man and nature. The symposium has been organized by the National Academy of Sciences–National Research Council in cooperation with the Departments of Interior, Agriculture, Health Education, and Welfare, and other interested Federal agencies. Twenty-five authorities in the fields of agriculture, biology, chemistry, conservation, and public health will report progress in biological, chemical, genetic and special physical methods of pest control as well as in research on the ecological and environmental effects of these measures. Special evening sessions will deal with the broader implications of pest control for human health and well-being and for the development of public policy.

The public symposium is intended to provide for an exchange of informed views on problems encountered in balancing, on the one hand, the need to protect the nation's supply of food and fiber from pest damage, and on the other hand the maintainance of safeguards to human health and the preservation of a viable environment for plant and animal life. Of special interest to conservationists will be the session for Wednesday, February 2, when the symposium will consider the problems of persistence of pesticides in the environment, their metabolism and fate in plants and animals, biological enhancement of pesticides, and the evolution of resistance to pest-control measures in both hosts and pests.

Attendance at the symposium will be open to scientists from federal and state agencies, colleges and universities, and industrial organization, as well as conservation specialists, legislators, administrators, regulatory personnel, and interested laymen.

Pesticide Monitoring Program

Further on the subject of pests and pesticides: the Federal Committee on Pest Control, in a simultaneous release by the Departments of Interior, Agriculture, and Health, Education, and Welfare, has recently announced approval of a comprehensive program to monitor levels of pesticide residues in people, fish and wildlife, food and feed, soil, and water in the United States. The FCPC, which is an interagency group, reviews all pest control activities conducted by Federal departments or financed wholly or in part with Federal funds.

Objective of the monitoring program is to determine the extent to which pesticide residue levels exist in the United States and to detect the increases or decreases that may occur in the future. Data developed by the program will be made widely available through publication of summaries and by other means, the Committee has stated.

Wild Rivers Movie

During early summer the Humble Oil and Refining Company released a particularly fine film on a subject currently much in the minds of conservationists—the projected national wild rivers system. *Wild Rivers*, in full color and with commentary (the photographer was Larry Madison and the narrator, Burton J. Rowles) runs 28 minutes and looks at the scenic and outdoor recreational potentials of ten of the rivers, or parts of rivers, that have been mentioned for inclusion within the wild rivers system. The film is available on loan without charge, other than return postage, from Humble Oil, P.O. Box 2180, Houston, Texas 77001; or for persons or organizations strategically located, from Modern Talking Picture Service film libraries in 22 of the nation's cities.

Litterbugs Are Expensive

Keep America Beautiful, Inc., founded to educate Americans in the economics and esthetics of keeping their cities and countryside clean, recently reported that litter cleanup costs the American taxpayer $500 million each year. Street cleaning, highway litter removal and park, beach, waterway and recreational area cleanups all add to the bill, making a nationwide total of approximately one billion dollars a year to dispose of the trash left on public property by thoughtless individuals. The cost is so high because, according to Keep America Beautiful Inc., many citizens "feel no personal responsibility" for the appearance of their cities and countrysides. Increased travel, greater outdoor recreational facilities and increased leisure provide more opportunity for littering.

Since 1953 Keep America Beautiful Inc. has been working to preserve and improve the nation's urban and rural beauty. This year it published the results of its campaign: New York City is thirty percent cleaner than it was in 1955; Kentucky has had a $7 million rise in tourist spending since its anti-litter program; Maryland has been relieved of cluttered highways and 63 percent of its highway litter removal costs; and West Virginia reports that its cleanup efforts attracted 46 new industries to the State, providing jobs for 5000 workers.

Book Reviews

MAN, CULTURE, AND ANIMALS. Edited by Anthony Leeds & Andrew P. Vayda. American Association for the Advancement of Science, 1515 Massachusetts Ave., N.W., Washington, D.C. 312 pages. Price $8.00; Prepaid to AAAS members, $7.00.

All human society of past, present, and future—as far as science can now predict—has and will evolve with the active participation of the non-human members of each society. It is difficult to imagine the course of human history without including domesticated and non-domesticated animals; even our everyday lives would be radically changed if animals were suddenly removed from the scene. Although the human environment is closely affected by animals, little coordinated effort was made to categorize and fully explore the depths of the animals' contribution to the human world until the 128th annual meeting of the American Association for the Advancement of Science was held at Denver, Colorado, in December 1961. The symposium, which was entitled "The Role of Animals in Human Ecological Adjustments," arose from the need for information and study of the continuing relationships between man and animals in all parts of the world; the book *Man, Culture, and Animals* is based on that symposium. It includes the work of the original participants as well as additional work by anthropologists and geographers who had data to present relating to the theme of the study.

Man, Culture, and Animals encompasses a broad range of human activities, all of which turn around the need for and use of animals. The book deals with a variety of man-animal relationships, such as "Reindeer Herding and Chukchi Social Institutions," by Anthony Leeds of the Department of Anthropology at the University of Texas; "The Myth of the Sacred Cow" by Columbia University Department of Anthropology Professor Marvin Harris; and "The Euro-American Ranching Complex" by Arnold Strickon of the Department of Anthropology at Brandeis University. Most of the treatments of these relationships, however, are economic; the anthropologists tend to deal with the basics of survival and disregard the emotional necessities of life.

Anger directed toward the defense of helpless animals, rather than toward the animal itself, may have been a significant step in the humanization of homo sapiens. In any event affection and the other feelings and uses centered around animals have made an undeniable contribution to human culture and this enjoyable book—to be read by scientists and laymen alike—helps to understand and appreciate that contribution.

THE INLAND SEA. By Morton M. Hunt. Doubleday & Company Inc., Garden City, New York. 144 pages. $3.95.

When I was very young and very energetic, I spent many sun-filled days playing on the beaches and frolicking in the waters of Long Island Sound. I loved the taste of sand-grit in my teeth, the cold splash of waves on my bare legs. But more than this I loved the Sound for what it was: a conglomeration of wild, rushing rapids; miles of pink-white beaches; sturdy fishing villages; and miniature smokestacks dotting the shores. It is easy to remember that microcosm which is the Sound, for within its span of 250 miles it encompasses a cross-section of America. As Morton M. Hunt explains, "To see the world in a grain of sand is a more difficult feat than I care to attempt, but I *have* attempted here to see a good deal about modern America in that little Mediterranean Sea known as Long Island Sound." The "little Mediterranean" is delightfully described by Hunt as he makes a journey—which can also be called a pilgrimage—around the Sound to record its beauties before they are swallowed up by an irreversible trend toward overdevelopment that portends, unchecked, the scenic ruination of the entire Long Island Sound area. In the fifty years or so that the Sound has been a center for water and shore recreation, industrial development, subdivision, land speculation and commercial fishing have rapidly deteriorated the pristine environment which once was its trademark, almost to the status of floating slum. Few attempts have been made to preserve the beauty of some of the best remaining shores of the Sound, which stretches from New York's skyline to the quaint Mystic seaport in the heart of Connecticut. Some wealthy landowners have staked claims to the best portions of the shoreline in an attempt to stave off overcrowding and industrial development; but such private havens do little to ease the strain imposed by hordes of pleasure-seekers.

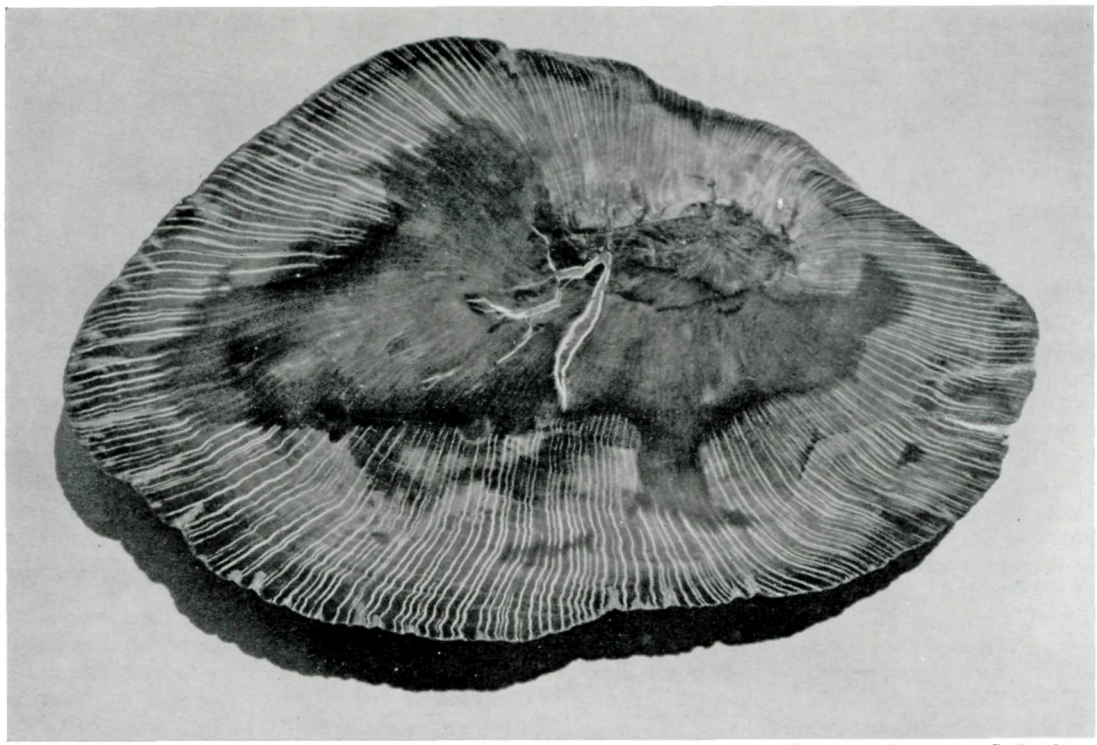
Hunt's *The Inland Sea* holds within its relatively narrow confines a great variety of human activities intermingled with the flavor of a wilderness grasping for survival. His little book is not so much a narrative of the Sound, but a beautifully written and almost poetic adventure—aboard a boat—between a man who loves the Sound and the Sound, which has hardly escaped any man.

GEOLOGY OF MOUNT RAINIER NATIONAL PARK, WASHINGTON. By R. S. Fiske, C. A. Hopson and A. C. Waters. Geological Survey Professional Paper 444. U. S. Government Printing Office, Washington, D.C. 1963. vi + 93 pages, illustrated, with maps. $1.75.

and

GLACIAL RECONNAISSANCE OF SEQUOIA NATIONAL PARK, CALIFORNIA. By François E. Matthes. Geological Survey Professional Paper 504-A. U. S. Government Printing Office, Washington, D.C. 1965. x + 58 pages. illustrated, with maps. $1.25.

Readers who may be geologists, either amateur or professional, or who have at least a strong penchant in the direction of the earth sciences and earth-history, will find most rewarding these two accounts of nature's shaping hands in two of our great national parks—Mount Rainier in Washington and Sequoia in California. The writing in the Geological Survey's Professional Papers has always been maintained at a high level of clarity and precision; it has never been intended as romantic. The Survey's professional papers deal with geological facts, hypotheses, and conclusions, not with natural beauty, though on occasion an author may allow admiration for a beautiful natural scene or a monumental natural work to flicker briefly through the printed page. The work on Sequoia Park's glaciology was prepared posthumously by Fritiof Fryxell from the notes of a geologist who will forever command the respect and admiration of co-workers in all parts of the world, the late François E. Matthes.



Photograph by Moulton B. Smith

Cross-section of agatized *Schilderia adamanica*, a tree of the Upper Jurassic of northeastern Arizona.

A LITTLE MORE THAN sixty years ago, a group of thoughtful citizens of Arizona Territory were working to prevent the destruction of one of the world's greatest and most colorful cemeteries for ancient tree life—the so-called petrified forest of the Territory's northeastern desert-land. Out of the effort came the Petrified Forest National Monument, proclaimed by President Theodore Roosevelt during December of 1906, a scenic and scientific reserve now called Petrified Forest National Park.

THIRTEEN YEARS after the President's protective order the National Parks Association came into being to early take its place as the nation's leading conservation organization concerned primarily with national park system matters; to help keep then-existing parks and monuments in as natural a condition as possible, free of artificiality or "improvement." It has continued its protective work to the present. You can assist the Association in its efforts in any of several ways: by contribution to the Association's general funds over and above regular dues; by remembering the Association in your will; or by helping secure new Association members. All dues over and above basic annual dues, and all contributions, are deductible for Federal income taxation, and gifts and bequests are deductible for Federal gift and estate tax purposes.

National Parks Association

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