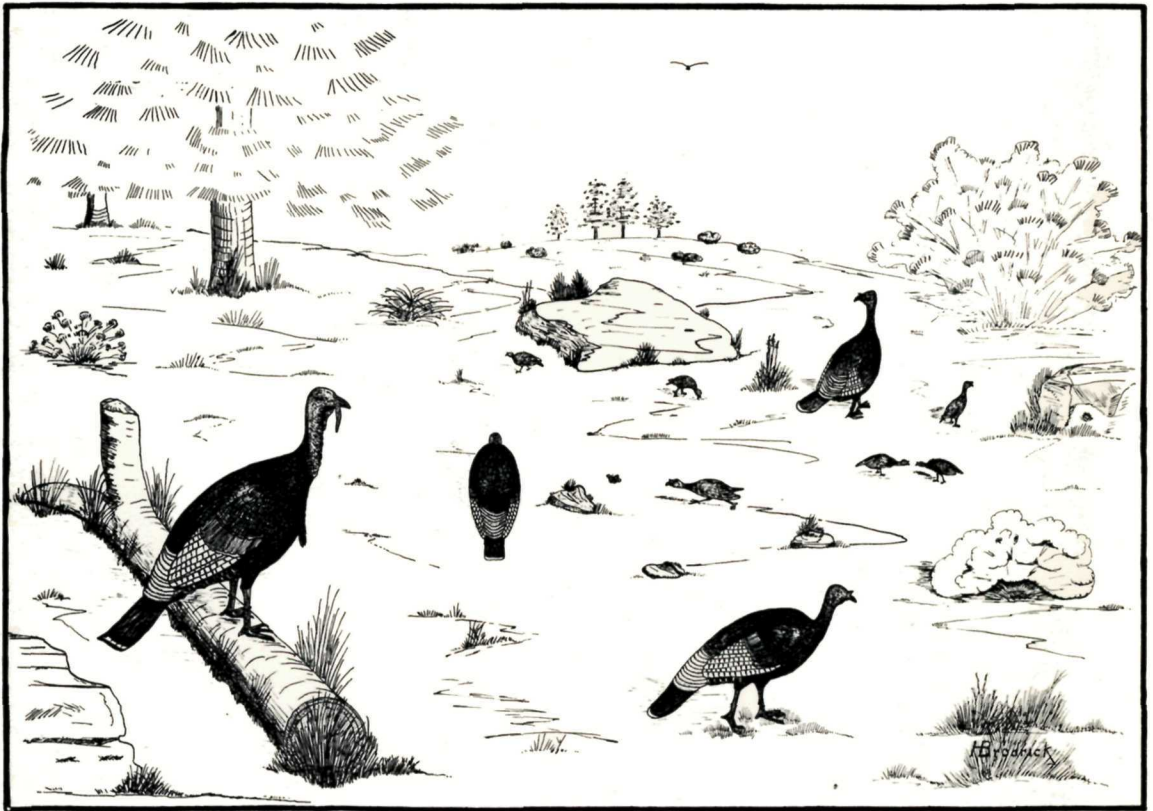


REGION III QUARTERLY



NATIONAL PARK SERVICE

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M. R. Tillotson Regional Director

Leo A. McClatchy Editor

Santa Fe

New Mexico

October 1940

R E G I O N I I I

ARIZONA - ARKANSAS - NEW MEXICO - OKLAHOMA
TEXAS - UTAH - AND SOUTHERN PARTS
OF COLORADO AND NEVADA



NEWTON B. DRURY

DIRECTOR, NATIONAL PARK SERVICE

NEWTON BISHOP DRURY

Newton Bishop Drury of San Francisco, newly appointed Director of the National Park Service, learned so much about destruction, in World War I, that he has been a crusading conservationist ever since. California, his native state, will long remember him for his effective work that has assured for all time the preservation of priceless groves of magnificent Redwood trees. He was Secretary of the Save-the-Redwoods League, for 20 years.

The development of California's State Park System, in the past 10 years, came largely as an outgrowth of the successful Save-the-Redwoods movement. Newton Drury was an executive of the California State Park Commission, from the time of its organization, to last August, when his appointment to the National Park Service became effective. During that period he had charge of the acquisition of park properties representing a valuation of over \$12,000,000, and he had much to do with the raising of private contributions to match state funds.

Mr. Drury graduated in 1912 from the University of California, where he had been President of the Student Council. Later he was an Assistant Professor there, and for a time he was secretary to the university's president, the late Benjamin Ide Wheeler. He was a First Lieutenant in the Air Service (Balloon Section) during the World War. He is a Research Associate in Study of Primitive Landscape, Carnegie Institution of Washington; a Vice President of the American Forestry Association; a director of the National Conference on State Parks; and an honorary life member of California's Sierra Club.

In announcing his appointment to succeed Arno B. Cammerer, who resigned because of ill health, Secretary of the Interior Ickes said:

"Mr. Drury is outstanding in the field of conservation occupied by the National Park Service and is a nationally recognized authority on park affairs."

The new Director was born in San Francisco, in 1889, the son of Wells Drury and Ella Bishop Drury, both pioneers. His father was an early-day Nevada and California editor, and Newton Drury has had newspaper and advertising experience.

Mr. Drury is the fourth Director the National Park Service has had - three of them from California - since the Service was created by the Congress in 1916.

SLIGHTLY CUCKOO

By Earl Jackson,
Custodian,
Montezuma Castle National Monument.

George - that's short for *Geococcyx californianus* - didn't know what it was all about for quite a spell, at first. Offhand, you might say anybody coming from the Cuckoo family wouldn't be too intellectual anyway, but that's a matter of opinion. For that matter a skunk, by his name alone, would have been omitted from a four-footed social register; and yet you never saw a better gentleman than a skunk.

George's unawareness was mostly a natural condition for one of his tender age. He was only a dark spot inside a white shell, surrounded by yolk and albumen. He grew fast at this stage of his career and finally, on a morning late in May, completed his first official task - a house-breaking job. This was from the inside out, and effectively cast him free of the egg shell.

His mother must have been of an affectionate and understanding nature, otherwise she would have kicked this ungainly apparition from the nest, and hidden her head for shame at having produced such a thing. That skinny body with the oversize head was completely black and completely nude, and the head wobbled in a disconcertingly loose manner.

Thus a Roadrunner was born. As one of the Ground Cuckoos he belonged to one of the 200 odd species which make up the Cuckoo clan. Most of these are foreigners, less than a dozen being represented in the Americas. George should have had considerable pride in his New World relatives, however, for they were definitely higher class folk than many of the Old World ones; these New World cuckoos were self-respecting birds who built their own nests and raised their own young entirely, never resorting to that lazy and unmoral practice of going to other birds' nests and throwing out the eggs, that they might lay their own in such spots.

Most of the American cuckoos live in the tropics, frequenting the same general country as their eloquent and colorful relatives, the parrots. Roadrunners are a hardy brood which can live in a great many places. They range from as far south as Puebla, Mexico, through the Mexican tableland, to as far north as Northern California and Western Kansas, and eastward to central Texas. They are not particular about altitude, as long as it is reasonable, say anywhere from sea level to a 5,000-foot elevation for late summer.

Even George's father would have been appalled if he had found it necessary to memorize all the names by which he is known. Folks call

him the Cock of the Desert, the Chaparral Cock, the Snake Killer; the Lizard Bird, the Churca, the Correcamino (Spanish for Roadrunner), and Paisano, which is the Mexican way of calling him Fellow Countryman. The latter name is in as good standing south of the border as Roadrunner is to the north, and also stands pretty well in New Mexico, where he is the state bird.

George was worried about none of this. He was resting. After he had regained some strength he commenced to root about in the nest. It was a sizable affair, nearly a foot in diameter, located in the midst of a low and thick-set Hackberry tree. Its architectural features would not have flattered a designer, but served adequately as a labor of love in which to rear one's children. It was made of stout twigs, and was lined with small white roots, the inner bark of a juniper, some feathers, and for good measure a few somewhat redundant manure chips and mesquite pods. Part of a discarded snake skin was also carelessly twisted into the structure.

There were four other eggs in the nest. These were very much in his way. On the second day a little sister hatched out of one of them, and at about the same time George, having digested the yolk which had remained in his body at birth, became hungry. He informed his mother of the fact in no uncertain terms. He had a ravenous appetite, and a remarkable capacity. It took a great deal of his mother's time catching grasshoppers and lizards and other small delicacies for him. If his father hadn't been interested in the young family, the feeding task might have become difficult. As it was, when two more little black babies were hatched about two weeks later, the father was able to care for the older children, while the mother handled the younger ones.

George was a vigorous specimen, and quickly lost the midnight color of his birth. He looked even more clownish, however, with pin feathers coming bluntly out of his wings and neck. When Mamma or Papa came with a lizard he would ungallantly have allowed the rest of the children to go hungry, he was so eager to get his widely opened bill forward. The parents were disciplinarians, however, and never forgot the correct rotation for feeding. Only when it was his turn would one of them stick the head end of a lizard, or whatever it happened to be, down into his mouth.

Frequently, it happened when one of the small Paisanos was given a large or a long lizard it wouldn't all go down at once. This bothered neither him nor his parents. He would swallow what he could, then placidly wait, the tail hanging out of his mouth, while digestion made room for more centimeters of lizard flesh. Finally, with the assistance of some rhythmic gulps, the meal would disappear.

Rearing a family in early summer wasn't a complicated problem.

Doubtless most birds figured that out long ago, since most of them do it then. There were young grasshoppers and crickets, spiders, worms beetles, ants, bees, centipedes, scorpions, lizards, and mice, to name a few items of Paisano food. Later in the season there would be luscious big tarantulas, cicadas, parts of cactus fruits, several kinds of seeds, and many other delicacies.

It must have seemed to the folks like the kids would never grow up. George was a strapping adolescent before he left the security of the nest for good, about the middle of July. By this time nobody would have had any trouble recognizing him for a Paisano, although his plumage, especially that of the tail, was not as completely developed as in a mature individual. Even an ornithologist couldn't have told from looking at him, whether his name should be George or Phyllis. For that matter, the same would hold true when he was full grown. Which didn't bother him at all. Whatever Mother Nature had figured out, was all right with him. Right now, like most teen-age youngsters he was greatly concerned with the consumption of huge quantities of food.

Having to provide his own bill of fare was not so simple as having it brought fresh killed to his palate. He made many a futile dash after some lizard or grasshopper which outwitted his inexperience. But he learned fast, and grew quickly acquainted with the sandy mosquito flats near his home, and with the creosote and palo verde covered hillsides above. He soon forgot about the old homestead, except when he happened to be in the vicinity, and would drop by and gaze vacantly at his mother, still patiently engaged in rearing a last chick. Poor Mother! Only a human mother could have fully sympathized with Mrs. Paisano for such a haphazard way of raising a family, one at a time.

One day George made a mistake which nearly cost him his life. Any Paisano could have made it, but not many would have forgotten that cardinal principle of always swallowing sizable prey head first. It was on a damp, rather steamy day, just after a summer shower had soaked into the ground. He found a particularly large centipede, about six and a half inches long. Characteristically, the centipede was very active, and almost managed to escape under a stone, when George nabbed its tail end. A quick jerk flipped it into the light again. George pecked savagely at its head two or three times, until he was convinced this appetizer was ready for his gullet. The centipede was still wiggling, but anybody knows a centipede can continue to thrash about long after it has been killed. George grabbed one end - the wrong one - and started to swallow it. The crushed head-end whipped around like a spring, to the thin covering of the bird's throat, and the poison carrying jaws snapped once, twice, thrice. The third time they connected, through flesh.

George was never to know such pain again. He managed to disgorge

the tormentor, and then began to flop around like a chicken with its head off. Finally, between tortured gasps for air through his sore and greatly swollen throat, he managed to drag himself into the shade of a salt bush. Here he collapsed and lay as if dead. Toward evening he arose, a weaker but wiser bird. He managed to capture and swallow a few grasshoppers before it became too dark to hunt, and then found his way to his roost, a few feet above the ground in a hackberry.

He reached his full size that summer, and learned a lot. Never satisfied to rest on his laurels as an epicure, he pushed himself ahead until he could perform the gastronomic feat of swallowing an 18-inch rattlesnake. He had to do this a few inches at a time, of course. He loved nothing better than a big lizard or a small snake, for one of these creatures seemed made just to go down his throat. He wasn't particular whether the young snakes were harmless ones or venomous ones. They were just snakes to him, ergo, good eating.

George found an easy way of locating grasshoppers. Experience taught that he could find more grasshoppers in the vicinity of feeding quail, where there were several birds to scare them up, than he could spot just by himself. So he frequently enjoyed catching those which flew up out of reach of the quail. He got along all right with the little folk, and they didn't seem to mind.

He had as much curiosity about him as a spinster in a country town. This trait led him to investigate a strange conformation of the landscape near the creek, from which came many odd noises and emerged huge creatures which were not birds, but walked on two legs, and vibrated the earth when they walked, somewhat as cattle do. Thus he came to see the house in which lived a ranger and his wife and children. And one day the wife caught a mouse in her kitchen and threw it out in the yard when she knew George was looking. He was not aware of the joy with which she summoned her husband and children to see her newest conquest over the wild, but he was aware that the dead mouse was powerful good eating. So he got in the habit of looking about the yard every day or so. Mrs. Ranger thought about setting out food every day, but her husband told her it was not such a good idea. He said it was better not to get the wild creatures in the habit of depending upon somebody furnishing food, for it would only work a hardship on them when they couldn't get it. So George's meals came only often enough to remind him that here was a good place for an occasional handout.

Knowledge of the free meals kept him from the worst pangs of hunger several times during that winter. It was a hard winter on the desert, and December and January found him with a "lean and hungry look." There were practically no insects at all to be found, even under moldy leaves. He subsisted almost entirely on seeds, and on the

few unwary juveniles of the mouse and rabbit clans that he could catch. These meals of fresh meat were few and far between. All the lizards were in hiding for the winter, with the exception of one extremely hardy variety called the Arizona Tree Uta (*Uta ornata symmetrica*). These fellows would come out on the warmest winter days and bask for an hour or two on the south side of some heat-soaked boulders.

On his hungriest days he usually found that Mrs. Ranger had thrown out something for him, and this was a great comfort. He began hanging around the house a great deal, and the whole family became well acquainted with his odd footprints. Like all cuckoos, his toes were arranged in two pairs, two pointing forward and two pointing backward. One could tell which direction he had gone, because the forward pointing toes left a deeper impression in loose soil.

The children especially enjoyed watching George's antics. He was an unconscious clown, and looked clumsy at nearly anything he did. It delighted them to see him hurrying along with his head and neck straight forward and his tail sticking out straight behind, for all the world as though he were late for an appointment. Then to see him suddenly throw up his long tail when he wanted to stop suddenly, and almost lose his balance, invariably brought laughter. They found that while George preferred to be a landlubber he could and would fly when necessary. Most of his flying, however, was in the form of gliding, from the top of a low tree or hill.

In February George became gravely insulted. It happened that Mrs. Ranger was trapping and banding birds that winter. The birds, after she had identified them and placed little numbered bands on their legs, would be released unharmed. One of her wire traps was located under a hackberry on a sandy flat just above the creek. George happened by just after two Gambel's sparrows had entered the trap. Ordinarily he had no impulse to bother smaller feathered creatures, but this time the combination of hunger and of excitement at the frenzied fluttering of the captives as they beat their wings against the cage wall, attracted him. He circled the trap several times trying to reach the birds, and finally stuck his head into the opening. He still couldn't reach them, so he pushed. The opening was designed for much smaller birds than he, but with some squeezing he forced his way inside.

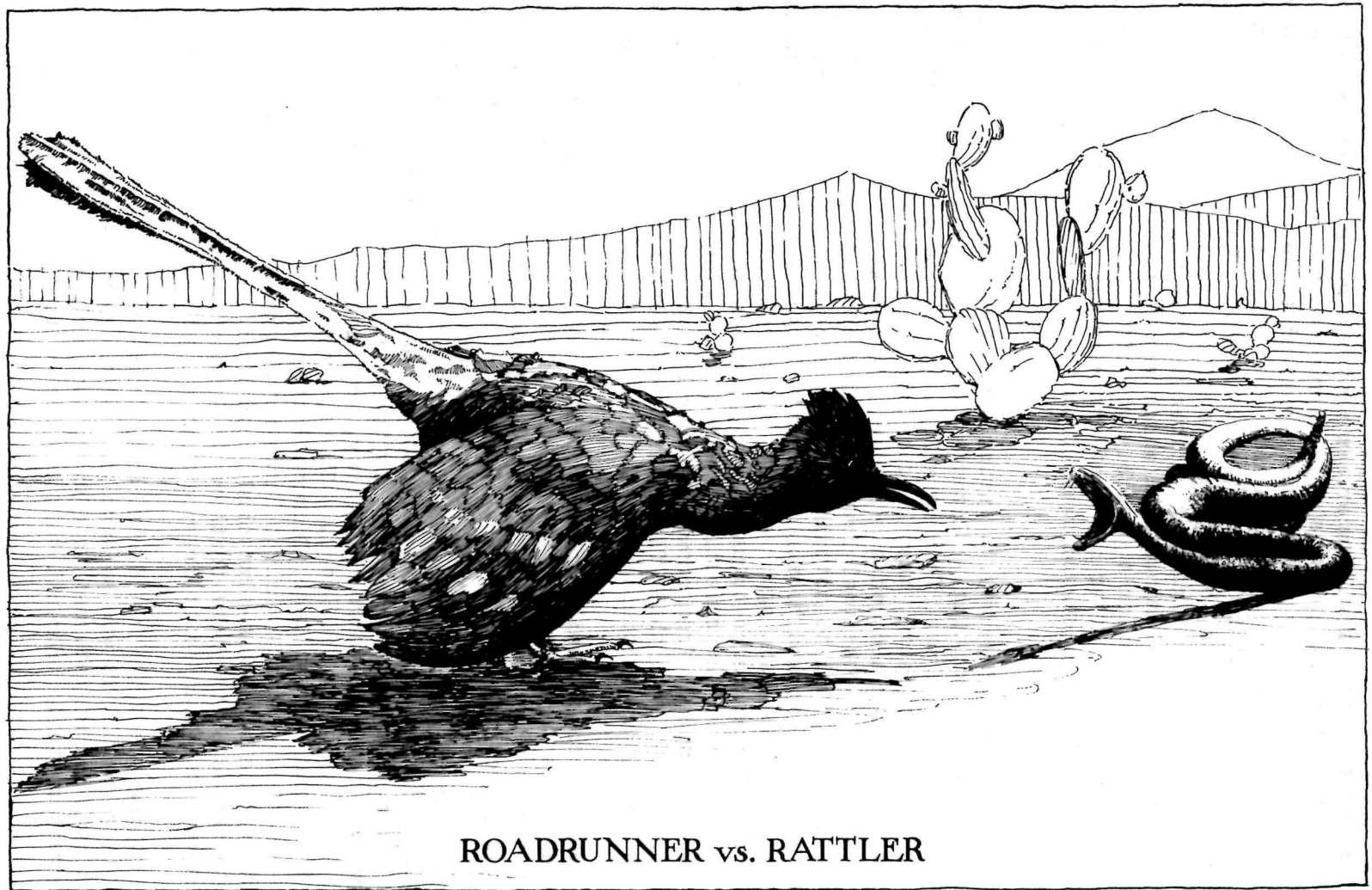
Once past the doorway George found he could neither straighten out nor stand erect. Acute claustrophobia assailed him, and he became panic-stricken. With savage abandon he fought the trap, running his long beak in and out through the wire openings, bruising the flesh until he was soon bleeding freely behind the nostrils, and his feathers were all rumpled up from one end to the other. Never had his pride and his dignity been so assailed.

About this time Mrs. Ranger saw what was going on and called the children to watch, while she slowly approached the cage and lifted it. The sparrows flew away while she struggled to get George out of the trap. That done, she took him into the house to give first aid for his bleeding, and put iodine on the cut face. This burned like fire, and when she took him outside a moment later, he streaked for the bushes like a bolt of lightning. Then he felt the crowning indignity of all - a numbered aluminum band which was fitted loosely on his left leg, and which he couldn't possibly get off. George was peeved for several days. Even after his feathers were all correctly preened and his sores healed, he stayed away from the house. No more misplaced confidences for him!

Late winter gave way to spring, and freezing nights were a memory. Buds began bursting. Lizards and snakes found the weather satisfactory. George was feeding well and feeling in fine fettle. He felt so well, in fact, that he decided any bird as peppy as he was should get married and raise a family. He became articulate about it, and began making occasional loud chuckling crowing noises, which would have sounded musical to nothing on earth except another Paisano. Something must have worked, because it wasn't long before he met Georgiana. They were of the same age, and it was a case of mutual attraction. His courtship was tempestuous, their honeymoon idyllic. They located their nest low in the spreading branches of a giant mesquite, where it was well shrouded from prowlers' eyes by a bushy algerita bush. We were not there when their first child-to-be was born, but may we not suppose there was rejoicing in the family at the sight of the egg?

George took family responsibility well, spending most of his hunting hours as close to the vicinity of the nest as possible. One day a couple of weeks later, while Georgiana was placidly sitting on the nest, cocking an eye at her husband as he strolled past the mesquite, death hovered near. As George was about to pass a low limestone ledge about 30 feet away, he felt something hit his left wing. It was an instantaneous touch, and was gone as quickly, but before it could have been repeated, he moved. In the merest fraction of a second, George was standing three feet away, cocking his head on one side to gaze intently under the ledge. There, drawn far back under the rock, was the head of the huge Diamond Rattlesnake (*Crotalus cinereus*) that had struck short. Only a large rattler would have felt ambitious about eating a Paisano-size bird, and this one had missed a kill by the thickness of the hard feathers on George's wing. A yellow drop of venom attested this as it dripped from a feather tip to the ground.

Hoping the snake would come out, George waited in the vicinity of the ledge until it was so dark he had to go to roost. Normally he would have had no interest in a snake too large to eat, but this was a different matter. For all that his cuckoo intelligence could ascer-



ROADRUNNER vs. RATTLER

tain, the snake was a menace to his wife and children. In the next few days the tracks of Paisano and snake crossed several times, but neither saw the other. Yet it must have been written that these two should clash, for the snake was so pleased with the feeding to be had in several engaging rodent nests nearby that it would not leave.

Just at sunset of a rather cool day, when the temperature was hovering around 85 degrees, bird and rattlesnake chose the same time to traverse a clear space in the mesquite and "catclaw" bushes. They were fully 20 feet from any cover when they became aware of each other. George checked his customary headlong stride, tail in air, at the same time Crotalus was withdrawing his five and a half feet from a prone crawling position into a coiled striking pose. A warning rattle sounded and the enemies faced each other motionless for a second. Crotalus moved first, for he disliked intensely to expose himself like this. He started toward the bushes.

George, who was nervously raising and lowering his crest and tail, moved quickly to defeat this strategy. Wings spread and feathers drooping, he made a bee-line toward the reptile's head. Whereupon Crotalus, with even greater speed, withdrew his head and neck, and George veered off to one side, just out of reach. The snake, infuriated, coiled again, rearing his head and neck fully eight inches above the ground. His head was drawn well back, while his tail and rattles were out in front of him. This was so he wouldn't overbalance when he struck, and was entirely different to the "coiled rope" attitude of a loafing snake.

George darted in again, and the reptile struck. It hit the spread wing feathers, doing no harm, and again a drop of wasted venom fell to the ground, while the bird retreated to begin an erratic circling dance. It wasn't really a dance, but resembled one, as, with head lowered and his wicked looking reddish flecked eyes gleaming their hatred, he darted in and out, in and out, always just out of range. Every time Crotalus lunged and missed, George moved a little farther around the circle, thus forcing the snake to constantly turn and turn in order to face his enemy. This necessity prevented the snake from any rapid backward movement. Of course, a snake can't literally throw himself into reverse gear, but he gets the same effect; facing an enemy, Mr. Rattler can flee with the main part of his body while his head and neck still point the original direction, thus effectively serving as a rear guard for his retreat.

The sound of the snake's rattles, at first recognizable as such, was so rapid a vibration now that it was closer to a hum. It was audible 150 feet away, and was something of a blend between the sound of a cicada, the hiss of a tea kettle, and the drone of an airplane, and was filled with all the connotations of death. Even one who has not

previously heard a snake rattle and does not recognize the sound, finds that its vibration stirs something within him which is primitive and elementally afraid.

Despite George's efforts to the contrary, Crotalus had succeeded in edging several feet nearer a big mesquite and its widespreading basal branches. Frenziedly the bird darted in again, his wing feathers stirring up dust, and his head and neck equalling the snake's sinuosity and speed of weaving movement. Crotalus struck, in a great flutter of feathers and dust, and George emerged on the other side, panting. The snake was even closer to the bush. Again George had saved his life with his beating wing feathers, but he had again failed in his objective, that of driving his sharp beak into the enemy's skull. He began his restless darting in and out again, and this time Crotalus was showing the effects of persecution. Blinded with rage the snake now struck viciously at each half lunge of the bird, and his own powerful body wearied. His lunges slowed, and his body weaved uncertainly each time he reared his head and neck.

The Paisano rested a moment, and Crotalus' rattles vibrated more slowly. Suddenly the snake abandoned caution for a moment to swing his body back in a half gliding, half crawling semblance of a loop. This brought him within five feet of protection, but now he had to meet another rush. This time George was faster than the tiring snake, and amid a threshing of coils, his beak struck home. Crotalus, mortally hit, lashed valiantly but futilely at George, and then tried to conceal his injured head. Another lightning sally crushed the bones of his skull.

George was such an exhausted victor that it was all he could do to stand, as he staggered drunkenly a few feet away to stand with feet wide apart, wing and tail feathers drooping from fatigue now, his head drooping and his tongue lolling. In this pose his wife found him when she came proudly to announce that she had laid another egg. And strangely (or was it so odd?) George's head lifted, he drew up his wings, and his impudent tail soared on high again. For had he not truly come into his own? He was husband, father, and mighty foeman and defender of his family.

HEALTH SAFEGUARDS IN THE PARKS

By H. B. Hommon,
Senior Sanitary Engineer,
U. S. Public Health Service.

Water pumped from the 4,300-foot well in Mesa Verde National Park, Colorado, has a temperature of 110 degrees Fahrenheit. It has the taste of dissolved iron, and there is a slight odor of hydrogen sulphide. Taste, odor, and heat are removed by discharging the water over a cooling and aerating tower, treating with lime, settling in a tank, and filtering through a rapid sand filter. The water then is cool and palatable.

On the South Rim of Grand Canyon National Park, Arizona, where scarcity of water several years ago necessitated hauling it 100 miles in tank cars at the almost unheard of price of more than \$3 per 1,000 gallons, "industrial" water is now manufactured at 35 cents per 1,000 gallons. This water, used exclusively for such purposes as generating steam in railroad locomotives, flushing toilets, and irrigating lawns, is made by reclaiming sewage whose disposal previously was something of a problem in itself.

And what becomes of the millions of tin containers that bring into Yosemite National Park, California, a large amount of the food consumed by the half million visitors there each year? The cans are pressed into bales, thus reducing their volume about 90 per cent, and are then used to fill borrow pits or are otherwise buried. This prevents creation of unsightly and fly-breeding dumps. The same practice is followed in other parks.

Visitors to the national parks and monuments have little, and frequently, no conception of the work that goes on behind the scenery to provide safeguards for protection of their health. It's all accomplished under supervision of the U. S. Public Health Service. The effectiveness of the program can be readily measured when it is explained that since its inauguration in 1921, only three cases of typhoid fever have been reported in the national parks and monuments west of the Mississippi River. The sources of infection of those three cases have never been determined, so it seems reasonable to conclude that they may have originated outside the parks.

There is no place in any national park or monument where untreated sewage is discharged into a stream or lake. Where there is only a small volume of sewage the general practice is to settle it in a tank and either discharge the effluent into covered channels in porous sub-soil, or into open ditches or ponds in isolated places, or to filter it through sand. For the larger volumes produced in such areas as Yosemite Valley, and the South and North Rims of Grand Can-

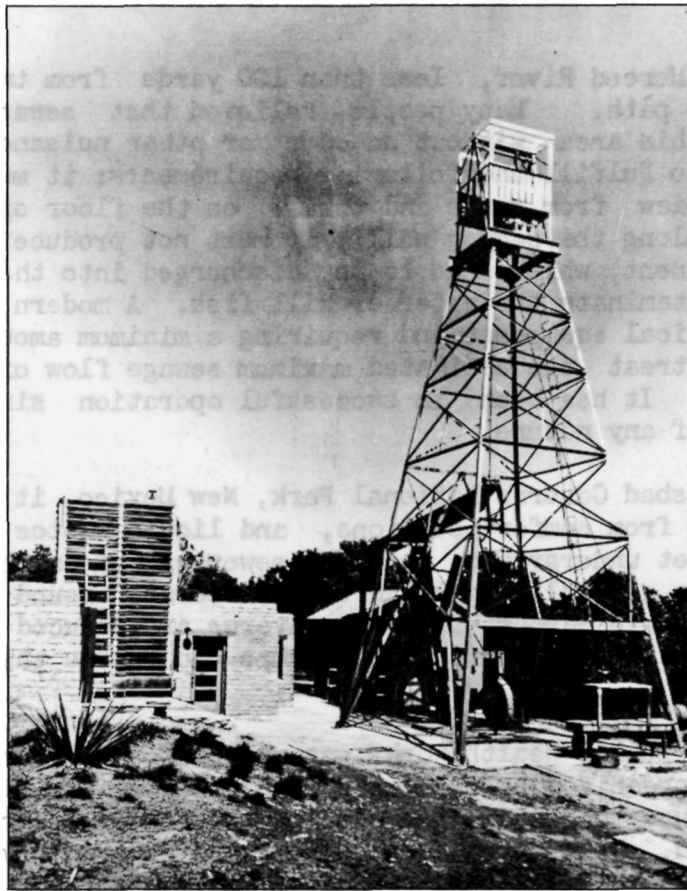
yon, complete treatment and disinfection of the sewage is required, and it has been necessary in each case to design a plant to meet local conditions. Although it is used exclusively for industrial purposes, the effluent from the plant at the South Rim of the Grand Canyon now meets the U. S. Public Health Service bacteriological standards for water supplies used for drinking and culinary purposes on common carriers in interstate traffic. This plant produces approximately 165,000 gallons of water daily during the summer. To preclude any possibility of making cross-connections between the fresh-water piping system and the reclaimed sewage-water pipe lines, the latter are covered with vitrified pipe, have a lower pressure than the fresh-water lines, and the outlets are painted red and posted with warning signs.

At the North Rim of Grand Canyon, and in Zion, Mount Rainier, Yellowstone, and some of the other national parks and monuments, the sewage is settled, then disinfected if necessary, and sprayed over natural ground surfaces in places where there is practically no runoff to streams. This is a practical, economical and inexpensive method of sewage disposal which can be used wherever local conditions are favorable.

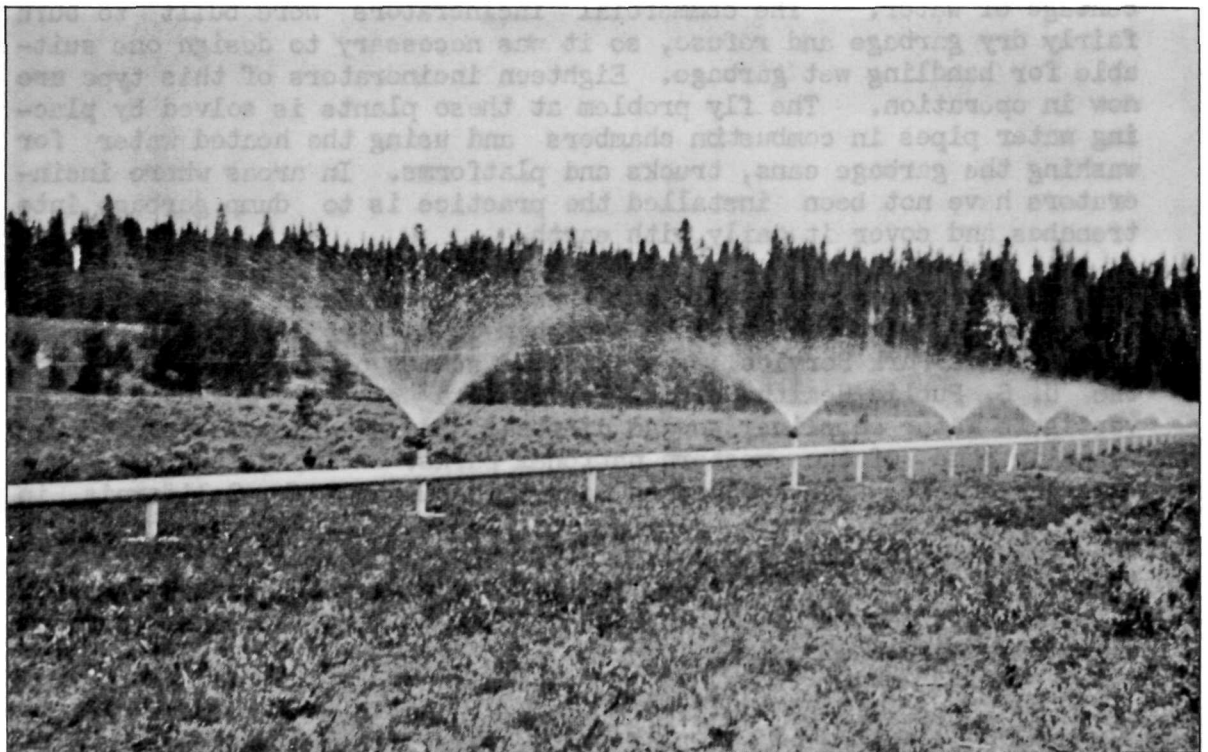
A sewage treatment plant of unusual design was constructed at the headquarters area in Rocky Mountain National Park, Colorado, to meet severe local conditions. The sub-soil is impervious, there is a small volume of sewage, sub-zero weather prevails over long periods, and a high degree of treatment is required. The unusual feature of the plant, which consists of a septic tank and sand filter, is the building over the filter. This building has glass on the side exposed to the sun, to prevent freezing of the filter in winter. The filter, warmed by the sun, has operated without serious trouble from freezing even when the temperature has been 28 degrees Fahrenheit below zero.

In cases where developed areas in national parks and monuments are adjacent to lakes or rivers, the problems of sewage disposal become involved with many practical considerations. At the Hemonway Wash development in Boulder Dam National Recreational Area, Nevada, the lodge, cabins, and campground are being constructed just above the high water level of Lake Mead. It was not considered advisable to discharge even highly purified sewage into the lake. The only alternative was to pump it to a treatment plant located where there would be no interference with present or future developments. The plant and pumping station were recently completed and are now in operation.

The most difficult problem of sewage disposal was in Yosemite. A treatment plant constructed in 1921 became so badly overloaded and was so obsolete by 1930 that it caused a serious odor nuisance and had to be replaced. The lower end of the valley where it was necessary to locate the new plant, is very narrow, and the site selected was adja-



MESA VERDE WATER PLANT



SPRAYING TREATED SEWAGE

cent to the Merced River, less than 100 yards from two main highways and a bridle path. Many people believed that sewage could not be treated in this area without an odor or other nuisance. The plant would have to fulfill the following requirements: it must not be prominently in view from roads and trails on the floor of the valley or the trails along the canyon walls; it must not produce odors or noise; and the effluent, which had to be discharged into the Merced River, must not contaminate the water or kill fish. A modern treatment plant using mechanical equipment and requiring a minimum amount of space was designed to treat the estimated maximum sewage flow of 1,200,000 gallons daily. It has been in successful operation since 1931 without complaints of any nature.

In Carlsbad Caverns National Park, New Mexico, it is necessary to pump sewage from comfort stations, and liquid wastes from the lunch room, 750 feet underground, into the sewer system on the surface. Sewage pumps are generally designed to lift sewage around 150 feet. Solids in the liquid wastes from the caverns are reduced to a very small size, by comminutors, so that the pumps can handle this waste without stoppage.

Before public health work was undertaken in these recreational areas on an organized basis, it was the general practice to haul garbage and refuse to places just outside the developed areas and pile it on the ground. Many of these garbage dumps covered several acres, and all of them were a serious nuisance. This was prior to the days of extensive public campgrounds, when practically all garbage and refuse came from the kitchens of hotels and lodges, and contained a high percentage of water. The commercial incinerators were built to burn fairly dry garbage and refuse, so it was necessary to design one suitable for handling wet garbage. Eighteen incinerators of this type are now in operation. The fly problem at these plants is solved by placing water pipes in combustion chambers and using the heated water for washing the garbage cans, trucks and platforms. In areas where incinerators have not been installed the practice is to dump garbage into trenches and cover it daily with earth.

The beginning of public health work in national parks and monuments can be traced to the late Stephen T. Mather, first Director of the National Park Service. In the late summer of 1920, he requested the U. S. Public Health Service to detail a sanitary engineer to investigate water supplies, sewage disposal, and general sanitary conditions in some of the western national parks. The writer was given this assignment, and arrived in Sequoia National Park, California, in September of that year. The general sanitary conditions there, as they pertained to cleanliness of campgrounds and buildings, were satisfactory. The water supplies were from springs which were apparently not seriously contaminated. There were no comfort stations. Garbage and refuse were hauled to a dump.

General Grant National Park, adjoining, was next visited, and then Yosemite, followed by Yellowstone, in Wyoming. In General Grant, now a part of the Kings Canyon National Park, sanitary conditions were about the same as in Sequoia. In Yosemite, raw sewage was being discharged into the Merced River; and in Yellowstone, untreated sewage from the hotels, lodges, stores, and residences flowed directly into streams. Some of the water supplies in Yellowstone and Yosemite were either contaminated or subject to potential contamination.

The superintendents of these four parks were, of course, aware of the conditions, but they were handicapped by lack of funds. There was no trained personnel. The report to the Surgeon General included a recommendation that a sanitary engineer from the Public Health Service be detailed for temporary duty with the Park Service. Mr. Mather then requested that such an assignment be made. The detail was given to the writer, in May, 1921, when he was placed in charge of Interstate Sanitary Districts 5 and 6, with headquarters in San Francisco. Inspections were made that summer in all of the western national parks.

Since only two of the parks had resident engineers, it was necessary for the Public Health Service engineers to prepare plans and cost estimates for the sanitary utilities most urgently needed. The Congress was fairly liberal with appropriations, and within a very few years allotments were made regularly for additional employees, for water-works, and development of campgrounds. The number of visitors to the national parks and monuments increased at a rapid rate from year to year, and additional areas were added to the System, but adequate sanitary facilities have been provided to meet these increased demands.

From 1921 to 1932 the cooperation of the Public Health Service, as represented by the San Francisco office, extended to all national parks, including those in Alaska and Hawaii. In 1932 the country was divided into eastern and western divisions. The western office was given the territory west of the Mississippi River, except that Hot Springs National Park, Arkansas, was placed under the eastern division, with headquarters in Interstate Sanitary District No. 2, in Washington, D. C. This arrangement is still in effect.

The National Park Service, cooperating closely with the Public Health Service, has made every effort to provide complete protection for the health of park personnel and the millions of people who visit the parks and monuments each year.

FOSSIL FORESTS

By M. V. Walker,
Associate Park Naturalist,
Crater Lake National Park.

The word fossil, as applied to fossil forests, may be defined as "any indication of the former existence of plant or forest growth." These indications may be any of the following: petrified wood, coal, fossil leaf impressions in sandstone or shale rocks, casts or molds of trunks, branches, leaves, and sometimes cones and fruits. A fossil forest might be made up solely of the very delicate leaf impressions of the trees and shrubs of some prehistoric forest, with these impressions now preserved in the sandstones and shales of various geological periods.

The term petrified forest infers a "change to stone", so that we should expect to find a forest literally turned to stone. This is indeed far from the truth, for there are certain very definite limitations regarding the possibility of an object being petrified. To petrify, the specimen must be solid like wood, yet porous and cellular enough for the infiltration of water in which various minerals have been dissolved. For that reason a petrified forest is bound to be limited to the trunks and branches of the trees and shrubs which made up the original living forest. A petrified forest is also a fossil forest, but many of the fossil forests are not petrified forests.

The Petrified Forest National Monument, Arizona, is the most outstanding petrified forest in the United States. It is also a fossil forest, for, in addition to petrified logs and branches of a prehistoric forest, it has fossil evidence of the leaves of the trees, the cone scales, and the undergrowth which was composed of various types of ferns, rushes, and cycads.

In north central Kansas there is an exposed layer of sandstone called the Dakota Sandstone. Very few fragments of petrified wood are to be found in this formation but some of the sandstone has many beautiful impressions of fossil leaves which indicate the former presence of a great forest. This is a fossil forest where scientists recognize such forms as eucalyptus, sassafras, birch, beech, walnut, and acacia. These are forms that for the most part are now found far away from the plains of Kansas, yet the forest grew and flourished there many millions of years ago.

Although each one of our petrified forests may have a slightly different story as regards the type of mineral replacement, the geological age, or the kind of trees, a number of general conditions were the same in each instance. The tree trunk or branch did not remain on the surface of the ground or the water, or it would have decayed.

HOW OLD ARE THE FOSSIL FORESTS?

Geological Era	Geological Period	Age in Years	Fossil Forest Localities
Cenozoic	Recent		
	Pleistocene	2,000,000	
	Pliocene	17,000,000	Redwood Fossil Forest, California
	Miocene	37,000,000	Ginkgo Fossil Forest, Washington. Florissant Fossil Forest, Colorado. Yellowstone National Park Fossil Forest.
	Oligocene	47,000,000	Fossil Wood in White River Formation of South Dakota, Wyoming and Nebraska.
	Eocene	100,000,000	Fossil Leaf Impressions, Green River, Wyoming.
Mesozoic	Cretaceous	121,000,000	Black Hills Petrified Forest, South Dakota. Texas Fossil Forests. Fossil Leaves in Dakota Sandstone, Ellsworth County. Petrified Wood in Comanchean Formation, Harper County, Kansas.
	Jurassic	151,000,000	Fossil Cycad National Monument, South Dakota. Fossil Wood and Cycads, Freeze Out Hills, Wyoming. Fossil Ginkgo Leaves, Douglas County, Oregon.
	Triassic	177,000,000	Petrified Forest National Monument, Arizona. Utah Fossil Forest, Zion National Park and Capitol Reef National Monument. New Mexico Fossil Forest, Tucumcari, New Mexico.
Paleozoic	Permian	213,000,000	Fossil Leaf Impressions in the Supai Formation, Grand Canyon National Park, Arizona.
	Carboniferous	295,000,000	Coal Beds Fossil Forests, Carbonized Trunks and Leaf Impressions, Coal Beds of Pennsylvania.
	Devonian	337,000,000	New York Fossil Forest, Near Gilboa, New York, on Schoharie Creek.

The first step in its preservation was that it was either buried in the ground or submerged in water, thereby protecting it from the elements of wood decay and disintegration. A log would sink in the water when it became water-logged, or it could be buried in the ground by the deposition of silt or sand carried by streams during flood periods. Volcanic eruptions of ashes and mud might cover such objects as were on the surface of the ground.

The second step requires that water, which has in solution certain minerals, must come in contact with the buried wood and completely saturate it. This may be the normal ground water or mineral charged water of lake or stream.

The third step, and the one which is perhaps least understood, involves the deposition of mineral matter in the cells and woody portion of the tree. Undoubtedly this infiltration and precipitation must be repeated many times before a large tree trunk can be completely replaced with minerals and thus petrified. In some specimens this replacement was so slow and perfect that the original structure of the cells, growth rings, and pith rays are easily recognized. In others the conditions were such that although the outward appearance of the tree trunk is unmistakable, the entire inner structure is a mass of mineral material without a trace of the original cellular and woody structure. This last example is hardly more than a cast or mold.

The fourth step has to do with the presence of the petrified wood on the surface of the ground today. The answer is that although the trees were once buried perhaps by hundreds or thousands of feet of rock, erosion has since removed this covering and once more these objects have come to rest on the surface of the ground.

Thus we see that the recipe for a petrified forest requires burial or submergence; infiltration and saturation; mineral deposition (replacement or infilling) by precipitation; and finally, exposure by erosion. Like all good recipes there are possibilities of unlimited slight deviations, each one producing peculiar results which only add to that long list of nature's secrets.

"How long did it take?" is one of the interesting questions about petrified forests. The answer is far from satisfying, for very little is known about the time involved in the actual mineral replacement. Modern experiments have proven that it could be quite rapid, or again the replacement of even a small branch might require hundreds or thousands of years. It seems that the process can be speeded up, slowed down, or brought to a complete standstill by slight variations in mineral content of the water; by introduction of foreign minerals, or by failure to provide proper conditions of saturation and deposition of the minerals carried by the water. The placing of small blocks of wood in certain of the hot springs of Yellowstone National Park,

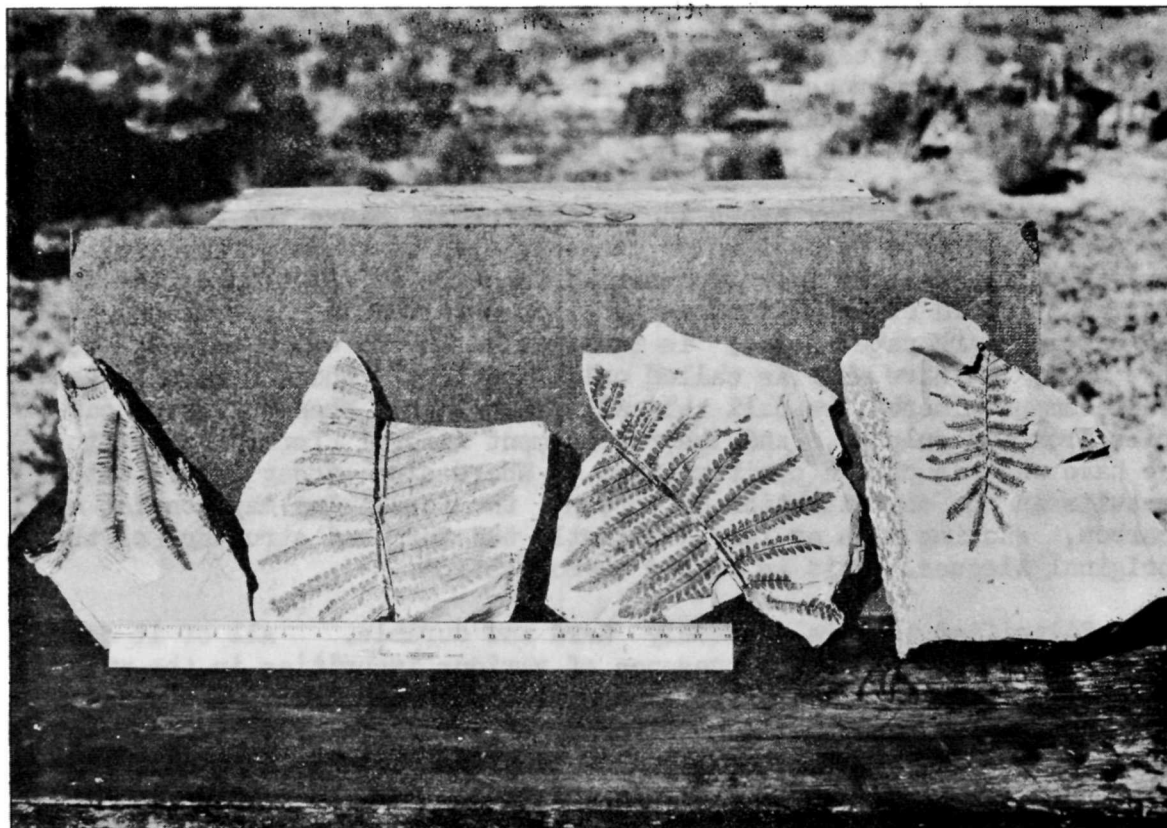
Wyoming, and the study of others which were found in the springs, give us a clue to the process of replacement or infilling, and also give ample proof that the time element involved in the replacement is an extremely variable one.

Petrified wood may occur in various forms. Since the replacement process involves a deposition or concentration of the minerals carried by water, a great variety of minerals might be in solution in the water which would result in various types of petrification or replacement. If calcium carbonate (lime) is in solution in the water and replaces the wood, we have what is called calcification. Where silica is the replacement mineral, we call this silicification. When the water carries iron and sulphur, and the replacement mineral formed is pyrite, we have what is called pyritization. Where slow decay under water results in the concentration of carbon, the fossil log may consist of carbon, showing more or less distinctly the form and structure of the original tissues. This is called carbonization.

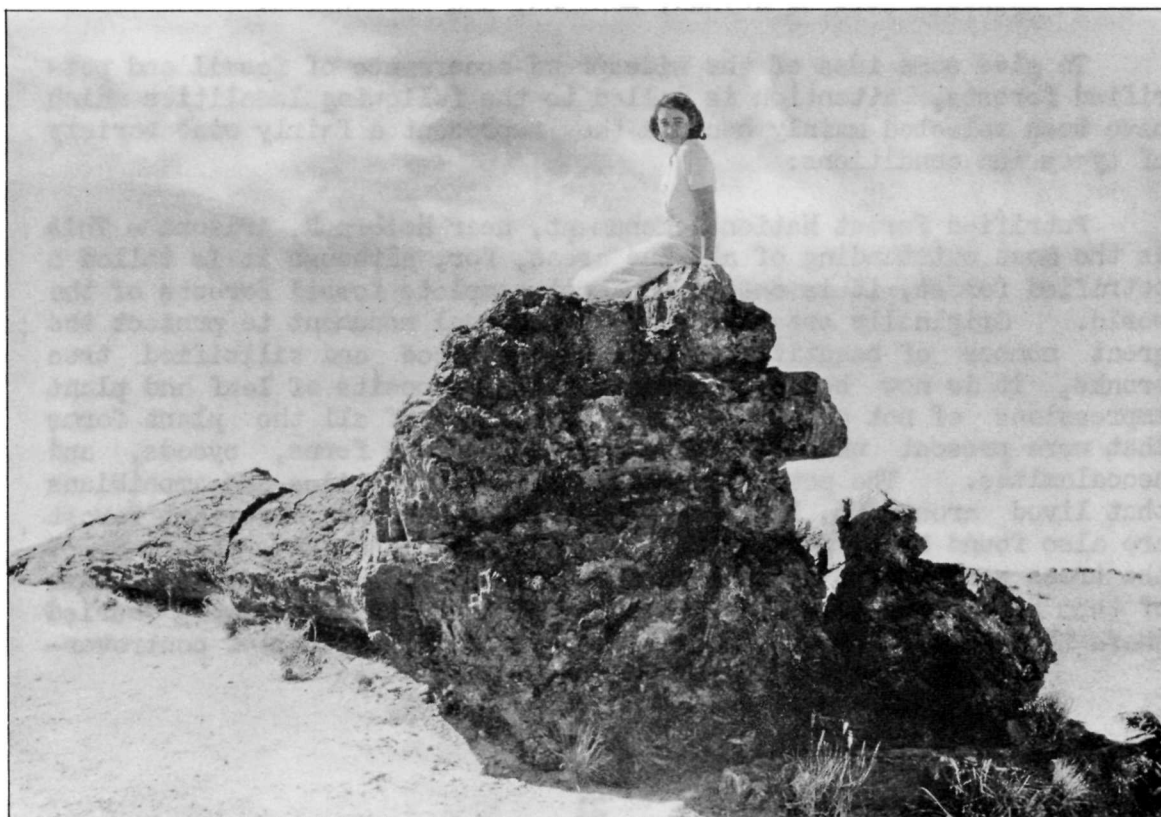
Silicified wood is extremely hard and durable. All of it does not look the same, for the presence of various impurities in the water along with the dissolved silica, such as iron, manganese, and aluminum, may produce not only different forms of structural replacement but will often result in the formation of beautiful colors and tints. Thus when the silicified wood is highly colored we may, depending in each case on the color, get such forms of petrified wood as agatized, opalized, jasperized, or carnelianized. This explains the beautiful agatized wood in the Petrified Forest National Monument, and the highly colored opalized wood of Nevada, Montana, and Washington.

To give some idea of the widespread occurrence of fossil and petrified forests, attention is called to the following localities which have been selected mainly because they represent a fairly wide variety of types and conditions:

Petrified Forest National Monument, near Holbrook, Arizona - This is the most outstanding of all the areas, for, although it is called a petrified forest, it is one of the most complete fossil forests of the world. Originally established as a national monument to protect the great number of beautifully colored agatized and silicified tree trunks, it is now becoming known for its deposits of leaf and plant impressions of not only the trees, but also of all the plant forms that were present when the forest grew, such as ferns, cycads, and neocalamites. The petrified bones of great reptiles and amphibians that lived around the lakes and pools of this once luxuriant forest are also found here. It is believed by some authorities that some of the trees were buried upright in the position in which they grew. Most of them are on the ground. This may indicate that they were buried where they fell. However, this theory is still a matter of controver-



FOSSIL LEAF IMPRESSIONS



PETRIFIED TREE

sy. Others were carried by rivers and streams for some distance, as shown by the battered and torn ends.

Ginkgo Fossil Forest State Park, near Ellensburg, Washington, on the Columbia River - This area contains among its petrified tree trunks the remains of a very interesting type of tree called the Ginkgo. It is commonly known as the Maiden-hair tree. Although once widely distributed over the world it is now native only in China and Japan. An old lava flow covered the sedimentary rock in which this forest probably grew. The petrified logs are buried in the lava, which is believed to have flowed into a lake basin in which there were either water-killed stumps, water-logged trees, or floating driftwood. As the lava cooled, a deposit known as "pillow lava" was formed around the tree remains. The replacement mineral is silica, in a form commonly called opal.

Florissant Fossil Forest, near Colorado Springs, Colorado - Some of the petrified trees have been identified as sequoias, thus proving that the sequoia trees were once much more widely distributed over the United States than they are today. The deposit, which seems to be an accumulation of silt and volcanic mud and ash in an old lake basin, is also noted the world over for its fossil remains of insects, fishes and other animal forms. Many of these are preserved as very delicate impressions in the fine-grained thin-bedded shales of this miocene lake deposit.

Redwood or Calistoga Petrified Forest, near Calistoga, Sonoma County, California - Here we have the petrified remains of great sequoia trees that were buried and preserved by the volcanic eruptions of Mt. Saint Helena. Some of these specimens are very large and many appear to have fallen in the same direction, that is, away from the onrushing volcanic deposits. Continued excavating would probably reveal a large number and variety of trees.

New York Fossil Forest, on Schoharie Creek, near Bilboa, New York - This is often referred to as "the oldest known petrified forest", for the large stumps of tree ferns date back to the devonian period, some 337,000,000 years ago. Other tree-like forms here seem to indicate that in this period the first true forest growths appeared. Reconstructions and restorations of this devonian forest are on exhibit in the New York State Museum in Albany.

Fossil Forests of Yellowstone National Park, Wyoming, near the Lamar River - Although there are several fossil-bearing localities in Yellowstone National Park, the petrified forest areas are probably the most widely known. This petrified forest is known the world over because erosion has now exposed not only one, but several standing petrified forests, one above the other, indicating that a forest grew and

was buried and another grew and was buried, until some twelve or more successive forests had been buried by the volcanic ashes and mud that accumulated and finally filled this old basin.

Fossil Cycad National Monument, near Edgemont, South Dakota - Petrified trunks of cycads, another type of tree now extinct in North America, were found so abundantly in a small area here that it was set aside as a national monument. The replacement of these specimens was so perfect in every detail that when thin sections were made and studied microscopically, it was possible to reconstruct the actual flower parts with great accuracy. The cycads, like the ginkgos, became extinct in North America for no explainable reason, and are today found native in only a few isolated places in the world.

Black Hills Fossil Forests, near Rapid City, South Dakota - There is a large amount of petrified wood scattered throughout the jurassic and cretaceous deposits exposed around the Black Hills region. Many of the specimens are well preserved silicified trunks of trees that measure several feet in diameter and occasionally 100 feet long.

Texas Fossil Forests, near Glen Rose, Madera Springs, Big Bend National Park Project, and Palo Duro Canyon State Park - Petrified wood is widely scattered over Texas, and in some instances it is highly colored. In some sections, such as near Glen Rose and Fort Worth, these forests have been almost completely destroyed by private individuals who have taken the petrified wood for use in constructing buildings and fences. Most of these petrified and fossil forests are found in exposures of the cretaceous age. Early cretaceous forests have been pretty well reconstructed from studies of the fossil leaves found in such exposures in several Texas localities. Petrified wood of triassic age is quite abundant in the Palo Duro Canyon State Park, near Amarillo.

Utah Fossil Forests, near Zion National Park, and Capitol Reef National Monument - Petrified wood is found in many of the triassic and cretaceous exposures in this region. Large silicified logs several feet in diameter and 50 or more feet in length may be seen in the southwestern corner of Zion National Park, and also near the village of Fruita, in Capitol Reef National Monument. There are a few fine petrified logs in the triassic and cretaceous exposures east of Bryce Canyon National Park and scattered over the Escalante and Paria drainages. Fossil leaf impressions of ferns, cycads, and neocalamites have been found in the chinle exposures in Zion and Capitol Reef, and cretaceous fossil leaves have been found in the sandstones below Bryce Canyon National Park. A silicified trunk of a cycad was found as a washed boulder along the Virgin River in Zion Canyon.

The study of fossil forests has made possible the reconstruction of typical scenes of each of these different geological periods. The

student of historical geology has been able by a careful study of these remains to visualize the conditions that prevailed in each area. Research in one area has made it possible to reconstruct the trees with their leaves, foliage, and in some cases, their flowers. In another instance, through indirect evidence, there appear signs of attacks by insects such as bark beetles, thus making it possible to picture the forest pests of bygone days. The underbrush of some fossil forests may even be worked out in detail, one area having growth of ferns, rushes, and cycads, while in another the growth was composed of shrubby currants, laurels, dogwood, and vines. The animal life that was present in the old forests may sometimes be pictured when the fossil hunter is fortunate enough to find the petrified bones, teeth, and skeletons of giant reptiles and amphibians. In other regions the delicate impressions in the shale reveal such forms as bees, butterflies, beetles, flies, and wasps.

One of the interesting facts learned from the study of fossil forests is that many types of trees which are now restricted in their natural range, such as the sequoia in California, were once widely distributed over the United States. For example, there are fossil sequoias in Colorado and Wyoming. Such forms as ginkgos, cycads, and araucarias, now found only in very restricted growths in foreign countries, once grew luxuriantly in Washington, South Dakota, and Arizona. The dense jungles of ferns, rushes, and cycads indicated by the fossil remains in the Petrified Forest National Monument would tend to prove that this region which is now an arid plateau country, was once a swampy lowland with an abundance of moisture. A study of fossil forests is a key to the past in which is revealed a wide variety of forest growths in as many different environments, some tending to indicate that temperate or semi-tropical humid conditions once prevailed in areas that today are arid and frigid; or that low valleys and inland lakes once existed where we now have high mountain ranges.

PROGRESSIVE FIRE-FIGHTING

By Clair V. Cooke,
Ranger,
Carlsbad Caverns National Park.

Speed is essential in combatting forest fires, so foresters have developed an efficient fire detection and transportation system, which includes use of airplanes and parachutes for dropping men and supplies. Fire-line construction has lagged somewhat in the speeding up of the fire-suppression game. Machinery for all-round use in the construction of fire lines has not proved practical everywhere. However, a new method in the use of old reliable hand tools has done much to speed up line construction in most types of forest, grass, and brush fires. This is known as the progressive, or one-lick method; one-lick, because the workers progress along the line without passing one another, each hitting one "lick" in a place with an axe, McLeod tool, shovel, or other tool. Upon more extensive use it was found that it often worked better to provide for the men hitting more than one lick in a place, hence the progressive method, which is now being taught in National Park Service fire schools.

In tests that have come to my attention this method has shown increased speed over the old sector method, and variations of the sector and other methods. Nearly the same kinds of tools are used so the question arises as to why this method is so much faster. The largest single saving of time probably is made by men not having to stop work while others pass them. Also, time is saved by men using the tools with which they are most familiar.

Perhaps a sample "lineup" will help. This lineup can be varied to suit the timber type, ground cover, and experience of men doing the work. For an average timber type a twenty-man crew foreman would work the men about ten feet apart in this order:

1 1 1 1 1 1	1 1 1 1 1 1 1 1	1 1	1 1 1	1
Mopup crew, Pulaski tools, shovels and backpack pumps. Snag fellers, if needed.	Line construction crews; McLeod tools (Clearing crew) and shovels.	Sawyers	Axemen	Line
				ter

This accounts for twenty men and can be varied to suit the number of men and conditions. A straw boss would ordinarily be with each of the three divisions. The foreman would work back and forth along the line, keeping the line closed as much as practical, considering safety and the fact that each man should be kept busy. Some of the points mentioned against this method are: it is too strenuous; the lead men do most of the work, leaving the rear men to loaf; it takes a well-trained crew which you don't always have when using CCC youths.

It is admitted that a well worked out progressive method of attack sets a fast pace. This can be remedied by rest periods of five

to ten minutes per hour. It will be found that the accomplishment will still exceed that of other methods, and that the men will be better satisfied to stop long enough to roll a smoke and enjoy it than they are when getting all of their rest on their feet while passing each other. Time is usually a vital element, especially when trying to beat the extreme burning period of midday or afternoon.

Good supervision by the foreman and strawbosses will keep the procession moving fast enough so there will be work for all. The foreman should keep a full view of the whole job and signal the lead to slow up or move ahead, as required. An efficient man on the rear helps a lot, especially with the inexperienced crew. If the rear line builder knows what the finished fire line should be, he can be used as a pace setter and each of the others instructed to keep the proper distance ahead of the man behind him. With each worker further instructed to tell the man ahead to get out of the way, the crew will usually get to swinging along and constructing a surprising amount of line. Sometimes less men per crew is the solution. If ten men will control the fire quickly, why take twenty?

Once the overhead understand this method, it probably can be used with a more inexperienced crew than is required for other systems. With the progressive method each man, as a rule, needs to be able to use only one tool. Even the least experienced man can do some good with a shovel or McLeod tool, while the inexperienced axeman may do practically no good, and in addition may be a menace to the safety of himself and others. As compared with the sector method, the progressive method has the advantage of not depending upon inexperienced individual workers to build and hold a section of line. A chain is no stronger than its weakest link. If you have a chain of men building individual sections of line, one individual who is weak with a pulaski, or in fire knowledge, may lose his section and cause the loss of the entire line.

In some types it has been found useful to have extra tools with the crew so that changes can be made if the lineup as used in the start does not work to the best advantage. When a large variety of tools is needed it may be necessary to use one man as a tool carrier. A couple of extra shovels, axes or pulaskis will, as a rule, be sufficient to balance the tools with the ground cover encountered. Usually the foreman or strawbosses can accomplish this by carrying a tool of some kind in each hand and making changes when necessary.

PARK SERVICE RANGERS

By Hugh M. Miller,
Superintendent,
Southwestern National Monuments.

A lot of boys want to grow up to be rangers. The juvenile conception seems to include the Lone Ranger, Texas Rangers, Nelson Eddy, and forest rangers engaged exclusively in riding and fishing, and fighting forest fires. The Park Service ranger isn't so definite a part of it, but the word ranger connotes romance in any context. There is still a faint confusion; in the adult public's mind, between park rangers and forest rangers, though millions of persons meet park rangers every year. Most of us who wear the National Park Service uniform have tried courteously to explain the difference when park visitors identify us with the Forest Service. It is not at all sure that we succeed. Perhaps if our uniforms were not green, but sky blue or scarlet, the visual aid would help our friends to file their ideas correctly. Forest rangers are such uniformly fine fellows that our feelings are not hurt badly, yet our pride in our own organization is such that we would like to be identified with it. Thus it is pertinent to set forth the difference.

First of all, the park ranger and the forest ranger work for different departments of the government. The park ranger does his daily tasks for the Department of the Interior; the forest ranger, for the Department of Agriculture. The forest ranger is primarily concerned with the conservation and wise commercial use of his district; the park ranger, with the preservation intact of the area's primitive values and noncommercial public use for purposes of recreation and inspiration. The obligation to protect the values entrusted to his charge is basic in the duties of each. Thus many of the actual functions are similar - both take precautions to prevent and detect forest fires; each is a key man in the organization which fights forest fires and combats insect infestations. At other points there may be similarity. Recreational use of the national forests is encouraged and there still is grazing in certain federal park areas. Supervision and control is exercised by the ranger in each case. In both services the ranger force is the protection force. The essential difference lies in the different types of use for which the areas are intended. The park ranger has no timber sales, no cutting permits; grazing permits, only rarely. The forest ranger has them all, but he has only incidental, instead of highly developed, concern with the traveling public.

Many National Park Service areas are either almost treeless or have nothing that could be described as a forest. Yet these areas do require protection and they have park rangers to effect it. And so the park ranger is not necessarily a forester at all. He may be pro-



"ASK A RANGER"

tecting an important archeological area, or a fine stand of desert vegetation, or a superb geological exhibit, or an historic building and the lands which surround it. He may need no horse and saddle, may make no lonely patrols. The distinction is important in the southwest, where rangers selected from the eligible lists maintained by the Civil Service Commission frequently are assigned to archeological areas which lack enough shade to shield a languid hen from the rays of the noonday sun.

The editor asks, for the benefit of aspirants, "What qualifications are necessary to obtain appointment as a Park Service Ranger?"

The last civil service examination to establish a list of persons eligible for appointment to positions as park ranger was given in 1937. In its announcement of the examination, the commission stated that;

Applicants must possess the following qualifications:

1. They must be citizens of the United States.
2. Education and experience.—They must show that they have had at least 30 months of responsible field experience of a progressive and technical character in park or forest work, involving such activities as fire and insect control, protection of wildlife and of scenic or historic features, which experience must have included at least 6 months of actual employment as foreman or employment in a similar position involving the supervision of at least three or four men; provided, that the successful completion of each year of study in a college or university of recognized standing in work prerequisite for a degree in forestry, biology, archeology, geology, history, landscape architecture or engineering, will be accepted in lieu of 12 months of the prescribed experience up to a total of 24 months, and that applicants who substitute 2 years of study in the above majors for the prescribed experience will not be required to show experience as foreman; and, provided further, that in any event at least 6 months of the required experience must be shown.

At least 1 year of the required experience or education must have been acquired within 5 years next preceding the date of the close of receipt of applications.

Seasonal Experience.—Applicants who show that they served at least two seasons of at least $2\frac{1}{2}$ months each as ranger or guard in a national park, national monument, or national forest as described above, will not be required to show the 6 months' experience as foreman.

Nonqualifying Experience.—No credit will be given for (a)

experience acquired before the applicant reaches the age of 18 years; (b) forestry experience such as lumbering, cruising, scaling, etc., or other types of forestry work not directly related to park activities; (c) routine woods or ordinary farm or plantation work; (d) rodman, chainman, laborer, etc., on survey work.

3. Age.—They must have reached their twenty-first but not their fortieth birthday on the date of the close of receipt of applications. These age limits do not apply to persons granted preference because of military or naval service, except that such applicants must not have reached the retirement age.

4. Physical Ability.—Applicants must be in sound physical condition and good health, able-bodied, and capable of enduring hardships and performing severe labor under trying conditions. The commission will reject the applications of persons whose height and weight are grossly disproportionate, other measurements being considered; also the applications of persons who have flat foot, hernia, organic heart disease, or other serious physical defects which, in the opinion of the commission, would render them unfit to perform the duties of the position. Vision, without glasses, must be at least 20/40, both eyes combined, with at least 20/50 in the weaker eye.

Height and Weight.—Applicants must measure at least 5 feet 7 inches in height without boots or shoes, and weigh at least 145 pounds in ordinary clothing without overcoat or hat. The height and weight requirements will be waived for persons entitled to military preference.

Invalids and consumptives seeking light out-of-doors employment are not qualified for the work and should not apply.

While these specifications may be modified for future examinations, they offer the most dependable answer which can be given to the editor's question.

The duties of a park ranger were described in the same announcement, in the following language:

Duties.—Under general supervision, to be in responsible charge of a ranger district in a national park or monument, or of specific units of work in a ranger district, or to act as assistant to a park ranger in responsible charge. Such duties involve protection of the forests from fire; fire prevention and insect control; protection and study of scenic features, flora, and wild animal life of the park or monument; planting of fish; giving of reliable and authentic information to, and the

protection of, the public visiting the park or monument; preservation of law and order; prevention of accidents; registration of visitors and issuance of automobile permits. The duties require men of strong physique, who must fight fires in summer and patrol the parks through heavy snow in winter.

Emphasis is placed on forest protection, but in practice eligibles are drawn from the park ranger list for filling vacancies in positions as custodians of national monuments. These positions have been established at the same grade and salary; that is, field grade 8, at \$1860 per annum. This is done on the theory that the requirements of protection are paramount in many of the national monuments, though the duties of a custodian of a national monument involve the assumption of a larger proportion of administrative responsibility than is usual under strictly ranger assignments. In the southwestern group of national monuments alone there are twenty permanent positions which are normally filled from the park ranger register, though in only three cases is forest protection a highly important problem. Considering a certificate of eligibles now in process, a total of ten selections will have been made for the Southwestern National Monuments during a period of twelve months. This is higher than average, as the result of the establishment of new positions, but the record indicates that a given eligible's chances of appointment are enhanced by the existence of positions in which forest protection is not a primary consideration.

This phase of ranger employment is recognized in that part of the announcement quoted above which accepts college or university training in archeology, geology, history, landscape architecture, or engineering in lieu of practical experience up to twenty-four months; and experience as a seasonal park ranger for the remaining six months' experience requirement.

While the announcement sets up no minimum educational requirement, and admission to the examination might have been on practical experience alone, education approximately equivalent to high school graduation would have been necessary to enable the applicant to pass the written tests. The word equivalent is used advisedly, for actual high school graduation was not a stated requirement. In fact, most of the eligibles who have been certified from the 1937 register have been college graduates or men who have had some college or university training, and of these a large proportion had been forestry students. The author has scanned each new certificate, eagerly looking for the budding archeologist who took the park ranger examination, but the nearest was a competent young forester who had collected arrow heads when he was a boy. Those arrow heads landed him at the ruin of a prehistoric cliff dwelling - but he says he likes it.

On the job the park ranger is a man of many trades. In many, per-

haps most, park areas he is a practical forester who fights fires, packs animals, builds and maintains trails and telephone lines, plants fish, protects wildlife, enforces the law, and fixes anything that needs fixing, from a broken ski harness to a dirty carburetor. He may often be isolated, but if he doesn't like people he shouldn't be a park ranger, because park visitors perennially bloom in his door-yard and they are his chief reason to be. If he cannot welcome them with an honest glad-to-see-you smile, he isn't in the tradition of his Service. He is the diplomat, the guide, and friend. He must answer the same question a thousand times, each time with courtesy and interest in the person who asks it. At the checking station, on the trail, at the campground, wherever you find him, his name might be Sam because he is the wise uncle to everybody. He's the backbone of the Service, whether he's called a ranger or a custodian. "And the rangers," most park or monument visitors will tell you, "are so nice to you!"

It is almost impossible to list all of the things a ranger may do in a day's work. He rescues people from all sorts of predicaments, ranging from funny to tragic. In Chaco Canyon National Monument, New Mexico, the custodian buries the bodies of Indians who die in the vicinity - a real service, though extra-curricular, because the Navahos fear the evil spirit which lurks in a dead body.

At Organ Pipe Cactus National Monument, Arizona, Custodian William Supernaugh, who came off the park ranger register less than a year ago, has charge of 330,000 acres of outstanding desert country. There is no one to help him. Cattle are still grazed on the monument, and there are a number of mining claims. He must exclude hunting and wood-cutting. He is supposed to be looking after some of the few desert big-horn sheep left in the United States; he may collide at any time with smuggling across the Mexican border; he has been helping to locate an important road; he built the little checking station with his own hands; he has been chief assistant to a well-driller; and has spent a good deal of time checking the title to private lands within the boundaries. Almost any ranger or custodian has equally diverse, though different, duties. It's no job for a one-track mind! That's about all you can say with any degree of positive definition, except that the basic idea of protection is always present.

A word may be said about the temporary or seasonal ranger positions. Temporary rangers are employed each summer at the national parks and at many national monuments to help out during the months of the greatest number of visitors. The seasonal positions usually are from three to four months' duration, cannot extend beyond six months. Seasonal ranger positions are not subject to civil service rules and regulations. Selections are made by the Secretary of the Interior from applications submitted to him. Many fine young men are attracted to these summer positions, which are open to qualified students, teachers, and others who are free during the summer months. Applicants must be at least 21 years old. No tests or physical examinations are

ordinarily given, though good educational background and sound physique are requisites. The duties may be any of the duties of permanent park rangers, but the seasonal rangers usually work under the immediate supervision of experienced regular employees. The training is excellent for any young man who wishes eventually to enter the permanent ranger service. Many positions on the permanent ranger staff have been filled with eligibles who first came to the Park Service as "temporaries." Most park superintendents prefer eligibles who have had several seasons' experience as temporary rangers. It should be clearly understood, however, that seasonal experience does not in itself establish eligibility, which can be gained only through competitive civil service examination.

The park ranger is a relatively new thing under the literary sun, and he is less fabled in song and story than other rangers in different settings. But his "public" numbers fifteen million or so, and it likes him.

THE CAT SPANKER

By Robert R. Budlong,
Custodian,
El Morro National Monument.

Domestic cats are cute pets but they are out of place in a wildlife refuge. Marauding tabbies from nearby farms wreaked such havoc among our bird population that it became necessary to do something about it. An effective and humane device was constructed that functions automatically to discourage such visitations, and now, seemingly, no cat will venture within the boundaries of this national monument more than once. The contrivance includes a platform upon which some salmon is placed as bait. Through a trigger arrangement actuated by the weight of the cat as he is about to sample the fish, a bent lath is suddenly released and applied smartly to the south end of the feline. Propelled down a metal chute and into a tub of cold water, he emerges with great speed, streaks for the nearest boundary fence, and never returns. While I never could find one of the victims, after one application of the "spanker", my neighbors tell me that their cats have become rather shy. The pussies stay at home, keep looking over their shoulders, and have spells of resting in a most peculiar manner. They look thoughtfully off into space, as though some memory bothers them. They frequently go to sleep standing up, or rest lying down; seldom do they just sit. And they have acquired a distaste for salmon!

The "walloper" consists of a three-sided pen and a long chute that leads down toward a large washtub of water. Incorporated in the floor of this chute is a delicately-hinged platform, flush with the floor, and supported lightly by a rubber band stretched beneath it. When the platform is depressed about a sixteenth of an inch it closes an electric circuit and releases the tripping device. This consists of a large rat-trap with an iron washer fastened to the pan and an electro-magnet built into the trap directly beneath the pan. The magnet is actuated by a 22½ volt battery. The weight of the cat depresses the platform and closes the electric circuit; the magnet pulls the rat-trap pan down, the wire jaw flies forward and knocks free a long nail that is held in place back of a carriage-bolt head. To this nail is fastened a long cord, which in turn is tied to a lath, the opposite end of which is firmly fixed to a heavy post in such manner that when the lath is strongly-bowed, the string is long enough to let the nail catch beneath the carriage-bolt head, keeping the lath bent until released by the rat-trap. This lath is not ordinary building lath, which has insufficient strength and spring, but stronger and sterner stuff. When this bent lath is released, it flies forward, and through a nicety in adjustment applies a vigorous spanking to the posterior extremity of the cat. It is best to pad the business-end of the lath with a sponge-rubber kneeling-pad, such as is used by some housemaids and gardeners. The result is a severely-spanked cat. The entire operation takes but a fraction of a second,



STUFFED "KITTY" DEMONSTRATES SPANKER

and, Presto! your cat problem is solved. An added refinement in construction is to connect one wire leading to the magnet through the metal parts of the trap via the trigger, to break the electric circuit as the trap is released, thus preventing the battery from running down.

You must build the entrance to the spanker carefully, so that the cat will voluntarily assume the correct position. Once that happens, his future actions become involuntary. Therefore, we make a three-sided blind just ahead of our tunnel, or chute, and place some salmon just beyond the movable platform in the floor. The cat will eventually stalk into the open end of the blind and cautiously approach the salmon. If we take a series of measurements of average cat length, average stride of front legs, average distance from front paw to nose, and so on, we can properly adjust our hinged platform so that when the cat's front paw touches the platform and releases the mechanism, only about five-and-a-quarter inches of cat protrude from the blind. It is essential that the cat have its tail erect, but Nature attends to this. The cat feels anticipation or something, and it is the nature of cats to hold the tail erect at such moments. With respect to "average" on the necessary cat measurements: this depends upon the size of cats raised in your vicinity. Keep accurate notes of these measurements. I find that seven cats will give sufficient average. You obtain this by adding each column (length of foreleg, length from extended paw in normal creeping position of the cat to tip of nose, etc.) and dividing the totals by the number of cats. From these measurements you determine the length of the entrance from where the spanker stops, to the edge of the hinged platform.

All parts must be covered with sheet metal. Don't use wood throughout - you can't be sure of grain direction in the wood, and moisture raises the grain, so line it with zinc or galvanized iron-sheeting. By further experimentations you can readily determine the proper tension on the lath. You should spank the cat violently enough to propel him a predetermined distance, but not cause any injury. This tension is regulated by lengthening or shortening the string from the lath to the nail that holds the lath in its bent position.

We next come to the problem of what to do with the cat as he is propelled forward. He invariably goes head-first. You might do as I did with one spanker that was the most effective of all: contrive another propelling device where the cat emerges from the tunnel that will release from the shock of his landing and propel him vertically over the nearest fence. This, I have observed, adds to his humiliation. If you have no fence, you will find that it is not very difficult to construct one, in order to achieve just the right effect. However, I find that by building the tunnel so the far end has a strong downward direction; and by placing a large-size washtub full of cold water beneath this, satisfactory results are obtained. You should remember that pressure and friction produce heat. Not that the cat will become hot-headed - quite the contrary. He will go into the tub headfirst, but the warmed end will immediately be completely submerged. It has seemed to me that this cooling device is most humane.

WILD TURKEYS

By Russell K. Grater,
Junior Park Naturalist,
Boulder Dam National Recreational Area.

Probably no nation has ever been blessed with such a wide variety and abundance of wildlife as has the United States. Certainly no nation endowed with a wildlife population of a comparable nature has outstripped us in our destruction of these wonderful resources during the past 75 years. One by one some of our most important wildlife species have slipped from our national scene and into oblivion, never to return. Very famous at one time and still retained on the official state seal of California is the huge grizzly bear of the Sierra Nevada - now only a legend in national parks such as Yosemite and Sequoia. Gone also are the Merriam's Elk of the Southwest, and the Audubon's Bighorn of the Great Plains badlands. The buffalo, which adorns the seal of the Department of the Interior, has faced extinction in the past, and the question of its continued existence was a serious matter not so many years ago. Found on our national seal, the bald eagle has been largely exterminated throughout much of its former range, and only the energetic labors of conservationists have kept it from joining the ranks now occupied by the passenger pigeon and the great Auk.

Almost completely overshadowed by the fate of his larger wildlife neighbors, the bird once seriously considered for our national seal has only in the past decade received the protection and attention necessary for his continued existence. This bird is the wild turkey. A familiar sight even in our grandfather's day, the fate that befell this finest of game birds is too well known to repeat. An outcast on the road to extinction, it finally received the attention it merited. While the turkey has now become an important species in the conservation plans of several states, and is found in quantity on some of the nation's wildlife sanctuaries, it seems a bit strange that of all the various national parks and monuments, it was only recently that such an area contained this bird. It was not until the establishment of such parks as Great Smoky Mountains, in North Carolina and Tennessee; and Mammoth Cave, in Kentucky, that the turkey finally attained a rank of major importance in the areas under National Park Service jurisdiction.

While other park areas are known to contain turkey, it is at Great Smoky Mountains National Park that we find them in the most encouraging numbers. From that area we learn that "the status of wild turkeys.....is now considered very favorable. No estimate of numbers of turkeys when the National Park Service began administration of the

area is available, but field observations by Service personnel indicate that the numbers of these birds have more than doubled since the land came under our jurisdiction. Our 1939 census figure of 150 birds is probably a very low estimate.

"One of the important factors placing a handicap on the comeback of the birds has been the loss of the chestnut. There is an abundance of oak acorns and occasionally a good crop of beech mast so that the food supply is thought to be adequate for as large a population as can be expected. The increase in turkeys has paralleled an increase in gray foxes and has emphasized the soundness of the Service policies in allowing natural populations to work out their adjustments without human interference.

"Wild turkeys survived their most critical period, probably the 1920's, on the relatively high and inaccessible ridge tops. In recent years they have spread to lower elevations and now are frequently seen as low as 1,500 feet elevation. Some of the birds permit observation at distances as close as 100 feet, but every effort will be made to keep them truly wild creatures. It is well known that turkeys move about considerably, and flocks in the Great Smokies have been traced to move as much as 12 miles within a few days.....The birds move off the park very little at present. Mature open hardwoods, where oaks predominate, are preferred habitats. Within the park, the environment is so much more favorable that we do not expect any great number to be taken by hunters outside the park for some time."

In Mammoth Cave, the park was stocked by the State of Kentucky in 1932 with turkeys obtained from points outside the state. Some of these birds were trapped wild stock from Texas while the rest came from Iowa where they had been pen-raised. It was not until 1935 that any figures were available to indicate whether the plan to stock the area was successful. In June of that year a hen turkey with fifteen young was reported. Some weeks later this was followed by reports of a hen with eight young and one with fifteen. In 1936, a total of twenty-seven were recorded during the year, some of which may have been counted in more than one area. No other reports are available until August of 1939, when a hen turkey and eight young were seen along the Green River east of the cave. No records have been obtained since that time, thus the real status of these birds within the park is still somewhat uncertain, although it is apparent that they have become fairly well established. The time may well come when the park will be one of our best known turkey sanctuaries and this attraction may vie with the cave itself for public interest.

The situation at Shenandoah National Park, Virginia, is not so clear. Formerly abundant through the area, turkeys have been regarded in recent years as probably extinct in the park, although a few indi-

viduals may be present but unrecorded. At Jamestown Island, in Colonial National Historical Park, Virginia, Biologist O. B. Taylor reported seeing a few turkeys, but their status was not defined.

Only a few of our national monuments are known to contain turkey, and, of these, the residency of the birds in some areas is not yet established. In the West, Bandelier National Monument, New Mexico, is undoubtedly of primary importance as a turkey sanctuary. Until 1932, hunting was allowed in the monument prior to its assignment to the jurisdiction of the National Park Service. Lacking a permanent custodian, little could be done to actively protect turkeys until 1934. In September of 1937, Custodian C. G. Harkins reported that "indications of the Merriam Turkey nesting within the boundaries of the monument are very evident. They range in and out of the boundary on the north, but, on the South Mesa, they stay inside throughout the year. The poults reach about one-fourth grown in July, as a flock was observed the latter part of July along the west boundary consisting of nine poults and the hen". There are no records of any nesting birds in the monument since that time although flocks of yearling hens and young gobblers were seen both in 1939 and 1940. The latest estimate of turkeys from the area (1939) was 50.

Turkeys have also been recorded at Walnut Canyon National Monument, Arizona, but due to its small size the monument is of restricted importance as a turkey sanctuary. However, it is surrounded by a wild turkey refuge and thus should maintain a fairly constant population, although contributing little in the way of breeding grounds.

A rather unusual situation exists in Grand Canyon National Park, Arizona, as regards turkeys. For several years there has been agitation to introduce these birds along the South Rim of the canyon in areas of a suitable nature. Studies were made by the author in 1935-36 to make sure that turkeys actually existed at one time in that area, in order to justify their reintroduction. Much conflicting data were compiled during these studies. Some sources of information were exceedingly vocal in their insistence that turkeys were at one time very numerous throughout the region; others were equally as sure that no such conditions ever existed and were only figments of the imagination. However, from these welter of contradictory reports, evidence tended to prove that the birds were once found along the South Rim, but probably in limited numbers. Meanwhile unforeseen events were taking place on the north side of the canyon. The Kaibab Plateau, while excellent turkey country, had never been known to contain any because of the isolated nature of the region. This is the home of the Dusky Grouse. Thus it was rather disturbing to learn that wild turkeys were being released in the national forest immediately adjacent to the park. Investigations showed that the new additions to the avian fauna of the plateau were thriving, and, from the last accounts received, a few turkeys have now been seen in the park and are apparently becoming

well established. What the eventual results will be are still in the future. The effects, if any, upon the Dusky Grouse will be watched with interest. In the meantime, Grand Canyon finds itself with the unusual situation of turkeys being established on the north rim where they should not be found, and not present on the south side of the canyon where their presence would meet with approval.

Years of study at Mesa Verde National Park, Colorado, produced the conclusion that turkeys were once found in the park area, and suggestions that the birds be reintroduced have met with approval.

At Mesa Verde, as well as in other southwestern park areas, the turkeys are the Merriam's Turkey (*Meleagris gallopavo merriami*). Those found in the eastern parks and monuments are the Eastern Turkey (*Meleagris gallopavo silvestris*).

It has taken years to establish parks and monuments in which the wild turkey can find refuge and propagate its kind. Now only a museum piece in many parts of the country, the return of this king of game birds to his former abundance in specially designated sanctuaries established and maintained by both state and federal agencies seems assured. The time is rapidly approaching when a visitor to these areas will be able to include in his collection of wildlife memories the picture of a truly wild turkey, head high, keenly alert, and poised for a speedy retreat into the cover of his forest home. Such a memory will occupy in the onlooker's mind a niche reserved for the best creations of Nature.

ODDITIES

Lightning bolts are among the permanent exhibits in White Sands National Monument, New Mexico. Forked lightning calcines the gypsum crystals that are known as sand, and forms Plaster of Paris. When the rain wets these streaks of Plaster of Paris, the composition is turned into rock, or lightning bolts.

If all the trees in the Petrified Forest National Monument, Arizona, were broken apart, and their semi-precious jewels extracted, there would be a small mountain of glittering stones worth a fortune. The stones include agate, carnelian, amethyst, topaz, and jasper.

Geologists believe that the water in the hot springs, boiling springs, and warm springs scattered throughout the United States, has been heated by contact with subsurface volcanic rocks, or by vapors given off by those rocks. These springs are located mainly near extinct volcanoes. Examples are in Yellowstone National Park, Wyoming; Hot Springs National Park, Arkansas; and the proposed Big Bend National Park, in Texas.

The North Rim of Grand Canyon National Park, Arizona, is supplied by what is believed to be one of the highest lifts of water, for domestic purposes, in the world. The water comes from a spring in Bright Angel Creek, far down in the canyon, and is raised 3,800 feet through a four-inch pipeline. Part of the flow passes through turbines that generate power for electric pumps to furnish the "juice" for the lift. The machinery was lowered from the canyon rim on a four-mile tramway built for that purpose.

Plants representing three zones are growing in one community, in Carlsbad Caverns National Park, New Mexico. On the rolling plateau above Slaughter Canyon, the elevation is such that one would expect a community dominated by pinyon pine and juniper. Instead, there is a mixture of alligator-bark juniper, yellow pine, madrone, sotol and yucca, along with various grasses, but no pinyon pine. The yellow pine belongs distinctly to a higher zone; the sotol and yucca, to a lower zone.

NATIONAL PARK SERVICE AREAS IN REGION III



