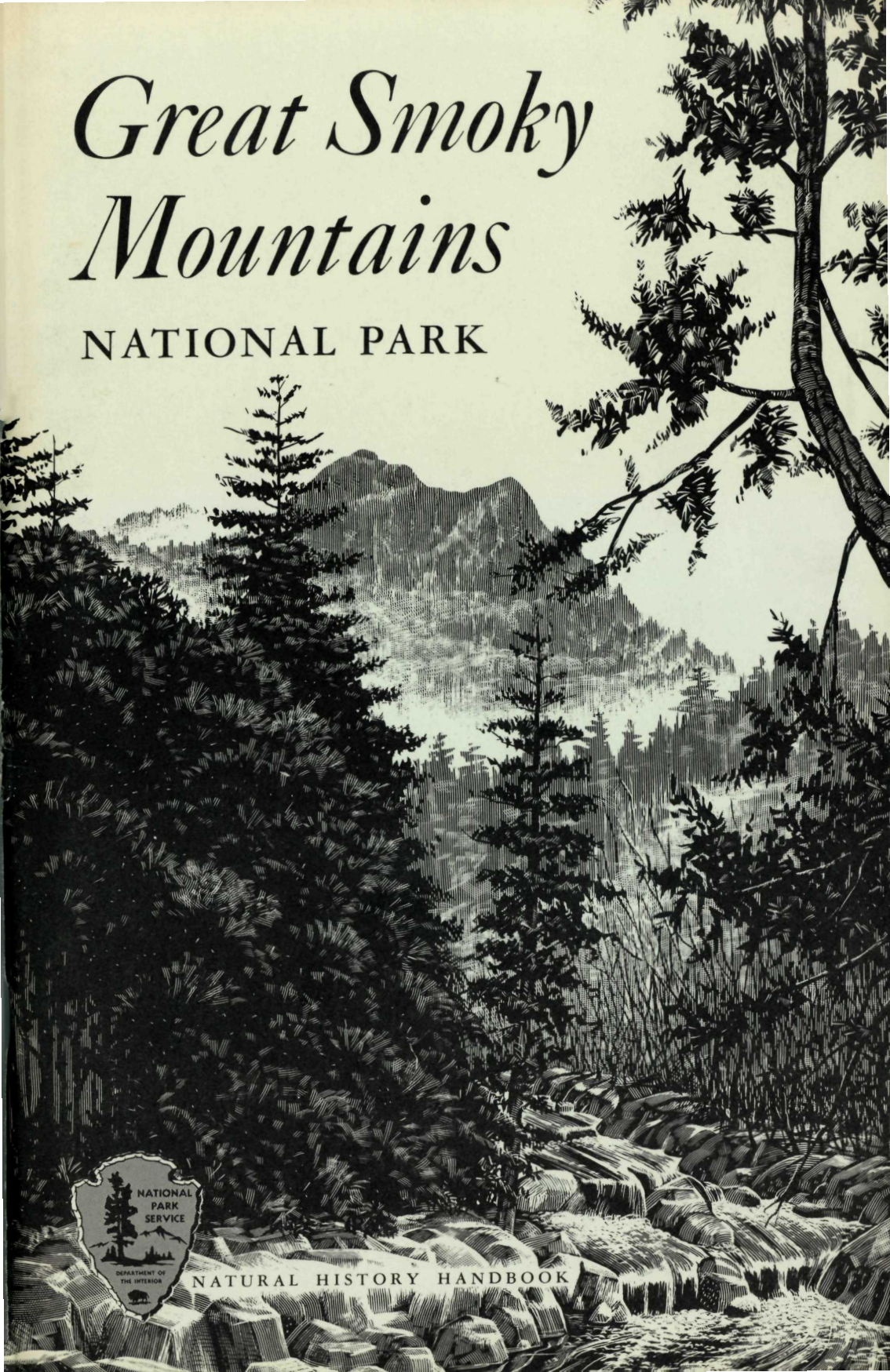
Great Smoky Mountains

NATIONAL PARK



NATURAL HISTORY HANDBOOK

UNITED STATES DEPARTMENT OF THE INTERIOR
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Conrad L. Wirth, *Director*

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Great Smoky Mountains

NATIONAL PARK

North Carolina and Tennessee



By Arthur Stupka

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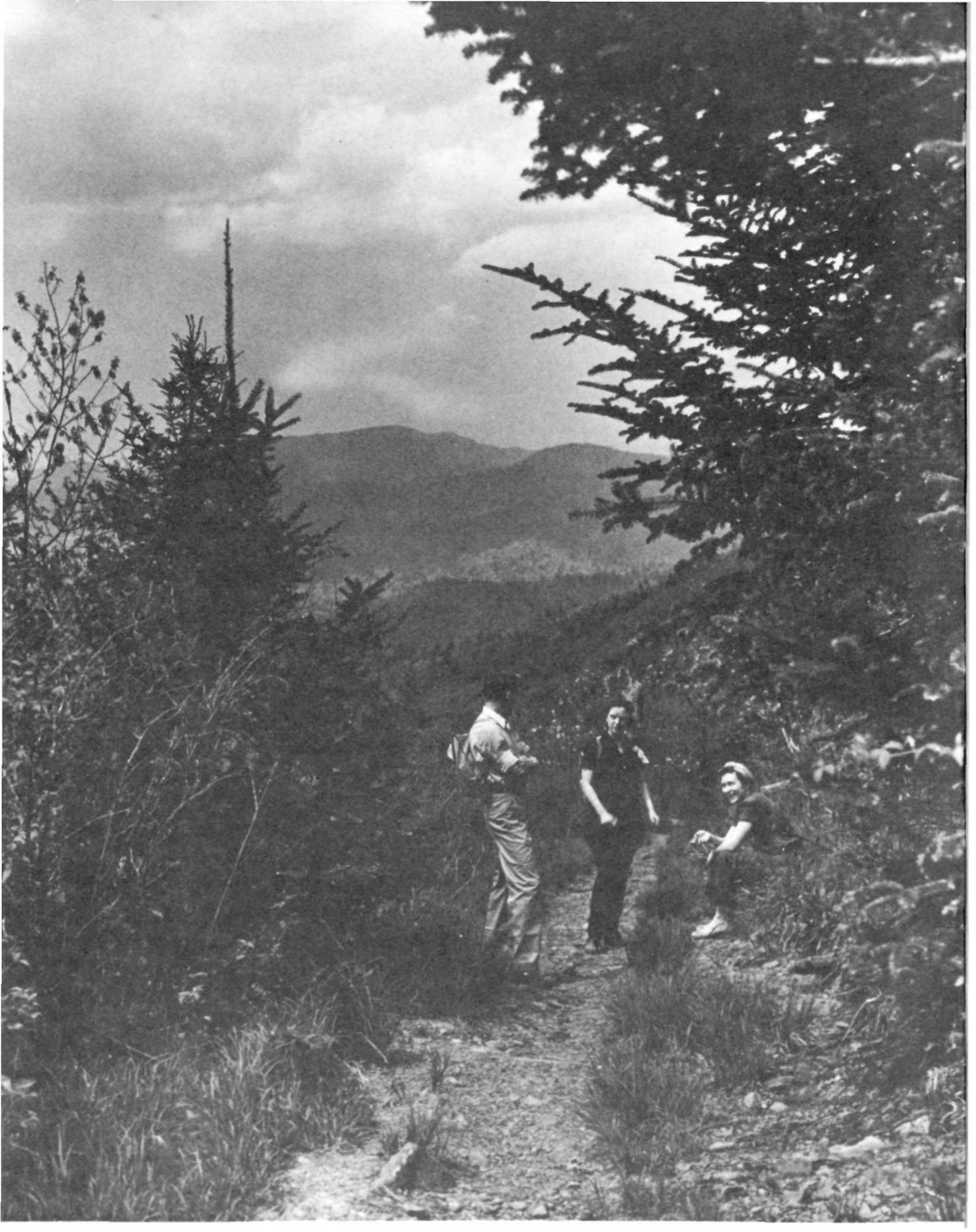
The National Park System, of which Great Smoky Mountains National Park is a unit, is dedicated to conserving the scenic, scientific, and historic heritage of the United States for the benefit and enjoyment of its people.

It is a pleasure to acknowledge my indebtedness to Robert E. Lennon, United States Fish and Wildlife Service, and Vernon C. Gilbert, Jr., National Park Service, for their help in preparing significant parts of the manuscript.

ARTHUR STUPKA

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Hikers stop to rest along the Appalachian Trail. In the distance is Clingmans Dome, the park's highest mountain. There, this foot trail reaches its highest altitude (6,643 ft.) in the 2,100 miles from Maine to Georgia. Courtesy, Tennessee Conservation Department.



Mountain Wilderness

THE GREAT SMOKY MOUNTAINS, *primeval and time-worn, are densely carpeted with vegetation from base to summit. This prevalence of plant-life, coupled with the haze which pervades the scene and broods over this ancient land, engenders a peculiar enchantment, a genuine charm which appeals to us in a warm friendly way. We look down from one of the summits upon range after range receding into the dim horizon, and we are reminded that these mountains are but one segment of the Appalachians. Wisps of fog rise up from the valleys and low-hanging clouds roll through the gaps following the rains that make these mountains the Nation's region of highest precipitation outside the Pacific Northwest. This, in part, accounts for the variety of plantlife and the great size attained by a number of trees and shrubs. Nowhere are there more champion trees than in Great Smoky Mountains National Park; from 15 to 20 species reach record proportions.*

The forested land which prevailed here had been practically undisturbed until about a century ago. A few pioneers had appeared, and to them the wilderness presented a truly formidable environment. But man did not make much impression upon the scene until the advent of lumber companies, mostly early in the 20th century. Fortunately, the region was of such difficult access that a considerable amount of its virgin forests was left intact, and this later became a part of the park.

While great changes were taking place in nearby communities, several generations of strong-willed mountaineers, beginning with the earliest pioneers, continued in their simpler way of life. Here the people, like the trees, marked time, as it were, until the idea of a National Park became a reality. Their story is intimately interwoven with the story of this misty wilderness.

The Mountains Appear

If you stand on one of the lofty peaks of the Great Smoky Mountains and view the wavelike sequence of ridges which finally lose themselves in the hazy distance, you are awed by the grandeur that nature has lavished upon this mountainous region. Its landscape is the product of almost incomprehensible forces. Here, throughout countless ages, the surface of the land has undergone profound change. The main story has been one of erosion, but let us go back many millions of years and begin the geologic account with the rock-making and the building of the mountains which took place in another age, for the Smokies are a part of the oldest range of mountains in the country.

Most of the rocks that compose these mountains belong to a group called the Ocoee series. They were formed from sediments—muds, sands, and gravels—derived from a very ancient land mass and deposited in great quantities, probably on the floor of a shallow sea. Here they gradually accumulated in extensive layers to a thickness of 20,000 feet or more. Deep burial and compaction, plus the chemical action of water depositing natural cement among the particles, changed the sediments to rock.

So ancient are these Ocoee rocks that they contain no fossils of plants or animals, having been formed before life was abundant on the earth. According to geologists, these rocks antedated the Cambrian period of the Paleozoic era, more than 500 million years ago.

The vast thickness of the sediments and the theory concerning their source captures the imagination. What was it like, this land mass from which the silts, sands, and gravels were derived?

> Some of the rocks of the Ocoee series . . . are made up of innumerable pebbles of quartz and feldspar; these pebbles were derived from the breaking apart, under the influence of weather, of individual crystals of an ancient granite mass. The conglomerate looks somewhat like granite and is composed of the same materials but these materials have been broken up, transported, reconstituted in strata, and once more consolidated. The granite from which the conglomerates were derived probably stood as mountain ranges at the time when the Ocoee series was being formed. (See "Selected Bibliography," King and Stupka, 1950.)

The accumulation of sediments extended over long periods in geologic time. Following this, the land surface was raised and subjected to tremendous lateral pressures which caused the rock formations to buckle into folds and to break in many places, forming overthrust faults. This major disturbance of the earth's crust is known as the Appalachian revolution, an epoch of mountain-building in the Eastern United States which transpired some 200 million years ago. The uplift that brought the higher Rocky Mountains into being came at a much later time.

Mount Le Conte (elev., 6,593 ft.), as seen from Newfound Gap. The prominent scars on the side of this mountain resulted from a cloudburst which occurred on September 1, 1951. Most of the dark-colored, spired evergreens are red spruce. Courtesy, Tennessee Conservation Department.



The overthrust of rock formations is well exemplified in the scenic valley of Cades Cove. Here the Ocoee rocks were thrust several miles, causing them to override much younger formations in the valley section to the north. Those younger rocks, mostly limestones, were formed during the Ordovician period of the Paleozoic era. In contrast to the older, lifeless Ocoee series, the younger rocks contain fossil remains of primitive sea animals. In the ages following the overthrust, constant stream erosion gradually cut through the ancient rocks and revealed the younger limestones beneath. Even though all rocks exposed to the weather are altered, not all are equally susceptible; thus the limestones, once exposed, weathered and eroded with comparative rapidity, producing a level-floored valley almost entirely surrounded by steep-sided mountains. Today in this scenic cove you can stand almost encircled by mountains composed of rocks 200 million years older than the rocks of the valley floor.

Following the Appalachian revolution and the uplift of the land, the relentless forces of rock-weathering and erosion began carving the valleys. This was evidently renewed several times; each time erosion reduced the entire region to an almost featureless plain, but again the processes of cutting down were renewed by uplifts in the land. Evidence of these ancient plains can be seen as a series of high ridges of approximately equal height. The valleys as we see them today have been carved from what was once a much higher land surface. Geologists explain it in this manner:

> The present ridges and mountains are not caused by upheaval, but by erosion, whereby the valleys have been carved out of the same rock formations as those that still project above them. One may therefore conclude that the landscape of Great Smoky Mountains is not made up so much of ridges rising between the valleys as of valleys cut between the ridges (King and Stupka, 1950).

Your appreciation of the landscape will be increased by an awareness that these valleys were carved by stream erosion, a phenomenon we witness almost daily. Every year thousands of tons of soil and rock fragments are washed down the slopes and are carried away by the streams. Usually, this is a very slow process, but there have been cases of tremendously accelerated erosion, when tons of material have been removed in a matter of minutes. On the south face of Mount Le Conte are huge scars which bear testimony to the tremendous force of flood waters. Here a cloudburst caused complete destruction to parts of a mature forest, stripping large trees from the mountainside and piling up debris for miles in the valley below.

It is intriguing to imagine the enormous amounts of sediments that have been removed through the ages to produce the valleys that we see today. When we consider the present depth of the valleys and the fact that these mountains stood thousands of feet higher in the geologic past, we get some idea of the grand scale of erosion in this area. As one geologist, George H. Chadwick, has stated, "Even the Grand Canyon fails to dwarf what is here visible."



Little River, one of many fine trout streams in the park. These cold, rock-strewn watercourses are, for some visitors, the outstanding attraction in the area.

In the time of the last geologic epoch, the Pleistocene, glacial ice spread over a large part of the land surface of the world. It covered Canada and extended into the northern United States. During one period, the ice sheet moved as far south as the Ohio River, but it never reached the Great Smoky Mountains. Perhaps, during the ice ages, the highest ridges of the Smokies were bare of trees and were covered with snow. The cold climate of that time left its mark upon the landscape in this area. The huge boulders, or "graybacks," lying on the slopes and in the valleys were moved there by forces that are no longer evident. It appears that these rocks were broken off and removed from the mountaintops by frost action, and they gradually accumulated as boulder fields on the slopes and in the valleys below. You may see examples of such boulder fields along both the Big Locust and the Buckeye Nature Trails, adjacent to U.S. 441.

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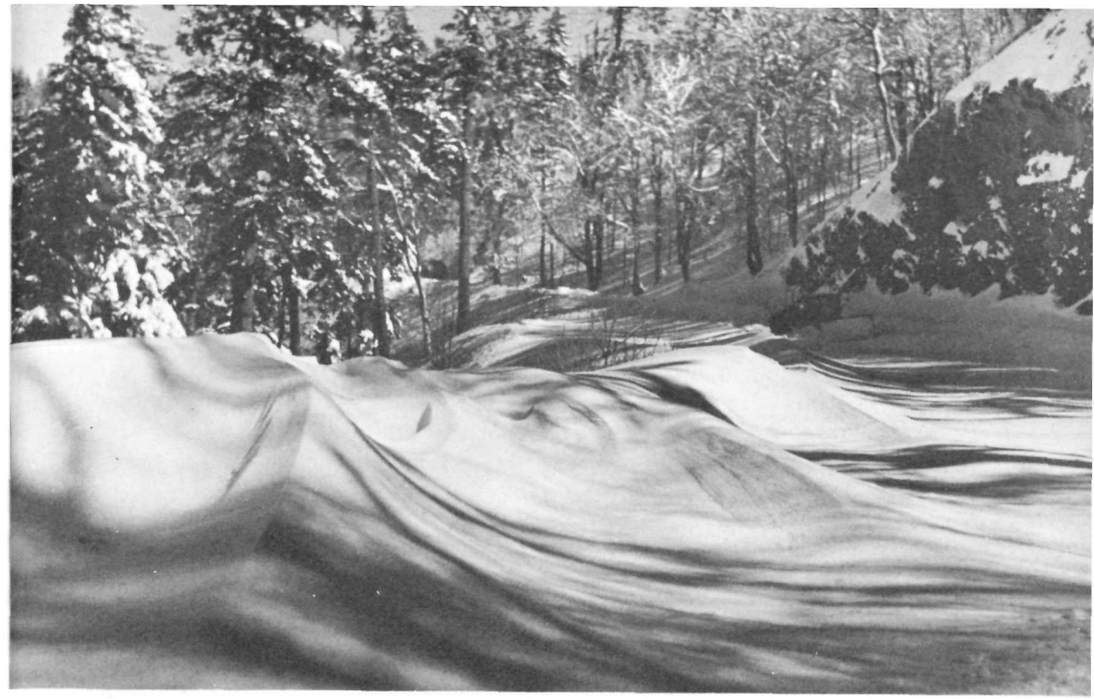
As the great Pleistocene ice moved slowly southward, many Canadian-zone plants and animals migrated before it and found a haven in the southern Appalachians, well beyond the limits of glacial ice. In the Great Smoky Mountains, most of the species of forest trees survived the rigorous climate which prevailed. Here, in the heart of the deciduous forest region of Eastern North America, there are more kinds of native trees than in any area of comparable size in the United States. In fact, in all of Europe there are not many more tree species than grow in Great Smoky Mountains National Park. The outstanding attraction of this area is its flora; so profusely does it grow that it covers the mountains everywhere with an unbroken mantle. There is no timberline here, and rock exposures are uncommon. But beneath the living layering of green, and the thin crust of soil which nourishes it, is the great mass of solid rock which has no life and whose secrets have become dimmed through unnumbered centuries.

The Climate

What will the weather be like in June? In October? What kind of winters can you expect? Does it rain very often? When is the atmosphere clearest? In a park like the Great Smokies, where you must get out on the trails in order to have some of the most rewarding experiences, climatic conditions are important. Answers to questions of this kind are not as difficult to come by as they used to be, for each passing month and year adds its quota to the statistics. Nevertheless, in our temperate climate the months and the seasons vary considerably from year to year in the amounts of precipitation, in the extent and intensity of heat and cold, and in the number of clear and cloudy days.

Of the four seasons, winter is ordinarily the most unpredictable. Precipitation, usually in the form of rain in the lower altitudes and snow in the uplands, is quite variable. Generally, snowfall is light along the margins of the park and progressively greater as one gains altitude. Snow may accumulate to a depth of 3 feet in the spruce-fir zone, but such amounts are very infrequent. During the milder winters, snowfall may be very light throughout the park. Freezing rains may cause hazardous driving conditions along the transmountain road during this season, but workcrews are called out at all hours and sanding or snow-plowing operations may continue long into the night in order to keep the road clear. Ordinarily the motorist is not likely to be inconvenienced by snow and ice.

Temperatures, in contrast to precipitation, decrease as you gain



The high Smokies receive more snow, more rain, and more fog than the surrounding areas of lower altitudes. The higher we go, the colder the temperatures and the shorter the growing season. Courtesy, Tennessee Conservation Department.

Countless numbers of the fringed phacelia form white carpets in second-growth forests in late April. More than 200 species of plants are in flower at that time of year. Courtesy, Thompsons Photography, Inc.



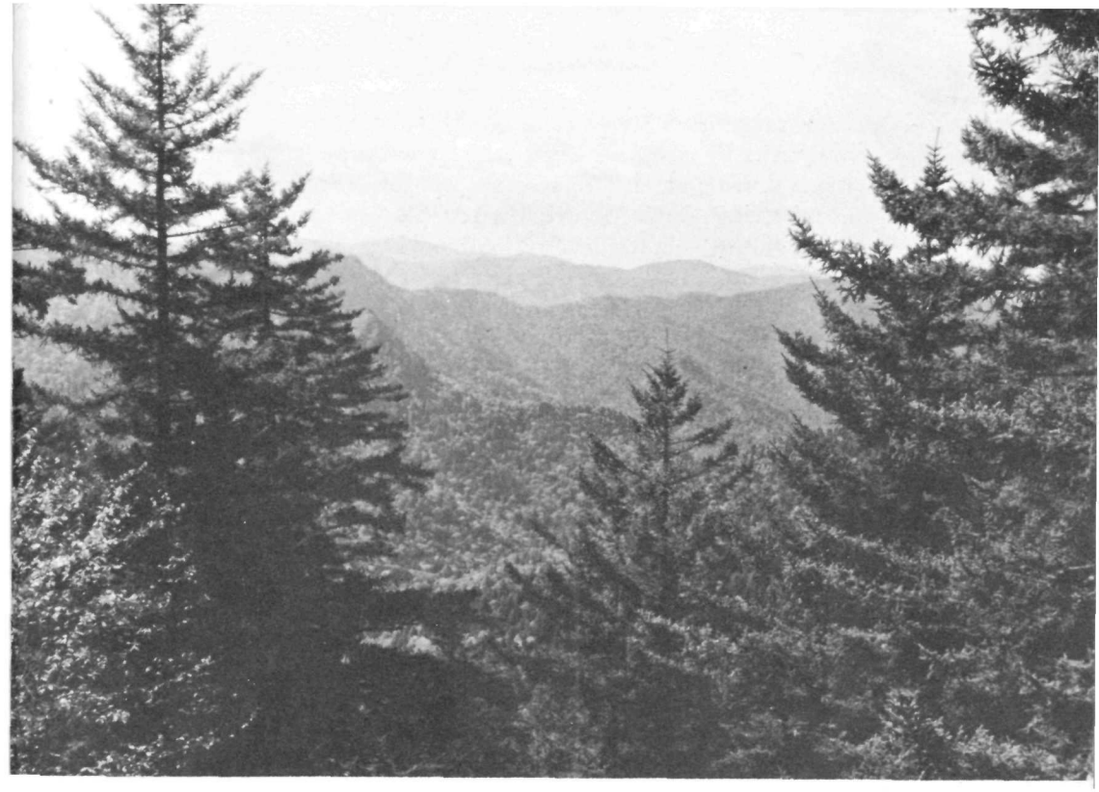
altitude. According to studies made by Dr. Royal E. Shanks, of the University of Tennessee, the average rate of temperature decrease is 2.23° F. per 1,000 feet. His research led him to the conclusion that in terms of both climate and vegetation the nearest low-altitude equivalent of the Great Smokies' spruce-fir forest region is located about 1,000 miles to the northeast—in northeastern Maine or adjacent New Brunswick.

Below-freezing temperatures are to be expected during much of the winter at the higher altitudes. Even in Gatlinburg, Tenn., at an elevation of 1,300 feet above sea level, the mean daily minimum temperature for the three winter months beginning with December is approximately 3° below the freezing point. The mean daily maximum, on the other hand, is 20° above the freezing point.

While spring may be knocking at the door of Great Smokies as early as January in some years, this welcome season may, on occasion, experience so many delays that its arrival may not materialize until late March or early April. A spring visit to the Great Smokies is particularly rewarding for those who are interested in wildflowers and in birds. Unlike the three winter months (December, January, and February) whose average temperatures show but little change, the months of spring (March, April, and May) show a rapid and steady rise both in the daily maximum and in the daily minimum readings. The reverse condition prevails in autumn. In the spring, precipitation will average about the same as in winter, both as to amount as well as to number of days with some precipitation. Hikers and campers should come prepared for a variety of weather conditions; those who hike the Appalachian Trail or other high-altitude trails will require warm clothing, especially in early or middle spring. At the lower levels, and in many of the towns and cities near the park, practically summerlike conditions prevail by middle May.

It is during the summer (June, July, and August) that park visitation is heaviest. This is also the hottest and wettest season of the year; brief afternoon or evening thundershowers are fairly frequent. For the most part the nights are cool enough for comfortable sleeping, but the days in the low-altitude communities usually range from warm to hot. However, you may obtain relief from high temperatures by driving to the higher Smokies, where cool weather is the rule. Blankets or sleeping bags and a raincoat are recommended for the high-altitude hiker or camper. Biting gnats occur in some localities at this season, especially near streams and damp places and where air drainage is inadequate. An insect repellent, therefore, should be included in your knapsack.

Colorful trees and the fine weather for outdoor activities make autumn the favorite Great Smokies' season for many visitors. These



At high altitudes, forests of red spruce represent the Canadian zone at its southernmost limit in the Eastern United States.

months (September, October, and November) are the driest of the year, and they are the months of the clearest atmosphere. Days of early autumn may be quite warm, while those late in the season may be wintry.

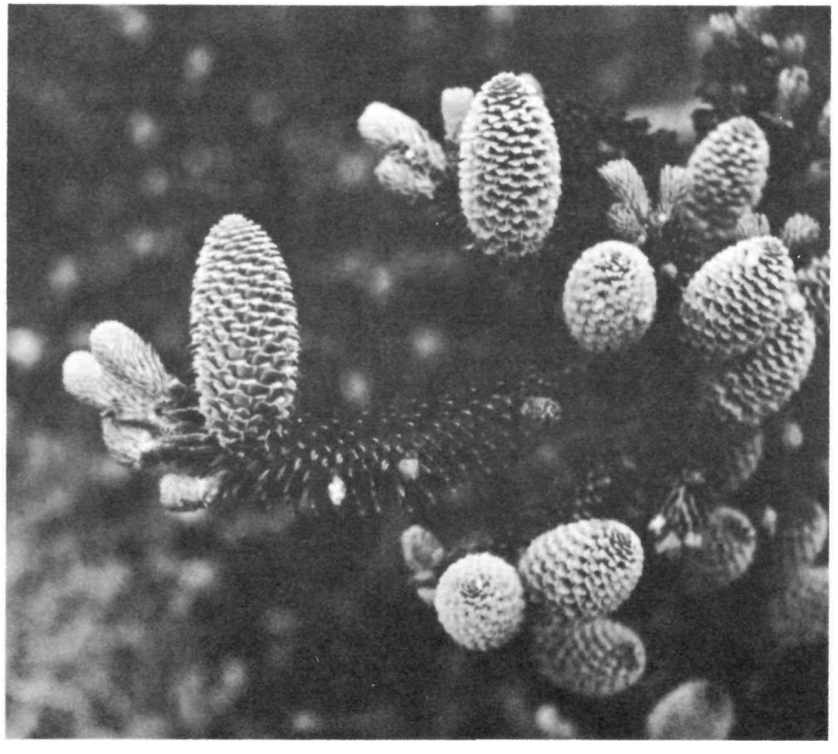
A Bit of Canada Stranded in the Smokies

Vegetation to Great Smoky Mountains National Park is what granite domes and waterfalls are to Yosemite, geysers are to Yellowstone, and sculptured pinnacles are to Bryce Canyon National Park. There being no timberline in the southern Appalachian Mountains, plants are practically everywhere; in this regard the Great Smokies have an appearance quite unlike the higher ranges of the Far West where great expanses of barren, or mostly barren, rock are characteristic. The low-altitude clearings made by white man during the 19th and early 20th centuries are rapidly reverting to forest. For

this reason, more than 95 percent of the park's 800 square miles is now dominated by forests. Since almost 40 percent of the forests is essentially unaltered, this represents probably the finest wilderness area in the eastern half of the United States. More than 1,300 kinds of flowering plants, almost 350 mosses and liverworts, 230 lichens, and more than 2,000 fungi have been found here.

Geologists tell us that the Great Smokies remained above the influence of ancient inland seas which covered vast areas of our country hundreds of millions of years ago. Neither were they directly affected by the Pleistocene icefields which extended southward to southern Ohio. While the continental glaciers made life intolerable wherever they penetrated, the Great Smoky Mountains served as a haven for Canadian-zone flora and fauna. In a sense these plants and animals waited out the great freeze for generation after generation until, finally, the climate began to moderate, the glaciers began to melt, and living things began to repopulate what had

Cones of the Fraser fir disintegrate on the branches when mature. However, they are frequently harvested, when green, by the red squirrels. No other tree in the park has upright cones.



been an ice-fettered land. But while some migrated north in the wake of the retreating ice, others were left stranded in these higher ranges of the southern Appalachians, inching their way to higher and higher ground as the warming cycle continued. And such is the trend which has continued down to our time. Present-day man is living out his time in a warming interval which appears destined to continue its inroads upon the icefields of northern North America while it shrinks the glaciers remaining in the highest Sierras and in the Rockies and while it whittles away at the lower fringes of the dwindling spruce-fir forests in the Smokies. Essentially the uplands of the Great Smokies are a kind of Canadian island left stranded in the sky by climatic changes.

A warming cycle tends to reduce slowly the extent of the Canadian-zone forests of the southern Appalachian Mountains. But mankind has accelerated the pace a thousandfold so that now only about one-tenth of the original stand of spruce remains. (See "Selected Bibliography," Korstian, 1937.) Fortunately, an excellent representation crowns the highest peaks of the park, where it has permanent sanctuary. Gatlinburg, Tenn., and Cherokee, N.C., are communities located on the north-central and south-central boundaries of the park, respectively. A motorist starting at either of these communities can be in a Canadian environment in 30 minutes, not only as far as the vegetation is concerned but also from the standpoint of the dominant birds and mammals. Even many of the insects are identical with, or closely related to, northern forms.

The Fraser fir, or "balsam," which comprises the bulk of the Great Smokies' forests on mountains exceeding 6,000 feet, appears very similar to the balsam fir of northern New England and Canada. Botanically, the two species are distinct. The Fraser fir is readily distinguished from the red spruce, which often grows associated with it, by its upright cones and by the blunt aromatic needles which are green above and lined with gray below. A scattering of blisters is evident in the bark of many of these trees. The red spruce grows to greater height and diameter; its cones are pendant, the sharp-pointed needles are the same shade of green above and below, and bark blisters are never present.

Land of the Great Forests

The forests of the Great Smokies are notable for the large variety of native trees. How many kinds are there? It would be difficult to find two botanists who would agree on the answer. The difference between a shrub and a tree is, at best, rather vague—some-



The Chimney Tops as seen from the transmountain road. This most photographed landmark towers above the head of the Sugarlands Valley. Many species of trees make up the dense forests, here and throughout the lower and middle altitudes. Courtesy, Tennessee Conservation Department.



Along one of the trails in the park, a hiker admires the straight trunk of a big yellow-poplar. Eastern hemlocks are in the foreground. Courtesy, Tennessee Conservation Department.

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what like the difference between a pond and a lake, or a hill and a mountain. Where are we to draw the line? A generally accepted definition is that a tree is a woody plant with a well-defined stem and crown, has a diameter of 2 inches or more, and attains a height of at least 8 feet. This will include a number of plants which ordinarily are shrublike but which, on occasion, become arborescent, or treelike; examples are mountain-laurel, witch-hazel, staghorn sumac, the three kinds of native plums, mountain winterberry, the various hawthorns, three species of *Viburnum,* mountain stewartia, the tree sparkleberry, alder, devils-walkingstick, and alternate-leaf dogwood. Counting these, there are more than 100 kinds of native trees in the area.

Some of the trees, such as the red spruce and Fraser fir, are found only in the colder and more moist situations at high altitudes; others, such as scarlet and black oaks and most of the pines, grow only on dry exposed slopes at low and middle elevations; still others, notably yellow buckeye, basswood, and mountain silverbell, are the

Naturalists measure the largest known eastern hemlock, which has a trunk circumference of 19 feet, 10 inches. Courtesy, Dr. William Hutson.



"key" species in protected valleys below the usual limits of spruce and fir. A few trees, such as the Allegheny serviceberry, range over a wide variety of habitats, but all are limited by combinations of such factors as temperature and length of growing season (these two being correlated with altitude) and by moisture and depth of soil (these being correlated with topographic position).

COVE HARDWOOD FORESTS

These forests occur in sheltered situations, at low and middle altitudes (below 4,500 feet) where there is a considerable depth of soil. Dominant trees are yellow buckeye, basswood, yellow-poplar, mountain silverbell, eastern hemlock, white ash, sugar maple, yellow birch, American beech, black cherry, northern red oak, cucumber-tree, and, in former years, American chestnut. All these grow to record or near-record proportions in the park. Wherever a number of these are found together, and where the ropelike strands of the common Dutchmanspipe make good growth, we find ourselves in the splendid big-tree groves of the Great Smokies. It is largely due to the occurrence of various unspoiled stands of these cove hardwood forests, along with the stands of Canadian-zone spruce and fir at the higher elevations, that Great Smoky Mountains National Park deserves its reputation as an outstanding wilderness stronghold.

It may be difficult for some of us to realize that the cucumber-tree grows to be greater than 18 feet in circumference, yet such a tree stands in the Greenbrier area of the park. A yellow buckeye is almost 16 feet in circumference, a yellow birch over 14 feet, a mountain silverbell almost 12 feet, a sugar maple over 13 feet, and a yellow-poplar over 24 feet—these are circumference measurements taken at 4½ feet from the ground. All are cove hardwood species in the park.

Fraser magnolia, one of the many smaller trees in these forests, also reaches record proportions here; specimens are known to attain a height of over 75 feet and a trunk diameter of more than 2 feet. A number of shrubs, one of the most prevalent of which is the rosebay rhododendron, and a long list of spring-blooming herbs are to be found in the cove hardwood forests.

HEMLOCK FORESTS

The eastern hemlock is a common tree along streams and lower slopes up to an altitude of 3,500 to 4,000 feet. It also occurs on exposed slopes and ridges at middle altitudes and up to almost 5,000 feet, where it stops rather abruptly, there being practically no

hemlocks above 5,500 feet. Associated with the hemlock are such trees as the red and sugar maples, American beech, yellow and sweet birches, black and pin cherries, American holly, yellow-poplar, and mountain silverbell. Both the rosebay and catawba rhododendrons are common shrubs in hemlock forests, the former being an abundant streamside understory while the latter occurs in heath "balds" on the higher exposed ridges. Drooping leucothoe, smooth hydrangea, scarlet elder, thornless blackberry, mountain-laurel, and hobblebush are the other shrubs one might expect here. The variety of spring-blooming herbs is not nearly as extensive as in the cove hardwood forests.

NORTHERN HARDWOOD FORESTS

These forests, largely dominated by yellow birch and American beech, occur mostly above 4,500 feet. Often they are almost surrounded by red spruce and Fraser fir. Such trees as sugar maple, black cherry, and eastern hemlock—all a part of the northern hardwood forests—reach their uppermost limits at, or near, the 5,000-foot elevation. Red maple, striped maple, American beech, yellow buckeye, and Allegheny serviceberry drop out before, or at, the 6,000-foot elevation. Yellow birch, pin cherry, and mountain maple may reach the summits of the higher mountains where, normally, spruce and fir are dominant. The variety of shrubs in these forests is limited mostly to smooth hydrangea, drooping leucothoe, catawba and rosebay rhododendrons, thornless blackberry, and hobblebush. Herbaceous plants, especially those which bloom in the spring, are of considerable variety; some of the most abundant of these include the Virginia springbeauty, common fawnlily, creeping bluet, American woodsorrel, fringed phacelia, great starwort, trilliums, violets, crinkleroot, and yellow beadlily.

SPRUCE-FIR FORESTS

Along the high State-line ridge which runs the length of the park, a forest of spruce and fir extends in an almost unbroken stand from the western slope of Clingmans Dome to near Cosby Knob, close to the park's northeastern corner—an air-line distance of approximately 25 miles. Only in the vicinity of Charlies Bunion, swept by the great fire of 1925, is there an appreciable break in the evergreen chain. On the Tennessee side of the park, the finest growth is on Mount Le Conte, third-highest peak in the Smokies; on the North Carolina side, the area southward from Mount Guyot (second-highest peak), between Hughes Ridge and Balsam Mountain, contains the most extensive spruce-fir stand. Above the 6,000-



Fraser fir and red spruce (right). These high-altitude trees in the Great Smoky Mountains are symbolic of the Canadian zone.

foot altitude, the only trees occasionally associated with the red spruce and Fraser fir are yellow birch, pin cherry, American mountain-ash, and mountain maple.

So dense does the growth of trees become that shrubs and other plants may be practically absent over wide areas. However, in places the following shrubs may be found: catawba and Carolina rhododendrons, southern bush-honeysuckle, Allegheny menziesia, scarlet elder, dingleberry, thornless blackberry, roundleaf gooseberry, hobblebush, witherod, and Blueridge blueberry. Ferns prevailing at these high altitudes include the toothed woodfern and hayscented, lady, and common polypody ferns. Most conspicuous of the spring-blooming herbs include creeping bluet, Virginia springbeauty, American woodsorrel, pallid violet, painted trillium, erect trillium (white and purple forms) and yellow beadlily; the summer-blooming herbs that you are most likely to see include acuminate aster, white wood aster, cluster goldenrod, pink turtlehead, Indianpipe, and Rugel's groundsel.

CLOSED OAK FORESTS

On intermediate to dry slopes, at low and middle altitudes, the forests are dominated by four kinds of oaks (white, chestnut, northern red, and black), three hickories (pignut, red, and mockernut), and by red maple, sweet birch, sourwood, yellow-poplar, blackgum, black locust, and mountain silverbell. Formerly, the ill-fated American chestnut was a very important component of this forest. Small trees, especially flowering dogwood and witch-hazel, and such shrubs as mountain-laurel, rosebay rhododendron, smooth hydrangea, flame azalea, oil-nut, buckberry, and pale sweet shrub are often present. Vines include the common greenbrier and Virginia creeper, while common herbs and herblike plants include galax, trailing-arbutus, white wood aster, halberdleaf yellow violet, false foxglove, early pedicularis, and goldenrods.

OPEN OAK AND PINE STANDS

Four kinds of oaks and an equal number of pines dominate these forests which occur on dry exposed slopes and ridges. The terrain is usually rocky. Whereas the trees normally do not form a closed canopy, the shrub layer may be quite dense and is often dominated by the evergreen mountain-laurel. The northern red oak of the closed oak forests is replaced by the scarlet oak in these drier stands; otherwise the same species of oak are dominant. Pines (Table-Mountain, pitch, and Virginia) are most plentiful on the driest sites; eastern white and shortleaf pines may occur along with red maple, sourwood, blackgum, sassafras, Allegheny serviceberry, and black locust. American chestnut persists as basal sprouts. The majority of the tall-growing shrubs of the closed oak forest are also to be found here. In addition, huckleberries and blueberries may become abundant. Checkerberry wintergreen, trailing-arbutus, eastern bracken, galax, various asters, and pussytoes are common lower plants.

Balds

Although there is no true timberline in the southern Appalachians, there are treeless areas on some of the higher mountaintops and ridges. Owing to their lack of forest cover, such places are called balds. That designation, however, is a relative one since other plants form a dense carpet over the balds. If these plants are largely shrubs belonging to the heath family, such balds are known as heath balds; if grasses and sedges prevail, the balds are termed grass balds.

Heath balds are locally referred to as slicks. From a distance they may appear to be smooth, or "slick," but, in reality, they are veritable entanglements which are almost impenetrable. Catawba rhododendron, mountain-laurel, blueberry, and sandmyrtle are the dominant shrubs, and, since all but the blueberry are evergreen, these slicks remain green throughout the year. However, there comes a time, usually in mid-June, when the profusion of spectacular bloom is such that even the greenery is masked out by innumerable flowers. A floral luxuriance pervades all these high-altitude (above 3,500 feet) slicks, and this is the time when rhododendron and laurel festivals are celebrated in neighboring communities. You should then experience the thrill of being in the midst of such a spectacle of floral beauty by hiking to Alum Cave Bluffs, or, a week or so later, to Mount Le Conte or along the Appalachian Trail.

In a region so completely dominated by forest, how is one to account for the numerous heath balds? Ecological investigations made by Dr. Stanley A. Cain (1930b, "Selected Bibliography") point to three factors: windfall, landslide, and fire. Of these, fire is of greatest importance. Long before man came upon the scene, light-

Cones of the Table-Mountain pine are the spiniest of any of the cones from the five pine species found in the park.



ning strikes resulted in fires. Although such catastrophes were of serious consequence to most species of trees, the rhododendrons and mountain-laurel sprouted back readily.

Unlike the heath balds which are practically impenetrable, the grass balds are inviting meadowlands over which you may roam at will. Grasses, sedges, and various other herbs predominate. Being located on, or near, the main crest of the Great Smoky Mountains, all afford places from which outstanding panoramas of the park and vicinity are to be had. Along the margins of some of these clearings, particularly on Gregorys Bald, there are spectacular concentrations of wild azaleas. A number of theories which attempt to explain the origin of the grass balds of the Smokies have been advanced but, as yet, none can be regarded as being entirely satisfactory. In other words, we don't know how these high-mountain grasslands came into being.

Once man appeared upon the scene, the modifying effect of his clearing operations and the grazing by his livestock was considerable. A century of cattle- and sheep-grazing must have been an important

Heath "balds" consist largely of catawba rhododendron and mountain-laurel. They outline the peaks and ridges in this rugged section of the Smokies near Alum Cave Bluffs. Red spruce, the dominant forest tree on these higher mountainsides, gives way to yellow birch in the intervening valleys (lower left). Courtesy, W. M. Cline Co.





Spence Field Bald, located on the State-line ridge above Cades Cove, is the largest mountain meadow in the park. The question of how these bare areas originated in a region of heavy forest is undecided.

factor in keeping these meadows in an open condition. Since 1936, when cattle grazed on Gregorys Bald for the last time, there has been a very real invasion of plants from the adjacent forest. Does this mean that the grass balds will disappear? Not in our lifetime. But if future generations should witness the transformation to a forested condition, such a change will be a natural one, unaffected by man—a change in keeping with the National Park Service policy of not interfering with nature's scheme of things.

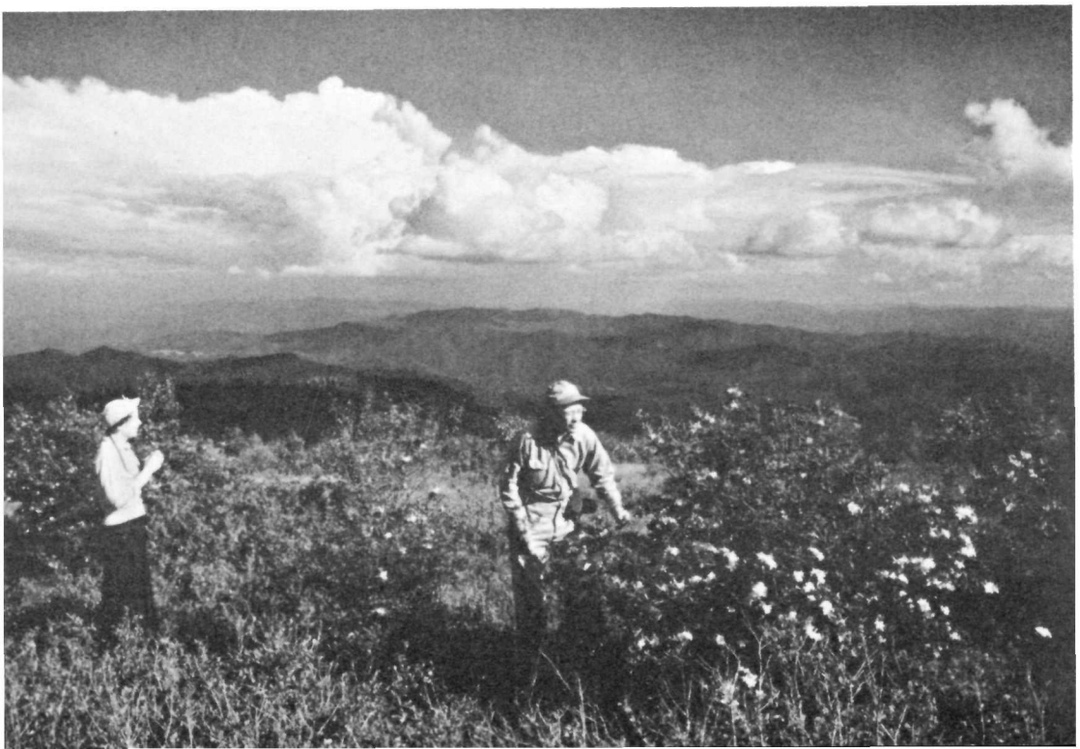
The finest floral spectacle in the park comes during the last half of June, usually between June 20 and 25, when the wild azaleas on Gregorys Bald come into bloom. As a result of long-continued natural hybridization between the white- and orange-colored forms and their progeny, the flowers are yellowish, buff, shell-pink, salmon, and various shades of red. Domelike Gregorys Bald, located near the western end of the Great Smokies range, rises 3,000 feet above Cades Cove. For those who enjoy hiking, the top of Gregorys Bald, 4,948 feet, should constitute an unrivaled objective if the trip can be made in late June. Best access is via the Gregory Ridge Trail, which begins at the terminus of a spur road in the southwestern corner of Cades Cove. This trail, also called the Big Poplar Trail, passes through a splendid forest of mature yellow-poplars, eastern hemlocks, and other giant trees.

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Andrews Bald, in the foreground, and snow-covered Silers Bald, on the main ridge in the distance. Some of the early mountain settlers grazed their cattle in these clearings in the summer.

Wild azaleas bloom on Gregorys Bald in late June. Here, where sheep were once pastured, is one of the finest floral displays in the Smokies. Courtesy, Thompsons Photography, Inc.



Farewell to the Chestnut

As you walk along the forest trails you are reminded time and again of the incomparable disaster which, within the lifetime of many of us, has swept relentlessly through the ranks of the American chestnut. Years and decades have passed since this catastrophe took its terrible toll, yet, even now, there are numerous relics of this once-abundant, ill-fated tree. A surprising number still stand, bleached and dead—ghostlike, and in a severe kind of nakedness. Within the memory of man there has been no forest tragedy so calamitous nor so devastating.

The blight which has ravaged the elms and the blister rust which threatens the white pines—together, these have not been as deadly as the parasitic fungus that causes the disease to which the chestnut has succumbed.

The lamented chestnut is practically gone. Sprouts continue to grow from the old stumps, although in markedly diminishing numbers, and near the upper limits of its range in the mountains some of the trees may have a few branches where some leaves and even a few flowers and fruits appear. But the die is cast and a noble species is doomed, victim of one of the most destructive and rapidly spreading tree diseases known. By September 2, 1940, at which time President Franklin D. Roosevelt dedicated Great Smoky Mountains National Park, approximately 85 percent of the American chestnut trees in this area had been either killed or affected by the blight; and 10 years later, more than 95 percent were affected.

At some time near the turn of the century, before the enactment of plant-quarantine laws, the parasitic fungus that causes the disease known as chestnut blight was brought from Asia into the United States. It was first discovered in this country in New York City in 1904; from there and, later, from other centers, it spread rapidly. In the southern Appalachian Mountains, most of the damage was done in the late 1920's and early 1930's. No remedy has been found.

The fast-growing American chestnut, along with the yellow-poplar, was the big tree of the Great Smokies forests. Some specimens attained trunk diameters of 9 to 10 feet. Unlike the yellow-poplar, however, the chestnut often developed a spreading crown, especially when growing in the open. Associated with various kinds of oaks, it formed one of the dominant types of forests in these mountains.

We have witnessed the demise of a species of tree which for all-around usefulness to man had few, if any, equals. Foresters regarded it, by all odds, as the best hardwood timber tree in America. Its lumber was straight grained, easily worked, exceptionally durable, and of the highest quality. It was easily split into fence rails and

shingles and, since it resisted the attacks of wood-destroying fungi to a remarkable degree, it was used extensively for fence posts, railroad ties, telephone and telegraph poles, and mine timbers. Its other uses were too numerous to mention. Tannic acid, extracted from the bark, was used in tanning leather.

The nuts, sweet and palatable, were enveloped in spherical burs bristling with long spines. These were opened by the witchery of early frosts, much to the satisfaction of squirrels, bears, wild turkeys, and other forms of wildlife. Ordinarily the crop was a bountiful one, and it attracted boys from city and country who came with burlap bags to claim this delicious harvest. During the first quarter of this century, one of the common sights on the street corners of our eastern cities was that of the chestnut vendor, who roasted the native chestnuts and sold the aromatic fruit for a nickle a bag.

Now that misfortune has come to this splendid tree, the calamity of its extinction has laid a heavy hand on many species of wildlife, especially those who fed directly upon its fruits. Acorns are a substitute, of a sort, but there will come years when for some unknown reason the oak trees do not set fruit. Such was the year of 1946. Black bears, unable to find acorns, left the sanctuary of the National Park in quest of food, not knowing, of course, that the situation was identical elsewhere throughout the southern Appalachians. Many of the bruins never returned, the mortality being estimated at between one-third and one-half of the park's population. Gray

The spiny green burs of the American chestnut contain glossy brown fruits, which were the favored autumn fare of bears, squirrels, turkeys, and other forms of wildlife.





A ghost forest of American chestnut. The bark drops off after the fungus blight kills the tree.

Sprouts growing around the stump of a dead chestnut tree.



squirrels fared even worse, a mortality of 90 percent being estimated for some of the watersheds. Fortunately, such reductions in animal populations are of infrequent occurrence. If the chestnut had not been destroyed, an exodus of such proportions would not have taken place. On the other hand, this is an example of how species are influenced to travel and invade new habitats.

One day in December, several years ago, a work crew employed in a fire-hazard-reduction project near the eastern boundary of the park began cutting a large dead chestnut tree. Suddenly, from a cavity high up in the main trunk, a flying squirrel appeared, then another, and another, until finally 26 of these attractive animals had deserted their communal winter nest. Aroused from their daytime slumber, the squirrels planed off into the nearby trees.

Unlike woodchucks and jumping mice, flying squirrels remain active through the winter, during which time they will share a bed with others of their kind. The site usually chosen for a winter bed and, later, for a nest for the young, is in the cavity of a tree. Dead trees are often more suitable than living ones, and hence the chestnut, in death as in life, assumes an important role in the forest.

Bears

After your summer visit in Great Smoky Mountains National Park, the chances are you will remember the roadside or campground bears above all else. Bears are the most popular feature in a number of our National Parks, and in the Smokies, where the population of bruins runs into the hundreds, opportunities to observe these large wild animals are plentiful during the summer.

Since National Parks are wildlife sanctuaries where no disturbance of the native animals is allowed, decades of protection have served to break down the wild bears' fear of man. Now, instead of depending on their own resources for a living, many bears patrol park roads and campgrounds, where they give the garbage cans a frequent going-over and where occasional food offerings, *an illegal and dangerous practice,* make paupers of them. Bears are usually hungry, and since they will feed on almost any kind of plants or animals, garbage is quite acceptable. Feeding them, however, represents misguided kindness; the bruins come to expect such generosity from everyone, and, consequently, trouble is imminent. Park regulations prohibit the feeding of bears, and violators are arrested. Every year, doctors located in communities near the park treat a number of cases of bear bites and bear scratches. Some of the accidents have come about as follows:



Mother and cubs.



One man was occupied with feeding candy to two small cubs when the mother bear appeared and insisted upon having some of the food. Shoving the big bear aside with one hand, the man continued offering candy to the cubs when suddenly he was struck a fierce blow in the face.

One person placed his foot upon a sandwich which some careless lady tossed to the ground in front of a bear; the bite in the leg required medical attention.

A bear, prompted by the food which a lady kept offering to the animal, entered the car wherein the generous(?) person was sitting. Her efforts to coax bruin out of the car resulted in injuries.

A man, of sorts, required medical attention after he applied a lighted cigarette to a bear's nose.

Another man attempted to boost a bear into the front seat of his car so that he might take a picture of bruin sitting beside his wife, who was behind the wheel!

Hikers need not be concerned about the likelihood of an unpleasant encounter with bears along park trails, although in the vicinity of roads and campgrounds there is always the possibility of meeting a panhandling bruin who seems to know that you are carrying a lunch or a candy bar and may even insist on acquiring it. What's to be done? (One of the questions most often asked of park rangers and naturalists is, "What should I do when I meet a bear on the trail?") First, you should wave your arms and make a lot of noise. This, in the majority of instances, will deter the animal. If it doesn't, remember that he is interested not in you but in the food you are carrying, and consequently, as a last resort, throw the food away—in a direction which will cause the bear to leave the trail and permit you to *walk past.* Do not run! The likelihood of such an encounter is so remote that the thought of it should not prompt you to alter your plans of hiking the fine trails and seeing the attractions afoot. The great majority of park bears will give you a wide berth.

If you spend the night in one of the shelters along the Appalachian Trail, it is recommended that you suspend all food items from a tree outside the shelter in such a way that bears cannot reach them. As part of your equipment, you should have a clothesline and a net-bag such as is used for packaging oranges. Tie one end of the clothesline around a rock about the size of a hen's egg and tie the other end around the bag containing your food items; throw the rock over a horizontal tree limb and pull the bag up to a position high enough (8 feet) so that even a large bear, standing upright, could not reach it. Remember that all black bears are good tree-climbers, so don't make the mistake of suspending your food too close to the trunk of the tree or to limbs that will support the

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Bears often claw and chew coniferous trees. They also chew trailside signs.

weight of one of these animals. Some overnight hikers who failed to take such precautions have spent a sleepless night.

A mother bear with cubs should be treated with more than the usual respect. Although she may appear to be disregarding her offspring, the chances are she is quite on the alert, and it is most unwise to get between mother and babies or close to them. Even the larger and more powerful male bears appear to keep their distance from females with cubs. Unlike the bear in our storybooks, the "daddy" bruin has no hand in the rearing of the young; in fact, he is one of the few enemies which the cubs have, for cannibalism among bears is simply one more way of obtaining food.

At birth the cubs are naked, blind, and very small, weighing less than a pound apiece and measuring 6 to 9 inches in length. Usually there are two cubs and frequently, three; quadruplets are uncommon and quintuplets quite rare. Some naturalists state that the mother is 3 years old when her first-born appear; others say she is 4. Most seem to agree that the mother has cubs every second year. It is not unusual to find yearling (last year's) cubs attended by their mother up to the coming of their second summer, in which case they probably shared the same winter bed. The mating season, in June and July, severs relationships between the mother and her cubs, and the latter who are now a year and a half old, are left to shift for themselves.

Do bears hibernate? The question has aroused considerable controversy, largely because the word "hibernate" has been used too loosely. Bears "den up" for long periods, usually beginning in middle or late December. Unlike jumping mice and other winter sleepers, however, they do not pass into a truly torpid condition. The normal basic rate of metabolism is maintained—the animals' temperature remains unchanged, and their respiration and heart beat are the same as in the summer. Consequently, bears cannot be regarded as true hibernators.

During the colorful autumn season, many park visitors ask the question, "Where are the bears?" Signs warning the people not to feed these animals remain posted along park roads, but few, if any, bruins remain in the vicinity of garbage cans and campgrounds. With fewer visitors, the "pickins" have been reduced proportionately. But more important is the fact that nature's various wild harvests, particularly acorns and beechnuts, are now ripe and available, and bears are doing what bears have done for unnumbered ages—feeding on mast, as these fruits are called.

For a number of years, and up to the time of World War II, "bear shows" were staged daily in some of the western National Parks, and thousands of visitors enjoyed them thoroughly. Food, usually garbage from park restaurants and hotels, was hauled to a designated area at a certain time of day. Bears were on hand in varying numbers, and a ranger or naturalist was present to tell the people about the interesting animals. Such a program, however, was more in keeping with manmade parks and zoos than National Parks, where it has long been an accepted policy that every species shall be left to carry on its struggle for existence unaided, as being to its greatest ultimate good, unless there is real cause to believe that it will perish if unassisted. The presentation of the animal life of the parks to the public shall be a wholly natural one and no animal shall be encouraged to become dependent upon man for its support. In keeping with that policy, the bear shows in all National Park Service areas were discontinued. No such shows were ever featured in Great Smoky Mountains National Park.



White-tailed deer are quite common in Cades Cove and vicinity but are rare elsewhere in the Smokies. Since some of them appear to be attracted by lights, motorists should use caution while driving at night. Courtesy, Tennessee Conservation Department.



Raccoons are at home in shallow water, where much of their food, such as crayfish and frogs, is to be found. Their normal time of activity is during the hours of darkness. Courtesy, Tennessee Conservation Department.

Other Mammals

The southern Appalachian Mountains, although noted for the richness of their plantlife, have not harbored a rich variety of fur-bearing animals. The larger mammals, particularly, are few. A visitor to Great Smoky Mountains National Park, after seeing black bears along the transmountain road and white-tailed deer in Cades Cove, is not likely to observe any other species whose size exceeds that of a woodchuck. At night, however, automobile headlights may reveal a gray or red fox, an opossum, a raccoon, and, on rare occasions, a bobcat on or near the road.



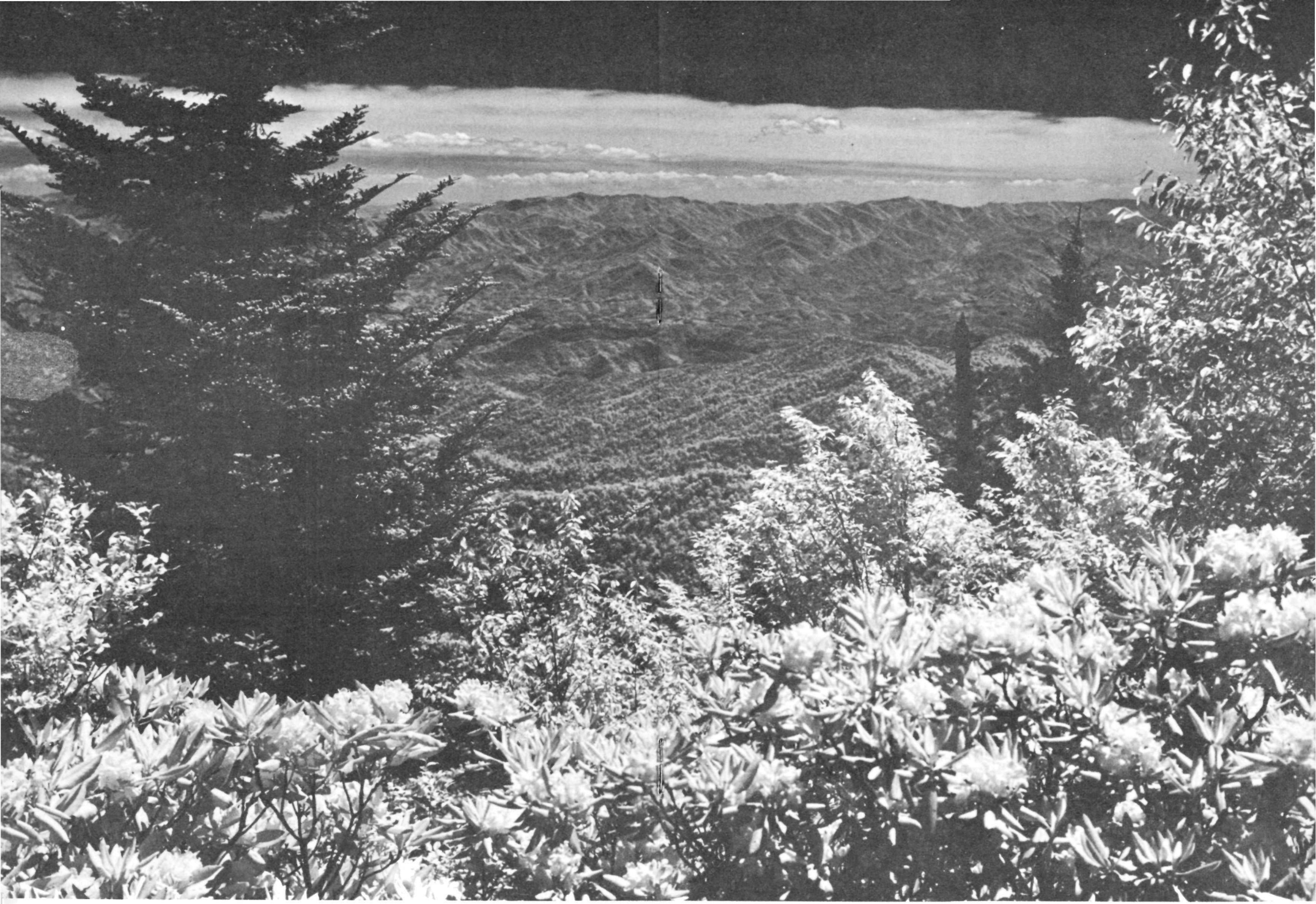
The bobcat, along with all native wildlife, is given full protection in National Parks. These wary, nocturnal animals are seldom seen, but they are not as rare as might be supposed. Courtesy, Tennessee Conservation Department.

The woodchuck, also called groundhog and whistle-pig, is the largest of the park's rodents.





Large eyes and soft, silky fur distinguish the flying squirrels. They sleep during the daylight hours, often choosing a hollow, dead chestnut tree for their home. Courtesy, Tennessee Conservation Department.



The vast sweep of the Great Smokies, revealed to the viewer but usually subdued in ordinary photographs, is strikingly recorded on haze-penetrating infrared film.

In years gone by the bison, elk, mountain lion, wolf, otter, and fisher found a home in these mountains, but long before the establishment of a National Park here these animals had disappeared. It is unlikely that any of them were ever very plentiful.

The fact that at least 50 kinds of native mammals are known to dwell in the park may be somewhat surprising. Of that number, almost half (24) belong to the family of rodents, or gnawing animals.

Woodchucks are the park's largest rodents and the ones most likely to be observed by the motorist. These animals frequent the grassy road-shoulders where mowing operations serve to perpetuate their preferred kind of food. Although appearing to pay little or no attention to passing vehicles, these "groundhogs," or "whistle-pigs," are very much on the alert, as visitors who have attempted to approach them on foot will testify.

They pass the coldest part of the winter in hibernation—a trait shared by other rodents such as the jumping mouse, of which two kinds occur in the Smokies, and the eastern chipmunk, the park's only ground-dwelling squirrel.

The muskrat is mostly absent over much of the park, owing to the scarcity of its proper habitat. However, in some places near the boundary, where the streams have a lesser gradient,, this semi-aquatic rodent may become fairly plentiful.

Of the tree-inhabiting squirrels, the "boomer," or red squirrel, is most frequently encountered in the high-altitude forests; like its cousins in New England, Canada, and the Far West, this animal is small in size and big in voice and actions. Boomers are often observed perched on the rims of roadside garbage cans in the higher Smokies. Gray squirrels, similar in appearance to those which accept tidbits from the hand of city-park visitors, are generally distributed throughout forests at low and middle altitudes; in years when acorns are scarce, these squirrels migrate out of the area in search of food. Fox squirrels are rare; they have been observed only in a few places along the northern boundary of the park. Flying squirrels, of which two species occur, are seldom seen by mankind, owing to their nocturnal habits. Their progress through the air is by no means a true flight; actually they should be termed "gliding" squirrels.

To complete the list of park rodents, mention should be made of the cottontail, whose numbers vary considerably from year to year. Also, there are nine species of wild mice and three native rats.

The omnivorous opossum is fairly common at low and middle altitudes. Like the bear, it displays considerable interest in the contents of garbage cans in campgrounds and along roadsides.



Young great horned owls. The eggs from which these birds emerged were laid in midwinter. No other birds begin their nesting activities so early in the year. Courtesy, Tennessee Conservation Department.

Three species of moles, seven or eight shrews, seven bats (the only mammals capable of true flight), the longtail weasel, the mink, and two skunks complete the list of native mammals known to inhabit the park.

Birds

To many visitors a drive over the transmountain road, which bisects the park at right angles to the main ridge, serves as an excellent cross section to the birdlife of this area. Starting at Gatlinburg, Tenn., where the elevation is 1,300 feet above sea level, or at Cherokee, N.C., at 1,900 feet, we find such common permanent residents as cardinal, Carolina wren, song sparrow, tufted titmouse, eastern phoebe, Carolina chickadee, and various woodpeckers. During the breeding season, species which become just as prevalent include the red-eyed and the yellow-throated vireos, wood thrush, indigo bunting, Acadian flycatcher, brown thrasher, and such warblers as the yellow, prairie, black-and-white, hooded, Kentucky, worm-eating, yellow-throated, and golden-winged, the yellowthroat,

American redstart, ovenbird, yellow-breasted chat, and Louisiana water thrush. By the time we reach an elevation of approximately 3,500 feet, such strikingly arrayed breeding birds as the scarlet tanager and rose-breasted grosbeak might be added to our list, and from there to the top of the Smokies the birdlife closely resembles that of northern New England.

Owing to more extensive logging operations in the years before this area became a National Park, the North Carolina side of the transmountain road has relatively little spruce and fir below Newfound Gap (elev., 5,040 ft.); on the Tennessee side, this Canadian-type forest extends upward from near 4,000 feet. There the wood thrush is replaced by the veery; the common crow, by the common raven; the Carolina chickadee, by the black-capped; the screech owl, by the saw-whet. There the common warblers are the chestnut-sided (in the more open places), Canada and black-throated blue (in rhododendron thickets), and Blackburnian (in treetops). These high-altitude forests are the home of the olive-sided flycatcher, whose whistled question, "What peeves you?", can be heard for great distances.

Whether heard in Maine or in the Great Smokies, querulous nasal notes of the red-breasted nuthatch, the high-pitched lisping of the golden-crowned kinglet, the clear whistle of the solitary vireo, and the thrilling roundelay of the winter wren become associated with spruce and fir.

The crowlike bird that you may see in these higher altitudes is, in all probability, a raven; no bird symbolizes the untamed wilderness atmosphere of these mountains as does this black-feathered master of flight. If you hear its deep throaty notes there should be no question concerning its identity, but if the bird remains silent you might readily identify it by its soaring flight and wedge-shaped tail. Ravens occasionally utter clear liquid notes, resembling xylophone music. For many a bird watcher, the experience of being entertained by the side rolls, dips, and power dives of this magnificent bird against a background of unspoiled coniferous forests is more thrilling than the most elaborate man-staged exhibition. The latter is artificial, whereas the former is as real as the rain, the mountains, and the growing things. The raven is doing what its ancestors have done for many millions of years; but mankind, by encroaching ever more on the wilderness, has also come close to destroying the big ebony-colored bird, which is just as much a part of the picture as the unbroken ranks of spruce and fir. National Parks serve to preserve segments of the American wilderness so that future generations also can have the opportunity of experiencing some of the breathtaking sights which Audubon, Lewis and Clark, and Muir experienced.

Although red crossbills often appear in pine forests at the lower altitudes of the park, these eccentric and gregarious finches belong rightfully, in the Canadian zone. During some years these birds are quite plentiful, while at other times they may be rare or absent. In years gone by when cattle ranged on the high-mountain meadowlands, the herders knew this as the "salt bird." Crossbills are exceptionally fond of salt, and since they were very approachable while feeding on the salt which had been distributed for the benefit of the cattle, the name they were known by was entirely appropriate. Breeding takes place in the park, at least in some years, for there have been observations of the adults feeding young which must have left the nest but recently. Yet no nest has been discovered in the area. In this regard the red crossbill is like the saw-whet owl, a much rarer species which breeds in these mountains but whose nest or eggs have yet to be found here.

During some winters the pine siskin, another unpredictable finch, may be the most abundant species of bird in the park. Flocks consisting of several hundred birds may frequent Newfound Gap in late autumn or early winter, milling about in an exceptionally restless manner and, all the while, uttering a distinctive unmusical buzzing crescendo. There is some evidence that a few may nest in the park, but more information is needed.

Wild turkeys range over much of the park, but they are most often observed in Cades Cove and vicinity. They find acorns in the oak forests, grasshoppers and other insects in the open fields, and a variety of wild fruits in season. Courtesy, Tennessee Conservation Department.



Of all the Canadian-zone birds in the park, none is more plentiful or more likely to be encountered along the high-altitude trails than the Carolina junco. This is the approachable, dark-gray sparrow-size bird which you will find hopping about unconcernedly in the parking areas at Newfound Gap and Clingmans Dome. When it flits away to another feeding place, the white of the outer tail feathers shows conspicuously. It resembles the slate-colored junco of New England and Canada, but is larger, of a lighter and more uniform coloration, and has a darker bill. In winter, when both the northern and the resident subspecies are present in the park, they often occur in the same flock. The song—a cheery, bell-like, tinkling trill—is much more musical than that of the chipping sparrow or worm-eating warbler with which it may be compared. The deeply cupped nest is built usually on the ground below overhanging roots; observant hikers often find the attractive nest when the close-sitting bird is flushed from the trailside. The

Ruffed grouse on a drumming log in the forest. The males, by an accelerated beating of the wings, create the unique crescendo that you may hear, particularly in April and again in October. Courtesy, Tennessee Conservation Department.



first eggs may be laid in late April, and it is not unusual for a late snow to cover the ground close to the incubating bird. A second set may be laid in July.

Early frost may be the signal which causes the Carolina juncos to leave the dark coniferous forests of the higher Appalachians and wing their way down to the foothills, usually in October. Approximately 6 months later this migration is reversed. Here, as elsewhere throughout the world where high mountains are features of the landscape, certain birds have a vertical migration pattern.

In addition to the Carolina junco, there are other southern Appalachian breeding birds (subspecies) which are closely related to, but not identical with, more northern forms. These include the solitary vireo, brown creeper, winter wren, and black-throated blue warbler. The red crossbills are in need of further study to determine whether a resident population exists. The two breeding chickadees represent distinct species (Carolina and black-capped).

Wild turkeys, largest birds in the area, appear to be holding their own. You must keep in mind that National Parks give sanctuary to these birds and to all native forms of life (except fish). The bobcats, foxes, and other predators are given the same protection as those species on which they prey. Research has shown that predation—the act of one animal preying upon another—has been very much overrated in its effects upon animal populations. The cutting of forests, the draining of swamps, the construction of endless miles of highways, and various other man-caused changes to the landscape have had infinitely more influence on the welfare of our wildlife than predation. Also, the wild turkey populations in the National Park are probably affected more by the climatic conditions which prevail during the early life of the chicks, by diseases, and by the occasional failure of the acorn crop than they are by the attacks of other animals.

Along with the croak of a raven, another sound symbolic of wildness is the drumming of a ruffed grouse. This muffled crescendo, resembling the noise of an engine in the far distance, is made by the beating wings of the male while he perches on a log in the forest. Most of the drumming is done in April and October. Is the male proclaiming to other male grouse the fact that it is here that he has staked out his territory? Or, as some observers believe, does the male drum in order to attract the female's attention? Ruffed grouse are fairly common in some parts of the park, and they may be encountered from the lowest to the highest altitudes. Other birds whose distribution in the park shows no regard for altitudes include the robin, chimney swift, hairy woodpecker, bobwhite, ruby-throated hummingbird, black-throated green warbler, catbird, and rufous-sided towhee.

There are water impoundments along the park's western and southwestern boundaries, but within the area there are no permanent lakes or ponds. Consequently water and shore birds ordinarily bypass these mountains in their migrations. There have been instances, however, when numbers of night-flying coots, ducks, and shore birds have been grounded while snowstorms of late October and early November swirled over the Smokies. Apparently mistaking the wet glistening road for a watercourse, some of the birds, in trying to alight, were injured or killed by the impact. The only record of a golden plover in the park came during the first snowstorm of the season, in late October 1953.

All bird observers know that any region, if studied long enough, is bound to have its list of rare or unexpected species. The Great Smokies is no exception. According to park records, a listing of the 10 rarest birds would include white pelican, common egret, brant, snow goose, pigeon hawk, red phalarope, laughing gull, sooty tern, red-cockaded woodpecker, and white-winged crossbill. Both the golden and bald eagles are quite rare, especially the former. The practically uninterrupted forest growth is unsuited to the golden eagle, whereas the absence of large bodies of water accounts for the scarcity of the bald eagle. The large reservoirs just outside the park have not, as yet, affected the status of the bald eagle in this area. Peregrine falcons nested on a prominent ridge near Alum Cave Bluffs for many years, but since they deserted this site these splendid birds have been observed rather infrequently.

The eastern box turtle is usually quite active during and after summer rains. This is the most common turtle in the park. Courtesy, Isabelle Hunt Conant.



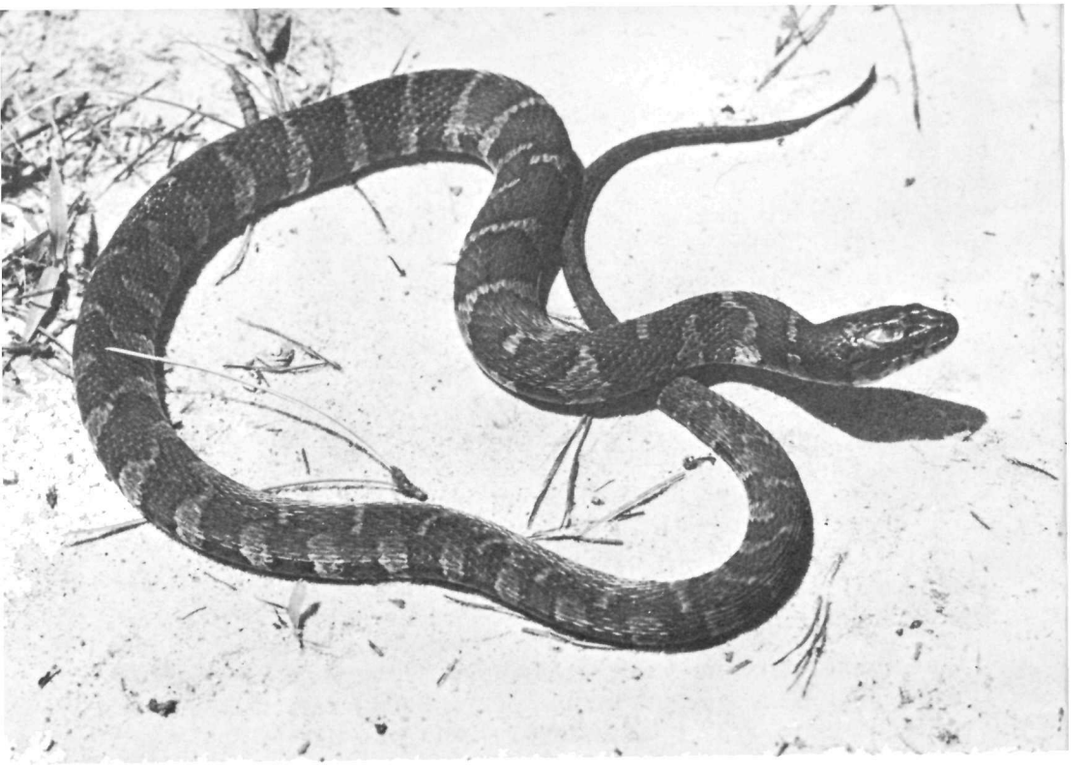
Approximately 200 kinds of birds have been observed within the borders of the park. If we were to add the birds which have been reported from a narrow marginal band of land and water (reservoirs) within a few miles of the park's boundary, the number would approach 240. Permanent residents, such as robin, cardinal, and song sparrow, total more than 60; those found here only during the breeding season, such as chimney swift, wood thrush, and red-eyed vireo, total approximately the same. At least 100 kinds of birds have been observed in the park and immediate vicinity during the winter. Of that number, 90 percent have been seen by organized groups engaged in taking the annual Christmas bird count (1935–57) sponsored by the National Audubon Society. As many as 64 species have been observed in one day in the winter. The spring migration, featured by a large variety of warblers, is usually at its peak during the last days of April. Autumn migration is often characterized by a heavy flight of Swainson's thrushes in late September and early October.

Turtles

Four of the seven turtles known to occur in the park are restricted to the lower and warmer westernmost part of the area; these are the eastern painted turtle, common map turtle, Troost's turtle, and musk turtle. The strictly aquatic spiny softshell turtle inhabits the lower streams along the northern as well as the western boundaries. The two remaining species have a much greater distribution within the park, the eastern box turtle ranging up to 4,000 feet, while the common snapping turtle rarely wanders above 2,500 feet. The former is easily the most common turtle in an area where permanent ponds and lakes are nonexistent; the latter, a notoriously savage reptile, is the park's largest turtle.

Snakes

Only two of the 23 snakes in Great Smoky Mountains National Park have venomous properties: the timber rattlesnake, which may range to 6,000 feet in places where the original forest has been disturbed, and the copperhead of the low and middle altitudes. In the Smokies, rattlesnakes rarely exceed a length of 4 feet, although reports of specimens more than 5 feet in length have been received. Chipmunks, red squirrels, gray squirrels, cottontails, and mice have been found in the stomachs of these snakes.



The common water snake is well named. It is found in all the lower altitude streams, where it preys mostly upon fishes and frogs. Courtesy, Isabelle Hunt Conant.

Rocky woodlands and old fields are favorite haunts of the black racer. Courtesy, Roger Conant.



Hikers may cover hundreds of miles of park trails and fail to encounter a single rattlesnake, yet this species can hardly be regarded as scarce or rare. If you should encounter a rattlesnake while hiking in the park, the chances are it will attempt to get out of your way. If it should hold its ground, usually coiled and "buzzing," you can readily cause it to become more reasonable by the use of a fairly long stick. These heavy-bodied, slow-moving serpents are not aggressive. Danger from snakebite is greatest if you leave the trail in a region where there are rocky outcrops. In that case, be on the alert and look where you place your feet or your hands.

It is also important to remember that these two kinds of poisonous snakes may be active both day and night during the warmest part of the summer, and hikers should use flashlights or lanterns if walking about after dark.

Copperheads, although they do not occur as high in the mountains as rattlesnakes, often are found in the same kind of situations, and the two species are known to hibernate together. A smaller snake than the rattler, the copperhead may be identified quite readily by the hourglass pattern repeated along the length of its body. Copperheads are more secretive than rattlesnakes; a favorite haunt is in the immediate vicinity of an old sawdust pile.

The largest of the 21 nonpoisonous snakes in the park include the pilot black snake, black racer, pine snake, common king snake, and corn snake. Of that number, the latter three are among our most handsomely marked serpents. Our smallest snakes include the worm snake, ground snake, DeKay's snake, red-bellied snake, crowned snake, and ring-necked snake. The rarest snakes in the park include the mole snake, scarlet snake, black king snake, scarlet king snake, queen snake, and the crowned snake. Still to be mentioned, in order to complete the list of Great Smoky Mountains National Park snakes, is the eastern hognose snake, eastern milk snake, rough green snake, common water snake, and common garter snake—the last two being, in all probability, the most abundant species in the area.

Lizards

Well over 100 kinds of lizards are found in the United States, yet only one, the gila monster of the southwestern deserts, is poisonous. Of the eight kinds of lizards in the park, three belong to the group known as skinks, or blue-tailed lizards. Locally they are termed "scorpions" and, in spite of the fact that they are quite

harmless, are considered dangerous. This reputation may have been gained by their tendency to bite when captured. The largest of the three native skinks may reach a length of 10 or 11 inches. In the extreme western end of the park lives a legless lizard known as the "glass-snake," or "joint-snake," rarest and largest of the eight species of lizards. Seldom observed, it is occasionally turned up by the plow and, if captured, will squirm so violently that the tail may part from the body and break into a number of pieces. There is no truth in the belief that the broken pieces may become rejoined or may grow into new individuals. Like most lizards, this one has movable eyelids and external ear openings, characteristics which snakes do not possess; these characteristics, together with the absence of legs, are reliable means of identification.

The lowest altitude in the park is along the western boundary, where, on the warm dry ridges, we find such lizards as the six-lined race runner, the Carolina chameleon, the little brown skink (ground lizard), and the common fence lizard. The last named is widespread throughout the park, occasionally occurring up to 4,500 feet. All the other lizards tend to remain below the 2,000–2,500-foot altitude.

Salamanders, Toads, and Frogs

The southern Appalachian Mountains have long been regarded as the home of a large variety of amphibians. It is an ancient region of heavy precipitation and numerous streams and rivulets. Within the National Park alone the vertical distance between the lowest and highest points of land is almost 5,800 feet. The plant-life is dense and rich in the number of species; here one finds Canadian-zone stands of spruce and fir on the higher summits grading down to sweetgum and sycamore at the base. These mountain forests are the habitat for at least 27 kinds of salamanders, ranging from the pigmy salamander, less than 2 inches long when mature, to the big hellbender, which may grow to 29 inches. The pigmy salamander is strictly terrestrial and is found only in the high-mountain forests, whereas the hellbender is entirely aquatic, living only in the warmer low-altitude streams.

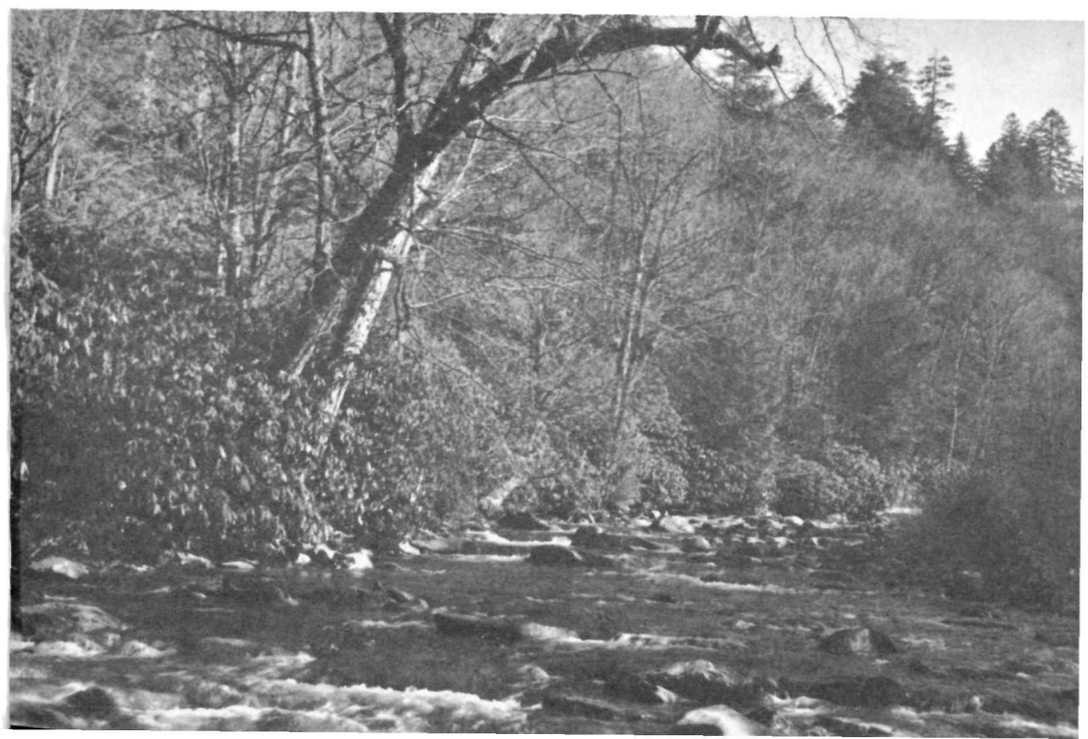
The red-cheeked, or Jordan's, salamander is of exceptional interest, since its entire range appears to be restricted to Great Smoky Mountains National Park. Adults average about 4 inches in length. With the exception of reddish or orange cheek patches, the coloration throughout is blackish. Like the pigmy salamander, the first specimens of which were discovered in the Smokies, Jordan's salamander is a land form, living under rocks and logs at the higher altitudes.

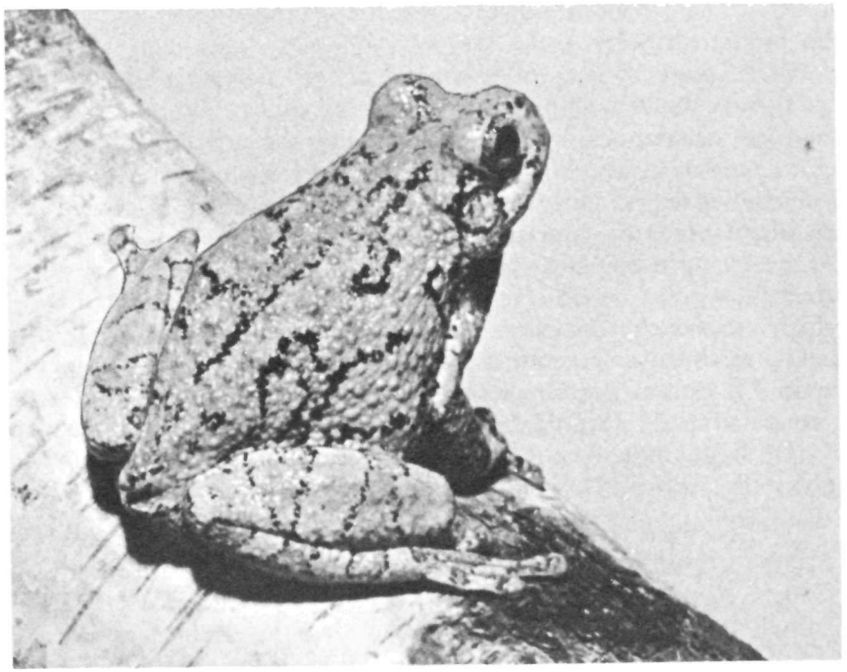
While most species of salamanders will lay eggs during the spring, the hellbender will lay her string of eggs in summer; the marbled salamander, in the autumn; and the attractively marked spotted salamander, in the winter. It is not unusual to find the jellylike egg-clusters of the spotted salamanders in temporary woodland pools in January.

On certain warm rainy nights in early spring, large numbers of salamanders may be observed upon the wet macadam-surfaced road which crosses the Smokies from Cherokee, N.C., to Gatlinburg, Tenn. Such an emergence is described by Dr. Willis King in his report "A Survey of the Herpetology of Great Smoky Mountains National Park." (See "Selected Bibliography.") In his discussion of the large mountain purple salamander, which occurs mostly at altitudes above 2,500 feet, Dr. King writes:

> On the night of April 20, 1937, Mrs. King and I were driving from Gatlinburg to Waynesville between 8 and 9 p.m. It was a warm foggy night, following a period of showers. On the Newfound Gap road, Tennessee side, between 3,500 and 5,000 feet elevation we saw at least 200 salamanders of this species crawling about on the road. They could be seen at considerable distance because of the contrast

Numerous streams and rivulets make this region the habitat for many salamanders. This stream is the West Prong of the Little Pigeon River.





The snoring drone of the gray treefrog is one of the late-spring and summer sounds in lower altitudes of the park. Courtesy, Isabelle Hunt Conant.

> of their light bodies on the black surface of the road, but even more striking was the reflection from their eyes. The presence of so many of these comparatively uncommon animals made the observation all the more interesting.

Although an emergence of salamanders in April appears in order, as many as eight species of amphibians (five salamanders, two frogs, and a toad) have been observed on this same road on a wet night in November, and nine species (five salamanders, three frogs, and a toad), on a day and night in December. On the latter occasion (December 3, 1950) three specimens of mountain purple salamanders which had been killed by passing vehicles were collected; one of these was a female with a large quantity of eggs in the body cavity. How soon would these eggs have been laid if the animal's life had been spared? Much remains unknown concerning the natural history of a number of our salamanders.

The presence of these amphibians at night on the wet, macadam-surfaced road may be due, in part, to the temperature and, in part, to the food which is available there. Roads of this kind are likely

to be warmer than the ground on either side and, when wet, serve to attract a considerable number of earthworms and other small invertebrates, where they are readily secured by the salamanders. But such a situation is hazardous to all concerned, for not only passing vehicles but various predators kill the slow-moving salamanders once they leave the protection of the nearby forest. Since the remains of salamanders have been found in the stomach of a screech owl, and since screech owl remains have been found in the stomach of an opossum—both the owl and the opossum having been killed by passing cars along the road—a chain reaction such as the following is within the realm of possibility.

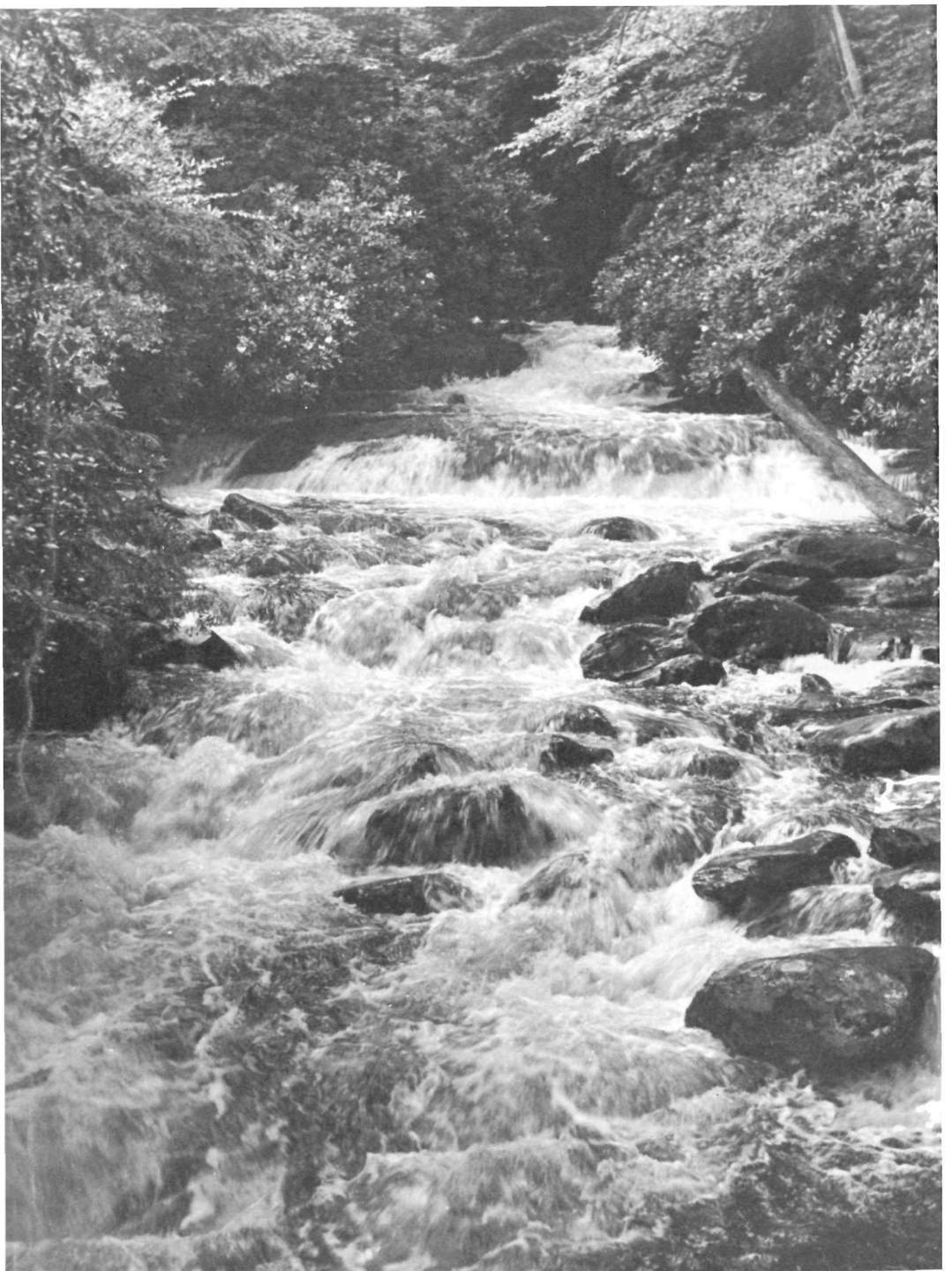
The setting is the main transmountain road in the Great Smokies on a warm, rainy night: (1) Earthworms become stranded on the road; (2) a salamander appears and begins feeding upon the earthworms; (3) a screech owl, while patrolling the road, discovers the salamander and alights to feed upon it; (4) a passing car kills the owl; (5) an opossum finds the dead owl in the road and, while feeding upon it, meets a similar fate. One could go on and extend the chain with a fox feeding upon the opossum, but since Reynard in all probability would carry the opossum into the nearby woods before beginning his meal, the sequence will end there.

The American toad, Fowler's toad, and 10 species of frogs occur within the park. Unlike the salamanders, which are voiceless, frogs and toads are well endowed in this respect, and their singing may be loud and persistent. These animals are the first to give voice to the coming of spring, and this may be as early as January in the case of spring peepers, chorus frogs, and wood frogs. Egg-laying commences soon thereafter. Toads lay their eggs in long strings, while frogs lay theirs in gelatinous masses. Only the American toad, spring peeper, and the gray treefrog occur at high altitudes in the park, and these are uncommon there.

Fishes

Over 600 miles of some of the finest wild trout streams in the southern Appalachians are found within Great Smoky Mountains National Park. These fast-flowing, boulder-strewn watercourses, with their intermittent pools and numerous cascades, are among the park's most attractive natural features. A total of more than 70 forms of fishes live in these waters.

Native to the park and still common in headwaters is the colorful eastern brook trout. Before the park was established, factors such as logging, the introduction of the exotic rainbow trout, and



Hundreds of miles of trout streams—fast-flowing, clear, and cold—drain the slopes of the Smokies. Rosebay rhododendrons thrive along the banks of these watercourses. Courtesy, Tennessee Conservation Department.

inadequately regulated fishing changed the original conditions, bringing about the reduction in numbers and distribution of this brilliant native trout. In cooperation with biologists of the U.S. Fish and Wildlife Service, the National Park Service is attempting to reestablish the original Appalachian strain of eastern brook trout in some of its former haunts. Results from the initial experiments are encouraging.

The brook trout of park streams is relatively small, rarely exceeding 12 inches in length. Notwithstanding this, it is highly prized by fishermen because of its beauty, its willingness to take a lure, and its delicate flavor when fried.

Around the turn of the century, the adaptable rainbow trout was introduced into the major streams of the Great Smoky Mountains. Now firmly established with self-sustaining populations, this western trout is the most abundant sport fish found in the park. Specimens as large as 20 inches are occasionally taken by the active angler.

The brown trout, introduced into this country from Europe, is occassionally found in a few park streams. It is assumed that this species has moved into the park from waters farther downstream.

In the lower sections of several streams, below elevations of 1,600 feet, the native smallmouth bass is found in limited numbers. The largemouth bass is present in the lower part of Hazel Creek.

Principal among the fishes found in the park is a minnow, the stoneroller, or "hornyhead," which is abundant and widely distributed. Although small, rarely over 8 inches, it is favored as a table fish by many residents of this vicinity. Among the 2 dozen other members of the minnow family found in park waters are the bright-hued warpaint shiner, the emerald shiner, and the rosy dace.

Three species of brook lampreys, the eel-like forms of primitive fishes, inhabit park streams. In contrast to the large parasitic sea lampreys of the Atlantic Ocean and the Great Lakes, these brook lampreys are small and harmless, spending most of their lives in burrows in the bottoms of the larger streams.

Of the 11 darters present, some are very common. These spectacularly colored little fishes have been called "the warblers of the water world of fishes."

Among the other park fishes are 6 kinds of suckers, 9 sunfishes and basses, 6 bullheads and catfishes, the long-nosed gar, the freshwater drum, and two sculpins.

Although extensive collections of fishes have been made, the exact number of species or subspecies which occur within the park has not been determined. More than 70 forms have been identified. The classification of the fishes of this region is especially difficult be-

cause of the intergradations which have occurred between forms from the south and the north and from the Atlantic slope and the Mississippi Valley. It is possible that a number of new forms still remain to be described from park waters. This, in addition to the known variety of park fishes, makes this fish fauna of great interest to naturalists, biologists, and sportsmen.

Fishing in the park is a particularly enjoyable and rewarding recreational activity. The waters are not overcrowded with anglers, and the streams and surrounding forests are beautiful and generally undisturbed. Most of the trout taken by the angler are vigorous and colorful wild fish. Only limited numbers of trout are stocked from hatcheries operated by the Bureau of Sport Fisheries and Wildlife. These plantings are made only in streams where natural reproduction is inadequate.

Several selected streams in the park are open to year-round sport angling on a fishing-for-fun-only basis. The angler uses artificial lures and catches as many fish as he desires, or can, but he returns them to the water unharmed. This experimental program affords more high-quality sport for more anglers in a manner that does not impair the fishery resources.

You may secure a copy of current fishing regulations at any park ranger station or visitor center or by writing to the Superintendent, Great Smoky Mountains National Park, Gatlinburg, Tenn. You may also secure from the superintendent a list of fishes known to occur in park streams.

Man in the Great Smoky Mountains

Up to a century ago, the area we now know as Great Smoky Mountains National Park was virtually unknown. Cherokee Indians, whose reservation joins the park to the south, came in occasionally to hunt or fish and a few hardy white settlers dwelt in simple cabins which they built from the forest trees. By the start of the 20th century, several hundred families, mostly descendents of colonists from England and Scotland, were living in the Great Smoky Mountains. Isolated from the outside world, they lived a life of self-sufficiency. What they couldn't make they had to do without. Their resourcefulness in the construction of simple implements for use on their farms and in their homes becomes very evident when we examine these objects as displayed in the visitor center at Oconaluftee, near the park's Cherokee entrance.

Farming was done along the narrow bottomlands, in the wider coves, and, often enough, on fairly steep hillsides. The tending of livestock occupied a considerable portion of the mountaineer's time. Cattle, sheep, and hogs roamed the forested mountainsides, where food was ample during most of the year. Hunting, trapping, and fishing served to bring welcome variety to the monotonous fare of these people. On those infrequent occasions when trips were made to a nearby community, needed items were obtained by barter. The entire family usually engaged in the harvesting of wild berries and nuts.

Mostly unaware of the great changes which were taking place beyond these mountains, the people continued in their relatively primitive way of life until recently. Their names, their speech, and their music are reminiscent of past generations.

A number of log cabins, barns, and other structures that became part of Great Smoky Mountains National Park when the mountaineers sold their property and moved away have been rehabilitated. Park visitors now, and for generations to come, can examine these buildings in such places as Cades Cove and Roaring Fork, where some of the structures remain on their original sites, and in the Oconaluftee Visitor Center area, where they are grouped to facilitate easy inspection.

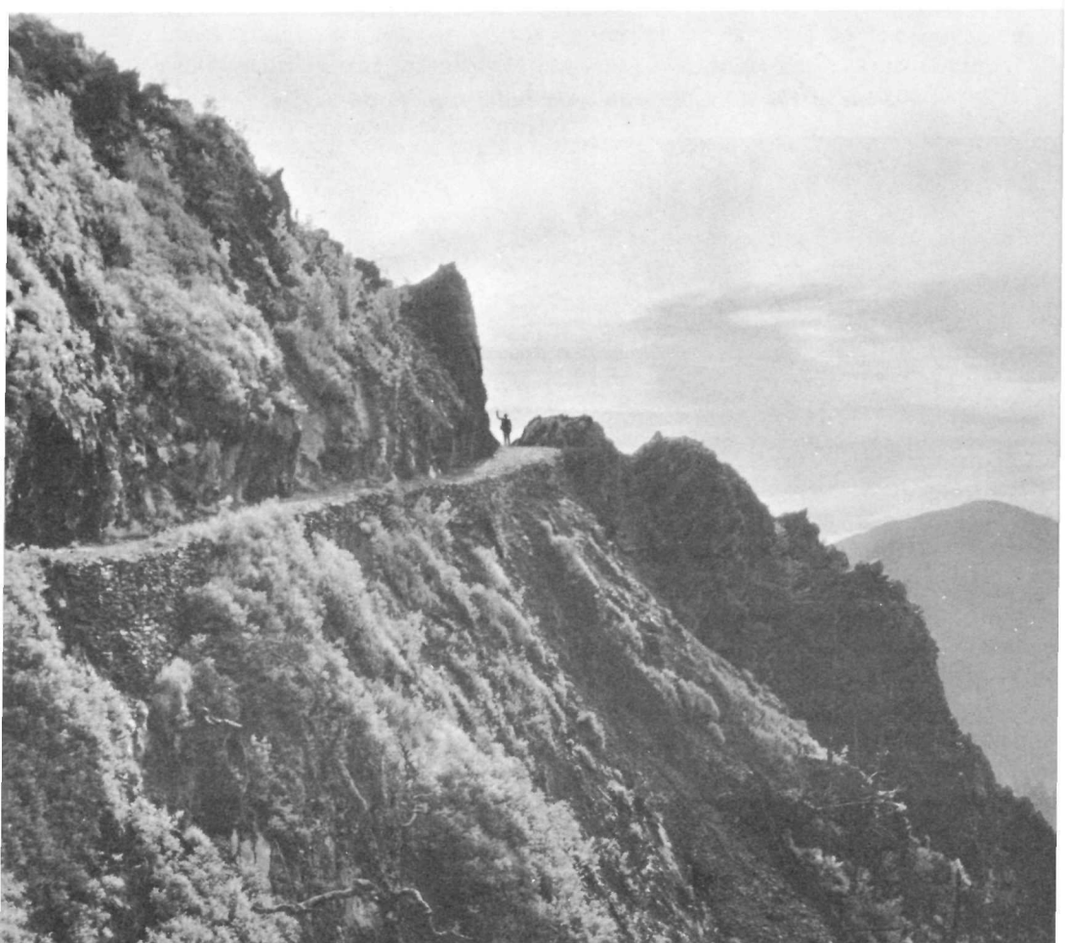
Some of the works of man seem indigenous to the region.

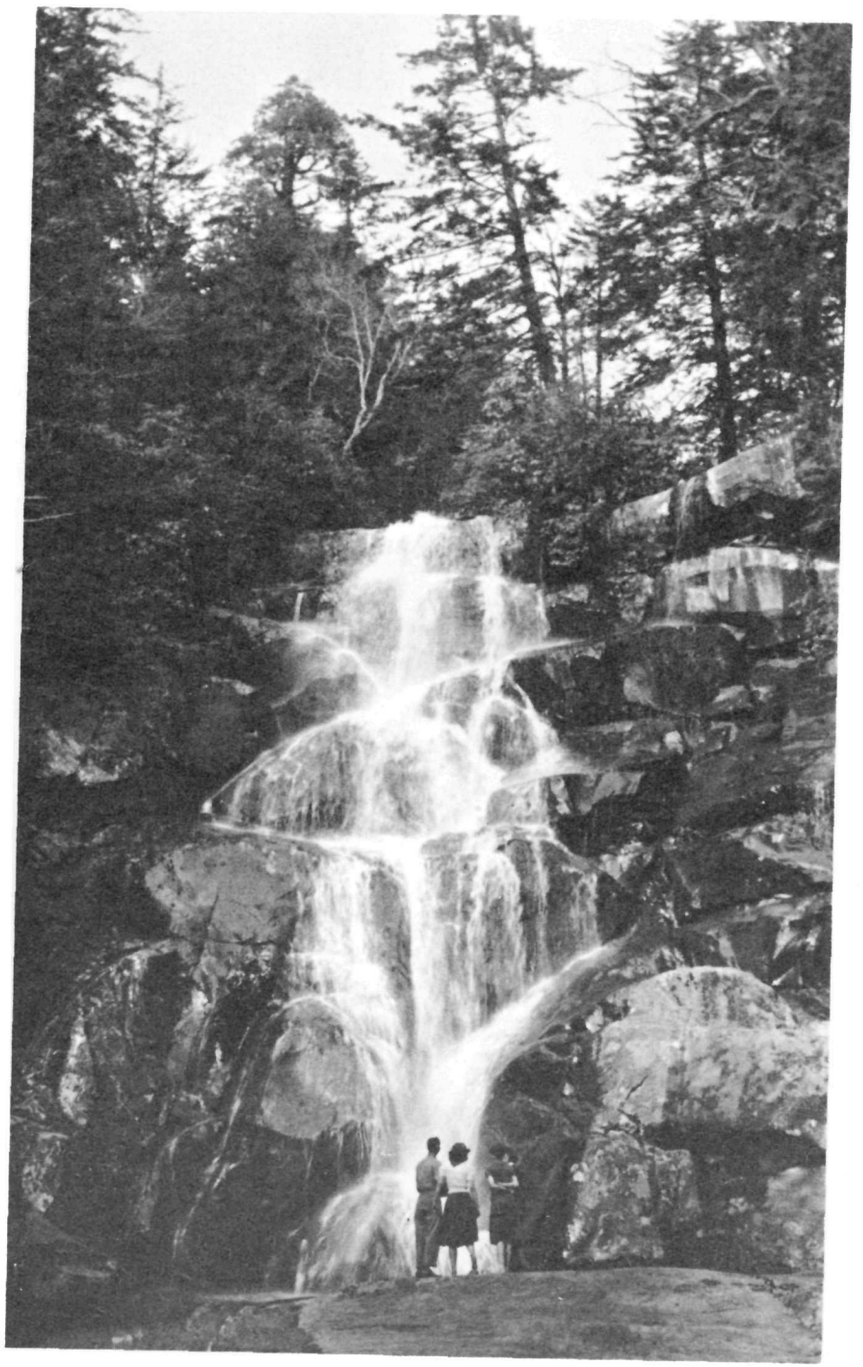


Trails

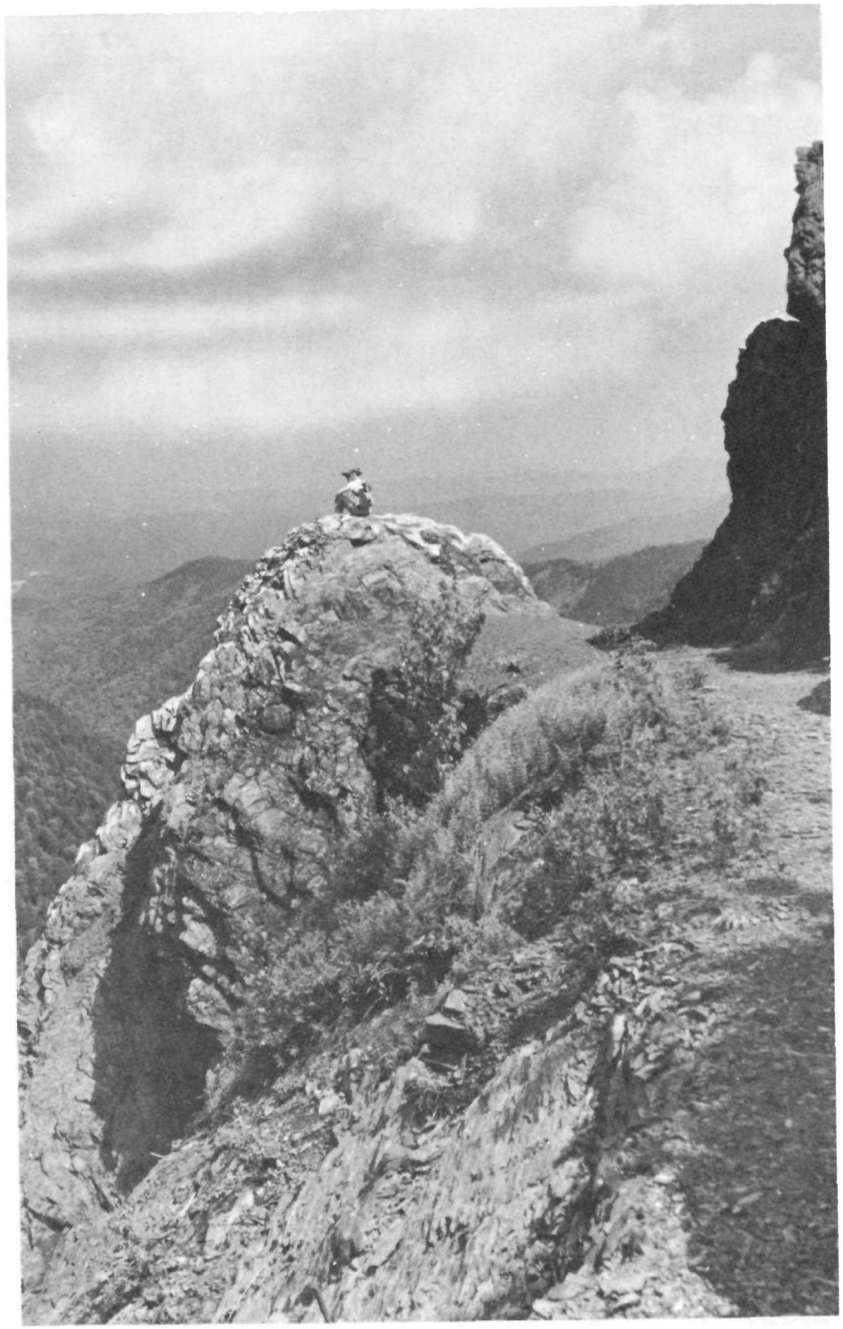
Do you want to view the thrilling spectacle of colorful wild azaleas in bloom, the sylvan majesty of a grove of forest giants, the sparkling beauty of a waterfall, the awe-inspiring panorama from Myrtle Point? If so, then you'll have to go by trail. Several hundred miles of well-engineered trails, built mostly in the thirties by the Civilian Conservation Corps, make almost all parts of the park accessible to the hiker and horseback rider. Trails follow streams, lead along ridge crests, drop down into secluded valleys, and climb to mountain summits. Whether your main interest is plants or birds or rocks or views, or simply the exhilaration of being out of doors, the most rewarding route is via trail.

The hiker is on the Appalachian Trail, 4 miles from Newfound Gap.
Courtesy, Thompsons Photography, Inc.





One of the finest waterfalls in the park is Ramsey Cascades. It is reached by a trail which passes through a splendid forest of giant trees.

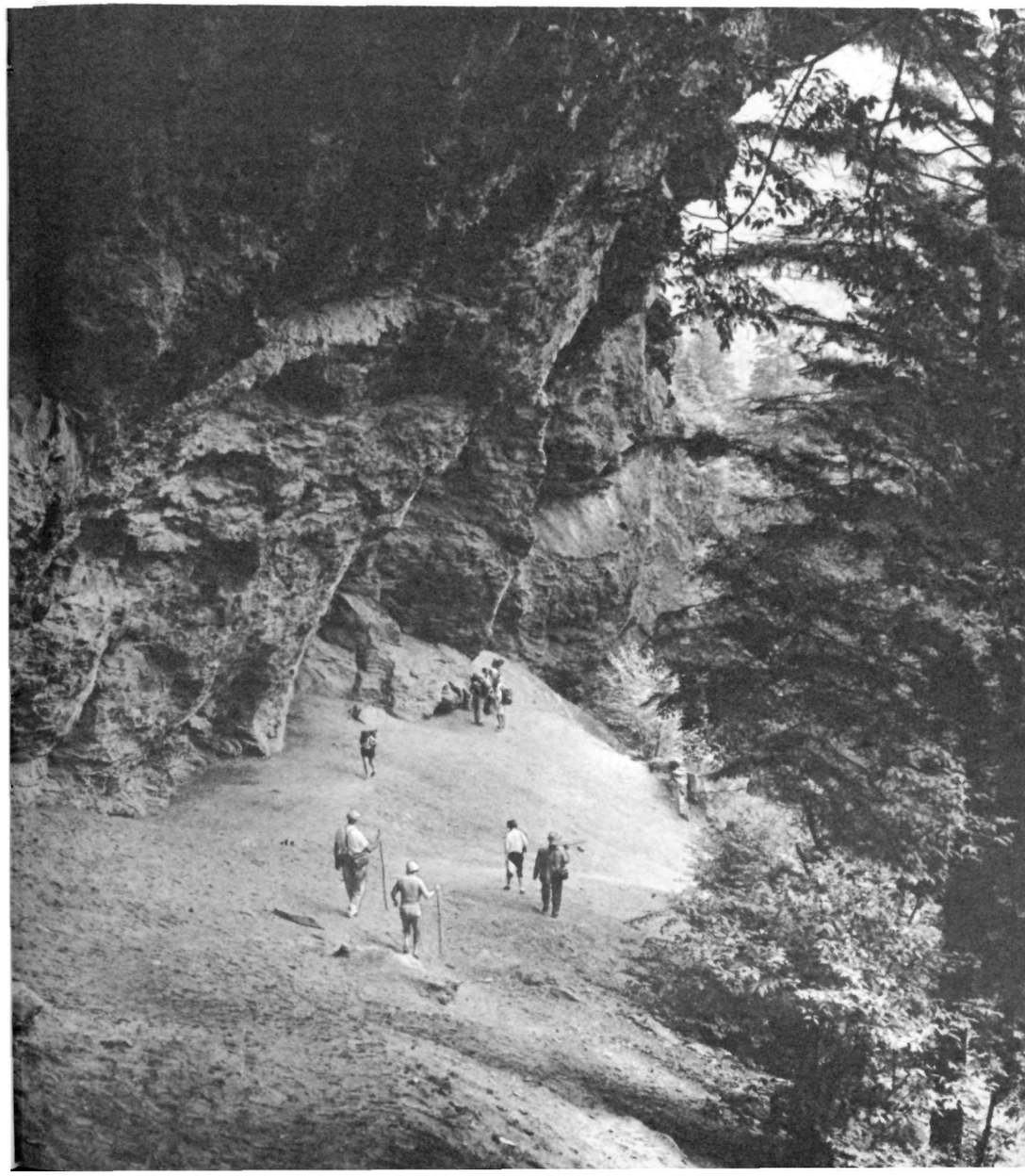


Charlies Bunion. Denuded by the disastrous fire of 1925, this area will be reforested eventually by the natural invasion of plants. Courtesy, Tennessee Conservation Department.

Trails in the park are well marked, but bears will chew the signs, on occasion, and may even destroy them. Damaged signs should be reported.

The map in the pocket inside the back cover shows the trails in the park. More detailed maps may be purchased in the headquarters and Oconaluftee areas, where other large maps and relief models are on display.

Alum Cave Bluffs.



Annual Spring Wildflower Pilgrimage

During the last weekend in April, when the variety of spring wildflowers is near its peak, a special event draws large numbers of nature enthusiasts to Great Smoky Mountains National Park. This, the annual Spring Wildflower Pilgrimage, features hiking trips, nature walks, photographic tours, bird-watching, and illustrated talks. Botanists from various colleges in the southern Appalachian region assist the park naturalists in leading groups of visitors over park trails, the accent being on getting acquainted with wildflowers. As many as 200 species of plants have been observed in bloom during the 3 days of the pilgrimage. This event serves as an introduction to the naturalist program in the park, which begins May 1 and continues for 6 months. Information relating to the current Spring Wildflower Pilgrimage may be obtained during March and April from the Chamber of Commerce, Gatlinburg, Tenn.

The evergreen leaves of this catawba rhododendron are wider and not as sharply pointed as the leaves of the rosebay or great white rhododendron. Temperatures as low as 20° below zero have been recorded in places where these shrubs grow. Courtesy, Tennessee Conservation Department.

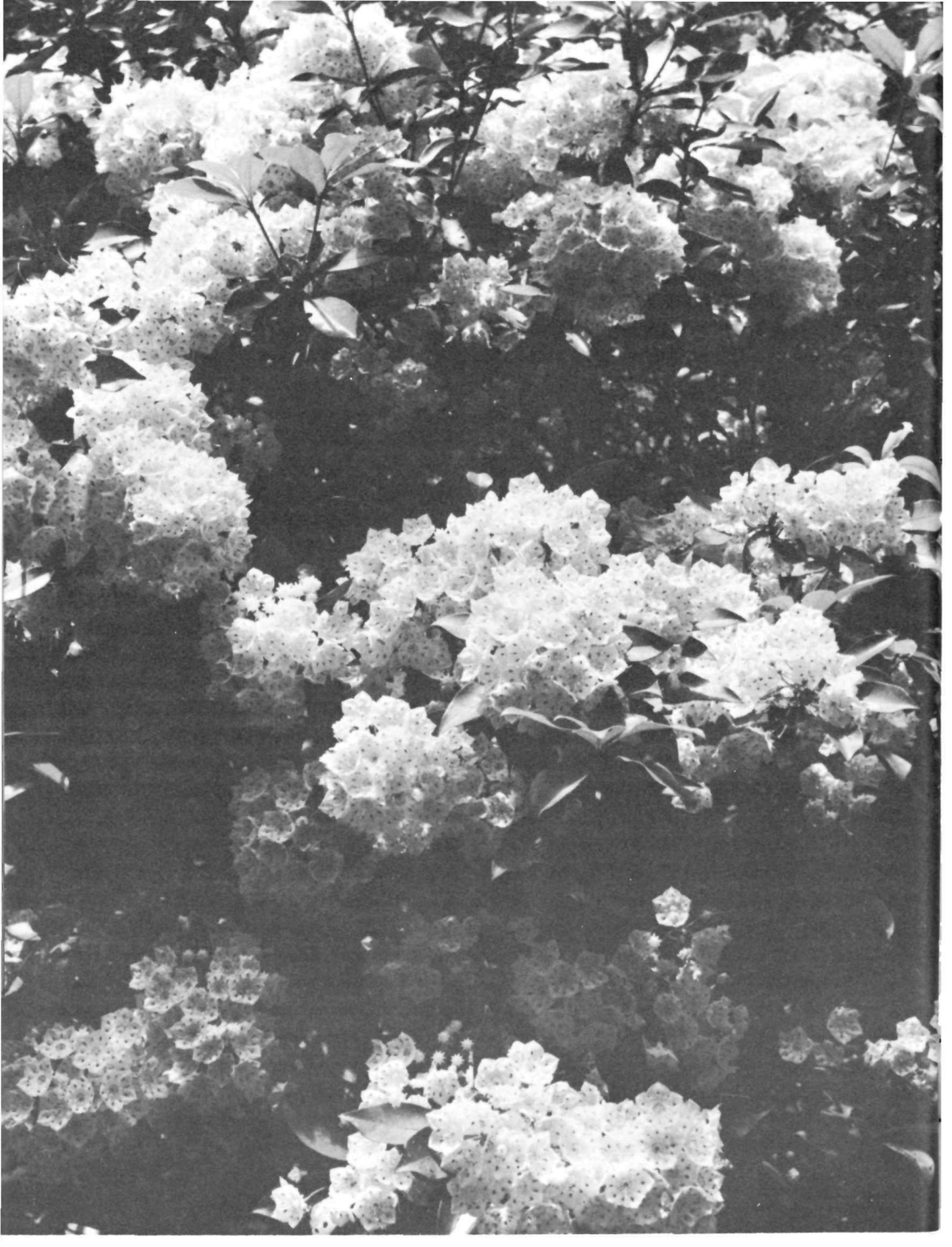




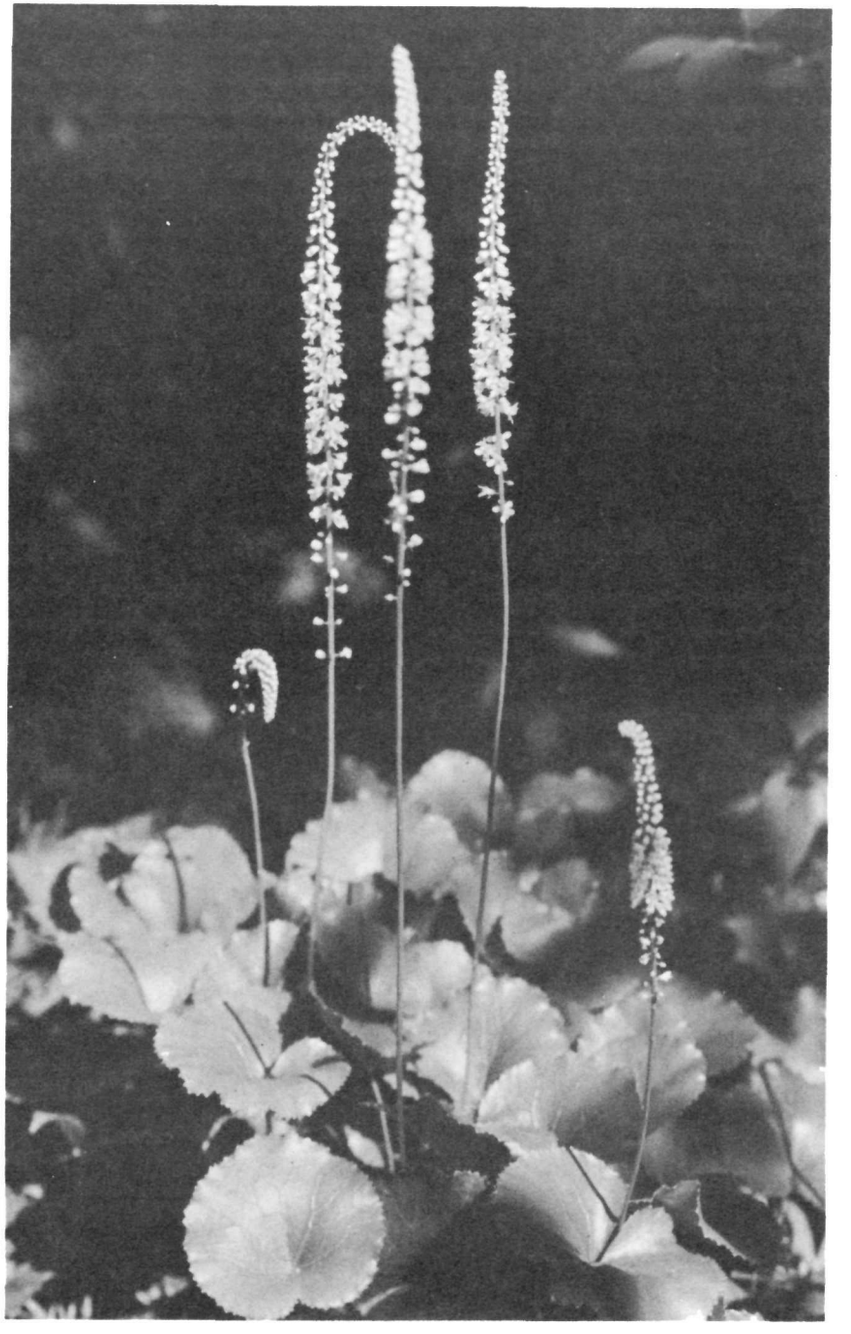
The birdsfoot violet has the largest flowers of all violets in the park. Courtesy, H. Lou Gibson.

Three petals, three sepals, and three leaves=trillium. This is the erect white species whose local name is "Stinking Willy."





Mountain-laurel is known as "ivy" by some of the local residents. During most years it bears white or pink flowers from middle May to middle June. Courtesy, Tennessee Conservation Department.



Flowers of the galax appear in middle and late spring. The thick leathery leaves may become reddish and purplish in late autumn and winter. Courtesy, Thompsons Photography, Inc.



The showy orchis is one of the 29 species of native orchids in the park. In woodlands, where it occurs, the flowers appear in late April and early May. Courtesy, H. Lou Gibson.

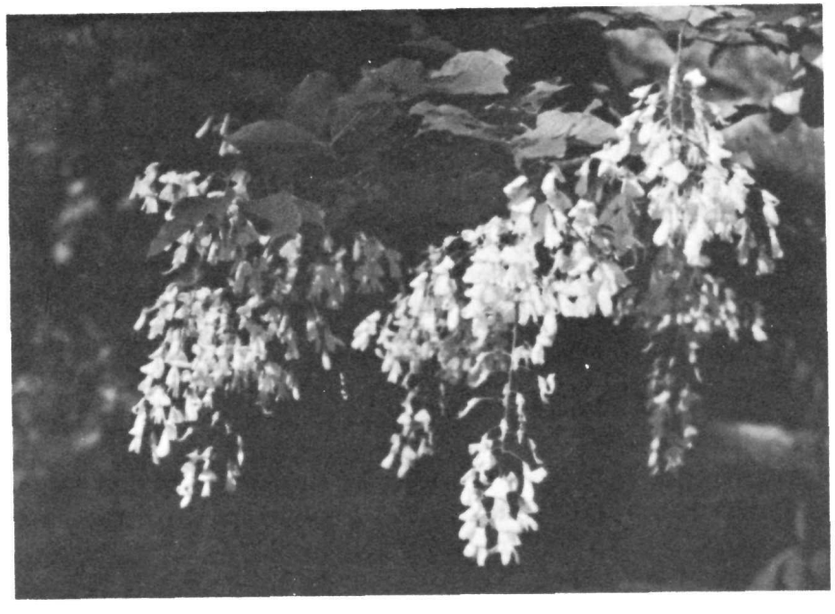


What some people regard as a single dogwood flower is actually a bouquet in the center of four chalky-white bracts. In the park, this common small tree is usually at its height of bloom from middle to late April. Courtesy, Tennessee Conservation Department.



Petals of the fringed phacelia, a member of the waterleaf family, are usually white; but pale-pink, blue, and lavender shades are not uncommon. Courtesy, H. Lou Gibson.

The flowers of yellowwood appear in May. This tree is rare and local throughout its range.



Naturalist Service

The National Park Service invites all visitors to participate, without charge, in the naturalist-conducted hiking trips. These begin May 1 and continue through October—a 6-month program. Waterfalls, big-tree groves, wildflower concentrations, outstanding views, and other attractions are the objectives visited under the guidance of a park naturalist. With the exception of the overnight trip to Mount Le Conte, no reservations are necessary.

Talks, with or without illustrations, are given at frequent intervals in campgrounds and in visitor centers. Trips and talks are described in the *Naturalist Program,* a monthly bulletin (published from May through October) available from the Superintendent, Great Smoky Mountains National Park, Gatlinburg, Tenn. Copies are posted in the park's visitor centers, campgrounds, and elsewhere.

Conservation and Preservation

This, the finest mountain wilderness and virgin hardwood forest in Eastern North America, was saved and set aside for you and for those who will come after you. Who are the people whose wisdom and generosity and effort created this National Park?

Suggestions for a National Park in the southern Appalachians were made as early as 1885. Dr. Chase P. Ambler, of Asheville, N.C., organized and directed an intensive campaign from 1889 to 1905 for a 12,000-square-mile National Park in North Carolina, Tennessee, South Carolina, Georgia, and Virginia. The boundaries included the Great Smoky Mountains. In spite of strong public support, this project failed for lack of Congressional action.

The successful movement for a National Park in the Great Smoky Mountains was officially started by Willis P. Davis, of Knoxville, Tenn., at a meeting held on December 21, 1923. As a result of the original study and planning by Davis and others who saw the far-reaching benefits, Congress authorized the park in 1926. In 1927, the State Legislatures of North Carolina and Tennessee passed enabling acts. Through the Laura Spelman Rockefeller Memorial, the late John D. Rockefeller, Jr., matched State funds, and land acquisition began. Later, Federal funds were made available to complete the work.

Combined gifts—from the people of North Carolina and Tennessee, from private and public funds—enabled the Governors of the two States, on February 6, 1930, to present 158,876 acres of land to the Secretary of the Interior. On September 2, 1940, President Franklin D.

Roosevelt formally dedicated Great Smoky Mountains National Park to the mission of preserving and protecting the wild beauty and natural features of the area for all time.

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Appendix—Common and Scientific Names of Plants and Animals

This list of common names and their scientific (Latin) equivalents includes only those plants and animals that are mentioned in the text. With minor exceptions, authority for the scientific names of all plants and for the common names of all plants except trees is the second edition (1942) of *Standardized Plant Names,* edited by Harlan P. Kelsey and William A. Dayton. Authority for the common names of trees is *Check List of Native and Naturalized Trees of the United States (Including Alaska),* by Elbert L. Little, Jr. (U.S. Department of Agriculture Handbook No. 41, published in 1953).

PLANTS

Alder—*Alnus* sp.
Ash, white—*Fraxinus americana*
Aster—*Aster* sp.
  acuminate—*Aster acuminatus*
  white wood—*Aster divaricatus*
Azalea—*Rhododendron* sp.
  flame—*Rhododendron calendulaceum*
Basswood—*Tilia* sp.
Beadlily, yellow—*Clintonia borealis*
Beech, American—*Fagus grandifolia*
Birch, sweet—*Betula lenta*
  yellow—*Betula alleghaniensis*
Blackberry, thornless—*Rubus canadensis*
Blackgum—*Nyssa sylvatica*
Blueberry—*Vaccinium* sp.
  Blueridge—*Vaccinium pallidum*
Bluet, creeping—*Houstonia serpyllifolia*
Bracken, eastern—*Pteridium latiusculum*
Buckberry—*Gaylussacia ursina*
Buckeye, yellow—*Aesculus octandra*
Bush-honeysuckle, southern—*Diervilla sessilifolia*
Cherry, black—*Prunus serotina*
  pin—*Prunus pensylvanica*
Chestnut, American—*Castanea dentata*
Crinkleroot—*Dentaria diphylla*
Cucumbertree—*Magnolia acuminata*
Devils-walkingstick—*Aralia spinosa*
Dingleberry—*Vaccinium erythrocarpum*
Dogwood, alternate-leaf—*Cornus alternifolia*
Dogwood, flowering—*Cornus florida*
Dutchmanspipe, common—*Aristolochia durior*
Elder, scarlet—*Sambucus pubens*
Fawnlily, common—*Erythronium americanum*
Fern, hayscented—*Dennstaedtia punctilobula*
  lady—*Athyrium filixfemina*
Fir, balsam—*Abies balsamea*
  Fraser—*Abies fraseri*
Foxglove, false—*Gerardia laevigata*
Galax—*Galax aphylla*
Goldenrod—*Solidago* sp.
  cluster—*Solidago glomerata*
Gooseberry, roundleaf—*Ribes rotundifolium*
Greenbrier, common—*Smilax rotundifolia*
Groundsel, Rugel's—*Senecio rugelia*
Hawthorn—*Crataegus* sp.
Hemlock, eastern—*Tsuga canadensis*
Hickory, mockernut—*Carya tomentosa*
  pignut—*Carya glabra*
  red—*Carya ovalis*
Hobblebush—*Viburnum alnifolium*
Holly, American—*Ilex opaca*
Huckleberry—*Gaylussacia* sp.

Hydrangea, smooth—*Hydrangea arborescens*
Indianpipe—*Monotropa uniflora*
Leucothoe, drooping—*Leucothoe catesbaei*
Locust, black—*Robinia pseudoacacia*
Magnolia, Fraser—*Magnolia fraseri*
Maple, mountain—*Acer spicatum*
red—*Acer rubrum*
striped—*Acer pensylvanicum*
sugar—*Acer saccharum*
Menziesia, Allegheny—*Menziesia pilosa*
Mountain-ash, American—*Sorbus americana*
Mountain-laurel—*Kalmia latifolia*
Oak, black—*Quercus velutina*
chestnut—*Quercus prinus*
northern red—*Quercus rubra*
scarlet—*Quercus coccinea*
white—*Quercus alba*
Oilnut—*Pyrularia pubera*
Orchis, showy—*Orchis spectabilis*
Pedicularis, early—*Pedicularis canadensis*
Phacelia, fringed—*Phacelia fimbriata*
Pine, eastern white—*Pinus strobus*
pitch—*Pinus rigida*
shortleaf—*Pinus echinata*
Table-Mountain—*Pinus pungens*
Virginia—*Pinus virginiana*
Plum, native—*Prunus* sp.
Polypody, common—*Polypodium vulgare*
Pussytoes—*Antennaria* sp.
Rhododendron, Carolina—*Rhododendron carolinianum*
catawba—*Rhododendron catawbiense*
rosebay—*Rhododendron maximum*
Sandmyrtle—*Leiophyllum lyoni*
Sassafras—*Sassafras albidum*
Serviceberry, Allegheny—*Amelanchier laevis*
Silverbell, mountain—*Halesia monticola*
Sourwood—*Oxydendrum arboreum*
Sparkleberry, tree—*Vaccinium arboreum*
Springbeauty, Virginia—*Claytonia virginica*
Spruce, red—*Picea rubens*
Starwort, great—*Stellaria pubera*
Stewartia, mountain—*Stewartia ovata*
Sumac, staghorn—*Rhus typhina*
Sweetgum—*Liquidambar styraciflua*
Sweetshrub, pale—*Calycanthus fertilis*
Sycamore, American—*Platanus occidentalis*
Trailing-arbutus—*Epigaea repens*
Trillium—*Trillium* sp.
erect—*Trillium erectum*
painted—*Trillium undulatum*
Turtlehead, pink—*Chelone lyoni*
Violet, birdsfoot—*Viola pedata*
halberdleaf yellow—*Viola hastata*
pallid—*Viola pallens*
Violets—*Viola* sp.
Virginia-creeper—*Parthenocissus quinquefolia*
Winterberry, mountain—*Ilex montana*
Wintergreen, checkerberry—*Gaultheria procumbens*
Witch-hazel—*Hamamelis virginiana*
Witherod—*Viburnum cassinoides*
Woodfern, toothed—*Dryopteris spinulosa*
Woodsorrel, American—*Oxalis montana*
Yellow-poplar—*Liriodendron tulipifera*

MAMMALS

Bear, black—*Ursus americanus*
Bison—*Bison bison* (extirpated)
Bobcat—*Lynx rufus*
Chipmunk, eastern—*Tamias striatus*
Cottontail, eastern—*Sylvilagus floridanus*
Deer, white-tailed—*Odocoileus virginianus*
Elk—*Cervus canadensis* (extirpated)
Fisher—*Martes pennanti* (extirpated)
Fox, gray—*Urocyon cinereoargenteus*
red—*Vulpes fulva*
Mink—*Mustela vison*
Mountain lion—*Felis concolor* (extirpated)
Mouse, jumping—*Zapus hudsonius* and *Napaeozapus insignis*
Muskrat—*Ondatra zibethica*
Opossum—*Didelphis virginiana*
Otter—*Lutra canadensis* (extirpated)
Raccoon—*Procyon lotor*
Skunk—*Spilogale putorius* and *Mephitis mephitis*
Squirrel, flying—*Glaucomys volans* and *G. sabrinus*
fox—*Sciurus niger*
gray—*Sciurus carolinensis*
red—*Tamiasciurus hudsonicus*
Weasel, longtail—*Mustela frenata*
Wolf, gray—*Canis lupus* (extirpated)
Woodchuck—*Marmota monax*

BIRDS

Bobwhite—*Colinus virginianus*
Brant—*Branta bernicla*
Bunting, indigo—*Passerina cyanea*
Cardinal—*Richmondena cardinalis*
Catbird—*Dumetella carolinensis*
Chat, yellow-breasted—*Icteria virens*
Chickadee, black-capped—*Parus atricapillus*
Carolina—*Parus carolinensis*
Coot—*Fulica americana*
Creeper, brown—*Certhia familiaris*
Crossbill, red—*Loxia curvirostra*
white-winged—*Loxia leucoptera*
Crow, common—*Corvus brachyrhynchos*
Eagle, bald—*Haliaeetus leucocephalus*
golden—*Aquila chrysaetos*
Egret, common—*Casmerodius albus*
Falcon, peregrine—*Falco peregrinus*
Flycatcher, Acadian—*Empidonax virescens*
olive-sided—*Nuttallornis borealis*
Goose, snow—*Chen hyperborea*
Grosbeak, rose-breasted—*Pheucticus ludovicianus*
Grouse, ruffed—*Bonasa umbellus*
Gull, laughing—*Larus atricilla*
Hawk, pigeon—*Falco columbarius*
Hummingbird, ruby-throated—*Archilochus colubris*
Junco, Carolina—*Junco hyemalis carolinensis*
Kinglet, golden-crowned—*Regulus satrapa*
Nuthatch, red-breasted—*Sitta canadensis*
Ovenbird—*Seiurus aurocapillus*
Owl, saw-whet—*Aegolius acadicus*
screech—*Otus asio*
Pelican, white—*Pelecanus erythrorhynchos*
Phalarope, red—*Phalaropus fulicarius*
Phoebe, eastern—*Sayornis phoebe*
Plover, golden—*Pluvialis dominica*
Raven, common—*Corvus corax*
Redstart, American—*Setophaga ruticilla*
Robin—*Turdus migratorius*
Siskin, pine—*Spinus pinus*
Sparrow, chipping—*Spizella passerina*
song—*Melospiza melodia*
Swift, chimney—*Chaetura pelagica*
Tanager, scarlet—*Piranga olivacea*
Tern, sooty—*Sterna fuscata*
Thrasher, brown—*Toxostoma rufum rufum*
Thrush, Swainson's—*Hylocichla ustulata*
wood—*Hylocichla mustelina*
Titmouse, tufted—*Parus bicolor*
Towhee, rufous-sided—*Pipilo erythrophthalmus*
Turkey—*Meleagris gallopavo*
Veery—*Hylocichla fuscescens*
Vireo, red-eyed—*Vireo olivaceus*
solitary—*Vireo solitarius*
yellow-throated—*Vireo flavifrons*
Warbler, black-and-white—*Mniotilta varia*
Blackburnian—*Dendroica fusca*
black-throated blue—*Dendroica caerulescens*
black-throated green—*Dendroica virens*
Canada—*Wilsonia canadensis*

Warbler—Con.
chestnut-sided—*Dendroica pensylvanica*
golden-winged—*Vermivora chrysoptera*
hooded—*Wilsonia citrina*
Kentucky—*Oporornis formosus*
prairie—*Dendroica discolor*
worm-eating—*Helmitheros vermivorus*
yellow—*Dendroica petechia*
yellow-throated—*Dendroica dominica*
Water thrush, Louisiana—*Seiurus motacilla*
Woodpecker, hairy—*Dendrocopos villosus*
red-cockaded—*Dendrocopos borealis*
Wren, Carolina—*Thryothorus ludovicianus*
winter—*Troglodytes troglodytes*
Yellowthroat—*Geothlypis trichas*

REPTILES

Chameleon, Carolina—*Anolis carolinensis*
Copperhead—*Agkistrodon contortrix mokeson*
Glass-snake—*Ophisaurus attenuatus longicaudus*
Lizard, fence—*Sceloporus undulatus*
Racer, black—*Coluber constrictor*
Race runner, six-lined—*Cnemidophorus sexlineatus*
Rattlesnake, timber—*Crotalus horridus*
Skink—*Eumeces fasciatus, E. inexpectatus,* and *E. laticeps*
little brown—*Lygosoma laterale*
Snake, black king—*Lampropeltis getulus niger*
common garter—*Thamnophis sirtalis*
common king—*Lampropeltis getulus getulus*
common water—*Natrix sipedon*
corn—*Elaphe guttata*
crowned—*Tantilla coronata*
DeKay's—*Storeria dekayi*
eastern hognose—*Heterodon platyrhinos*
eastern milk—*Lampropeltis doliata triangulum*
Snake—Con.
ground—*Virginia valeriae*
mole—*Lampropeltis calligaster rhombomaculata*
pilot black—*Elaphe obsoleta*
pine—*Pituophis melanoleucus*
queen—*Natrix septemvittata*
red-bellied—*Storeria occipitomaculata*
ring-necked—*Diadophis punctatus*
rough green—*Opheodrys aestivus*
scarlet—*Cemophora coccinea*
scarlet king—*Lampropeltis doliata doliata*
worm—*Carphophis amoenus*
Turtle, common map—*Graptemys geographica*
common snapping—*Chelydra serpentina*
eastern box—*Terrapene carolina carolina*
eastern painted—*Chrysemys picta picta*
musk—*Sternotherus minor*
spiny softshell—*Trionyx spinifer*
Troost's—*Pseudemys scripta troosti*

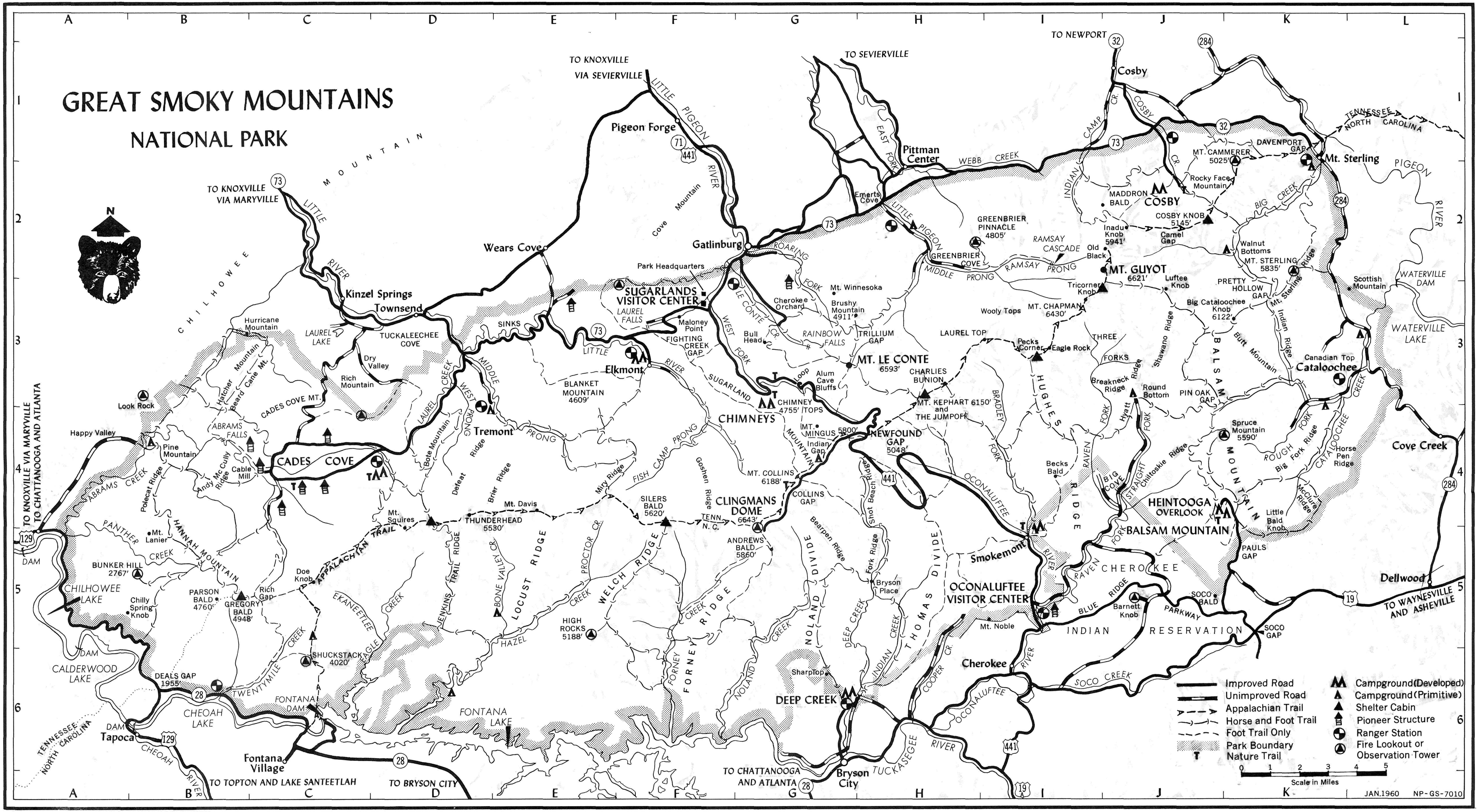
AMPHIBIANS

Frog, chorus—*Pseudacris triseriata feriarum*
wood—*Rana sylvatica*
Hellbender—*Cryptobranchus alleganiensis*
Peeper, spring—*Hyla crucifer*
Salamander, marbled—*Ambystoma opacum*
mountain purple—*Gyrinophilus danielsi danielsi*
Salamander—Con.
pigmy—*Desmognathus wrighti*
red-cheeked—*Plethodon jordani*
spotted—*Ambystoma maculatum*
Toad, American—*Bufo americanus*
Fowler's—*Bufo woodhousei fowleri*
Treefrog, gray—*Hyla versicolor*

FISHES

Bass, largemouth—*Micropterus salmoides*
smallmouth—*Micropterus dolomieu*
Carp—*Cyrinus carpio*
Dace, rosy—*Gila vandoisula*
Drum, fresh-water—*Aplodinotus grunniens*
Gar, longnose—*Lepisosteus osseus oxyurus*
Lamprey, American brook—*Lampetra lamottei*
chestnut—*Ichthyomyzon castaneus*
Lamprey—Con.
mountain brook—*Ichthyomyzon hubbsi*
sea—*Petromyzon marinus* (not found in park)
Shiner, emerald—*Notropis atherinoides*
warpaint—*Notropis coccogenis*
Stoneroller—*Campostoma anomalum*
Trout, brown—*Salmo trutta*
eastern brook—*Salvelinus fontinalis*
rainbow—*Salmo gairdneri*

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