WATER in GREAT SMOKY MOUNTAINS National Park

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

WATER in GREAT SMOKY MOUNTAINS National Park

Panoramic view of Great Smoky Mountains National Park.

NATURAL BEAUTY . . .

Visitors to Great Smoky Mountains National Park are greatly impressed by the natural beauty preserved in this wilderness recreation area. The green mountains poking through the misty haze that gives the park its name; the streams tumbling down boulder-strewn channels; the wealth of flowers and trees coloring the valleys and softening the hills; the wild animals roaming free in their natural environment; all are part of the scenic beauty that has made the Great Smokies the most popular national park in the United States.

. . . BASED ON WATER

But while we enjoy this natural beauty, we too easily ignore the natural resource that first carved and still feeds that beauty. We overlook the ingredient that must be understood and protected if the park is to be a source of enjoyment tomorrow. We tend to overlook the role of water in Great Smoky Mountains National Park.

The rugged landscape was sculptured by the erosive powers of rain and runoff. The lush vegetation that grows in such variety in only a few other places in the world has been preserved and nurtured by bountiful rainfall, the highest in the eastern United States. The animals, birds, and fishes also depend on the plentiful water supply. And finally, the human history of the Smokies, from early settlers to modern hikers and campers, has been determined largely by the availability of water.

Thus, a great deal of the appeal of the region is derived from the abundance of unpolluted water. Our easy enjoyment of the park also depends on the water resources. Nearly all the facilities offered by the National Park Service require a source of water. The campgrounds, picnic areas, exhibits, museums, comfort stations, ranger residences, and park headquarters all demand a supply of clean, safe water. Even the wilderness hiking trails with their isolated camps must have access to potable water.

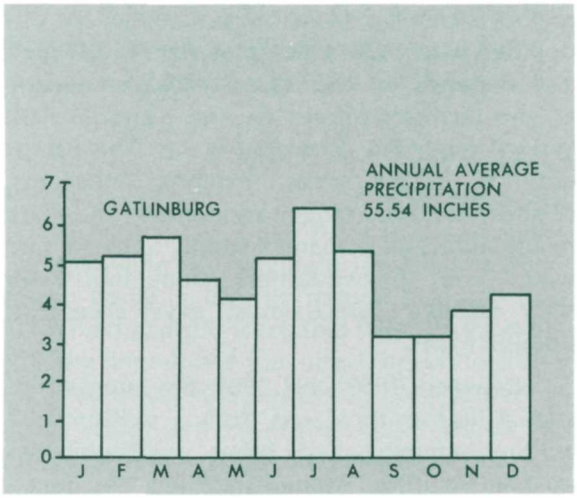
Between 1959 and 1968 the number of annual visitors increased from 3 million to 7 million, straining and often overtaxing the existing facilities. As new facilities are devel-

oped in the park or when old facilities are overtaxed, new water supplies must be found. Because of the need for knowledge of the water resources when planning such changes in their facilities and services, the U.S. Geological Survey at the request of the National Park Service studied the hydrology of Great Smoky Mountains National Park. This leaflet presents some of the highlights of that study.

A WEALTH OF WATER . . .

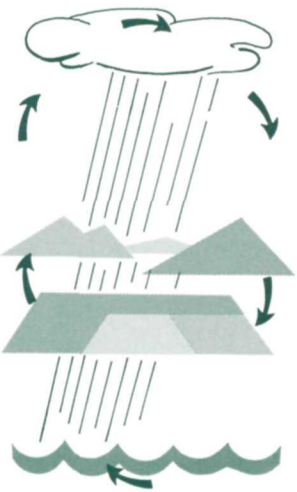
The park is in a remarkably favorable location to receive precipitation. This southeastern part of the chain of Appalachian Mountains intercepts moisture-laden winds from both the Atlantic Ocean and the Gulf of Mexico. These winds, upon rising over the mountains, are cooled, and the moisture condenses and falls as rain or snow, giving the region the highest annual precipitation in the eastern United States.

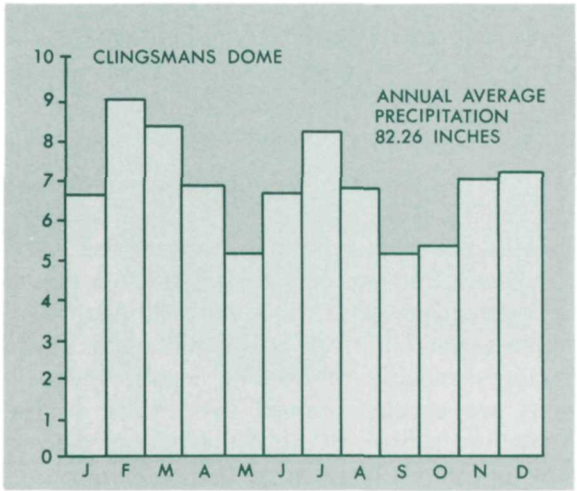
Average monthly precipitation in inches at Gatlinburg (altitude 1,460 ft.) and at Clingsmans Dome (altitude 6,250 ft.)



Precipitation in the park averages 64 inches a year and ranges from about 50 inches in the sheltered valleys to as much as 80 inches along the higher ridges. Altogether, some 890 billion gallons of water falls on the park each year. Of this rainfall, about 390 billion gallons is evaporated or used by plants leaving some 500 billion gallons to flow in streams or to replenish the lakes and the ground-water reservoir.

The continual process of evaporation of water from the oceans, movement over and precipitation on the land, and the return of the water to the sea through streams is called the hydrologic cycle. An important feature of the hydrologic cycle is the storage and movement of water in the soil and underlying rock. If water could not be stored underground, all precipitation would run off quickly after a rain leaving the streams and rivers empty. This is the way a

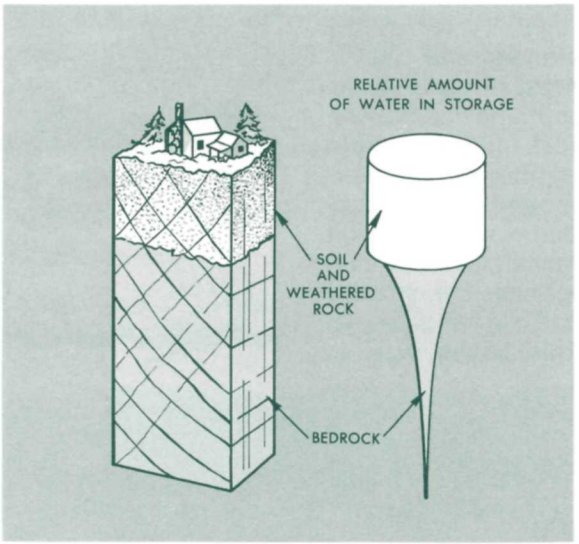




gutter works—it carries away excess water during and following a rain and then is dry soon afterwards. Most streams in the Smokies flow year-round. The streamflow during dry weather is supported by seepage of ground water into the channel.

How is the water stored in the ground? During a rain or as snow melts, tremendous quantities of water infiltrate down through the soil to a zone of weathered rock that may be from 2 to 50 or more feet thick. As much as 30 percent of this weathered rock may be open space left between the individual grains, cobbles, and boulders—open space that can and does hold large quantities of water. Below this

Most ground water is stored in pore spaces in the soil and weathered rock.



weathered zone even the seemingly solid bedrock holds water. Like all large masses of rock, the bedrock in the park is cracked and fractured and these fractures are full of water down to depths as great as 350 feet. Although less than one percent of the bedrock contains open fractures capable of holding water, bedrock wells are usually favored over wells in the weathered subsoil because the deeper slower moving water is less susceptible to pollution.

. . . PUT TO USE.

The huge ground-water reservoir does more than sustain streamflow and springs during dry weather. The underground reservoir also provides a source of high quality water that may be used for a water supply.

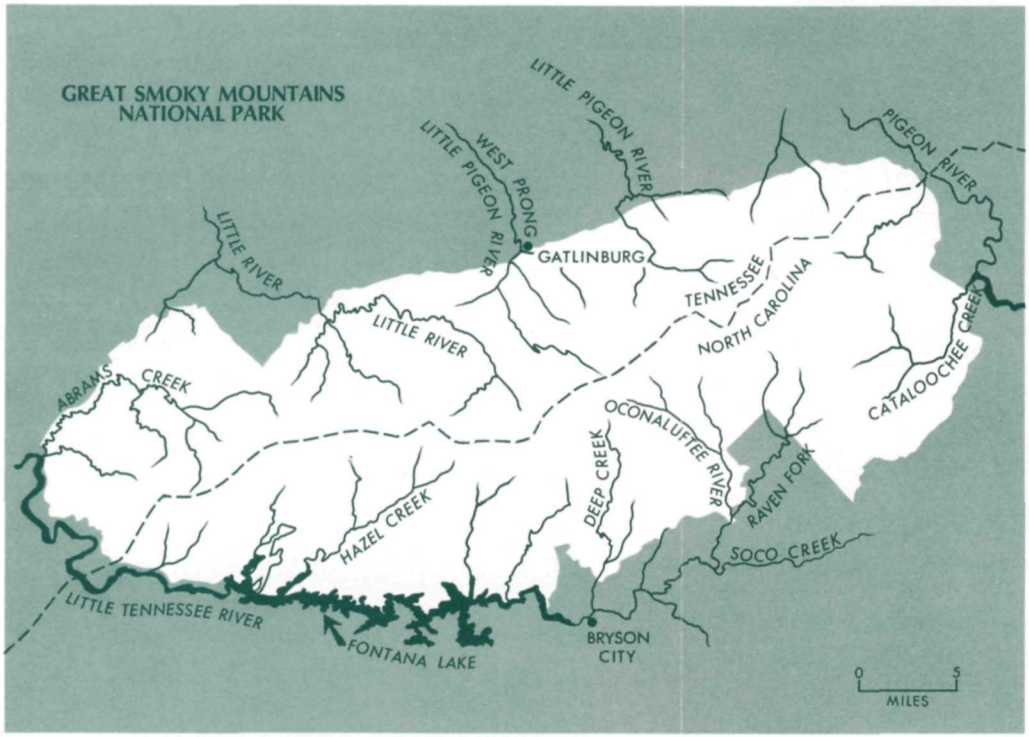
Many of the facilities in the park are served by wells that tap the ground-water reservoirs. In the park, wells may furnish little or no water in an unfavorable location, or more than 100 gallons per minute in a very favorable location. Generally it has been found that hollows and valleys are the most favorable

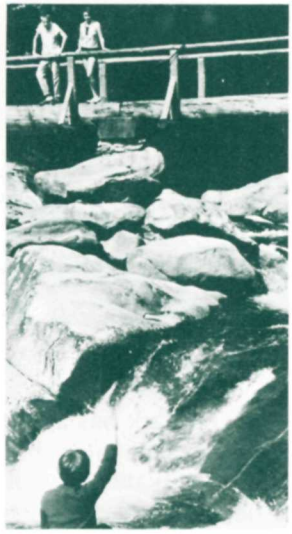
The Great Smoky Mountains rise over fertile fields near Gatlinburg.

A mountain stream—one of the many recreation areas in the Great Smoky Mountains.

locations for wells and that the tops and sides of the mountains are the least favorable. Although all wells obtain water from the pores and fractures in the rock aquifers, these fractures are replenished by water stored in the overlying soil. Therefore, deep, water-saturated soils are important in sustaining the yield of wells.

Rivers and streams of Great Smoky Mountains National Park.





If wells in the area do not supply enough water to meet demands, the Park Service turns to springs and streams as a source of supply. Numerous springs are found throughout the area. They generally consist only of dampness oozing from a hillside, but some springs in the park produce flows of 30 gallons per minute or more.

If a really large supply of water is needed, it is usually obtained from one of the numerous dependable streams in the park. During the driest part of an average year the streamflow ranges from about 40 to over 350 gallons per minute for each square mile of drainage basin. A stream with a 20-square-mile drainage basin could provide enough water each day for the personal use of 10,000 people!

Cascading water from one of the many "falls" and . . .

The park has an abundance of streamflow and, because man has not yet polluted the area, the water is of high quality. Of course, surface waters are always subject to some contamination and should be treated before drinking; however, the water found in the streams in the park is of such high quality that the necessary treatment is simple and economical. On the average, ground water in the park contains less than half a pound of dissolved minerals in every 1000 gallons of water, and the water in streams even during low flow contains only about half that much. By way of contrast, Lake Michigan water contains about a pound of dissolved solids in every 1000 gallons.

. . . a mountain stream holds fascination for visitors to the Park.

The visitors to the park use about 500,000 gallons per day during periods of maximum use and roughly 90 percent of this is not "consumed" but is returned to the hydrosystem. This withdrawal of water is a "drop in the bucket" when compared with the vastness of the water resources of the area.

THE EARLY WATER USERS . . .

The early settlers of this mountainous region were even more dependent on water than are the people living in the area today. Cut off from civilization, they relied on the local water resources to provide some of the needs and pleasures of life.

Of course, these pioneers used the water for drinking, cooling, and cleaning, and we can also be sure that many a trout provided some variety to what was mostly a cornbread and pork diet. Even the cornbread was in part water born: the stream furnished the power to

An old Mill still functions in a remote part of the Park.

turn the water wheels at the grist mills that ground the corn. Such water power was also used to operate drop-hammer forges and sawmills.

Homes and communities were built around springs. The cool waters from the springs, seldom exceeding 60°F, not only supplied pleasant drinking water but were also used to refrigerate milk, butter, and other perishables during the warm summer days. Settlers not fortunate enough to find springs were forced to dig wells down through the stony soil and into the weathered rock to obtain water.

FLOOD AND EROSION . . .

So far we have only talked about how essential water has been to the wildlife and history of the park. There is another side to the coin. Water can also be a nuisance and a calamity in the Great Smokies. Heavy rains can wash away hillsides and bubbling streams can quickly turn into raging torrents.

Most of the significant flooding in the park is caused by localized and very intense thunderstorm rainfalls. The many small streams in the park begin collecting water high along the ridges and the steep slopes, and intense rainfalls can cause extremely sharp rises in water levels. During a peak flood a stream may discharge 10,000 times as much water as it does during the low flows of early fall. Local residents describe cloudburst floods that produced "walls of water" rushing downstream and carrying tremendous boulders, uprooted trees, and tons of soil, rocks, and debris. Such floods do occur, but fortunately they are rare.

Looking downstream from Gatlinburg following the crest of a 1966 flood.

During heavy rains, the sides of hills, overburdened by the weight of the water absorbed by the soil and lubricated by the excess moisture, may collapse causing mud and rock slides. The scar left by the slide usually forms a channel for subsequent runoff that further erodes the hillside.

Extensive erosion is not limited to mud slides. During intense storms, runoff is not confined to channels and valleys but may flow in sheets down the mountain sides. Considerable erosion occurs in this manner, and deep gullies are sometimes formed, further disfiguring the hillside.

During floods, the stream channel itself may also be eroded. The swift floodwaters have a tremendous capacity for carrying a suspended load of rocks. Observers of such floods report hearing the grinding and bumping of boulders being propelled along the stream bed by the rushing water. In the flood plain along a stream channel, deposits of material ranging in size from clay particles to large boulders may be washed away only to be deposited farther downstream. Such erosion is particularly evident on the outside of channel bends where floodwaters have the greatest velocities.

Destruction from floods in the park results mainly from mud slides, erosion of hillsides, the erosion and refilling of stream channels, and from the swiftly rising waters traveling at extremely high velocities. Bridges, roadways, campgrounds and other structures often share the level valley bottoms where these dangers are greatest. Fortunately, the noise of the severe storms and the rising waters usually provide enough warning to prevent loss of life.

☆ U. S. GOVERNMENT PRINTING OFFICE : 1972 O - 455-879

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C. 20402 - Price 15 cents
Stock Number 2401-2083

The park serves as a reminder of what this country was like before the days of the pioneer. This remnant of wildness is not only a place for recreation and relaxation but also forms a basis for determining what damage mankind has done to his environment in most other areas of the country. This is especially apparent when the streams of the park, which have been protected in their pristine state by the National Park Service, are compared to many others in the United States. These sparkling waters, cool, unpolluted, and teeming with trout, are a ever-present reminder of what might be accomplished elsewhere.

(From material supplied by E. F. Hubbard)

* * *

For additional information, see U.S. Geological Survey Hydrologic Atlas 420: "Water Resources of the Great Smoky Mountains National Park," available from the Government Printing Office, Washington, D.C. 20402 at $1.50 per copy.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States —now and in the future.