

# The care and use of national forests.

An assistant chief of the Forest Service reviews many details of managing our 149 national forests, which cover 181 million acres. Many changes have occurred in them. Multiple use and sustained yield are basic principles in management. The forests have growing importance as sources of water, and the watersheds they cover need protection and restoration as never before. By *Edward P. Cliff*.

AN ACT OF THE CONGRESS in 1891 gave President Harrison power to establish forest reserves from the public domain. The first, the Shoshone National Forest in Wyoming, was created on March 30, 1891. Before he left office, more than 13 million acres were set aside.

Presidents Cleveland, McKinley, and Theodore Roosevelt proclaimed many million acres of reserves.

The Congress in 1911 enacted the Weeks law, which authorized Federal purchase of forest lands for the protection of watersheds. The Clarke-McNary law in 1924 broadened the purchase program to include lands chiefly valuable for producing timber. More than 18 million acres of national-forest land were acquired under these laws in the Eastern States.

Now there are 149 national forests in 38 States, Alaska, and Puerto Rico. They embrace about 181 million acres of federally owned land.

Every American citizen owns a share in them. They are held in trust by the United States for the benefit of all. Under the direction of the Secretary of Agriculture, the Forest Service has been assigned the responsibility to manage, protect, and perpetuate their resources of timber, water, forage, recreation, and wildlife.

Fifty years ago the national forests were used chiefly by people who lived in them or next door to them—

prospectors, trappers, homesteaders, ranchers. The distant shareholders rarely visited them.

Yesterday's backcountry now is crisscrossed with highways, roads, and trails through the steepest mountain country. Dams, reservoirs, conduits, and powerlines are almost everywhere. New towns have sprung up. Transportation has improved. In 50 years our population has doubled. Each day there are more people, who have more time and more facilities and a greater desire to share and enjoy the resources of the national forests.

The changes have changed the forests, too. Railroad logging has given way largely to more flexible truck logging. Ranchers find it more economical to haul their sheep and cattle in trucks to summer range to avoid the long treks on foot over dusty trails. Large areas of rugged backcountry are within easy reach of the hunter, fisherman, camper, and tourist. The airplane and jeep have replaced the old prospector's burro, and in many places the bulldozer and the Geiger counter have replaced his pick and shovel and guess and hunch.

The shift in our industrial centers to take advantage of power, water, labor, and the mobility of our population has affected profoundly the use of the national forests: There is much more use—and more different uses.

The problems of managing the national forest grow in complexity with increasing population pressure and increasing demands for the products and services the forests provide.

TWO BASIC PRINCIPLES that govern the management of the national forests are multiple use and sustained yield, which in combination mean coordinated management for the maximum continuous yield of their products and services.

Multiple use does not necessarily mean that all important uses of the forest occur on the same acre. Nearly all national-forest lands have great watershed values, and the protection of watersheds ordinarily comes first, regardless of other uses that might be permitted. A few areas are closed to all forms of use in order to protect the watersheds on which cities depend for water. Harvesting of timber and grazing are not permitted on some watersheds where the erosion hazard is high. Timber production has priority over other uses on areas especially adapted to growing commercial timber. Here recreation, livestock grazing, and wildlife are integrated as fully as possible without undue interference with the dominant use.

In other areas, campgrounds and other improved recreation areas are dedicated exclusively to public recreation. Here again the rule is not hard and fast. The cutting of timber on a few recreational areas and roadside strips is necessary for safety and insect control. Limited grazing is permitted in some places in recreational areas after the recreation season is over. Some 14 million acres of national-forest land, mostly rugged, high-mountain backcountry, have been set aside as wilderness, wild, and primitive areas, in which timber harvesting and other commercial forms of use are prohibited, although grazing, fishing, hunting, and camping are permitted.

The practice of multiple use in national forests, where diverse interests and groups of users are competing for

the use of the land, is a challenge: Every citizen shares in the ownership of the national forest and has a right to fair consideration of his needs and desires in his use of them.

THE VALUE of national-forest lands as sources of water was recognized when the first forest reserves were created. The Congress then specified that the forest reserves were to be managed "for the purpose of securing favorable conditions of water flows."

Legislation has continued to emphasize the important watershed values of the national forests. Maintaining a steady streamflow of satisfactory quality is an important function in the administration of the national forests.

Today the use of water for domestic uses, irrigation, power, industry, navigation, and recreation in the United States is about 145 gallons a person every day. By 1975 the estimated requirements will average about 284 gallons: Demands for water will double while the population is increasing about 21 percent.

National forests, including range, timber, brushlands, and the mountaintops above timberline, are among our most important water-yielding lands. They comprise 21 percent of the area of the 11 Western States, receive about 31 percent of the total precipitation, and furnish 53 percent of the annual streamflow. Average annual streamflow from the western national-forest area is estimated to be 14 inches. From all other lands in the 11 Western States, it is 3.3 inches. Some 1,800 communities in the West with irrigated agriculture and more than 600 hydroelectric developments depend to some degree on water from the national forests.

National forests in the East occupy only a small part of the land area. Many of them, however, are at the headwaters of major streams in hills and mountains, where the amount of precipitation is high. They therefore have particular importance as sources of rivers.

Two chief aims in managing watersheds are to obtain better water yields through improved control of streamflow and to produce water free of silt.

Good management of the national forests is based on proper attention to soil-vegetation-water relationships. To attain these aims, a constant effort is made to correlate the objectives of watershed management with other land-management activities in carrying on the day-to-day work in each national forest.

Much restoration work remains to be done on the watersheds. The need is greatest on the seriously eroded and denuded areas that cannot be treated in connection with other management programs. Many of these critically damaged areas predate the establishment of the national forests.

The needed work involves conservation measures to stabilize the soil and improve control of runoff—contouring, seeding and planting, gully plugs, check dams, water diversions, and spreaders and grade stabilizers.

Some pioneering work in watershed rehabilitation was accomplished in the 1930's by the Civilian Conservation Corps. These valuable demonstration areas show what can be accomplished. An active program to restore deteriorating watersheds has been undertaken since then. Work has been done on 66 projects in 53 forests.

I give examples of the results of such work.

Land-treatment measures completed in the Upper Meadow Creek watershed in the Fishlake National Forest in Utah are calculated to reduce the potential for flood damage to downstream property by 80 percent.

The hydrologic conditions on Trout Creek in the San Isabel National Forest in Colorado have been improved enough to allow restocking with fish in selected areas.

A start has been made on stabilization of coastal sand dunes in the Siu-slaw National Forest in Oregon. The dunes have threatened roads, buildings, lakes, and recreational areas.

The downward trend of land and water depletion in a number of severely gullied areas in the Piedmont region of the Southeast is being checked, and favorable hydrologic conditions are being restored.

In the Jefferson National Forest, the quality of the water supply of Marion, Va., was changed from high turbidity following storms to one of clear flow. The stream ran clear and within its banks during a major flood on January 29-30, 1957. A similar stream nearby, which had not been rehabilitated, ran muddy and overflowed its banks.

Similar work was accomplished on some 45 rehabilitation programs in national forests in conjunction with flood prevention, watershed demonstration, and area projects under Public Law 566. Included were restorations of burned areas, which, untreated, would be potential threats to life and property following rapid runoff of water.

Protection of the quality of the water supply is the forest ranger's dominant concern and responsibility in managing municipal watersheds, although the principle of multiple use can be applied on them if it is safe to do so.

Maximum yield of water may be the chief objective of watershed management in some sections. Significant increases in yield may be achieved in certain circumstances by reducing the density of vegetation, which in turn reduces the use of water by the plants. The effects of manipulation of vegetation to increase water yield, however, must be balanced against the adverse effects that may result to other important forest resources and uses.

The question of obtaining more water from the land has become a land-management problem in the national forests in the semiarid West.

To find out if greater runoff can safely be obtained, a pilot project has been initiated on the Coconino National Forest in Arizona. Dense thickets of young pine trees are being thinned by cutting and by use of controlled fire and heavy machinery. Heavy stands of valueless juniper are being rooted out

with tractors so grass can grow in their place. Experiments in controlling chaparral with chemicals have been undertaken. Timber stands at higher elevation on other Arizona forests will be cut patchwise to allow more snow and rain to get to the ground. The results of this work are measured in stream gages and sediment basins and in studies of soil and vegetation. They will give us information by which to evaluate the possibilities of watershed-management practices to get greater stream-flow from national forests and improve the water supplies of other semiarid localities.

IN THE UNITED STATES and coastal Alaska are 488,609,000 acres of commercial forest land—land suitable to growing continuous crops of timber of merchantable size and quality and not reserved for some other purpose. These lands now support some 2,000 billion board-feet of sawtimber. The national forests contain about 84.8 million acres of commercial forest land and 765 billion board-feet of sawtimber.

In the western national forests, which were reserved from the public domain, the timber is predominantly in old growth. The timber in the national forests east of the Mississippi River is predominantly second growth, because these areas were largely acquired by purchase of private lands and had been cut over before they were acquired.

The charter of the Forest Service directs the Secretary of Agriculture to manage the national forests for the continuous production of supplies of timber, to safeguard water yields, and to offer timber for sale at competitive bidding. The national forests are divided therefore into some 500 small units, or working circles.

A working circle is an area of timberland organized to produce a continuous supply of forest products. It may consist of a single large watershed, an entire national forest, or a ranger district. Each working circle is managed so it will produce a maximum of timber with full consideration for the other

resources. The timber crop may be saw logs, pulpwood, posts, and poles.

Timber is a long-term crop and takes many years to mature. The period—known as the rotation—varies with the type of tree species and productive capacity of the soil. For most national-forest working circles, the rotations are 80 to 150 years. That does not mean that cutting can only be done once during the rotation. On the contrary, good forest management requires repeated cutting at relatively short intervals.

Many methods of harvesting timber have been developed through experimentation and trial. All types of cutting can be assigned to two general classes—regeneration cuts and intermediate cuts.

A regeneration cut is the final harvest cut that occurs when the timber is mature; that is, at about rotation age. Individual trees or entire stands are removed, and the area is regenerated promptly. This may be accomplished by natural reproduction, or by planting of young nursery-grown trees, or by a combination of these methods.

Intermediate cuts are made at short intervals. Trees of poor form and quality, trees of less desirable species, and enough additional trees to leave room for remaining trees are removed. Such cuts are sometimes called thinning or improvement cutting.

Timber-stand improvement is another important activity in the management of the timber in the working circles. Undesirable trees and brush are removed, and the limbs from the lower part of the tree are pruned to produce clear lumber. Thinning also is necessary when the stands are too dense to make satisfactory growth. These measures help to produce a better crop of trees in less time.

The planting of nursery-grown trees often is necessary to keep the forest well stocked with productive trees. On 4.3 million acres in the national forests (mostly old burns), stocking is so poor or nonexistent that planting must be done in order to restore productivity.

Tree seeds are collected and planted, young trees are grown in nurseries, and the trees are planted on suitable areas according to methods we developed through research.

Trees are subject to many hazards. Many different bark beetles kill trees by tunneling under the bark. Several kinds of worms and caterpillars weaken or kill trees by eating the foliage. Wood-rotting fungi, various kinds of rusts, and some viruses attack trees.

A forest in a healthy growing condition is the best insurance against loss or damage from insects and diseases, and constant vigilance is necessary to detect unusual concentrations of them and to launch immediate attacks.

TIMBER from national forests is sold in predominantly small offerings. Nearly 30 thousand individual sales are made each year, of which about 90 percent are of less than 2 thousand dollars appraised value. Only one-fourth of the volume sold is in timber sales larger than 25 million board-feet. These sales are offered and sold at competitive bid.

About 7 billion board-feet of the timber is cut on sales annually with a total value of about 100 million dollars. By law, 25 percent of the receipts from the sale of national-forest timber is distributed to the States in which the forests are located. The distribution is made in each State on the basis of the area of national forests in each county. This money is available, in lieu of taxes, to the counties for expenditure for schools and roads.

The timber is managed so as to safeguard soil and other watershed values of the land. Roads are located away from streams and lakes. Culverts and bridges are designed to reduce erosion and silting of stream courses. Contracts for sales of timber specify that treetops and other logging debris be removed from stream courses or lakes.

Cutting in areas set apart for recreation is restricted to removal of unthrifty, insect-infested, and hazardous trees and thinning of the denser

stands. Scenic roadside strips are left. Timber is cut along streams and lakes so as not to spoil recreation values.

Good silviculture helps wildlife in most forest types. Food—from low weeds and shrubs—for wildlife grows best in openings. Den trees are reserved from cutting if wild animals need them. Certain strips or patches are left when large areas are planted so as to provide suitable openings.

In the national forests in the West, where the grazing of domestic livestock is an important use, it is necessary sometimes to restrict grazing on cutover areas to permit the seedling trees to become established. Grazing is again permitted there when the danger of browsing or trampling by livestock has passed.

PEOPLE VISIT the national forests for many kinds of recreation—to camp or picnic, hunt, fish, hike, swim, climb mountains, take pictures, study nature, enjoy scenery, ski, play in the snow, find a cool place, and rest.

Life in the forest is informal, and recreation areas in national forests are kept simple. Basic improvements are provided to make camping and picnicking more pleasant and comfortable and to provide for sanitation and fire protection.

Campgrounds are developed to accommodate family groups. The camp areas or units are spaced widely enough to retain a degree of privacy and a natural forest atmosphere. A family camping unit consists of a rustic table, a fireplace, and a level place for a tent. Toilet and garbage facilities are provided. In many areas water is piped to central locations.

Picnic areas have larger clearings and more group-play areas, and they are designed to provide for larger groups for shorter periods.

Most of the 4,900 improved public recreation areas in the national forests were constructed during the 1930's with emergency funds. Recreation use since the war has increased beyond any expectations.

Eighteen million persons visited the

national forests for recreation in 1946. Each year since then the number of visits has soared. By 1956 there were 52.5 million visits. We estimate that there will be 66 million annual visits for recreation by 1962.

To take care of them, the Forest Service developed a 5-year program. Its goal is to provide adequate sanitation and care at all national-forest public recreation areas; rehabilitate existing recreation facilities so that they will be safe and usable; and plan, develop, and install new areas to alleviate present overuse and accommodate future use as it develops. This program—Operation Outdoors—is planned for completion in 1962 at an estimated cost of 85 million dollars.

Under the program, only the basic improvements required for camping and picnicking are constructed. Resorts, hotels, motels, and ski lifts are not built by the Forest Service. Qualified individuals or companies are encouraged to install and operate them under special-use permits when there is a public need for them.

A special type of outdoor recreation need is provided by wilderness, wild, and primitive areas. Eighty-one such areas have been designated. They are managed so that the primitive environment will be protected and preserved. Roads and mechanized travel are prohibited in them. No commercial timber cutting and permanent occupancy, such as hotels, resorts, stores, or summer homes are allowed. A system of horse and foot trails and a minimum of fire lookout stations and other improvements essential to the protection of the forest are permitted.

Wilderness areas provide the last frontier where undisturbed Nature retains its primeval state in an area of more than 100 thousand acres. Wild areas are similar but smaller. Primitive areas are about the same as wilderness areas but were classified under a different regulation.

THE MAINTENANCE and improvement of wildlife habitat are primary objec-

tives in the management of national forests. Because wildlife is a product of the land—its soil, water, and vegetation—the Forest Service in its land-management activities sees to it that the needs of wildlife are protected and wherever possible improved.

One-fourth of the annual recreational visits to the national forests are mainly for hunting or fishing. Sportsmen's visits increased 186 percent from 1947 to 1956. This increase was more than three times the percentage rise in the nationwide sale of hunting and fishing licenses in those years.

Fish and game laws of the respective States apply on national-forest lands.

The Forest Service and the States have formal agreements that clarify each agency's responsibility in wildlife management, integrate management objectives and practices, provide for joint surveys and investigations, and authorize cooperative construction of direct habitat-improvement projects.

There is a wide field for increasing national-forest wildlife productivity by direct habitat-improvement projects. Food and cover for wildlife often can be improved by making clearings, breaking up brush fields, planting desirable food and cover plants, and fencing stream bottoms. The habitat of fish can be improved by planting on streambanks, development of flow-maintenance dams, and creation of new fishing waters by impoundments.

Most States have carried out habitat-improvement work in national forests. Each project is planned so that the improvements are consistent with overall forest-use plans.

One-third of the Nation's big game animals spend at least part of the year in national forests. This includes 80 percent of the moose, elk, and grizzly bear and more than half of the mule deer, black bear, and bighorn sheep.

Big game animals had reached a low ebb in most parts of the country a half century ago as a result of uncontrolled hunting. Their numbers have increased greatly since then as a result of two general sets of factors.

The first was a series of protective measures. Restrictive game laws were enacted and enforced. Predators were intensively controlled. Numerous wildlife refuges were established.

The second factor was the change in vegetative composition that resulted from the lumbering, grazing, and burning of forests. The increased growth of browse and other food and cover plants was ideal for deer. As the herds increased, overpopulations developed. State game officials and forest officers alike now know that the number of game animals that can be raised for the hunter's bag depends on the amount of forage the range will produce. They recognize that it is easier to build back a game herd than a depleted range.

State game administrators and forest officers are working together to gain public support for management practices that will balance the numbers of big game with the available forage supply. Joint surveys are made to determine herd and forage conditions and to develop effective management plans.

The national forests provide one of the largest public fishing areas in the world—81 thousand miles of streams and 2.25 million acres of ponds and lakes. Visits by fishermen to these waters exceed 9 million each year. The maintenance, protection, and improvement of fishing waters is an integral part of national-forest management.

FORAGE in the national forests contributes materially to the Nation's production of meat, wool, and leather.

The 101 national forests in States west of the Great Plains comprise 138 million acres, of which 44 percent, about 61 million acres, is grazed by livestock. About 1.1 million cattle and 2.7 million sheep graze there under paid permit, usually during the summer. These livestock are owned by some 20 thousand holders of permits. A limited amount of grazing is permitted in the national forests of the East where conditions are suitable for this type of use.

In managing national-forest ranges,

a plan of use is developed to restore forage production on deteriorated ranges and to sustain forage production on the rangeland that is already in satisfactory condition. The successful application of the range-management program depends on close cooperation between the stockmen who own and manage the livestock and the forest officers who manage the range to achieve the goals of soil stabilization, sustained yield of forage, stabilized livestock operations, and maximum yields of meat.

To assist in the planning of range management, the forest ranger collects information on the condition and trend of the soil and forage resource, relation of rangeland to other uses, and the best season and method of use. He uses the information to develop a practical plan that can be applied to the grazing allotment. Field inspections are made often to assure that the plan of use is being followed. The plan is revised when necessary to obtain better distribution of livestock and proper utilization.

Hundreds of local associations of holders of permits work with forest officers in the management of national-forest ranges. The Forest Service has encouraged the organization and operation of the local grazing associations and advisory boards for many years. Their advice is solicited and considered on all important questions. Local advisory grazing boards were given specific statutory recognition in an act passed by the Congress in 1950.

Approximately 6 million acres of national-forest range are in such unsatisfactory condition as to require special treatment to build up the forage crop. Range reseeding and control of noxious range plants offer possibilities for restoration of these depleted lands.

Methods of successfully reseeding certain types of western range have been developed. Range productivity is thereby increased many times. More than 750 thousand acres have been successfully revegetated and brought back into production. Stockmen in many areas help pay for the work.

Successful reseeding requires the re-

removal of worthless plants, proper seedbed preparation, and protection from grazing during establishment of the new plants. Control of noxious plants is accomplished by controlled burning, spraying with such chemicals as 2,4-D and 2,4,5-T, and by mechanical means such as plowing with heavy tractor-drawn equipment and bulldozing out unwanted juniper trees or other weed trees and shrubs.

Control of livestock, proper season and distribution of use, and rest-rotation systems of grazing require fences, water developments, and stock trails. Work done by the Forest Service to date includes construction of 29 thousand miles of range fence, 19 thousand water developments, and 2.5 thousand miles of livestock driveways.

We estimate that 20 thousand miles of additional fence and 15 thousand new water developments are needed to provide adequate improvements for good range management, in addition to the reconstruction and betterment of 20 thousand miles of fence and 13.5 thousand water developments already in place. The Government has invested about 18.4 million dollars in range improvements. Stockmen have contributed substantially in private funds for the construction and maintenance of range improvements and range revegetation.

Grazing policies in the national forests are clearly defined. The local settler is given preference in grazing privileges over the itinerant stockman and speculator. Stability of livestock operations is promoted through long-term permits and renewal preferences to established permittees. Grazing fees are adjusted yearly in relation to livestock market prices. Where adjustments in permitted numbers of stock must be made, they are made gradually to avoid sudden or drastic upsets in the operations.

MINERALS in the national forests generally are of three categories, depending on the laws authorizing their disposal.

The United States mining laws apply to metalliferous minerals on national-forest lands withdrawn from the public domain. Citizens may locate and enter mining claims on the basis of a valid discovery of a valuable mineral and may develop or patent such mining claims in accordance with the provisions of the mining laws.

The act of July 23, 1955, known as the multiple-use mining law, amended the United States mining laws and provided that the United States retain the right to manage and dispose of the vegetative surface resources on new mining claims prior to patent. It also provided a way for the Government to regain control of the management of surface resources on the older unpatented mining claims. Under this law, mining claimants still retain their rights to prospect and develop their claims for mining purposes. The law gives the Secretary of Agriculture authority to dispose of common varieties of sand, stone, gravel, pumice, pumicite, and cinders on the national forests by permit or lease.

The Mineral Leasing Act of February 25, 1920, applies to oil, gas, oil shale, coal, sodium, potassium, phosphate, and sulfur in Louisiana and New Mexico on national-forest lands reserved from the public domain. The Secretary of the Interior has discretionary power to lease such national-forest lands for mineral development. The lessee pays rental and royalty as determined by appraisal of the minerals or by competitive bids. These payments are credited to the receipts of the Department of the Interior.

The Mineral Leasing Act for acquired lands applies to oil, gas, oil shale, coal, sodium, potassium, and phosphate on most national-forest land acquired by purchase. The President's Reorganization Plan No. 3 of 1946 applies to other minerals on most national-forest lands acquired by purchase.

The leasing and disposal procedure for such minerals on acquired lands is similar to the one provided under the



Mineral Leasing Act of 1920, except that the consent of the Secretary of Agriculture is required before a lease can be issued by the Secretary of the Interior, and rentals and royalties are credited to national-forest receipts.

Mineral prospecting and development on national-forest land are extensive. In 1955, 7.4 thousand leases and permits covering more than 7 million acres were in force.

MANY SMALL TRACTS in the national forests are suitable for private uses, which are authorized by special-use permits if they can be justified and do not conflict with uses of greater public value. The permits specify the terms under which the use is authorized.

When land in national forests is used for a commercial purpose or by individuals only, a rental in keeping with the value of the use is charged. Public or semipublic uses usually are permitted without charge or for a small fee.

Approximately 55 thousand special-use permits in force in 1958 covered more than 3 million acres and a wide variety of activities, such as ditches, cultivation, summer homes, and rights-of-way for powerlines, pipelines, and roads.

Public-service uses—as for resorts, hotels, stores, organization sites, ski lifts, and boat docks—carry special stipulations as to the type of improvements to be constructed, the services to be offered, and public safety.

MORE THAN HALF of the nearly 10 thousand full-time employees of the Forest Service spend at least a part of their time on fire duties. Seven thousand additional men are employed seasonally for various jobs having to do with fire control. Many others are hired for short periods to fight large fires.

Machines have changed several aspects of the efforts to prevent and stop fires. "Smokechasers," who used to go to fires afoot or on horseback, now often use trucks, airplanes, and helicopters. When trucks cannot reach

them, the firefighters may get supplies by airplane or by trail tractors. Pack mules and horses are still used in rugged, remote areas.

Static-line parachutes and protective clothing make it possible to drop men near fires in mountainous areas. Men in the Forest Service make about 10 thousand airplane flights annually to detect fires and to transport airfreight, firefighters, and parachuted cargo for fire control. Ground lookout stations in many forests are supplemented by regularly scheduled air flights in order to discover fires more quickly.

Sometimes water and chemicals are dropped from airplanes directly on fires or just in front of them. The Stearman crop-dusting type of airplane has been used with marked success in this type of air attack. Several bombers that once belonged to the Navy have been adapted to this use. Helicopters also have been used for this purpose and to lay fire hose over rough terrain.

Much of the work to develop equipment has been carried out in cooperative projects with the armed services, industrial concerns, State forestry organizations, and others.

Mechanized equipment, such as tractors and plows, are building more of the firelines each year. This equipment can be effectively used on 15 to 20 percent of all fires and greatly reduces fire-control costs.

Smokejumpers—trained parachute-jumping firefighters—have been used in the national forests since 1939. They are used extensively on fires where fast initial attack is necessary. They have saved millions of dollars in firefighting costs and in resources.

Fire is still a hazard, however, and fighting fires is still a costly and dangerous job. As new areas of the forests are opened to use, more people come for work and play, and their activities increase the likelihood of fires. Operations connected with logging, sawmilling, mining, and transportation all cause some fires. Flammable cover in much of the forest area has changed

and increases the fire problem. Tops and limbs of trees left after logging increase the danger. Annual growth of weeds and grasses, which are highly flammable in the dry stage, is greater after timber cutting and before young trees re-cover the ground.

There has been a steady general drop in number of man-caused fires since 1940 in most national forests—an indication of the success of increased prevention work and the response by visitors and woods workers to please be careful with fire in forests.

THE DEVELOPMENT and administration of the national forests require considerable engineering. Forest supervisors' staffs usually include one or more professional engineers. They oversee the construction and maintenance of roads, dwellings, trails, landing fields, warehouses, offices, water-supply installations, and similar facilities. They also examine plans and inspect roads built by permit holders, structures, and other installations and provide topographic and planimetric maps.

The transportation system in national forests in 1958 consisted of about 24,250 miles of designated highways, 124,000 miles of development roads, 116,000 miles of horse and foot trails, and 190 landing fields.

Some of these roads are public roads, maintained by States, counties, and other authorities. Forest-development roads are open to public travel but as a rule are not maintained for heavy traffic. Loggers and other users therefore have to maintain about 13 thousand miles of development roads to the extent required for their use. The Forest Service periodically reconditions its roads.

Thousands of additional miles of access roads must be built, and former truck trails must be rebuilt to move logs, lumber, pulpwood, and other forest products to market. Primary roads must be routed and constructed with special attention to roadbed stability. Thousands of miles of branch roads must supplement the primary system

in order to provide ready access for combating insect infestations and diseases and salvaging merchantable timber damaged by windthrow or lightning-caused fires. The Forest Service has the responsibility for routing and designing these roads.

More roads also are needed to truck livestock to and from the ranges. Improved wildlife management often depends on roads to encourage better distribution of hunting. More and better roads to make lakes and streams more accessible are needed in places.

A dollars-and-cents price tag cannot be placed on the great and varied resources of the national forests. They contribute much to the economy of the Nation and to the people. A look at one national forest will give an idea of the total picture.

THE TARGHEE NATIONAL FOREST in southeastern Idaho and western Wyoming is an example. It forms a timbered semicircle around the head of the Snake River. The 1,650,300 acres of public land provide water, wildlife, forage, timber, and recreation that help sustain communities in 10 counties. Farmers in the upper Snake River Valley use water from the forest to irrigate crops valued at 85 million dollars annually. Some 16 million board-feet of timber are harvested. People from all over the country fish in its 516 miles of streams and 14,465 acres of lakes and reservoirs. Hunters take more than 3,000 big game animals—elk, moose, deer, bear, and mountain sheep—from the Targhee National Forest each year. In the summer more than 14 thousand cattle and 118 thousand sheep graze the lands.

To keep the resources of the Targhee productive for public benefit is the job of eight district rangers and a forest supervisor. They integrate the uses and plan, manage, and protect the forest so that its abundance may serve the American people now as well as in the future. So it is in varying circumstances with all the 149 national forests.