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THE MENTOR

THE FOREST

By HENRY S. GRAVES
U. S. Forester

DEPARTMENT OF
NATURAL HISTORY

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AMERICAN FORESTS

THE forests of America must have been a great delight to God; for they were the best He ever planted. These forests were composed of about five hundred species of trees, all of them in some way useful to man, ranging in size from twenty-five feet in height and less than one foot in diameter at the ground to four hundred feet in height and more than twenty feet in diameter,—lordly monarchs, proclaiming the gospel of beauty like apostles.

FOR many a century Nature fed them and dressed them every day,—working like a man, a loving, devoted, painstaking gardener; fingering every leaf and flower and mossy furrowed bole; bending, trimming, modeling, balancing; painting them with the loveliest colors; bringing over them now clouds with cooling shadows and showers, now sunshine; fanning them with gentle winds and rustling their leaves; exercising them in every fiber with storms, and pruning them; loading them with flowers and fruit, loading them with snow, and ever making them more beautiful as the years rolled by. Wide-branching oak and elm in endless variety, walnut and maple, chestnut and beech, ilex and locust, touching limb to limb, spread a leafy translucent canopy along the coast of the Atlantic over the wrinkled folds and ridges of the Alleghanies,—a green billowy sea in summer, golden and purple in autumn, pearly gray like a steadfast frozen mist of interlacing branches and sprays in leafless, restful winter.

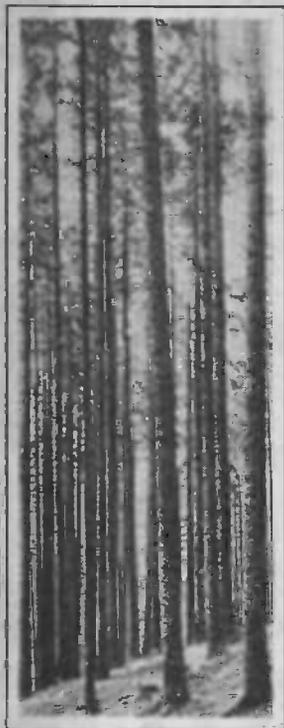
TO the southward stretched dark, level-topped cypresses in knobby, tangled swamps, grassy savannas in the midst of them like lakes of light, groves of gay, sparkling spice-trees, magnolias and palms, glossy-leaved and blooming and shining continually. To the northward, over Maine and Ottawa, rose hosts of spiry, rosinny evergreens,—white pine and spruce, hemlock and cedar, shoulder to shoulder, laden with purple cones, their myriad needles sparkling and shimmering, covering hills and swamps, rocky headlands and domes, ever bravely aspiring and seeking the sky.

THENCE westward were oak and elm, hickory and tupelo, gum and lirioidendron, sassafras and ash, linden and laurel, spreading on ever wider in glorious exuberance over the great fertile basin of the Mississippi, over damp level bottoms, low dimpling hollows, and round dotting hills, embosoming sunny prairies and cheery park openings, half sunshine, half shade; while a dark wilderness of pines covered the region around the Great Lakes.

THENCE still westward swept the forests to right and left around grassy plains and deserts a thousand miles wide; irrepressible hosts of spruce and pine, aspen and willow, nut-pine and juniper, cactus and yucca, caring nothing for drought, extending undaunted from mountain to mountain, over mesa and desert, to join the darkening multitudes of pines that covered the high Rocky ranges and the glorious forests along the coast of the moist and balmy Pacific, where new species of pine, giant cedars and spruces, silver firs and Sequoias, kings of their race, growing close together like grass in a meadow, poised their brave domes and spires in the sky, three hundred feet above the ferns and lilies that enameled the ground; towering serene through the long centuries, preaching God's forestry fresh from heaven.

HERE the forests reached their highest development. Thence they went wavering northward over icy Alaska, brave spruce and fir, poplar and birch, by the coasts and the rivers, to within sight of the Arctic Ocean. American forests! the glory of the world!

—JOHN MUIR.



LONG-BODIED TIMBER

THE FOREST

By
HENRY S. GRAVES

United States Forester



MENTOR GRAVURES

GENERAL SHERMAN TREE
PATRIARCHS OF THE MARIPOSA
GROVE

FIGHTING A FOREST FIRE
TREES OF FUTURE FORESTS
IN A TURPENTINE ORCHARD

A SAWMILL IN THE LONGLEAF
PINE REGION



IN STATELY COMPANY



THROUGHOUT the ages the forest has played a large part in man's progress and development. In the earlier stages it hindered and in the later stages helped man's struggle upward. It has furnished material for his dwellings, for the ships that have carried his goods across the seas, for his implements of peace and war. Its products have entered largely into his commerce, and have made possible his advances in many of the arts and sciences; while both its economic and its protective values have influenced the destinies of great nations.

To primitive man the forest furnished both food and a home. Later, when he had become a meat eater, man left the forest for the treeless plains, where he found in abundance the animals upon which he preyed. He became a dweller in the open places, and the forest was both a barrier to his wandering migrations and a protection against hostile tribes. Its darkness, gloom, and dangers caused him to think of it as the abiding-place of evil spirits. Goblins, gnomes, sprites, and other fearsome creatures dwelt in its hidden recesses. But there were kindly deities as well. The dryads, symbolical of the connection between the lives of trees and of men, and the nymphs, goddesses of moisture, also had their

homes in the forest, and certain groves were regarded as sacred. Tree worship was early and widespread.

As man increased in intelligence and ingenuity, and developed more effective weapons, he became bolder, and lost much of his old fear of the forest. He learned to use its materials for his needs. The earliest and most important service that the forest rendered and one that has come down to modern times was furnishing fuel for man's fires. From its woods also

he built rafts, dugouts, and finally boats, and with these, he was able to supplement his wanderings across the open places with ever-lengthening journeys along the waterways, and thus to explore territory hitherto denied him.

The forest became of growing importance as civilizations rose and fell. In the early days the cuttings were naturally unrestricted. Man helped himself to what was at hand, with no thought of the need for foresight, and with no knowledge of methods of control that would permit use without destruction. Grazing and fire swept away the young growth. The result was that in many places the forest disappeared entirely. Then the people suffered from lack of wood; and floods, avalanches, and landslides visited upon man the consequences of disturbing nature's balance.



A FOREST IN THE PACIFIC NORTHWEST



A PERFECT WATERSHED
The water of this lake is clear as crystal

Learning to Use the Forest

By such lessons the value of the forests and the necessity of protecting them from destructive agencies were taught. The first attempts to use the forest were crude, but as knowledge increased man learned how to eat the cake and have it too.

To the hardy adventurers that first came to America the almost unbroken forests of splendid timber were deterrent, rather than beneficial.

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They made exploration and travel difficult and perilous. They occupied the ground that the newcomers desired for farms. Before fields could be cultivated or crops could be sown, the woods had to be cleared away and the unusable material disposed of. Besides, the forest sheltered hordes of hostile savages and packs of preying wolves, which swept down on the lonely, scattered settlements, and brought fear and hatred to the pioneers. In that stage the forest was hostile and full of menace. The first thought of the settler was to clear it away and devote the land to better use, and, at the same time, to rid himself of the dangers it hid.

Later, when the new civilization was firmly established, the colonists began to exploit the forest resources of the land. Rafts of white pine were floated down the streams of New England to supply the demand for building material in the settlements along the coast. With great forests of unexcelled timber close at hand, shipbuilding flourished and American ships became familiar sights in every port of the world. Other wood-using industries sprang up. The continued development of the country produced an enormous demand for building material. Instead of a menace and danger, the forest became a vast storehouse from which untold millions of dollars were taken in timber and other products.



AN AISLE IN THE CATHEDRAL OF THE FOREST

Gradually the more accessible forests were recklessly cut away, and it became necessary to bring the needed timber from increasing distances. The industries dependent upon the forest were transitory; whole communities vanished and the tide of industrial development turned backward when the sawmills finished and moved on. Other forces, too, were at work. Certain changes that followed the removal of the forest could not be ignored. Hillsides, cleared of the timber they once supported, washed and gullied and became unfit for any purpose. Springs in cut-over lands dried up. Creeks were no longer clear, but turbid and full of sediment after the rains; alternate periods of flood and low water replaced the former equable flow of the streams; sand-bars appeared in the rivers, and hindered or prevented navigation.

The Forest Nature's Balance-Wheel

Unrestrained by the controlling forests, the forces of nature hastened their work of leveling the earth's surface, made easier by the unconsidered stripping of each additional acre of mountain woodland.

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It was only when these things forced themselves upon our attention that we woke up to the fact that the forest was one of nature's great balance-wheels in the matter of stream-flow, and realized that when we destroy the forest we throw out of gear the whole machinery of things. Everyone has seen bare hillsides cut by innumerable gullies; most of us have, at one time or another, noted how muddy the waters of creeks become after heavy rains. How many of us have connected the hillside gullies and muddy creeks with our annual floods and with the millions of dollars we spend in dredging our rivers and harbors? And yet there is a very close connection; and the forest—or, rather, the lack of the forest—plays a large part in all three.

As the rain or snow water falls upon the earth, it either runs off on the surface or goes into the soil. Cleared fields and open lands are pounded and compacted by the rain and baked by the sun, and it is hard for the water to soak in. In times of heavy rainfall, therefore, a large part of the water runs off on the surface, and in doing so cuts out channels and carries earth away. On steep slopes these channels soon deepen into



WHAT FIRE DOES

Scene of the great fires of 1910 in the Cœur d'Alene National Forest, Idaho



AN OREGON FOREST

On the southern slope of the Columbia River Gorge

gullies, erosion is rapid, and the soil is washed down into the streams. The coarse material forms sand-bars in the rivers, while the finer sediment is carried down and deposited in our harbors.

In the forest, however, the trees break the force of the falling rain and cause it to drop gently to the ground. The accumulation of fallen timber, twigs, and leaves, checks the runoff, which the spongy forest floor soaks up like a great piece of blotting paper. Humus is added to the soil by decay, making it

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RAINBOW FALLS
Chelan National Forest, Washington

rich, "mellow," and porous. In addition to this, the tree roots strike deep and furnish subterranean passage-ways for the soil water. Thus the capacity of the soil reservoir is greatly increased, and the water is gradually fed out to the springs and streams of the region. For these reasons the water of the creeks and rivers in a forested country is clear and free of silt.

The regulating influence of the forest also affects the local climate. Everybody knows that in summer it is cooler in the shade of the forest than in the open, while, in winter, bodies of timber are a valuable protection against the force of storms and cold winds.

All these things were known long ago in the older countries of Europe. The New World, however, had to have its lesson in fighting and wasting

the forest before its importance and the need of caring for it could be realized. And we have had it. We have seen vast stretches denuded of timber and left a desolate waste by the fires that often follow lumbering. We have seen hillsides, cleared of the protecting forest, washed and eroded. We have experienced the horrors of floods that assumed the size of national disasters. Properly cared for, the forest is man's friend and protector; abused or destroyed, it exposes him to the unrestrained might of the forces of nature, by which he is buffeted and swept about. Hard experience has taught us that by a little care the forest may be perpetuated even though its resources are utilized, and it is this that forestry, or the care of the forest, makes possible.

The Tree's Life Struggle

Now, the care of the forest involves a multiplicity of features that are not apparent on the surface. To most people the forest is merely a collection of trees, without rhyme



WHAT HAPPENS TO STEEP SLOPES WHEN THE FOREST IS CUT

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or reason; but to the woodsman the forest is a complex community not unlike a modern city. There is the same constant struggle for existence among trees as among mortals. We find towering individuals that have outstripped their fellows and stand distinctively above them. There are trees stunted and gnarled by the fight for light and moisture; others—the great middle-class of the forest—have obtained their share of the necessities and reached a comfortable maturity. Side by side we find old age and callow youth, failures and successes. Composed of living individuals, the forest is keenly sensitive to hostile agencies. Fire, insects, disease, and man may destroy the forest on great areas. But the forest responds quickly to good treatment, and more than justifies the care bestowed upon it.

Because trees, in their own way, are as susceptible as people to heat or cold, there is a wide variance in the make-up of forests. Some trees prefer the cold climate of the North and do not thrive in the South. Others will grow only in the hotter climates. A limited third class are able to adapt themselves to their location, and are found in both sections. For this reason the forest is characteristic of its location. The forests of New England are as typical of the region as the villages, and differ as much from the forests of the South as does the enunciation of the people. The climate, then, is the first great determining factor of the range within which trees grow. Differences in elevation result in the same change in the forest as differences in distance north or south.

The different trees have certain requirements of light and moisture and soil which must be met if the tree is to thrive. The hardwoods, or broad-leaved trees, for example, require in general a better soil than the



WHAT FORESTRY DOES

This timber has been logged, but enough trees are left to insure a future stand



IN THE FORESTS OF THE NORTHWEST

Giant Douglas fir, Sitka spruce, and cedar are found here

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conifers. For this reason the character of the soil is sometimes designated by the kind of timber it supports, and in parts of the South we hear such terms as "poor piney-woods land," and "good post-oak land." As a rule the conifers are clannish, and extensive areas are occupied by forests composed mainly of one species, while the different hardwoods mingle freely with each other, or even with some conifers.

After the general range of a tree has been fixed by the climate and by soil requirements, its abundance depends upon its success in the fight which it must wage with other trees. How constant, and how deadly and merciless a fight this is, only those that know the forest realize. For every tree that reaches maturity, thousands are overcome and die in their infancy and early youth. The twisted, misshapen forms of many trees are grim evidence of their desperate struggle for a "place in the sun." Some trees, like the spruce, are so constituted that they can play a waiting game and live years with very little light, and then put on rapid growth when an opening in the forest gives them more space. Others must have relatively large quantities of light to live, and die unless they get it. And, between these two extremes, there are many trees that get along very well on moderate amounts.

Thus the three factors of climate, soil, and light bring about characteristic forests in the different parts of the world. But because a tree is native to one region does not mean that it can not grow elsewhere. Oceans, mountain ranges, or other natural barriers are often responsible for confining certain species to relatively limited localities, when they may be adapted to grow elsewhere.

United States Forests

The forests of the United States may be divided into six great regions. The northern forest of the Lake States and the Northeast has in the past supplied us enormous quantities of the highest-grade building materials. The white pine, spruce, hemlock—among the conifers—and the beech,



UTILIZING THE FORAGE OF THE FOREST

birch, and maple are familiar trees of this region, which extends south along the Appalachian Mountains in a long, narrow tongue to north Georgia. South of this, extending from Ohio, Pennsylvania, and Illinois to the Southern States and including the lower slopes of the Southern Appalachian Mountains, is the central hardwood belt, the home of the oaks, chestnut, yellow poplar, and other well-known broad-leaved trees. Still farther

south and reaching down to the Gulf of Mexico lies the southern pinery, whence we obtain the longleaf pine, which, in addition to being a valuable timber tree, supplies the bulk of the world's supply of turpentine, rosin, and pitch. This region is characterized also by extensive stands of hardwoods in the swamps and along the streams. Down in southern Florida there is a belt of subtropical forest where the palms and other plants of hot countries flourish.

As we go west the towering forests give way to open, short-bodied stands of oak, and finally disappear entirely, the only trees being those along the streams. In the Rocky Mountains a new type of forest occurs, and the Engelmann spruce, lodgepole pine, Douglas fir, and western yellow pine form the stand.

On the west side of the Rockies in the north, the western white pine and western larch are added to the forest and are important timber trees, and when the Pacific slope is reached, we find a forest that is unlike any other. In the Northwest there are enormous stands of great Douglas fir, ten to twelve feet in diameter, and an abundance of western hemlock, Sitka spruce, and a number of other trees. The growth is rank and the forest dense.

In California these species give way to and are mingled with giant sugar pines, the redwoods, and their cousins the "Big Trees"—the patriarchs of all trees, and, indeed, of all living things.

Perhaps no other nation in the world was so bountifully supplied with such a variety of woods as we once had. But the great extent of the forest was its undoing. We have abused and destroyed our forest until already the time has come when we can see the end of our supply of virgin timber. We are still the heaviest users of wood of all the nations, and we take from the forest each year much more timber than the growth of the forest provides.

To the forest we can attribute much of the wonderful development which was made in the past century. Its great stores of cheap building material have made it possible for towns and cities to spring up almost



THE GRIZZLY GIANT*
Mariposa Grove, Yosemite National
Park, California



**HARDWOOD FOREST OF THE
APPALACHIANS**

The giant yellow poplar in the foreground will furnish many thousand board feet of valuable lumber

*Height, 204 feet; 93 feet in circumference and 29 feet in diameter at base; 64½ feet in circumference and 20 feet in diameter at a point 10 feet above the ground.

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overnight, and have enabled persons of moderate means to build and own their homes. From the forest we have secured the immense supplies of cheap paper pulp material which have given us a more widely distributed press than any other country. From it also we take 80 per cent. of all the pitch, tar, and turpentine used in the world, as well as acetic acid and other chemicals almost indispensable in the arts. And depending on the forest, there has developed the lumber industry, which employs 900,000 men and women, and represents an investment of two and one-third billion dollars. It is second only to agriculture among the basic industries of the United States.

Forest Reserves

It was to guard against the possibility of an exhaustion of our timber supply, and to continue the regulating influence on stream-flow and climatic conditions which the forest exerts, that the policy of establishing National Forests was inaugurated in 1891. The first to be created was the "Yellowstone Park Timberland Reserve," which was set aside in that year by President Harrison.

Other reservations were made out of the timbered portions of the public domain, until at the present time we have 147 National Forests, which comprise approximately one hundred and fifty-five million acres. They are located for the most part in the western mountains, and contain a stand of timber estimated to be about five hundred and sixty-five billion board feet, as well as a vast amount of cattle range and water power.

They are under the charge of the Secretary of Agriculture and are cared for by the United States Forest Service, which



THE WAWONA TREE, MARIPOSA GROVE
Height, 227 feet; diameter at base, 26 feet



THE MONTEREY CYPRESS

It takes its form from the ever-present winds that blow in from the Pacific

supervises the sales of timber, the stock grazing, and the use of the water power and other resources contained in the forests, and sees that provision is made for perpetuating all of these resources.

What the Forest Supplies

Many of the National Forests are in inaccessible localities, long distances from the nearest general market, but, though their timber is not available for present general use, they are of inestimable value to the scattered settlers of the region as sources of supply for the necessary building materials. The stand of timber in these forests is in the nature of a reserve supply to be used when the more accessible timber has been cut. Others are so located that a ready demand exists for their products. In such cases, as much of the timber as is mature and can be spared without reducing the amount of forest capital is sold for the general market, and the money deposited in the federal treasury. In the fiscal year 1917 the income from sales of timber of the National Forests was \$1,692,500. Of scarcely less importance than the timber is the forage which the National Forests contain. About twenty-four per cent. of the cattle raised in the West are dependent upon the National Forests for their summer feed, and it is estimated that no less than fourteen million cattle and sheep, inclusive of calves and lambs, use the National Forest ranges each year. A moderate fee is charged for the grazing privilege, the revenue from which in the fiscal year 1917 was \$1,549,795.



IN A SOUTHERN PINERY



HOW THE FOREST ADVANCES

In this No-Man's-Land, from which a glacier has retreated, the forest is beginning to advance

Aside from the vast resources which the National Forests contain and the revenue which they return to the Government, they exert other influences, indirect but far-reaching. All of the important streams rising

THE FOREST



COLLECTING SEED FOR FOREST PLANTING
In the hiding-places of squirrels, rangers find seed for planting new forests

in the western mountains have their sources within the forests, and their flow is largely controlled by the regulating influence which the forest exerts in absorbing and gradually releasing the water from rain and snowfall. Most of the great irrigation projects which have transformed hundreds of thousands of acres of arid desert into fertile fields are dependent for the life-giving water upon streams rising in the National Forests. It is essential to the success of these projects that the forested watersheds of the streams be protected from fire and indiscriminate cutting, which would result in alternate periods of flood and drought and in a gradual filling up of reservoirs by sediment.

Finally, the forests serve as great, unexcelled public playgrounds, where the residents of the faraway cities and the low, hot valleys can escape the summer heat.



MT. EDDY FIRE LOOKOUT STATION, SHASTA NATIONAL PARK, CALIFORNIA
From here warning of approaching flames is sent by telephone or heliograph to rangers

In the cool shade of giant pine and fir and spruce, by rushing, ice-cold streams, thousands of visitors pitch their camps. Carefully constructed roads and trails enable the traveler to penetrate the distant back country. Quiet valley and jagged peak tempt the adventurous explorer, while Nature's greatest textbook—the forest itself—lies open to all who care to learn the secrets and lessons it holds.

SUPPLEMENTARY READING

HANDBOOK OF TREES *By Romeyn B. Hough*
OUR NATIVE TREES *By Harriet L. Keeler*
THE TREE GUIDE *By Julia E. Rogers*
FARMS, FORESTS AND EROSION

A pamphlet published by the United States Department of Agriculture.

THE HUMAN SIDE OF TREES *By Royal Dixon*
FORESTS OF YOSEMITE, SEQUOIA AND GENERAL GRANT NATIONAL PARKS
By C. L. Hill

Published by the United States Department of Agriculture.

* * Information concerning the above books may be had on application to the Editor of The Mentor.

T H E O P E N L E T T E R

"I have just been visiting a tree I know," wrote Thoreau. An interpreter of trees was Thoreau. He knew their individual characteristics and their relative standing in the forest community, and he learned many secrets from the gossip of their leaves. Do you know a tree—even one? Have you ever tried to be a friend to the trees? The Druids, in the olden time, revered trees of all kinds, and held some trees sacred. Many of us today hold no trees sacred. We take their bounteous service to us for granted, and destroy them ruthlessly on the slightest pretext. To many, a beautiful bit of woodland is simply so many feet of lumber. And yet, as a great tree-lover has observed, "a fine flourishing tree is of more service, and is more of an ornament in the community than some human beings—and it lasts longer." The mere companionship of trees has made strong men out of weaklings. Ask a forest ranger: he will tell you that many a man has come out to the big woods half broken, and has gathered sap and sinew and strength from the friendly trees. Perhaps the man he will tell you about may be himself. That was so in the case of the ranger that told me.

★ ★ ★

Tree friends have personal qualities that endear them to us. We can feel their vitality, sense the individual aroma that each one exhales, and hear their voices. "Do you mean that trees have voices?" exclaims prosaic Peter Bell. Most certainly. Trees, indeed, have voices, and we have heard them often—the soft whisper of the poplar in the summer-night air, the long-drawn sigh of the maple and elm as the cool rain-winds stir them after a scorching day, the rustle of the horse-chestnut, and the moan of the pines. Tune up your ears, Peter Bell; you are missing much in this beautiful world of ours.

★ ★ ★

The saddest tree I know lives in New York City. It stands in a small enclosed space between two brick buildings—a slender, sickly elm, with a gash in its side. Sometime in the past, someone cared enough to give it a treatment of tree dentistry. But the cement filling has

fallen out, and the cavity is exposed to the inroads of decay. In the spring the tree tries bravely to make a fresh start. It buds, puts forth leaves, and stretches out its gaunt limbs invitingly toward the sunshine and spring showers, hoping for a revival of health and strength. But long before midsummer its leaves are yellow and dry, and its limbs droop limply. It has tried hard to make a "go" of things. Thirsting for the moisture in the gutter, it has thrust its roots out under the sidewalk until the paving stones have been displaced. It has reached out beyond the house line to catch the sunshine that falls there part of the day. But the city heat is merciless, the soil is poor, and the sunshine and rain are not sufficient—and then, too, there is that festering cavity in its side. The tree is one of the many sufferers in a great city, and all it can do is to suffer on—like the others. When the wind rises it leans out and flutters signals of distress to its fortunate brothers that live and thrive in the park nearby. That was what first attracted my attention to the tree. There was an air of pleading about it.

★ ★ ★

All that trees want is fair treatment—just something a little better than murder and arson. The green things of the earth respond readily to encouragement, and they remain steadfast and faithful under trying conditions. More than that, if Man gives Nature a rough deal, she refines and softens the effect of it by covering the defacement in a short time with a cloak of verdure. "Man marks the earth with ruin," wrote Byron, and it is tragically true today; but Nature is a great restorer, and comes readily to the rescue when Man gives her the chance.

★ ★ ★

It cheers the tree-lover mightily to read of the splendid work that Uncle Sam is doing for the protection of the forest reserves. Let the same spirit be carried into all communities, large and small, and let every community have a live, enthusiastic, intelligent Tree Commission. Then we may, though perhaps somewhat tardily, repay Nature for the damage Mankind has done her in the past.

A. D. Moffat

EDITOR

THE MAJESTY OF TREES

By WASHINGTON IRVING



HERE is a serene and settled majesty in woodland scenery that enters into the soul, and delights and elevates it, and fills it with noble inclinations. As the leaves of trees are said to absorb all noxious qualities of the air and to breathe forth a purer atmosphere, so it seems to me as if they drew from us all sordid and angry passions, and breathed forth peace and philanthropy.

There is something nobly simple and pure in a taste for the cultivation of forest trees. It argues, I think, a sweet and generous nature to have this strong relish for the beauties of vegetation, and this friendship for the hardy and glorious sons of the forest. There is a grandeur of thought connected with this part of rural economy. It is, if I may be allowed the figure, the heroic line of husbandry. It is worthy of liberal, and free-born, and aspiring men. He who plants an oak, looks forward to future ages, and plants for posterity. Nothing can be less selfish than this.

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