Forests and Future Resource Conflicts

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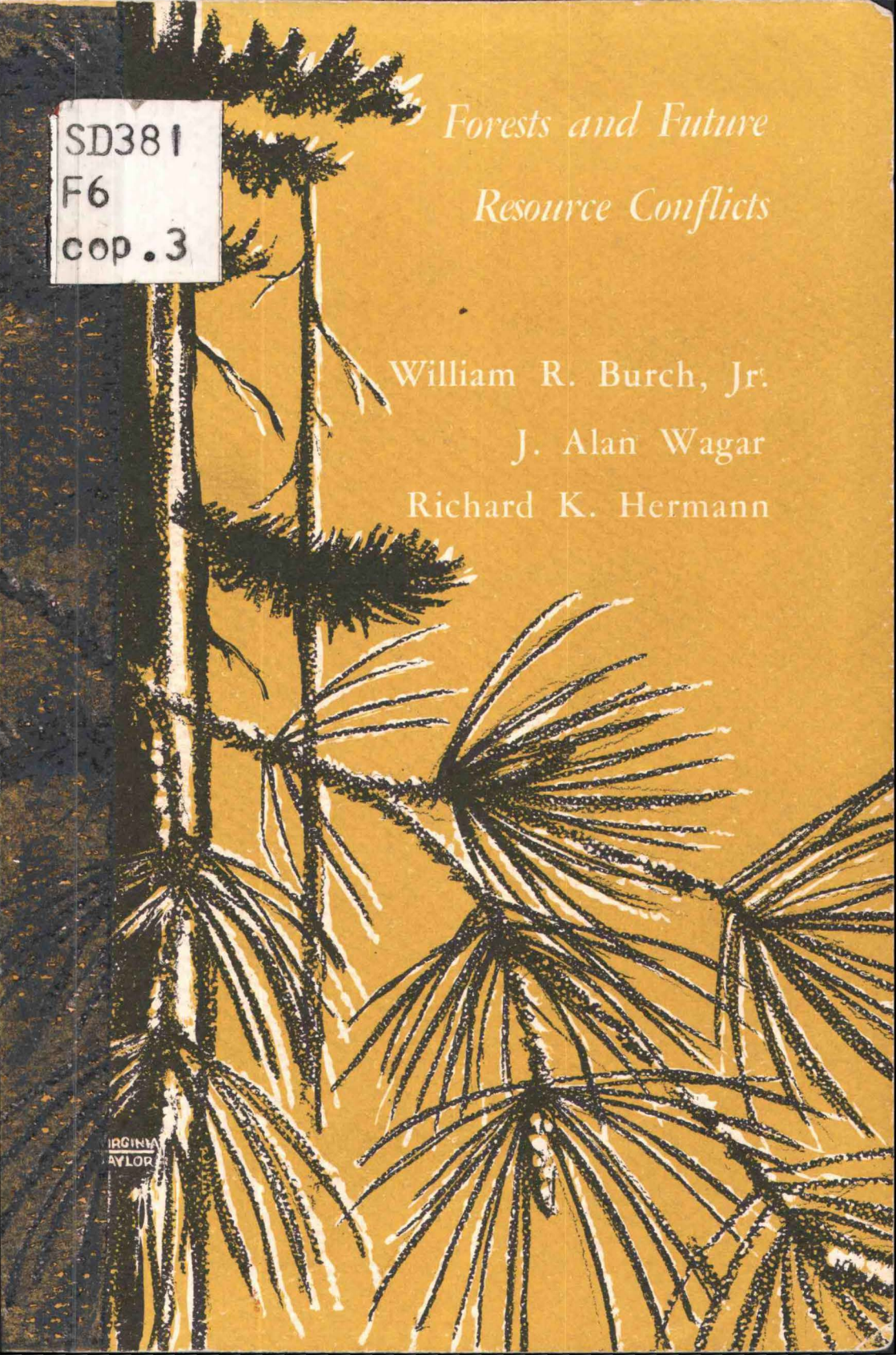

Man and Forests-
A Prodigal Relation

Richard K. Hermann

As long as man has been on this planet, forests have been part of his environment. They have shaped his destiny as he has shaped theirs. Today, because of a rapidly expanding human population, forests will become more important than ever as contributors to mankind's livelihood. Therefore, it is timely for us to pause and to consider how forests came into being, how they developed, and how they have been depleted.

Forests have had a long and often turbulent history. Written records cover only the most recent portion of this history. Our knowledge of the forests of prehistoric times contains many gaps. Inferences from the archeological and fossil record, however, permit us to draw a broad outline of past events.

FORESTS BEFORE THE ADVENT OF MAN

Forests began to appear in the Silurian period about 350 million years ago. Their development reached a peak during the Carboniferous period, 270 to 220 million years ago, when the climate was completely frost free between latitudes 60° N and 60° S (7). Although evidence is lacking that the forests of the Carboniferous period contributed anything to the development of modern arborescent types, these ancient forests are important in relation to the use and ultimate preservation of our present-day forests. Wood was the principal source of fuel before the widespread use of coal. When we look at our dwindling forest resources, we may be thankful that the forests of Carboniferous time, entombed in the strata of the coal

measures, have relieved our modern forests of much of a great and potentially destructive burden.

After the Carboniferous period came the Permian, about 200 million years ago, during which the world experienced a period of glaciation that dwarfed any of the glacial cycles of the Pleistocene epoch. The result was widespread destruction of old forms of plant and animal life and the beginning of the development of new forms. At the opening of the Tertiary period some 50 million years ago, trees as we know them today were already present (47). Early Tertiary time was marked by a favorable climate, but by mid-Tertiary time the climatic pendulum was swinging back again, and after the close of the Tertiary period the globe experienced once more a series of glaciations. The impact of the Pleistocene glaciations was less marked than that of the great Permian glaciation, and the floras of the world appear to have recovered lost territory with considerable ease, except in Europe. Many genera and species characteristic of the Tertiary forests of that continent disappeared permanently (23).

Looking back over the history of forests before the advent of man, one marvels at their biological resiliency. Forests persisted through tremendous geologic upheavals and catastrophic climatic changes. Perhaps there is hope that forests also will survive the destructive impact of man.

THE ADVENT OF MAN

How long *Homo sapiens* and other hominoid species have been active on earth is a matter of dispute, but we may safely assume that the million years of the Pleistocene epoch encompasses all truly human activity. Man's role in changing the face of the earth is of even shorter duration and probably does not extend for more than the last 20,000 years.

Early man was primarily a food gatherer and hunter. We can only surmise how he affected the forest. Paleolithic man had discovered fire as a tool. The extent to which he used it is unknown. But more and more evidence has accumulated to indicate that preagricultural men had a major effect upon their

environment by burning, both deliberately and accidentally (48). The existence of great forest fires is documented by thick layers of charcoal and even carbonized trunks at several sites in the Netherlands and in northern Germany. These strata frequently contain artifacts, fireplaces, and other refuse of the camps of Stone-Age hunters (36). Man's use of fire most likely brought about major changes in vegetation, but they were changes making earth more livable for him (10). Destructive changes that reduce basic resources and injure the capacity of the earth to provide for man come with later cultural developments. For Paleolithic man, conservation problems did not exist, except the difficult one of preserving himself in a vast and often hostile world.

The most important change in the relation of man to forests came with the domestication of plants and animals and the rise of agriculture somewhere between 7000 and 5000 B.C. (43). Activities of man in the millenia since then have reduced the area of the world's forests at least one-third, and perhaps more than one-half, to about 8 billion acres. The three main reasons for human pressure on the forests have been, and continue to be, demand for fuel, for industrial timber, and for crop and pasture lands.

FUELWOOD

Gathering and cutting firewood in preagricultural times probably had little or no impact on forests. Demand for firewood increased greatly when farming permitted significant increases in human populations. Invention of the pottery kiln, fired bricks, ore reduction, glassmaking, and other industrial processes made further heavy demands on the forests for fuel, a demand that has continued unabated to this day in many countries.

Statistics for fuelwood consumption in the past are lacking. But we can obtain some idea of present demands on forests by considering these facts. Of all the wood cut in the forests of the world, nearly one-half is still burned as domestic fuel. As recently as 1945, two-thirds of the people of the world,

mostly in tropical countries, still used wood for cooking their food (4). In this respect, wood and the land that produces it have been, and still are, an integral part of the world's food supply.

There is still another relation between fuelwood and food production. In parts of the world where living standards are low and forests have been cleared to the point of destruction, the common practice is to collect and dry animal dung for fuel. This practice would not be harmful except for the adverse effect on food production. Regions already devoid of trees suffer steady deterioration of soil fertility as a result of overgrazing and erosion in the wake of wholesale forest clearance (13). When dung of grazing animals is removed rather than returned to the soil to help maintain fertility, the cumulative process of deterioration is accelerated. The problem of land deterioration has become particularly severe in parts of the Indian subcontinent (18), and establishment of fuelwood plantations is sought as a remedial measure (8).

The importance of fuelwood is shown by a dramatic example from ancient Ethiopia. The custom was to move the capital city from time to time as the readily available supply of fuelwood became exhausted. Not until the time of King Menelik II were there any changes. When his capital, Addis Ababa, was threatened with a wood famine, he brought in fast-growing eucalyptus trees from Australia and thus saved his capital from relocation (58).

As early as 3000 B.C., the forests of Cyprus were depleted to provide fuel for copper and silver smelting. Wood remained the sole source of smelter fuel until the 17th Century when coke came into use (16). Beginning in Roman times and continuing through the Middle ages, large tracts of forest were felled throughout Europe because of need for industrial fuelwood. It was perhaps the iron industry that had made the greatest single demand, particularly in wooded valleys of the uplands of France and central Europe, where endless series of small metal establishments were to be found (38). As clearing progressed, huts of the charcoal burners moved on to still untapped forests.

INDUSTRIAL WOOD

The demand for timber as building and industrial material by ancient and modern civilizations put even greater pressure on the forests than did cutting of fuelwood. Wood played an important role in construction of buildings even in ancient times. It was King Solomon, nearly 3,000 years ago, who made an agreement with Hiram, King of Tyre, to furnish him cypress and cedars for the construction of the temple at Jerusalem (58). Solomon supplied 80,000 lumberjacks to cut the timber and 70,000 to skid the logs to the sea. Of the forest once covering 2,000 square miles, only four small groves are left today.

Wood was a common building material in Roman times, and the cities and villages of medieval Europe were built almost exclusively of wood, save for walls and cathedrals. In this country, the white pine stands of the Great Lakes were destroyed to build the farms and towns of the Corn Belt.

Demand for mining timbers was one of the significant reasons for early deforestation in southwestern Asia, mainland Greece, Cyprus, the Sierra Nevada and Sierra Morena of southern Spain, the Ore and Harz Mountains of central Germany, the Low Tatras of Slovakia, and the mining regions of North and South America. The forest destruction wrought by mining leads William Wright (59), in his discussion of mining in Nevada, to say that the Comstock Lode can in truth be called the tomb of the forests of the Sierras.

Abandonment of mines in the Spanish colonies of the New World was often forced by exhaustion of the necessary fuel and timber rather than the body of ore (57). Deforestation near mines in Mexico became so serious that the first viceroy of New Spain warned his successor in 1546 of an impending wood shortage (44). The result was the promulgation in 1550 of a forest regulation, probably the oldest in the New World (41). In Europe, too, regulation of forest use was begun early in regions where mining made heavy demands for props and charcoal. The Salzburg forest ordinance of 1237, one of the oldest in Europe, prohibited clearings in the interest of the salt mines "so that the

cut forests may grow up to wood again" (20. Because of the close connection between mines and forests, their administration was often combined under one man in the Middle Ages. Thus, it is no coincidence that ***Sylvicultura oeconomica***, perhaps the oldest technical treatise on forestry in central Europe, was written in 1713 by Hans Carl von Carlowitz, then director of mines in Saxony (45).

The shipbuilding industry has extracted a heavy toll from ancient forests, particularly in Europe, and most of all around the Mediterranean Sea (1). The forest was one of the casualties in the naval wars fought by the Phoenicians, Persians, Greeks, Romans, Arabs, Venetians, Turks, Spaniards, Dutch, French, and British, to name only the most important naval powers of bygone days. The mountains of Greece were nearly stripped of trees by the 5th century B.C. Thucydides (54) informs us that one of the purposes of the Sicilian expedition of Athens in 415 B.C. was to gain control of the abundant supply of ship timber in the forests of Italy. A century later, Theophrastus (52) observed that ship timber was scarce everywhere in the eastern Mediterranean. The western forests apparently did not last long either, because by the first century A.D., Pliny (39) refers to exhaustion of the timber supply from the Atlas Mountains.

Some forests in the Mediterranean, such as the famous cedar forests of Lebanon and the Taurus Mountains of southern Turkey, the forests of Cyprus, and the forests along the Adriatic coast, lasted well into the Middle Ages. The Turks were responsible for final destruction of the forests of Lebanon and Cyprus in the 16th century. The forests in Istria and Dalmatia along the Adriatic coast were still in existence, although in poor condition, when Venice acquired the region in the 15th century. The Venetians declared all forests national property reserved for ship timber and placed them under management. They instituted a forest service, regulated grazing, and prohibited clearing. A reorganization of this service and division into districts took place in the 16th century. But the underpaid district officers became black marketeers in timber and failed to enforce grazing regulations, so that by the close of the 18th

century the forests were completely ruined in spite of the attempts at reform (20).

With the overseas expansion of Europe, need for shipbuilding timber was increased greatly. In Britain, naval wars with the Dutch in the 17th century, and with the French in the 18th and early 19th century, put such a strain on the English oak forests that they have never recovered (15). Dutch fleets of the early 17th century were built mostly with timber from the oak forests of Germany, which were heavily logged to raise money for indemnities after the Thirty Years War. The rise of the Dutch Navy was even more dependent upon the forests of the Baltic countries, which also served as sources of supply to the British and Spanish navies (1). The timber and "naval stores" of these northern countries were as important to sea power in the 17th and 18th centuries as heavy industry was to be in more modern times. In the words of Darby (16), the timber problem remained acute for the navies of Europe until March 9, 1862. It was on that day that the Battle of Hampton Roads in the U.S. Civil War demonstrated the superiority of the ironclad ship. The era of wooden ships had suddenly ended, and it left a permanent mark upon the countryside of Europe.

CROPLAND AND PASTURE

Concerning the third major cause of forest reduction, we can state without exaggeration that forests have yielded far more ground to the agricultural pressures of expanding populations than to any other demand. About one-third of the original forest in the United States has been cleared, and much of this once-timbered land is now under cultivation (11). Brazil has lost 40 percent of her forest area, most of it to agriculture (56). The forests of India, China, and Europe have shrunk to less than one-fourth of their size since the beginning of agriculture. All over the world, farmers and herdsmen have won most of their land at the expense of the forest, and there is good reason to think that the forest will continue to lose ground. Through much of history the farmer has regarded the forest as his

enemy, a conflict already described by the Roman writer Secundus (21) when he asked "*Quid est agricola?*" (Who is the farmer?) and answered "*Silvae adversarius!*" (The enemy of the forest). We find the same attitude in the Middle Ages when we hear an Anglo-Saxon poet describe the plowman as the "Grey enemy of the wood" (22).

The tradition of converting forest into farm land is several thousand years old. Early agricultural practice probably was similar in both tropical and temperate regions. A piece of forest would be felled, burned, and the ashes used to fertilize the soil. The farmer would make holes with a stick and put in tubers or grains, protect the cultivated plants from wild animals, and reap. Because the supply of fertilizer provided by the ashes was usually sufficient for only a crop or two, these primitive farmers were forced to move on to a newly cleared and burned area and let the abandoned plots revert to forest. Such a shifting, forest-clearing system of agriculture developed on every continent and has persisted in large portions of the world to this day.

Neolithic and Bronze Age farmers in Europe practiced a migratory slash-and-burn agriculture (9). In Denmark, layers of charcoal have been observed in some of the bogs in horizons poor in tree pollen, indicating forest clearance, but rich in the pollen of grains, cereals, and weeds–especially the tell-tale ribwort plantain (*Plantago lanceolata*). Regeneration of the forest is attested to by the predominance of birch, alder, and hazel pollen in the succeeding layer of peat (26). Shifting agriculture and the burning of forest land, known as *Brandwirtschaft* in Germany and *Svedjebruk* in Sweden, continued in parts of central Europe (45), Scandinavia (33, 35), and Russia (19) well into the 19th century. In the Ardennes and French Alps, temporary clearing and burning, "*l'essartage*," were encouraged by a 1766 edict that exempted newly cleared land from taxation for fifteen years (5). In parts of Finland, the mosaic of patches of birch and alder, trees of the pioneer stage in succession, are indicative of areas where shifting cultivation has been practiced until recent times.

The shifting, forest-clearing system known as *ladang* in Southeast Asia and *milpa* in South America is well adapted to

tropical lands as long as the pressure of human populations is low and cleared areas can revert to forest and have fertility restored after agricultural use (24). The system breaks down when populations grow too rapidly and the land does not receive the rest and regeneration it needs for fertility. Collapse of the Mayan civilization that was supported by milpa agriculture has been attributed to this sequence of events (12). Population growth and adherence to shifting cultivation once again have created serious problems in parts of Latin America because of permanent forest destruction and subsequent erosion and depletion of soil fertility (56).

Perhaps the best studied example of the destruction of tropical forests by fire, primitive agriculture, and grazing is the island of Madagascar, which has lost nearly all of its forests in the last millenium (3). Shantz (49) reached the conclusion that forestsin tropical Africa occupy today only one-third of their original area as a result of the use of fire in primitive agriculture. Expansion of the Sahara Desert is thought to be caused largely by a combination of shifting cultivation and heavy grazing pressure. Three thousand years ago the whole western part of the Sahara was covered by parkland savanna and as late as the 16th century the southern border of the Sahara was about 250 miles farther north than today (25).

The history of land use in Africa is perhaps best known for the northernmost parts broadly referred to as the Mediterranean. This region has the dubious distinction of being almost everywhere the textbook example of destructive land-use practices. Indeed, the character of the land in the Mediterranean region has changed since the days of the great empires of Sumer, Assyria, Greece, and Imperial Rome (46). Why is it that Mesopotamia, the land between the rivers, once the agricultural center of some of the world's oldest civilizations, is today a desert? What has turned North Africa, once known as the granary of the Roman Empire, into a desert? The often advanced hypothesis that a climatic shift toward a drier and warmer climate caused the changes is untenable in light of our present knowledge. We have overwhelming evidence that man and not climate must be held accountable for the encroachment

of desert upon the formerly fertile lands of the ancient empires (44).

The forests of northern Africa from Morocco to Egypt, of Syria, Israel, Lebanon, and the Adriatic coast have been largely destroyed. On the average, about 15 percent of the land of Spain, Italy, Greece, and Turkey are still forested, but much of the forest is degraded. The process of land destruction, with minor variations, has followed the same course all over the Mediterranean. Forests were cut to provide more grazing land (27, 55), mostly for sheep and goats, and to provide wood for fuel and a wide variety of construction. Regrowth of the cutover land was prevented by heavy grazing, periodic burning, and continued cutting for fuelwood. The soil was left unprotected and was washed and blown away. As denudation reached advanced stages, an ever-increasing amount of detritus was carried from the mountains into the cultivated plains, covering them with thick layers of alluvium.

A comparison of the Nile and the Tigris and Euphrates river regions is enlightening when one ponders land deterioration around the Mediterranean. The agricultural lands of Egypt, irrigated by flood waters of the Nile, have been farmed for at least 6,000 years and have remained productive. Egypt still is densely populated, but the lands of Mesopotamia are mostly desert and now support only a small fraction of their former population. A look at the headwaters of the two river systems helps explain the differences between these two regions. The headwaters of the Nile lie in the highlands of Uganda and Ethiopia, areas that have remained largely undisturbed by human use. By contrast, the headwaters of the Tigris and Euphrates lie in the highlands of Armenia, which have been in the path of wave after wave of migration of nomadic tribes from the plains of Asia. The Armenian highlands have been deforested to provide grazing land for livestock and wood for the growing cities (42). Resulting erosion has caused an ever-increasing load of silt to be carried by the Tigris and Euphrates. As long as strong empires centered in the lands between the two rivers, the irrigation canals were kept open. But in the 13th century, invading Mongols destroyed the

irrigation systems and the silt-laden flood waters carried soil without interruption from the highlands to the sea. The silt has filled the Persian Gulf a distance of 180 miles from the point where the rivers emptied in Sumerian times (18). Thus, the population decline in Mesopotamia was not caused by loss of Mesopotamian soil through erosion. The fertile lands are still in place and life-giving waters still flow in the Euphrates and Tigris (31). But erosion in the deforested hinterlands caused silt to choke the ancient irrigation canals in the lowlands.

THE ATTRITION OF CHINA'S FORESTS

Perhaps one of the most impressive, although seldom mentioned, examples of reduction in forest area is provided by China (29). It is a large country, occupying about one-twelfth of the land surface of the world. The regions in northern and northwestern China along the Yellow River, where the Chinese first settled, once were wooded extensively (51). The early settlers apparently did little clearing and tribal chiefs set aside woodlands as hunting preserves called *yu*. About 2700 B.C., however, a period of extensive forest clearing began that lasted for nearly 1500 years until establishment of the Chou Dynasty.

The period of the Chou (1127-255 B.C.) was a golden age in Chinese history, both in general cultural achievement and land-use policy. A highly efficient forest administration was established under the Chou Dynasty, representing probably the first forest service to come into existence, and forest management was well organized and competent. After the Chou Dynasty, a general period of decline set in. Wars laid waste much of the settled land along the Yellow River, and forests were reduced to such an extent that wood for public buildings had to be brought from remote mountain areas in central China. As D. Y. Lin (30), former Director of Forestry of China, has phrased it "The demolition of forests by ax and fire has formed a sad theme for poets and historians, who have described the ruthless destruction and its devastating effects of which "China's Sorrow," flooding by the Yellow River, was one." During the Tan (A.D. 618-907) and Sung (A.D. 960-1128)

dynasties, some efforts were made at forest preservation. In succeeding centuries, however, destruction of forests accelerated as a result of dynastic wars and of a growing population's need for farmland, and the destruction soon extended from the Yellow River basin to the basins of the Yangtze and Pearl Rivers.

So, after more than 5,500 years of destructive action, interrupted mainly by the enlightened conservation of the Chou, the forests of today's China are no longer "boundless stretches" and have shrunk to about 9 percent of the total land area of the country, ranking China among the most severely deforested countries of the world.

FOREST CLEARING IN EUROPE

Development of agricultural practices in western and central Europe took a different course from that in other parts of the world and had a different impact on forests. Although neolithic man practiced shifting cultivation, a more stable type of agriculture emerged as populations increased. Because forests covered most of the land and because natural range land was scarce, conditions were unfavorable for the development of pastoralism apart from agriculture. Thus, from early times livestock were kept close to the farm lands and growing feed for stock became as important a part of farming as growing food for man. Although agricultural practices expanded, heavy forests served as a barrier against too rapid extension of farming lands.

Nonetheless, extensive forest clearing has taken place over the last 2,000 years. In Roman times, Europe still was covered with immense forests. The "Hercynian Forest" of classical writers such as Tacitus (50) stretched eastward from the Rhine river for a vast distance. And in his account of the Gallic Wars, Caesar (6) tells of men who had journeyed through this forest without reaching its end.

The first great period of forest clearing in western Europe began after the breakup of the Roman Empire in the 4th Century and ended under the reign of Charlemagne about 800

A.D. The second great wave of forest clearing came in the 11th and 12th centuries, receiving its greatest impetus from two historic developments. One was the establishment of new monastic orders, especially the Cistercian, which saw conversion of wilderness into arable land as its God-given mission. The other was the advance of the Germanic people eastward into Slavic lands (28). This advance, under the impetus of both economic and missionary motives, led to clearing of tremendous forest areas. The eastward movement of the Germanic pople in the Middle Ages has been compared to the expansion of the American people westward from the Atlantic Seaboard. What the new west was to Americans of the 19th century, the new east meant to Germans in the Middle Ages (53). Although historical analogies are often misleading, this comparison does emphasize the colonial character of much of medieval Germany.

The great medieval period of clearing did not continue uninterruptedly into modern times. A period of economic stagnation and marked population decline occurred between 1350 and 1450, during which many villages were deserted and field and pastures abandoned. The reasons for this recession are not fully known, but war and the "Black Death" undoubtedly contributed to it (40). The Hussit Wars (1419-1436) in Bohemia and the Hundred Years' War (1337-1453) between France and England reduced populations in many places by half or more. How common the return of woody vegetation to the untilled fields must have been is indicated by an old saying of people in southwestern France that "the forests came back to France with the English." In Germany, the Thirty Years' War (1618-1648) left a staggering legacy of devastation, and forests reclaimed much of the once cleared land.

Although considerable forest areas were left in Europe, shortage of wood became an increasingly serious problem beginning with the 16th century. Economic recovery and population growth in the late Middle ages were accompanied by an ever-increasing appetite for wood. Fear of a timber famine led locally to restriction of wood use and timber exports. An amusing restriction of this kind has been reported from a small town in Germany where the bakers were forbidden to bake

bread for any but the citizens of the town (20). By the middle of the 17th century the threat of a timber shortage had become so imminent that learned societies throughout Europe were asked to look for solutions. For instance, the British Admiralty in its alarm over the timber shortage consulted the newly founded Royal Society, which in turn asked John Evelyn to report upon the matter. The result was the appearance of his **Sylva or a Discourse of Forest Trees and the Propagation of Timber in His Majesty's Domain** in 1664. But it was not until the end of the 18th century that orderly forest management and the task of rehabilitating the forests of western and central Europe was begun (38).

That so much forest had remained in the heartland of Europe in spite of the many centuries of clearing and exploitation is surprising. The survival can be attributed, at least in part, to a conflict of interests that arose in the 10th century. Set against the advantages of obtaining agricultural land were the interests of the chase and the wish to preserve forests as hunting parks. Many of today's publicly owned forests are such former hunting preserves. Among the best known are the Forest of Dean, the New Forest (formed in 1079 by William the Conqueror who named it the New Forest because it was an addition to the already existing crown forests), the famous Spessart oak forests, and Bialowieza National Park in Poland. Until the end of World War II, nearly half of the forests in central Europe were on the large estates of private owners, who had acquired these lands in the late Middle Ages and managed them for a long time, primarily as hunting grounds. On occasion, however, we find forests that have been preserved and managed through centuries for timber production. Perhaps unique in this group is the *Murgschifferschaftswald* in the Black Forest, acquired as a mortgage lien by a group of woodsmen in the 13th century (58). They were known as rafters because they floated great rafts of fir down the Murg and Rhine rivers to Holland for sale to shipbuilders. To the present day, the original 12,000-acre mortgage has remained in the hands of some of their descendants. It may well be the only forest in the world

that in single private ownership has had an uninterrupted producing record for 700 years.

FORESTS OF THE "NEW CONTINENT"

Finally, we look at the part of the world that is most familiar—North America. It is interesting that wherever a few colonists have gone into countries of primitive culture, they have dropped largely to a primitive level of agriculture. This is well demonstrated by the history of colonization of the eastern United States, where land was ruthlessly cleared, which wasted the forest and eventually wasted much of the soil by erosion. With a forgotten history of land use and abuse behind them, the American settlers in a short time repeated every mistake that man has made since the first Neolithic farmer sank a digging stick into the ground. Through the southern states went waves of settlers, clearing and burning the forests to plant corn and tobacco and later cotton. Their crops made great demands on the soil and offered it little protection. Combined with careless husbandry, these practices were to leave a permanent mark on the American South.

Much of the hardwood forest of the eastern United States disappeared before the settlers' axes. North of the hardwood belt, the march of the lumbermen from Maine in the 1700's, to New York in 1850, to Michigan in 1870, to Wisconsin in 1880, and finally to Minnesota in 1890 was primarily a quest for white pine (14). The white pine loggers, with the destructive fires that followed in their wake, created a desolation so impressive that Americans finally realized that forests even in a new continent are not inexhaustible.

THE CONSEQUENCES

In discussing the major types of human pressure on the forest resource, I have drawn an often bleak picture. One may well ask whether anybody realized the magnitude of what was happening, and whether there is any hope for change. We know

that attempts have been made since ancient times to preserve forests—an example is the establishment of a forest reserve in the northern part of the Lebanon Mountains by the Roman Emperor Hadrian in the second century A.D. (34)—but these efforts were localized and generally without lasting effect. Not until the 19th century were actions taken toward establishing safeguards against mindless forest destruction. In the 19th century, the first really progressive forest laws were passed in Europe. In this country, a milestone was reached with the submission of a report to Congress in 1874 by the Franklin B. Hough Committee of the American Association for the Advancement of Science (2). This report emphasized the need for withdrawing and protecting forests on public land, a process that began with passage of the Organic Forestry Act of 1897.

An "ecological conscience" is by no means an idea that originated in our time. Indeed, one of the first to recognize that man was often irrational in his treatment of the environment and thus might ultimately destroy the very base of his subsistence was an American, George Perkins Marsh, lawyer, member of Congress, and minister to Turkey and Italy. He set forth his ideas about man's alteration of the earth in **Man and Nature or Physical Geography as Modified by Human Action** (32), which first appeared in 1864. His solution for environmental problems was that man should moderate his activities and develop a morality in respect to his use of the earth. He had some very concrete proposals, such as maintenance of certain proportions of land in forest and national control of natural resources. Above all, he thought it important to ascertain the probable effects of action before acting.

Marsh was a famous and widely recognized man both in Europe and in America. The House of Commons referred to his writings in connection with the alarming deforestation of India. He helped compile the irrigation laws of France, Italy, Spain, and California. Yet his work was submerged in the tide of opinion that everywhere saw progress in the command man had attained over nature.

Looking back over "7,000 years of conquest of the land," as Walter Lowdermilk (31) phrased it, we can see that the rise

of our species from savage to civilized man has come at great expense to the resources of the world, and particularly to its forests. One cannot argue that we should cease to utilize our forests, but one can argue that ruthless destruction for only temporary advantage, followed by permanent depreciation of our forest resources, will have catastrophic consequences. In a way we have come full circle. We have paid for advanced civilization and technology with destruction of much of our natural resources and, thus, have returned to a problem not serious since Paleolithic time, the problem of the survival of man himself. Raymond Dasmann (17) says, "Until industrial man, armed with powers greater than his ancestors could imagine, makes use of the wisdom which his ancestors so painfully acquired, he remains in peril. Like the gods of old, he can make the earth into a paradise if he so chooses, or he can destroy it."

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