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Chapter Fifteen

Global Forests

Nancy Langston

Forests across the world are changing rapidly and, by most measures, they are in a great deal of trouble. Healthy forests are central to healthy human communities, and degraded forests are often accompanied by poverty. As an Earth Day 2006 opinion piece in *The New York Times* put it:

> Our forests are the heart of our environmental support system. And yet, in the 36 years that have passed since the first Earth Day, on April 22, 1970, we have lost more than one billion acres of forest, with no end in sight. The people most vulnerable to the disappearance of forests are the poor: nearly three-quarters of the 1.2 billion people defined as extremely poor live in rural areas, where they rely most directly on forests for food, fuel, fiber and building materials ... Everywhere, forests prevent erosion, filter and regulate the flow of fresh water, protect coral reefs and fisheries and harbor animals that pollinate, control pests and buffer disease. That is why the single most important action we can take to protect lives and livelihoods worldwide is to protect forests.[1]

If forests are so critical for human communities, why are they so often degraded? It is not an exaggeration to state that forests made human evolution possible, nor is it an exaggeration to claim that the loss of forests would undermine the future of humans on earth. Yet forests and their histories are nevertheless invisible to many people. Many people see forests as little more than attractive backdrops to the real stuff of human history, but our human stories are intimately interconnected with forests. This chapter will explore some of the often invisible links between forest and human histories.

The air that we breathe, the fuel that powers our industrial development, the marine and terrestrial ecosystems that feed us – these are all dependent on forests, not just those from the present, but also those from the past. The carbon in the coal that threatens our future comes from ancient fossilized forests, their photosynthetic energy trapped 300 million years ago.[2] The fecundity of near-shore oceanic habitats – nurseries for the

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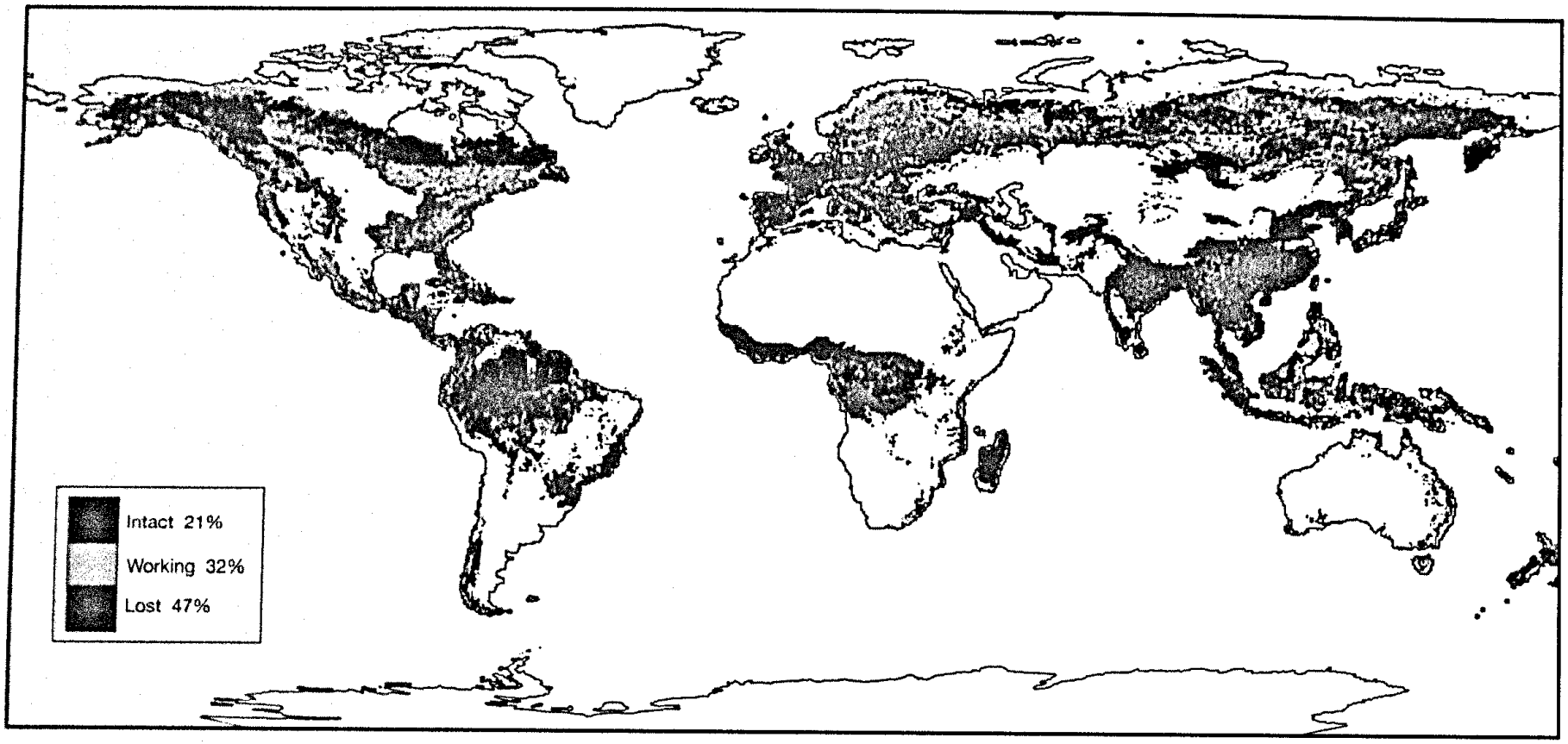

Map 15.1 Changes in global forest cover over 8,000 years. Based on *State of the World's Forests*, 2009, World Resources Institute, http://www.wri.org/image/view/10640/_original. This map is part of an initiative by Global Forest Watch, a group that uses global mapping as a tool to protect forests. "Intact forests" have not yet experienced industrial logging. They are typically large enough to maintain viable populations of wide-ranging species. "Working forests" have been significantly modified by logging and other extractive industries. "Lost forests" are forest land where there has been a period of complete clearance by humans with conversion to another land use. Data on intact forests were gathered in 1997. For more details see http://www.wri.org/publication/last-frontier-forests

marine life that feeds us – depends on the carcasses of ancient forests that have made their way to the sea. The soil that supports our grain production builds on the detritus of crumbled forests. We participate each day in an intimate exchange with the forests of the past.

Deep Forest History

As Michael Williams notes in *Deforesting the Earth*, deforestation is as old as the human occupation of the earth. Half of the forest that has vanished from the earth was gone before 1950 (see Map 15.1). But the footprint of humans on a landscape is not always that of a logger's boot leaving destruction in its wake – sometimes, forests spring up in human footsteps, particularly when people suppress fire or build soil for agriculture, and then abandon plots. Particularly during times of war or cultural tumult, forests expand, taking advantage of surprising opportunities.

Forests are dynamic ecosystems marked by disturbance and change. Cut a tree down and it usually grows back, given half a chance. Cut an entire forest down and it often returns – a changed forest, but a forest all the same. The key question in forest history should not be just what kills trees, but what threatens forest resiliency, preventing them from growing back after a disturbance. Resiliency is defined as the potential for a forest to regenerate after disturbances, whether those are anthropogenic disturbances such as logging, ecological disturbances such as herbivory and fire, or biophysical disturbances such as glaciation, erosion, and climate change.

The biophysical template of climate, soils, and glaciation constrains the possibilities for forest resiliency and recovery. You rarely see a red pine forest growing in the middle of the ocean, for example, and mangroves do not thrive on top of snowy peaks. Forests, however, are not merely responding passively to biophysical conditions. They lack the visible agency that marks animals, but plants, even more than animals, are agents of change on earth.[3]

Four and a half billion years ago, before plants evolved, the atmosphere contained very little oxygen, far too little to sustain animal life. The extraordinary innovation of photosynthesis changed this by fixing carbon from the air and releasing oxygen. By about 2.4 billion years ago, in the ancient world of the Devonian, photosynthetic bacteria were producing so much oxygen that the gas created an ozone layer, which in turn absorbed a significant amount of ultraviolet radiation, allowing cells to leave the ocean surface and colonize land. An evolutionary explosion of protoforests soon covered much of the planet. Plants, in other words, through photosynthesis, helped to create the climate and atmosphere that sustains them and ourselves.[4]

Ancient forests pulled carbon dioxide out of the sky and into the pores of the soil, "making the interface between the atmosphere and the earth viable for an explosion of terrestrial life."[5] Forest canopies created the first shade; forest roots bound dirt together into the first true soils; forest cellulose provided fuel for flames; and forest communities created new habitats where terrestrial animals could thrive. The result was a series of evolving feedback relationships that transformed the earth into an interactive system tying together atmosphere, oceans, rocks, soil, bacteria, plants, and terrestrial animals.

This system was dynamic rather than stable. When dinosaurs walked the earth some 200 million years ago, the carbon dioxide level was more than three times our current level (about 360 parts per million in 2010). Dense tropical forests responded to this increased carbon dioxide by spreading across much of the globe, creating a warmer,

wetter atmosphere. These forests thrived for millennia, until India eventually collided into Asia. The grinding of tectonic plates pushed up silicate rocks from within the earth's crust, exposing them to the weathering forces of wind and rain. Weathering used up much of the carbon dioxide in the atmosphere, leading to cooling and drying of the earth. Fire frequencies increased in the new climate, and burning fostered the spread of grasses, which in turn increased fires even more – a positive feedback loop that resulted in a steep decline of forests across the globe.[6]

Mammals that had relied on forests disappeared early in the transition from forest to grassland vegetation, while others adapted to the new savannas and grasslands. Morton writes that "among those forced down new evolutionary pathways by the change in the landscape were the African apes; as the woodlands they inhabited shrank and fragmented ... the apes faced a series of challenges that would lead to the evolution of the omnivorous hunting species from which modern humans are evolved."[7] People, in other words, are around because of an evolutionary radiation that resulted from forest change.

About 2 million years ago, the modern ice age began, with continental glaciers periodically expanding over much of the northern temperate zone. Each glacial cycle lasted for about 100,000 years of ice growth, followed by 20,000 years of warming, with massive repercussions for forests in Eurasia and North America that lay in the path of the ice. Forests were scraped away, and when the ice retreated, new forest communities had to start all over again, regaining their hold on formerly glaciated landscapes. Yet forests did not merely follow the retreating ice sheets north. They actually chased the ice north, as recovering forests changed local microclimates, melting the ice before them. When the most recent ice age ended some 11,500 years ago, forests spread back into the temperate zones and carbon dioxide levels rose once again. Wild grains became more fruitful with the increased carbon dioxide, a change which made them far more attractive for human harvesting, ushering in a world of possibilities for settled agriculture.

These glacial histories mean that forest communities that now exist across North America and Europe are relatively young, in evolutionary terms. In effect, because people followed the melting ice north into the grasslands and new forests, human disturbances have been part of those forests for as long as they have existed. It is difficult, if not impossible, to speak of natural or pristine states for these communities.[8]

In contrast, tropical forests were never leveled by glaciation, so they just continued developing as communities, becoming more complex and diverse over the millennia. Yet this greater age means that tropical forests often exist on older soils, where time and weathering have leached nutrients away. Thus, while they tend to have greater ecological diversity than temperate forests because of the greater time for coevolution and development of complex communities, they also tend to have less resilience to human disturbance.

Precolonial Forests

When the most recent ice age ended some 11,500 years ago, forests spread back into the temperate zones. As the ice receded and human populations increased with agricultural expansion, people became significant forces shaping forest-disturbance processes and plant communities. Yet groups of people did not evenly distribute themselves across the landscape, and the intensity of human disturbances varied significantly from one forest stand to another. Fishing, hunting, gathering and management of rice and other native

plants, gardening, the location of village sites, and trade networks all shaped forests, but not in homogenous ways.

In most of the northern forests across North America, Russia, and Europe, clearing for farming was restricted in extent, and hunting pressures and fire manipulation were probably the major effects of human populations on forests. Fire, even more than agriculture, was the major process shaping the movement of forests across space and time, determining the location of the ecotone between forest and grassland. In what are now the Great Plains of North America, for example, Indian manipulations of fire likely restricted the extent of forests across the center of the continent.[9]

In Amazonia, where soils are ancient and nutrient-poor, archeologists are increasingly arguing that human presence – particularly farming – may have helped increase the diversity and abundance of some forests, rather than destroying them. Tropical forests typically face high levels of rainfall and, over hundreds of thousands of years, water moving through soils can remove most nutrients, leaving only a clay that cannot hold on to nutrients. About 2,500 years ago, small groups of farmers began creating a particular soil in the Amazon now called "terra preta," or black earth. The writer Charles Mann describes terra preta formation as "a process reminiscent of dropping microorganism-rich starter into plain dough to create sourdough bread." Terra preta, which appears to cover about 10 percent of Amazonia, is generated by a special suite of microorganisms that resists depletion, so intense tropical rains do not leach nutrients from them. By mulching organic material, including fish and aquatic plants, ancient farming communities may have produced a meter of soil in just decades, a startlingly rapid rate. Anna C. Roosevelt, curator of archeology at the Field Museum of Natural History, argues that rather than destroying Amazonian forests, ancient farming communities, with their dense populations and intensive farm plots, may have improved these forests, for "the most luxuriant and diverse" forest growth now occupies mound sites where people once settled.[10]

Asia

In Southeast Asia, archeological evidence similarly shows that people have had a long and complex relationship with tropical forests. Records from 10,000 to 40,000 years ago describe human communities that thrived along the coast of Vietnam, the Malay Peninsula, and Sumatra, hunting a broad range of forest-dwelling species. Semi-sedentary cultivation of wild plant species such as yam was integrated with agroforestry by at least 6,000 years ago, yet human populations remained small. People living in small settlements established swidden fields of small plants such as yams in small forest clearings, enriching local soils. Farmers also domesticated indigenous forest trees such as durian, breadfruit, banana, and coconut, transplanting them from forest interiors to sites closer to their houses and swidden fields.[11]

Agriculture intensified in Thailand about 5,000 years ago. As fields became larger and yams gave way to cereal production, forests were less integral to food systems. Trees became a hindrance to farms, rather than part of the ecological system of food production. As farmers focused on growing cereal grains, they pushed back the forest, both physically and conceptually. Some anthropologists have argued that, in Southeast Asia, people who began engaging in permanent field agriculture essentially "locked themselves out of the forest" conceptually. The forest became fearful and dangerous in agricultural people's cultural mythologies, even though forest-dependent communities

continued to view the forest as a source of resources and cultural protection. The anthropologist Poffenberger writes: "Even today, forest dwelling communities like the Semang of the Malay Peninsula seek out the forest because it is 'cool' and therefore 'healthy,' while neighboring Melayu and Temair people regard it as disease-ridden and 'too cold'."[12]

Expanding trade networks in the first millennium led to new pressures on forests across the globe. In Asia, trade and associated rain-forest clearance began in the first century CE, when an extensive trade in ceramics began, linking ports throughout Southeast Asia with the interiors of rain forests. The trade in forest products helped create new governance structures and relations between peoples. The upland rain forests were beyond the administrative control of the royal courts, which had to establish new exchange relationships with the forest villages in the interior. Expanding sea trade in the modern world intensified the demands on forests across the globe and helped to link European and Asian centers of power. As European nations depleted their forests of suitable ship timber, they turned to Asia, particularly for lightweight woods from Asian rain forests. As early as the seventeenth century, the Dutch began negotiating contracts with Javanese rulers for access to teak forests, and commercial timber extraction became widespread in the nineteenth century. From the 1850s on, Burma, Thailand, and much of the lowland Philippines were intensely harvested.[13]

Even with new trade relations, forest peoples were often able to retain their distinctive identities and cultural practices. The power of the precolonial state was limited in forests, and local communities maintained substantial autonomy on what Mahesh Rangarajan calls "the fringes of the cultivated arable."[14] In particular, precolonial forests were usually explicitly gendered spaces, and forests were of fundamental economic and cultural importance to the lives of women. Forests provided the foods that sustained families with protein, minerals, and vitamins lacking in grains, and women collected those forest foods. Trees provided the fodder that sustained the small livestock that women usually tended, and fuel for cooking and heating. Understories provided habitat for the medicinal plants that women collected, developing intricate cultural practices in the process.

Europe

Within European and Mediterranean forests, similar transformations followed the expansion of agriculture and trade. During the beginning of the Neolithic period (c. 11,000 years BP), the climate became more arid, and a slow shift from hunting and gathering to agriculture began. Early farmers cleared many lowland forests for fields, and by 3,000 years ago, the lowland plains of northern Greece had lost significant forest coverage. As human populations increased, the search for arable land led people up the hillsides, where they cleared forests on steeper hills more prone to erosion. Cutting trees for fields, however, probably affected forest regeneration less than introducing goats. Repeated browsing by goats seems to have overpowered the resiliency of many forests, leaving them unable to regenerate.[15]

New technologies in shipbuilding made it safer for ships to sail the winds of the Mediterranean, which stimulated trade and economic growth from 600 BCE on. Ships required wood, so forests made their way into the sea, first sailing atop the waves and eventually sinking to the bottom of the sea, where the ruins of abandoned fleets became nurseries for new generations of marine life. Miners added to pressures on Mediterranean

and European forests, cutting down great swathes of timber to provide the heat needed for smelting. Silt increasingly filled in river deltas and harbors along the Mediterranean coasts, ruining ports that trade depended upon. With these combined pressures on forests, many Greek writers between 500 BCE and 25 CE commented on the rapid replacement of forests with pastures and fields.[16]

Material conditions and sociopolitical considerations such as the state, property rights, regulation, or economics do not entirely explain human transformations of forests.[17] We also need to pay attention to culture: the intellectual, spiritual, and religious networks of beliefs that affect peoples' relationships with the natural world, as the literary scholar Robert Pogue Harrison argues in *Forests: The Shadow of Civilization*.[18]

According to Harrison, western civilization has defined itself in opposition to the forest. Harrison argues that binary distinctions – between right and wrong, male and female, order and chaos, light and dark, history and the future – lie at the basis of civilization and patriarchy. Yet it is these distinctions and dualisms which the wild forest continually confuses. Forests have a way of destabilizing and reversing simple matters of right and wrong, natural and cultural. Outside the boundaries of society lies the forest, a place of refuge for outcasts, the mad, lovers, hermits and saints, and lepers. While doctrinal Christian attitudes toward forests were essentially hostile, saints' legends, for example, tell a different story: one devout soul after another took to the forest, and in its refuge they lived in the intimate presence of their gods. Laws go astray in the forests. Conventional distinctions collapse; the profane becomes sacred; the outlaw becomes the guardian of higher justice; the virtuous knight turns into a wild man; the wild man turns into a virtuous man; and the straight way becomes a circuitous path. Forests unsettle; they overturn stability, they confuse clear distinctions – but in that confusion, profound learning can occur. Forests are not just places of fear and evil. They are places of transformation: places where the human and wild meet and get entangled in a web of myth, ritual, stories, worship, and fear.

Harrison maintains that the Scientific Revolution and the Enlightenment attempted to empty the forests of this confusion. They tried to make the forests places purely of reason and production, where all that mattered about a forest was what it could produce for human needs. With the rationalization of forest management in the eighteenth century, forests became the object of a new science, which tried to reduce the messy, fertile complexity of myth and undergrowth to timber. An entire science of measuring the wood in a forest sprung up, the definition of a forest became little more than its timber. Many foresters trained in Europe found employment in colonial outposts, confronting the bewildering diversity of forests far from home.

Colonialism led to key shifts in forests and human communities, as over the course of several centuries, with the help of the new scientific foresters, ecological communities were transformed into collections of resources exported to feed the demands of distant markets. Many forest historians have noted that ecological simplification has been a problematic by-product of colonial forestry; James C. Scott's *Seeing Like a State* (1998) is unique in connecting this ecological simplification to a larger state project. Scott's work asks: what are the connections between ecological simplification and government power? Why do bureaucrats and governments so often try to simplify ecosystems? How does land tenure affect forest change? Scott argues that from the rise of the modern state in the eighteenth century, those in authority have tried to organize society and ecosystem through centralized, top-down plans that simplify human and ecological connections, to further the state functions of taxation, conscription, and the maximization of

the state's resources. He shows how centralized planning and "high modernism" have often led to radical ecological simplification and human disaster.

Property rights define the relationships between people, states, and forests, yet property rights are not static systems. The meanings of property are dynamic, and as institutions change within a state, so too do beliefs about property and access to forests. Property rights create relationships that are fluid yet often naturalized in such a way that their historical contingency becomes invisible to people who wield these rights as tools to control the behavior of others.[19]

Across the world, it is a reasonable generalization to state that most forests were traditionally some form of common property regimes. No single person owned all the rights to a forest; unlike agricultural lands, which did tend to be individual private property in many cultures, forests had broader – but not unrestricted – access. Customary tenure systems traditionally regulated access to common property resources within a forest such as fuel wood, grazing, and what foresters now awkwardly term "non-timber forest resources" such as berries and game. Customary tenure systems were based not on the authority of a centralized state, but rather on

> the values of a particular social group, and it is these values which confer legitimacy on local decision-making. Since patterns of interest within a particular social group continually evolve, due to changing conditions, such as population pressure and the value of resources, so the customs and practice in relation to how resources are managed will also evolve.[20]

Customary tenure systems were not perfect, of course, nor were they necessarily equitable. Powerful groups within a community could control preferential access to certain resources, and often socially marginal groups (such as women) were excluded from resource use.

With the growing power of the state, statutory tenure codes were drawn up by centralized governments, reflecting the values and interests of the state. One of the major forces behind the compulsory enclosures, Scott argues, was the tax collectors, who wanted a more detailed and accurate map of who owned and owed what. Customary tenure systems favored local knowledge, while statutory systems favored professional knowledge. Power shifted from those who knew the land to those who knew the law: "State simplifications such as maps, censuses, cadastral lists, and standard units of measurement represent techniques for grasping a large and complex reality; in order for officials to be able to comprehend aspects of the ensemble, that complex reality must be reduced to schematic categories."[21]

One of Scott's key examples is that of colonial forestry. For tax purposes, colonial foresters had to figure out a way to measure standing timber, and the most efficient and accurate way to do so was to legislate that the only legal forest was the measurable, regulated forest. The state simplified forests and land-tenure systems to make forests easier to tax, regulate, and ultimately control.

The links between people and forests were often invisible to the cadre of professional foresters who followed colonial powers around the world. By the nineteenth century, with the deterioration of customary tenure systems under colonial regimes of taxation and land allocation, forests lost many of their traditional protections from overuse. Professional foresters saw the forests being depleted and, being almost completely ignorant of the complex tenure systems that had traditionally regulated access to the forest, they drew the erroneous conclusion that the problem was the customary

tenure systems – not the breakdown of these tenure systems. In an effort to slow the deterioration of forests that resulted from the deterioration of tenure systems, colonial powers called on a new generation of technically trained foresters who attempted to use forest science, quantification, and conservation laws to slow forest destruction. Ironically, these attempts at forest conservation ignored the root causes of depletion, and so the result was often increased exploitation, accompanied by a centralization of decision-making that often led to ecological simplification and a failure to protect forest resources or communities dependent on forests, particularly women.

In colonial contexts, women lost many of their customary rights to forest access, and the diversity of forest life that sustained these uses also diminished. As colonial foresters transformed ecologically complex communities into professionally managed, sustained-yield forests, the diversity of women's work vanished in the forests, just as did much of the diversity of plant and animals that had supported their work – and the traditional tenure rights that gave women access to forests. Likewise, the very idea that women had anything important to do with forests vanished. With the increasing growth of sustained-yield forestry, "working forests" had room only for timber – not for medicinal plants, mushrooms, firewood, fish, insects, and herbs. "Working forests" became the province of "working men": of loggers, professional foresters, and corporate accountants. In the process, women lost many of their customary rights to forests, and women were increasingly defined as peripheral to the concerns of forestry.[22]

Yet even as colonialism led to intensified deforestation, it also shaped the roots of modern environmental concern, by providing "a context in which those on the periphery could witness and think critically about such change."[23] As historian Richard Grove notes in *Green Imperialism*, colonial powers in the eighteenth century expressed grave concerns about colonial deforestation – particularly in Caribbean islands – and its potential to lead to climate change and drought.[24] Desiccation concerns led to the first forest conservation policies of many of Britain's colonial states. For all the social, ecological, and political chaos sparked by nineteenth-century state interventions in forests, colonial forestry was not just "a set of simplifying practices exported from Europe and applied in the European colonies."[25] Colonial foresters encountered new ecologies, cultures, and politics, and those encounters transformed scientific practices, cultural perceptions, and developing environmental concern.

North America

Colonialism transformed forest communities, but it did not always mean a decrease in forests, at least initially. North America provides a useful case study. European exploration, trade, and wars from the 1600s to the 1800s altered American Indian groups' relationships with forests. Those groups who first entered into trade relations with the Europeans, particularly with French fur traders, often increased local intensity of hunting and trapping. Seasonal movements of people changed as well; as Indian contact with the French increased, they became located in larger, higher-density, and more persistent settlements around trading points, and this had significant effects on forests.[26]

Disease, famine, and wars, however, quickly devastated American Indian populations and, in the eighteenth century, American forests rebounded as human numbers dropped. The Iroquois Wars in the Eastern Great Lakes led to ripple effects across the Great Lakes region, as the Iroquois were the first to acquire guns and pushed westward, causing massive migrations, leading to new social relations, population pressures, and effects on local

and regional forests.[27] By 1750, Michael Williams argues, after disease decimated Indian cultures, the forest was "probably thicker and more extensive than ... at any time for the previous thousand years."[28]

European sea trade put an end to the eighteenth-century expansion of the forests. Before the advent of iron ships, European trade depended on wood because massive timbers were needed for shipbuilding. An intricate interplay developed between British military and commercial power, and Baltic and North American sources of timber and naval stores such as pitch and tar. The British navy required masts for ships, and conifers from Baltic forests provided the perfect combination of straightness, strength, and durability. The Baltic nations, however, were reluctant to supply the British navy with the timber it needed for masts, because, as Williams notes, "each Baltic supplying nation was at pains not to alienate influential customers and lose essential revenue." The British turned to its North American colonies as a more reliable supply of trees suitable for masts. The tall, straight white pines that dotted northern forests proved to be perfect substitutes. Yet colonists in North America wanted those trees for local building supplies and for their own export trade. In 1691 the Massachusetts Bay Charter reserved "All trees of the diameter of 24 inches and upward at 12 inches from the ground" for the Royal Navy, embittering colonists. By the eighteenth century, the best mast trees had been harvested, leaving very few old-growth white pines in the remaining forests.[29]

European colonists who came to North America were awed and often overwhelmed by forests that appeared inexhaustible. Immigrants hacked and sawed their way through forests that soon proved to be anything but limitless. Williams reports that the British artist and writer Basil Hall in the 1820s described fields with "numerous ugly stumps of old trees; others allowed to lie in the grass guarded, as it were, by a set of gigantic black monsters, the girdled, scorched and withered remains of the ancient woods."[30] By 1900, half of the original forest cover in the US had been eliminated, much to many people's surprise.

White pine was the foundation of American lumber industry for more than two and a half centuries. White pine rarely grew in pure stands, but it was a key component of mixed forests from west of the Great Lakes to the Atlantic coast. Commercial logging of white pine at first focused on Maine, which had large stands of pine, plus swift rivers and good lake connections. With excellent sources of water power for sawmills, and good water access to ocean ports, Maine was the first region in North America to develop a profitable large-scale export industry.

The demands of new technologies and new markets led to new stresses on American forests in the early nineteenth century. The combination of two things – large capital investment into steam-powered sawmills and the constant threat of fires – meant Maine lumber barons, to stay in business, needed a rapid return on investments, since neither the forest nor the mill might be around for long. The demand for quick returns meant that efficient logging operations needed to run night and day, with lands logged in the fastest, cheapest way. Little thought was given to future regeneration.

As Maine's pine forests declined, lumbermen and loggers headed west to the Lakes States' pineries. The first step in the development of the Midwest logging industry was the removal of Indian title to the land. Treaties negotiated in the 1830s and 1840s began the process of dispossessing Ho Chunk, Chippewas, and Sioux from tribal forest lands. Speculation in timberlands quickly followed, marked by the migration of the Maine timber baron Isaac Stephenson to Wisconsin in 1845. Stephenson found amazing stands of white pine growing on sandy soils deposited by the glaciers. One Wisconsin acre could

yield as much as 222 cubic meters (94,000 board feet) of white pine, while in other places, such as Maine, 23.6 cubic meters (10,000 board feet) had been considered a nice stand.

Before 1845, logging in the Great Lakes States had been driven by farming, not by an export market for timber. Wood had been cut largely for local farm consumption, and logging had provided farmers with cash to buy farming supplies. But by the 1860s, the rate of forest clearing for farming sharply declined as farmers pushed onto the fertile prairies. Those farmers needed lumber, as did a growing industrial economy, and the rate of cutting for industrial logging skyrocketed. By the beginning of the Civil War, 153 million acres of forests were cleared for agriculture – and over 12 times that amount had been cleared for industrial logging. As William Cronon argues in *Nature's Metropolis*, Chicago became the center of industrial transformations of the northern forests.[31] In 1847, the Illinois–Michigan canal was completed, linking the Great Lakes with the Illinois and Mississippi rivers. With the shorter, cheaper, route for lumber, the price soon halved, and a substantial deterrent to settlement on the prairies was removed.

Lumber production grew from 11.8 million cubic meters (5 billion board feet) in 1850, to 30.7 million cubic meters (13 billion board feet) in 1870 – a rate of production that the great pineries of the Lakes States could not sustain for long. Sawmills in the state processed 141.6 million cubic meters (60 billion board feet) of lumber between 1873 and 1897, and, by 1898, the federal forester Filbert Roth estimated only 13 percent of the white pine was still standing. The ecological and human effects of this deforestation were devastating, particularly for the Great Lakes Indian peoples.[32] Most American settlers had thought forests were so abundant that loggers could never reach the end of them. When the white pines that seemed like they would be around for ever were gone in less than four decades, deforestation and its effects became a galvanizing issue for the nascent American environmental movement.[33]

In response, Congress created the federal forest reserve system in 1891, withdrawing millions of acres of federal land from settlement and placing it under the control of the Department of Interior's General Land Office. The legislation, however, provided no means for administration or management of those areas, nor did the law state what kind of use could take place inside the reserves. It was increasingly unclear whether the reserves were intended for use – which most people interpreted as grazing and logging – or for protection. In 1897 Congress passed the Organic Act, which clarified the purposes of the reserves: to protect water flow and to insure a continuous supply of timber. The Organic Act gave the government the authority to use the forests and made it clearer that the forests were not preserves. But different federal agencies struggled for control of the forests, and corruption was rampant.[34]

Finally, in 1905, Gifford Pinchot, the most charismatic forester of his generation, won control of the forest reserves within the Department of Agriculture. Gifford Pinchot created a Forest Service that, he believed, would put an end to wasteful exploitation of resources by the rich for private gain. He set out to protect the forests, not for eternal preservation, but for fair, conservative, sustainable use. He believed that the government had an obligation to put an end to wasteful exploitation of resources by the rich for private gain, and scientific forestry was the tool the federal agencies would use to do this.[35]

When Gifford Pinchot lobbied to create the Forest Service, Americans feared a timber famine that would undermine the basis of economic prosperity. Wood was the building block of civilization, or so Pinchot thought: it supplied the fuel to drive

machines; the ties to build the railroad networks; the timber to build housing for a growing population.[36] Few of Pinchot's peers recognized that industrialization was about to have profound effects on forests – effects that were not always negative.

The shift from wood fuels to coal increased carbon-dioxide emissions into the atmosphere, but it also slowed deforestation. Without the shift to fossil fuels, fewer of the world's forests would have survived. With new sources of energy, canals gave way to railroads, steam engines gave way to steam turbines, and eventually they all gave way to the internal combustion engines of the car, truck, and aircraft. These technological innovations unleashed stored energy into the atmosphere, releasing the buried carbon of 100 million years in just a few centuries, changing the earth's climate cycles in ways that scientists are only beginning to comprehend.[37]

Twentieth-Century Forests

Before the twentieth century, logging had its most dramatic effects on the temperate forests of North America, Europe, and Russia. But since 1900, in historian Brian Donahue's words, "the temperate forests have largely stabilized in area (and are now even increasing in volume), while the great onslaught has fallen upon the tropics."[38] Ricardo Carrere and Larry Lohmann's book, *Pulping the South*, shows how net deforestation in the temperate developed world has dropped close to zero, with increasing protections on forests in the northern latitudes. Yet this has been accompanied not by a decrease in wood consumption, but by a shift toward the south – specifically, to the world's moist tropical forests.

Tropical rain forests cover less than 6 percent of the globe, but they contain at least two-thirds of all plant and animal species, making them critical hotspots for biodiversity. Yet while logging in temperate forests has leveled off or even decreased, tropical moist forests have been cleared at very high rates in recent decades. Tropical deforestation occurs not just because of industrial logging, but because poverty and government policies encourage forest clearance. Subsistence and commercial agriculture, industrial ranching, and mining all pressure tropical moist forests as much as commercial logging.

Globally, since the 1950s, tropical rain forest has been reduced by over 60 percent. In some regions, the loss has been even greater. Between 1960 and 1990, Brazil destroyed as much of its Atlantic rain forest as had been lost during the previous three centuries. Less than 7 percent of its original 120 million hectares (463,300 square miles) remains, and much of that exists in fragmented patches rather than in contiguous forest.[39]

In some regions, clearing of tropical moist forests has decreased. Brazil's deforestation rate has dropped from 2,800,000 hectares in 2004 to 750,000 hectares in 2009. Yet these efforts could be severely undermined by climate change. Increasing temperatures and aridity lead to increasing forest fires, which, combined with deforestation, can trigger positive feedback cycles of forest loss in the drier southern and southeastern portions of the Amazon. Eighteen percent of the Amazon is currently cleared, and the loss of only 2 percent more could trigger significant dieback. A global temperature increase of 3.5 degrees Celsius (6.3 degrees Fahrenheit) could lead to the loss of half of the Amazon, according to World Bank reports.[40] With the industry shift toward the tropics has come consolidation, loss of jobs, increase in chipping and pulping, intensive capital investments, and the ecological changes brought about by widespread resort to eucalyptus and pine plantations in the name of efficient forest science.

To many people, tree-planting at first seems entirely a good thing, motivated by Arbor Day impulses. But as Carrere and Lohmann argue, "planting a tree, whether native or exotic, is in itself neither a positive nor a negative process. It is the social and geographical structures within which that tree is planted which make it one or the other." *Pulping the South* shows that reforestation has a complex history, growing from agroforestry projects composed largely of fruit-bearing species such as olives, palms, coffee, cocoa, and apples. Teak and eucalyptus began to be planted in the nineteenth century as a response to depletion of oak in Europe. Nevertheless, extensive industrial tree plantations are a twentieth-century invention, established as a result of overexploitation of native forests for wood. Their justification was the discourse of environmentalism. Yet they developed out of what Carrere and Lohmann term "forestry imperialism," not in response to local needs. Carrere and Lohmann argue that

> the problems modern forestry science sets and solves in short are those thrown up by a politics of centralized control of land aimed at extracting a very few types of raw material in industrial quantities. Working exclusively within mainstream forestry science means not asking questions about, and thus tacitly supporting, that politics. Forestry science is thus not a "neutral tool" which can be detached from its social surrounding and adapted to any political purposes.[41]

Tree plantations, therefore, are a way of responding to problems brought about by the prevailing economic model without addressing their underlying causes: rising demand, decreasing access, and changing climate.

Research in Africa on forest loss and recovery illustrates how politically complex forest science has become since World War II. The rising power of postcolonial, transnational organizations such as the Food and Agriculture Organization of the United Nations (FAO) and environmental nongovernmental organizations has transformed forestry discourses and practices. Conservationists have long argued that deforestation has run rampant throughout Africa, with grave impacts for biodiversity. The political ecologists Melissa Leach and James Fairhead argue that West African forests are not nearly as degraded as often assumed, while James McCann suggests that much less of the Ethiopian highlands was forested in historical eras than conservationists and colonial officials believed.[42] Global nongovernmental and governmental organizations may have systematically exaggerated forest loss, with profound effects on African peoples, blaming them for deforestation which they have not caused (and which may not exist). Assumptions about forest history drive forest policy throughout the world.

If we abandon the myth of pristine forests untouched by people and reject the assumption that people always harm forests, what other concepts can guide forest protection? Resiliency remains a useful concept for a world struggling to protect forests. Some forests have been so simplified that they lack resiliency in the face of change. Industrial tree farms fragment ecological interrelationships to the point that they cannot function without extensive inputs of petrochemicals. Other forests still have enough complexity and diversity to sustain themselves, even as the climate shifts. The critical difference between resilient forests and degraded forests is not the presence of humans, but rather the presence of interconnected communities that allow for functioning ecological and evolutionary processes. In a rapidly changing world, sustaining resilient forests may well become one of the key challenges facing communities.

Notes

1 D. Melnick and M. Pearl, "Not Out of the Woods Just Yet," *The New York Times*, April 20, 2006, accessed from http://www.nytimes.com/2006/04/20/opinion/20melnick.html on March 8, 2012.
2 J. R. Fleming, V. Jankovic, and D. R. Coen (eds.), *Intimate Universality: Local and Global Themes in the History of Weather and Climate*, Sagamore Beach, MA, Science History Publications, 2006, pp. ix–x.
3 O. Morton, *Eating the Sun: How Plants Power the Planet*, New York, HarperCollins, 2008.
4 N. Langston,"Air: Climate Change and Environmental History," in D. Sackman (ed.), *A Companion to American Environmental History*, New York, Wiley, 2010, pp. 33–50.
5 Morton, *Eating the Sun*, p. 232.
6 S. Pyne, *World Fire: The Culture of Fire on Earth*, New York, Holt, 1997, and S. Pyne, *Fire: A Brief History*, Seattle, University of Washington Press, 2001.
7 Morton, *Eating the Sun*, p. 288.
8 M. Williams, *Deforesting the Earth: From Prehistory to Global Crisis*, Chicago, University of Chicago Press, 2003.
9 Williams, *Deforesting the Earth.*
10 C. Mann,"1491," *Atlantic Monthly*, March 2002, accessed from http://www.theatlantic.com/past/docs/issues/2002/03/mann.htm on January 21, 2011.
11 M. Poffenberger, *Communities and Forest Management in Southeast Asia*, Gland, IUCN, 2000.
12 Poffenberger, *Communities and Forest Management in Southeast Asia*, p. 14.
13 Poffenberger, *Communities and Forest Management in Southeast Asia.*
14 M. Rangarajan,"Environmental Histories of South Asia: A Review Essay," *Environment and History* 2, 1996, pp. 129–43.
15 Williams, *Deforesting the Earth.*
16 D. Hughes, *The Mediterranean: An Environmental History*, Santa Barbara, CA, ABC-CLIO, 2005; Williams, *Deforesting the Earth.*
17 S. Schama, *Landscape and Memory*, New York, Knopf, 1995.
18 R. P. Harrison, *Forests: The Shadow of Civilization*, Chicago, University of Chicago Press, 1992.
19 N. Langston,"Teaching World Forest History," *Environmental History* 10, 2005, pp. 20–9; L. Heasley and R. P. Guries,"Forest Tenure and Cultural Landscapes: Environmental Histories in the Kickapoo Valley," in H. M. Jacobs (ed.), *Who Owns America? Social Conflict over Property Rights*, Madison, WI, University of Wisconsin Press, 1998, pp. 182–207.
20 International Institute for Environment and Development, *Land Tenure and Resource Access in West Africa*, London, IIED, 1999, p. 2.
21 J. C. Scott, *Seeing like a State: How Certain Schemes to Improve the Human Condition Have Failed*, New Haven, CT, Yale University Press, 1998, pp. 76–7.
22 B. Agarwal,"A Challenge for Ecofeminism: Gender, Greening, and Community Forestry in India," *Women & Environments International Magazine* 52–3, 2001, pp. 12–16.
23 P. Sutter,"Reflections: What Can U.S. Environmental Historians Learn from non-U.S. Environmental Historiography?," *Environmental History* 8, 2003pp. 109–29.
24 R. H. Grove, *Green Imperialism: Colonial Expansion, Tropical Island Edens and the Origins of Environmentalism, 1600–1860*, New York, Cambridge University Press, 1995.
25 P. Vandergeest and N. L. Peluso,"Empires of Forestry: Professional Forestry and State Power in Southeast Asia, Part 1," *Environment and History* 12, 2006, pp. 31–64.
26 Williams, *Deforesting the Earth.*
27 The Iroquois Wars (or Beaver Wars) were a series of conflicts in the mid-seventeenth century between the Iroquois Confederation and largely Algonquian-speaking tribes of the Great Lakes and Ohio Valley regions, who were supported by the French.
28 Williams, *Deforesting the Earth*, p. 71.

29 Williams, *Deforesting the Earth*, p. 176.
30 Williams, *Deforesting the Earth*, p. 209.
31 W. Cronon, *Nature's Metropolis: Chicago and the Great West*, New York, W. W. Norton, 1992.
32 S. Flader (ed.), *The Great Lakes Forest: An Environmental and Social History*, Minneapolis, University of Minnesota Press, 1983.
33 M. Williams, *Americans and their Forests: A Historical Geography*, Cambridge, Cambridge University Press, 1989.
34 N. Langston, *Forest Dreams, Forest Nightmares: The Paradox of Old Growth in the Inland West*, Seattle, University of Washington Press, 1995.
35 C. Miller (ed.), *American Forests: Nature, Culture, and Politics*, Lawrence, KS, University Press of Kansas, 1997.
36 Williams, *Americans and their Forests.*
37 Morton, *Eating the Sun.*
38 B. Donahue,"People and Trees: A Review of Deforesting the Earth," *Science* 9, 2003, pp. 907–8.
39 W. Dean, *With Broadax and Firebrand: The Destruction of the Brazilian Atlantic Forest*, Berkeley, University of California Press, 1997.
40 J. Astill,"Seeing the Wood," *The Economist*, September 23, 2010, accessed from http://www.economist.com/node/17062713 on March 8, 2012.
41 R. Carrere and L. Lohmann, *Pulping the South: Industrial Tree Plantations and the World Paper Economy*, London, Zed, 1996, p. 11.
42 J. Fairhead and M. Leach, *Misreading the African Landscape: Society and Ecology in a Forest-Savanna Mosaic*, New York, Cambridge University Press, 1996; J. Fairhead and M. Leach, *Reframing Deforestation: Global Analysis and Local Studies in West Africa*, London, Routledge, 1998; J. McCann,"The Plow and the Forest: Narratives of Deforestation in Ethiopia, 1840–1992," *Environmental History* 2, 1997, pp. 138–59.

References

Agarwal, B., "A Challenge for Ecofeminism: Gender, Greening, and Community Forestry in India," *Women & Environments International Magazine* 52–3, 2001, pp. 12–16.

Astill, J., "Seeing the Wood," *The Economist*, September 23, 2010, accessed from http://www.economist.com/node/17062713 on March 8, 2012.

Carrere, R., and Lohmann, L., *Pulping the South: Industrial Tree Plantations and the World Paper Economy*, London, Zed, 1996.

Cronon, W., *Nature's Metropolis: Chicago and the Great West*, New York, W. W. Norton, 1992.

Dean, W., *With Broadax and Firebrand: The Destruction of the Brazilian Atlantic Forest*, Berkeley, University of California Press, 1997.

Donahue, B., "People and Trees: A Review of Deforesting the Earth," *Science* 9, 2003, pp. 907–8.

Fairhead, J., and Leach, M., *Misreading the African Landscape: Society and Ecology in a Forest-Savanna Mosaic*, New York, Cambridge University Press, 1996.

Fairhead, J., and Leach, M., *Reframing Deforestation: Global Analysis and Local Studies in West Africa*, London, Routledge, 1998.

Flader, S. (ed.), *The Great Lakes Forest: An Environmental and Social History*, Minneapolis, University of Minnesota Press, 1983.

Fleming, J. R., Jankovic, V., and Coen, D. R. (eds.), *Intimate Universality: Local and Global Themes in the History of Weather and Climate*, Sagamore Beach, MA, Science History Publications, 2006.

Grove, R. H., *Green Imperialism: Colonial Expansion, Tropical Island Edens and the Origins of Environmentalism, 1600–1860*, New York, Cambridge University Press, 1995.

Harrison, R. P., *Forests: The Shadow of Civilization*, Chicago, University of Chicago Press, 1992.

Heasley, L., and Guries, R. P., "Forest Tenure and Cultural Landscapes: Environmental Histories in the Kickapoo Valley," in H. M. Jacobs (ed.), *Who Owns America? Social Conflict over Property Rights*, Madison, WI, University of Wisconsin Press, 1998, pp. 182–207.

Hughes, D., *The Mediterranean: An Environmental History*, Santa Barbara, CA, ABC-CLIO, 2005.

International Institute for Environment and Development, *Land Tenure and Resource Access in West Africa*, London, IIED, 1999.

Langston, N., "Air: Climate Change and Environmental History," in D. Sackman (ed.), *A Companion to American Environmental History*, New York, Wiley, 2010, pp. 33–50.

Langston, N., *Forest Dreams, Forest Nightmares: The Paradox of Old Growth in the Inland West*, Seattle, University of Washington Press, 1995.

Langston, N., "Teaching World Forest History," *Environmental History* 10, 2005, pp. 20–9.

Mann, C., "1491," *Atlantic Monthly*, March 2002, accessed from http://www.theatlantic.com/past/docs/issues/2002/03/mann.htm on January 21, 2011.

McCann, J., "The Plow and the Forest: Narratives of Deforestation in Ethiopia, 1840–1992," *Environmental History* 2, 1997, pp. 138–59.

Melnick, D., and Pearl, M., "Not Out of the Woods Just Yet," *The New York Times*, April 20, 2006, accessed from http://www.nytimes.com/2006/04/20/opinion/20melnick.html on March 8, 2012.

Miller, C. (ed.), *American Forests: Nature, Culture, and Politics*, Lawrence, KS, University Press of Kansas, 1997.

Morton, O., *Eating the Sun: How Plants Power the Planet*, New York, HarperCollins, 2008.

Poffenberger, M., *Communities and Forest Management in Southeast Asia*, Gland, IUCN, 2000.

Pyne, S., *Fire: A Brief History*, Seattle, University of Washington Press, 2001.

Pyne, S., *World Fire: The Culture of Fire on Earth*, New York, Holt, 1997.

Rangarajan, M., "Environmental Histories of South Asia: A Review Essay," *Environment and History* 2, 1996, pp. 129–43.

Schama, S., *Landscape and Memory*, New York, Knopf, 1995.

Scott, J. C., *Seeing like a State: How Certain Schemes to Improve the Human Condition Have Failed*, New Haven, CT, Yale University Press, 1998.

Sutter, P., "Reflections: What Can U.S. Environmental Historians Learn from non-U.S. Environmental Historiography?," *Environmental History* 8, 2003 pp. 109–29.

Vandergeest, P., and Peluso, N. L., "Empires of Forestry: Professional Forestry and State Power in Southeast Asia, Part 1," *Environment and History* 12, 2006, pp. 31–64.

Williams, M., *Americans and their Forests: A Historical Geography*, Cambridge, Cambridge University Press, 1989.

Williams, M., *Deforesting the Earth: From Prehistory to Global Crisis*, Chicago, University of Chicago Press, 2003.

Further Reading

Guha, R., "The Prehistory of Community Forestry in India," *Environmental History* 6/2, 2001, pp. 213–38.

Guha, R., *The Unquiet Woods: Ecological Change and Peasant Resistance in the Himalaya*, Berkeley, University of California Press, 2000.

Langston, N., "American Forest History," in K. Brosnan (ed.), *Encyclopedia of American Environmental History*, vol. 2, New York, Facts on File, 2010, pp. 570–5.Shiva, V., *Ecology and the Politics of Survival: Conflicts over Natural Resources in India*, New Dehli and New York, Sage, 1991.

Tucker, R., *Insatiable Appetite: The United States and the Ecological Degradation of the Tropical World*, Berkeley, University of California Press, 2000.