“Deep Forestry”: Shapers of the Philippine Forests

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Abstract

Little attention has been paid to writing a more inclusive forest history of the Philippines, one that combines a biocentric and anthropocentric focus. Deep forestry is an attempt to do just that. It shows how the forest was shaped by climate, soil, fire, and animals as well as by human actions. Not only did people shape the forest, but the forest shaped the people. This article examines how these deep historical processes have worked out over time and explores the implications of adopting such a perspective.

Introduction

The forest is a dynamic place, a complex ecosystem that has adapted over time to climatic and edaphic conditions. More than trees, it is also about plants, animals, and the other agents that live in, use, and consume the forest. Yet when it comes to writing forest history, the complexity of this biophysical system often vanishes and is replaced by a simple chronicle of human wants, needs, and actions. Much forest history becomes a narrative of humans in the forest or, more precisely, the rate at which men and women destroy the forest over time. However, human actions are not alone in determining the composition of the forest; other shapers both precede humanity and continue alongside it. When deciding who the shapers of the Philippine forests are, this history has to start much earlier than human occupation and include a wider cast of protagonists.

Finding the right balance between nature and humanity in the forest has not always been an easy matter to determine. On the one hand, ecologists view people as just one among a variety of factors that alter the environment.[1] Historians, on the other hand, see the forest as largely "synthetic—man made."[2] As Donald Worster wrote in 1984, "there is little history in the study of nature and there is little nature in the study of history."[3] If the subsequent development of environmental history as a recognized subdiscipline has been partly driven by a desire to put the science back into history, the emergence of historical ecology has been more of an attempt to examine "history from the viewpoint of nature."[4] The result has been a profusion of new forest histories that do justice to both disciplines, although the scale is often on localized places rather than nations or larger regions.[5] There is a strong North American bias to these works, but the cultural ecology of European forests has also received attention.[6] The same cannot be said for Southeast Asia, until recently a heavily forested region. The focus here has mainly been on charting the rapid loss of forest or the attempts to conserve what little remains of it and its denizens. Accordingly, the ecology of the forest has mainly been seen as a political matter.[7]

"Deep forestry," then, is an attempt to put the nature back into the study of Southeast Asian forest history. It combines both a biocentric and anthropocentric focus. In the Philippines, climate and soil, for example, determine where and which species grow or predominate. Fire is often classified as anthropogenic, but it can also be autogenic, even in tropical forests. And then there are the living agents, starting not with the human presence but rather with those far older shepherds of the forest, the *anay* or white ants that prune away the weak and debilitated trees and consume the dead and dying ones. Finally there is humanity, with all its changing needs and wants as well as its increasing desire for

habitat at the expense of the forest. Over the centuries, these processes have shaped the forests of the Philippines in many and varied ways.

The Philippines comprise an arc of some 7,100 islands and islets scattered over approximately 500,000 square miles of the Western Pacific Ocean. The archipelago is characterized by active volcanism, strong seismic activity, and considerable isostatic imbalance. Most of the islands have a mountainous core that is punctuated on the larger ones by narrow structural or alluvial valleys and more extensive lowlands. Overall, approximately 65 percent of the land area of the archipelago is upland. Regular volcanic eruptions and active faulting bestow a degree of sharpness to the landscape of some regions while heavy rainfall in other areas weathers away the rocks to create a terrain of gentle slopes. Rivers are mainly short, have seasonal flows, and are prone to flooding.[8] Despite the physiographic diversity among islands, the archipelago is usually split into three major divisions: Luzon and some offshore islands, the chief of which are Mindoro and Palawan; the Visayan group comprising the major islands of Panay, Negros, Cebu, Bohol, Leyte, and Samar, as well as some smaller ones; and Mindanao in the south, including the myriad of small islands stretching from the southern tip of the Zamboanga Peninsula southward as far as northeastern Borneo (figure 1).

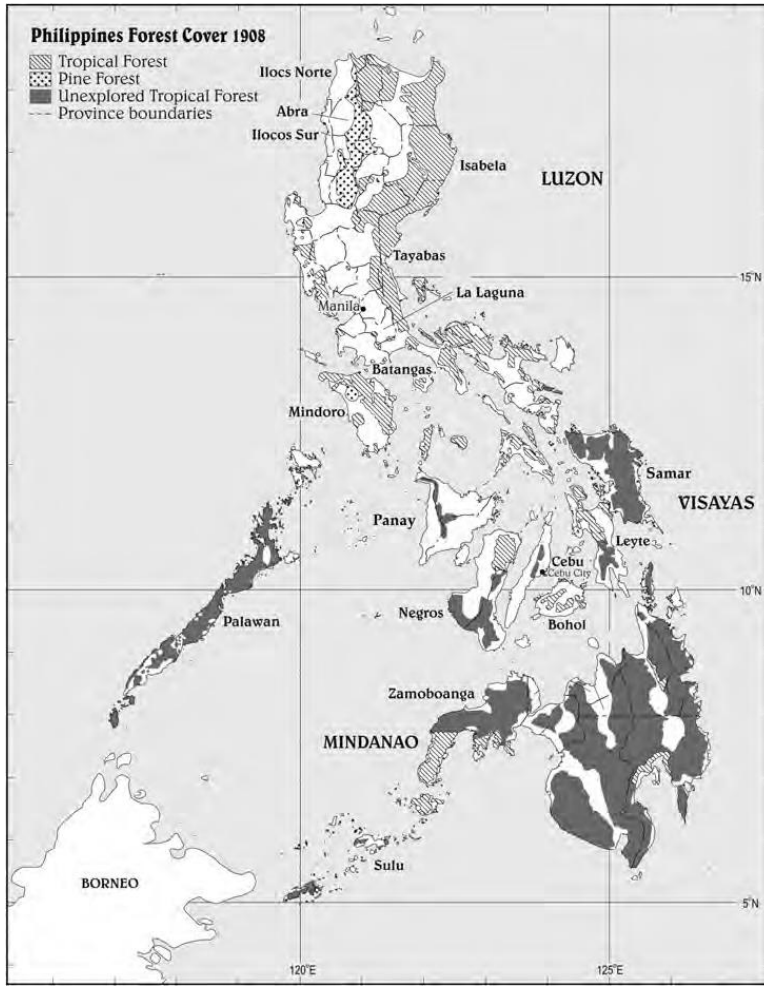

Figure 1 Philippine Forest Cover by Type in 1908. Credit: Author.

The peoples who inhabit these islands are no less ethnically and culturally diverse, speaking as many as two hundred distinct languages as well as countless dialects at the time of European contact. Prior to the advent of Spanish colonialism in 1565, there were no identifiable states in the archipelago and only a small number of weakly centralized or "segmentary" polities located mainly in Mindanao and Sulu.[9]

Colonialism integrated the Philippines into the world system, first as an important entrepôt of exchange between Asian luxury items and American silver, and subsequently as a supplier of raw materials such as sugar, tobacco, and hemp during the nineteenth century.[10]

The Spanish era ended in 1898 not with independence but rather with the imposition of yet another half century of foreign rule under the aegis of the United States. Much has been made of the "exceptionalism" of the American colonial administration with its emphasis on "benevolent assimilation" and gradual self-rule, but the colony continued to be exploited, mainly for the same tropical produce that was now destined increasingly for an American market, and with the important addition of lumber as a major export commodity.[11]

Independence came in 1946, but it did not bring any major changes to the economic orientation or market position of the new nation. Indeed, during the 1960s and 1970s, resource exploitation only intensified, especially of the islands' extensive timber reserves. The trees that had once cloaked the entire archipelago in a mantle of green were reduced to a few remnant stands of primary forest, leaving behind barren slopes prone to landslides and flash floods. To fully appreciate how this deforestation has been brought about necessitates an approach that balances an understanding of forest ecology with the narrative of environmental history.

Deep Forestry

Deep forest history develops from the norms and values that underlie deep ecology, which emerged in the 1960s as a radical critique of materialistic, Western-inspired consumerism and its ability to manage the earth's resources. Deep ecology distinguishes between an anthropocentric or

human-centered approach and a more biocentric one in which humans are treated as only one element in an ecosystem.[12] As defined by Arne Naess in 1972, deep ecology includes an awareness of the internal interrelatedness of ecosystems, ecological egalitarianism among species, diversity and symbiosis, an antisocial class posture, an appreciation of ecological complexity, and local autonomy and decentralization, in addition to a strong stand against pollution and resource depletion.[13] Deep ecology differentiates itself from "shallow" or reformist ecology. The latter advocates specific reforms to enhance the health and affluence of people in the developed world but without challenging the premises of the dominant social paradigm. Deep ecology offers, instead, an alternative vision founded on a complete rejection of the anthropocentric notion of the human dominance of nature.[14]

The American conservationist Aldo Leopold called on people to reject the primacy of human needs and instead "think like a mountain."[15] Harking back to Leopold's injunction, what I call deep forestry is an attempt to think more like a forest. Deep forestry places human behavior within a larger framework of change in the forest. In particular, it extends the web of relationships to include nonhuman agents. Its temporal reach, therefore, spans millennia rather than centuries. Exploring forest history from this perspective adds to both the knowledge of how the forest changed over time and the extent to which human actions contributed to these processes in the past.

Applying a deep forestry approach shows how the forests of the Philippines have been shaped as much by nonhuman factors as by human hands, although the balance has certainly shifted over time with human influence steadily growing. Climate, soil, fire, and animals such as the white ant have left

an imprint on the forest both through their own actions as well as through their impact on human agency.

Climate and soils

The climate of the archipelago is controlled first by latitude and then by altitude. The temperature at any given location is also greatly affected by the sea, topography, aspect, and prevailing wind direction. Lying between the equator and the Tropic of Cancer, the lowlands of the Philippines experience average temperatures in the mid to high 20°C, but the climate cools as the ground rises at a rate of approximately 1°C for every additional 150 meters in elevation.[16]

Rainfall is the most important influence on forest growth. Monsoonal or rain-bearing winds that shift their direction twice per year govern precipitation rates over the entire western side of the archipelago, creating distinct wet and dry seasons. Over the eastern part of the islands, however, rainfall is distributed throughout all months of the year, and there are no pronounced wet and dry seasons. These two different climatic regions roughly cut the Philippines in two along a north-south line running through the central cordillera of Luzon to Laguna de Bay, and then southward along the west coast of Panay to the Sulu Sea. There are certain notable exceptions to this division. Areas of the heavily forested regions of western Mindoro and eastern Palawan, which fall to the west of the divide, experience a nonseasonal climate. The western portions of the island of Negros and most of Cebu, which fall to the east of the divide, are monsoonal and much less heavily forested.[17]

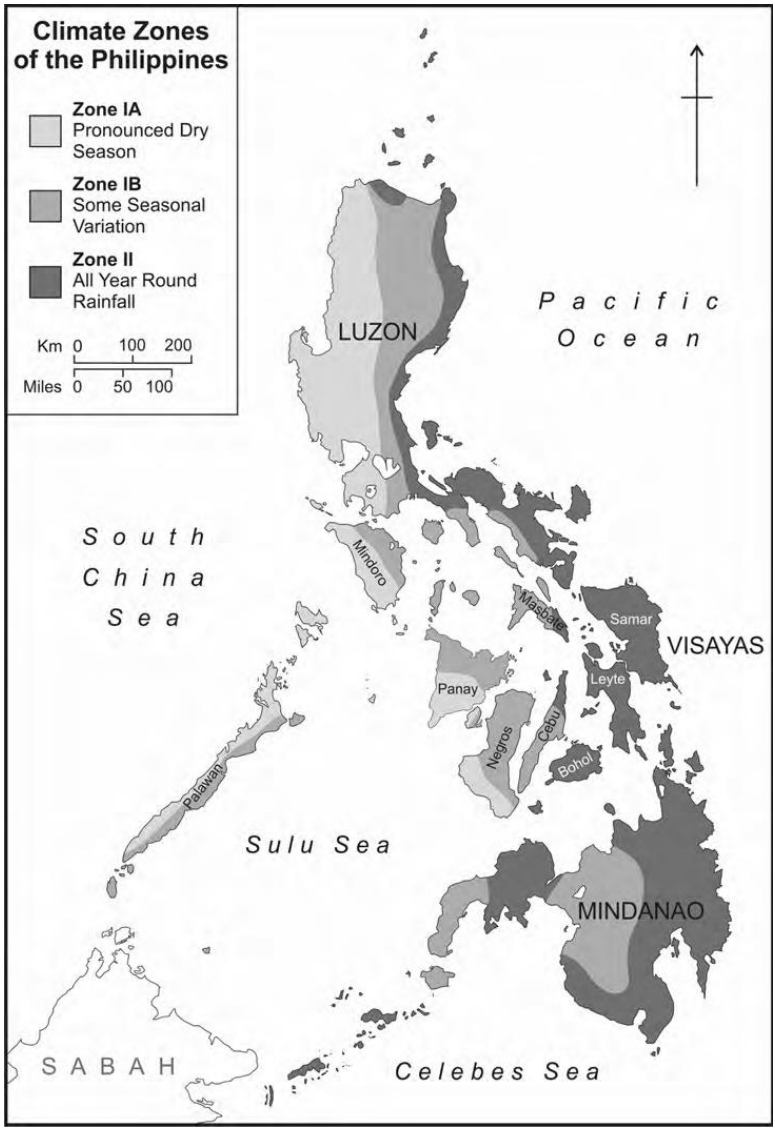

Figure 2: Climate Zones of the Philippines. Credit: Author.

Commenting on the distribution of tree species, Donald Matthews, professor at the new School of Forestry

established by Americans at Los Baños, wrote in 1914 about the need to "pay very particular attention to the local climate which is produced by the local topography, altitude and the direction of the wind movement."[18] While there is little difference in the total precipitation between west and east (approximately 2,500 mm), there is great variation in seasonal rainfall.[19]

In general, species consistently requiring a large amount of moisture in the soil develop well in the eastern region. The best development of dipterocarps (literally "two-winged fruits"), the principal family of trees to be found in the islands and in the Asian rain forests in general, occurs in the eastern and northern part of Negros and in other parts of the Visayas, on Mindanao, and along the east coast of Palawan. Species that flourish in fairly dry environments are found across the archipelago because there are areas of relatively low rainfall in both east and west. Moreover, at elevations over 900 meters, rain falls throughout the year, making the climate suitable to trees demanding high atmospheric humidity. As a rule, though, certain species prosper in one or the other region. Lauan (*Shorea negrosensis* and *Shorea contorta*), apitong (*Dipterocarpus grandiflorus*), and guijo (*Shorea guiso*) develop best in the east, where there is no seasonal change in rainfall; yacal (*Shorea laevis*), narra (*Pterocarpus indicus*), and molave (*Vitex parviflora* Juss.) grow best where there is a dry period.[20] Grasslands are also more common in areas with a prolonged dry season. Apart from typhoons during certain months of the year, the principal effect of the wind on vegetation depends on whether it is moisture bearing.[21]

Soil and subsoil are also important to the physical characteristics of the forest and to the distribution of species. Soil affords anchorage for trees and also constitutes the reservoir from which they derive water, nitrogen, and other

minerals. Its texture and the amount of air and water that the soil contains govern its fertility. Just as important as soil fertility is soil depth. In general, 1.5 meters is sufficient depth for almost any tree. If the soil is deep and moisture retentive, species that require high moisture may be able to exist in localities of relatively low rainfall. Conversely, trees that usually require less soil moisture may be unable to exist in regions of high rainfall if the soil is sandy or shallow.[22] All species of tropical trees grow better in soil that is minimally rich, deep, porous, moist, warm, and rich in humus.[23] Only very shallow-rooted species such as teak (*Tectona grandis*), molave, and mangrove species can survive in shallow tropical soils.[24]

As a result of the distinct precipitation shadow between the western and the eastern halves of the archipelago and differences in soil depth and moisture, the forests of the Philippines are quite varied in their composition. Six types of forests have been commonly identified. *Dipterocarpaceae* are generally large trees, reaching heights up to 50 meters and with diameters of 100 to 150 centimeters. They are mainly evergreens and are found on nearly all terrains from immediately behind the frontal beach to altitudes of about 800 meters. Species in the family vary greatly, including valuable hardwoods such as amugis, guijo, and yacal, as well as less valuable hardwoods like apitong, lauan, and tangile.[25]

The molave forest, in contrast, is composed of non-dipterocarp hardwoods such as molave and narra.[26] Such species form more open landscapes where the dominant trees are less abundant and are set farther apart, are short boled and irregular in form, and have wide-spreading crowns. These species thrive in topography similar to the dipterocarps but grow in much sparser stands. Their timber is much sought after because of its strength and durability, and for its value in shipbuilding, fort construction, and furniture making.

Other forest types are more localized: mangrove on the mud flats at the mouth of rivers and along the shoreline, beach forests in coastal areas, pine forests in the upland plateaus of northern and central Luzon, and mossy forests in the high mountain regions.[27]

In 1910, Harry Whitford, head of the Tropical Division of the Yale Forestry School, estimated that dipterocarps accounted for 75 percent of all forests, molave for 10, mountain for 8, pine for 5, and mangrove for only 2.[28] In other words, most of the forests of the archipelago were dominated by *Dipterocarpaceae*, leading geographer David Kummer to observe, "The history of deforestation in the Philippines is in large part the history of the decline of the dipterocarp forest."[29] However, it is not clear whether the forests have always existed in these proportions, although the predominant species have been dipterocarps for many millennia. Whitford noted the "more or less complete destruction of the original forest" with respect to molave. He also wrote that mangrove in thickly populated districts "has been reduced to such an extent as to render it valueless for anything except firewood"; that in coastal areas, where settlements were more numerous, "the original vegetation has been greatly modified"; and finally, he added that many mountain areas "have already been cleared of their forests by caiñgin [swidden] makers and are now covered in grass."[30]

The diary of American forester Gifford Pinchot, who visited the islands in 1902, gives some idea of how the forest might have looked before large-scale commercial felling of the dipterocarp forests began. Like other American foresters of the era, he was unfamiliar with the tropical species he encountered and tried to make sense of what he saw around him by comparing it to what he knew, stressing "the curious similarity between the forests of the Islands and some of our own," and how the general appearance of many trees

distinctly resembled “certain species at home.”[31] Nevertheless, his impressions are still valuable as a record of the forest at a particular time. In many places, Pinchot noted how the forest came right down to the water's edge, even overhanging the high-water mark and giving the shoreline “an enormously interesting and enormously fascinating appearance.”[32] The trees were of an extraordinary size, many with diameters in excess of 3 feet, but he was too unfamiliar with the species to get any idea of their distribution.[33] Even though the composition of the forest changed from island to island, he noted a general pattern. Beginning at the coast, the forest passed through gradual transformations: trees were shorter, smaller in diameter, and “less valuable” at the water's edge than they were farther inland. The finest timber, with the best logs, was always on the steepest slopes, but the forest began to diminish again at higher elevations. Pinchot marveled at the very fabric of the forest that included not only the trees but also the vines, ferns, rattans, and bamboos that sprang up and grew to immense sizes wherever the overhead canopy was disturbed.[34]

Fire and the Forest

These forests were not the work of climate and soil alone. Fire, too, shaped the forest, although the tropical vegetation was difficult to ignite and fire was not easily maintained in the moist shaded environment under the dense tropical canopy. In those areas of the archipelago without a distinct dry season, the rapid onset of decomposition and the relentless activity of insects meant there was little forest litter to sustain a fire. In old-growth forests, the ground was almost free from understory vegetation, and the large thick, leathery leaves of the surrounding trees were usually not particularly flammable.[35] In younger forests with a dense understory, the undergrowth never dried out.[36]

In those areas that experienced a dry season, it was also difficult for fire to spread. Large logs, when burned, usually only consumed the surrounding undergrowth for less than a meter on either side. Only under exceptional circumstances was the forest vulnerable to fire. If, for instance, the dry season was unusually hot, such as during an El Niño/Southern Oscillation event, then fires might spread from grasslands to forests.[37] Typhoons also left the forest more susceptible to fire. Some trees were blown down, others were stagheaded, and still more lost branches or had their trunks split open. Even the foliage of green and robust trees could turn brown in a storm's wake.[38]

While fire may precede human activity in the forest, it invariably accompanies it. Most fires were started by indigenous farmers practicing swidden or slash-and-burn agriculture (locally called *kaiñgin* [Spanish *caiñgin*]). While swidden agriculture exists in many variations, it shares certain characteristics, such as the use of fire in preparing the land, the shifting of crops from one field to another, and the abandonment of a field after a short period of use.[39] These fires released nutrients to fertilize the soil, and they were also a primary tool in clearing land for cultivation.

Fire influenced the type of vegetation that followed field abandonment. Where clearings remained in cultivation for more than one season, minimal tree reproduction occurred. The soil became dry and baked, which favored the colonization of cogon (*Imperata cylindrica*), a tall perennial grass native to Southeast Asia that constrained tree regeneration.[40] By 1914, it was estimated that almost half the archipelago, some 124,320 square kilometers (48,000 square miles) was covered in grasslands.[41] These grasslands were a constant menace to both farm and forest, acting as a breeding ground for locusts and as a source of fire.[42] Grassland fires are frequent in those areas of the archipelago that experience

a dry season, and the northeast monsoon that begins in May or June was an important factor in the spread and persistence of fires once started.[43]

In the mountains, too, fire fashioned a very particular vegetative regime. In the forests of northern Luzon, much of the terrain is exceedingly rugged, and fires, even when detected, are difficult to extinguish. Here, fire was frequent.[44] The Igorots of Benguet and other upland peoples were pastoralists who possessed fine herds of cattle that browsed on the rich grass between the pine trees. To maintain these pastures, the Igorots regularly burned the mountainsides during the dry season.[45] The succession of forest clearing to grassland was more likely to occur on sloping ground and in those areas with a pronounced dry season. While some fires were due to carelessness, many were deliberately lit by hunters eager to attract game, as well as by pastoralists.[46] The intense heat of these fires killed off surviving stumps and seedlings, causing the tree line to slowly recede over time.[47] In 1914, the American forest adviser, Donald Williams, stated that the frequency of fire by the early twentieth century was commensurate with the size of the population and in inverse proportion to the number of forest rangers.[48]

By the early nineteenth century, three distinct types of landscapes dominated most of the Philippines: cultivated areas, open or semi-open grasslands, and forest. The relative proportion of these areas varied according to physical features, soil quality, and the density of human population. As a general rule, agricultural lands occupied the fertile river valleys and adjacent slopes, grasslands spread over the rocky or steep slopes, and forests covered the mountains.

Europeans changed fire regimes, both intentionally and unintentionally. On the one hand, fire was the inadvertent consequence of the new steam-powered machinery used in

commercial logging at the beginning of the twentieth century. Sparks from railway locomotives caused fires.[49] Fires were more frequent during the dry season and especially in areas that had been logged. However, blazes were not generally large and mainly consumed the dry tops of trees and the refuse left from ones that had fallen.[50] On the other hand, fires might be intentionally set to clear the ground before logs were skidded to a landing. The slash, or woody debris, generated during logging operations proved highly flammable. Uncontrolled fire in logged-over areas destroyed all forest growth. George Ahern, first chief of the US Philippine Island Bureau of Forestry, noted, "Even under most favorable conditions following logging operations the young seedlings have difficulty in withstanding the strong isolation to which they are exposed, but after such a destructive fire conditions are rendered altogether hopeless."[51] While the bureau required that concessionaires fit efficient spark arresters to locomotives and logging engines and maintain an adequate firefighting force to both patrol and extinguish fires, the rigid exclusion of fire from the forest was well-nigh impossible.[52] Fires in logged-over sites were frequent events by 1930, and they were apparently "becoming more and more of a problem."[53] Sometimes, too, fires were deliberately lit by forestry officials "to clear up old caiñgins" or as a preventive measure before the start of the fire season.[54] Europeans also shaped the forest: they abetted the spread of fire to locales where it had rarely been seen before, and, by clear-cutting burned over areas, encouraged the spread of grasslands.

Anay: Shepherds of the Trees

The termite, or "white ant," was integral to the very fabric of the forest.[55] Known generically as *anay* in the Philippines, more than 1,500 different species are distributed throughout the tropics. In tropical forests, anay remove ground litter and

enrich the soil by working leaf matter deeper into it. Most species only attack dead plant material, but a few are serious pests to living trees.[56] In the Philippines, there are 18 genera of termite with a total of 54 species. Most species are dry-wood termites that establish subterranean nests and mainly attack wood already in contact with the soil, but some termites construct cellulose tunnels with which to ascend buildings. The most common species are the mound-building termite (*Macrotermes gilvus*) that constructs extensive systems of covered passages to attack dead wood including structural woodwork. The most destructive, however, is the Philippine milk termite (*Coptotermes vastator*), so called because the workers are white and the soldier ants emit a milky secretion when disturbed. Other common species include the Los Baños termite (*Microcerotermes losbanosenses*) that attacks waste lumber and woodwork such as roof joists and rafters, and the Luzon point-headed termite (*Nasutitermus luzonicus*) that prefers to construct nests on tree trunks. Together with *Cryptotermes cynocephalus* and *C. dudleyi*, these species are widely distributed, cause significant structural damage to buildings, and are considered serious pests.[57]

In many ways, anay were the real masters of the shade beneath the forest canopy, not because they devoured the ground litter or because they attacked damaged trees. They shaped the distribution of species growing in forests by influencing which trees people were willing to harvest. Of the hundreds of tree species found in the Philippine forest, only thirty to forty were regularly felled, a selection largely made by excluding "trees the natives knew the white ant would eat." Over hundreds of years, the effect of felling only a few tree species was the "complete exhaustion in certain provinces of the best kind of timber."[58] Tree species that anay did not eat were the timber mainly used by indigenous people.[59] As Gifford Pinchot noted in 1903, "You find the

ants everywhere, in the towns and out of them, and you find also that they have controlled the whole process of lumbering in the Islands until now, and the reason why the cut-over land is in its present condition in the Philippines, the reason why certain species are getting scarce in certain places, are almost entirely due to the fact that their timbers resist the white ant. What does not resist the white ant has been let alone."[60] Moreover, those portions of even the hardest untreated woods buried underground succumbed over time to the attacks of the white ant and had to be replaced.[61] Similar sentiments had been expressed twenty-six years earlier by officials in the Ministerio de Ultramar, the Spanish colonial office in Madrid. They, too, were aware of the situation and appreciated that "in Tayabas and other localities of this archipelago woods such as mangachapuy, betis, banaba and others of the most sought after species … are already very scarce."[62]

After the Spanish colonized the islands in 1565, white ants continued to influence which tree species were logged. There was an increasing demand for hardwoods resistant to anay for use in the construction of new urban centers and upland fortifications. Accessible stands of such timber were increasingly hard to find, and mature seed-bearing trees became exceedingly rare. This culling of the largest trees led to a form of genetic erosion, diminishing the contribution of a particular species to the general biomass, and to the attenuation of remaining stands with consequences for the fauna and flora dependent on them. Pressure on resistant tree species only diminished after 1910 when extensive field trials at the newly established timber testing laboratory at Los Baños discovered that creosote was an effective treatment against white ant. Subsequently, loggers harvested a larger number of timber species for construction purposes.[63]

In addition to white ants, other animals have also shaped forest cover. In particular, exotic herbivores like cattle, sheep, and horses prevented forest regrowth. Introduced by Spaniards in the sixteenth century, domestic cattle were never numerous in the Philippines until the late nineteenth century as the local population had neither the taste nor the wealth for beef.[64] Sheep were even less common and confined to upland areas. The horse, too, was not native to the Philippines. First brought from New Spain and subsequently imported in much greater numbers from China and Japan, horses were successfully bred on "great stock farms" established by the religious orders in the seventeenth and eighteenth centuries.[65] Unlike cattle, horses played a significant role in the economic life of the wider society, proving readily adaptable to the local terrain and to the transportation needs of the indigenous population. Horse ownership was widespread by 1800 with many peasant families reportedly having more than one mount. For most of the year, however, horses were moved to communal pastures in the uplands and left to scavenge for whatever they could find to eat. In more mountainous areas, they had already gone feral by 1689.[66] In this way, the horse was an unwitting agent hindering forest regeneration and turning cleared or logged areas into grasslands.

State and Forest

Making a division between nonhuman and human agents is somewhat arbitrary in deep forest history. It is often the symbiotic relationship between the nonhuman and human that proved to have such an important impact on the shape of the forest. Human actions in the Philippines undoubtedly had unforeseen results on the forest when coupled with the forces of the natural world, extending the reach of fire, bestowing on the white ant the power to determine which species were cut, or, as in the case of horses, hindering regrowth. All of these combined factors changed the composition of the forest

beyond recognition. However, human impact evolved over time in relation to the wider historical context, as a result of changes in demand for timber products and, ultimately, as the composition of the forest itself changed over time. In particular, the formation of the state in the mid-sixteenth century and the commercialization of forestry beginning in the mid- to late-nineteenth century were decisive turning points in the forest history of the Philippines. Not all timber has the same qualities, and some are more conducive to human purposes than others. Certain species, therefore, have been felled more often than others. Trees and timber products were used among other purposes for housing, transportation, furniture, utensils, writing, medicine, as a source of heat, and even as clothing. The tools of agriculture, the plough and dibbling stick, were primarily wooden, as were the majority of the weapons of war, the palisades of forts, and the hulls of canoes and warships. In tropical regions, the use of wood was even more commonplace; the sheer extent of the forest, the qualities, size, and shape of its trees, precluded the use of alternatives except for purposes of ostentatious display or in the case of absolute necessity. All this wood initially came from the forest, not from plantations, so that the recent history of the forest is largely commensurate with the history of the societies that lived in and about it.

Little is known about the precise impact of precolonial societies on the environment. While no hydraulic states emerged in the archipelago to rival those found elsewhere in Southeast Asia, Metal Age chiefdoms existed and were able to expand quite rapidly with the advent of a foreign trade in Chinese porcelain after the tenth century. The added wealth this trade provided even created the conditions whereby several larger scale interregional polities were able to develop at Manila, Cebu, Sulu, and Magindanao. Chiefly power rested on engaging in alliance-building exchanges through attracting foreign luxury goods and augmenting the available

labor supply by intensive maritime raiding. Raiding prompted the increased construction of coastal fortifications, an expansion of metal weapon production, the adoption of foreign military technology, and the emergence of a specialized warrior class—all of which required wood.[67]

Warfare was a highly developed aspect of daily life in the societies that Ferdinand Magellan and Miguel Lopez de Legazpi encountered in the sixteenth century. Weaponry was mainly for hand-to-hand combat and was made, at least in part, from wood: the hilts of bladed weapons, the shafts of fighting spears, the fire-hardened heads of bamboo javelins and arrows, the hardwood made into breastplates or the fibrous corky woods used in the construction of shields.[68] Many Filipinos spent much of their time on water, and many military engagements also took place at sea. In these circumstances, the construction of warships was a highly developed aspect of military technology. These *karakoras* (Spanish *caracoas*) were sleek, double-ended vessels of low freeboard and light draft with a keel shaped in one continuous curve. They mounted one or more square sails and had double outriggers on which up to four banks of paddlers provided speed in battle. They also had a raised platform amidships for a contingent of warriors. They were light, flexible, extremely maneuverable, and perfectly suited to the maritime conditions in which they operated: shallow drafted for inshore work, flexible enough to better resist coral reefs or running aground on rocky shores, and difficult to sink. They were also fighting machines par excellence as Europeans later learned to their discomfort. Karakoras reached bursts of speed of 12 to 15 knots in contrast to the 5 or 6 knots that a European galleon made.[69] As one Spanish observer, Francisco Combes, ruefully noted in 1667, "Their ships sail like birds, while ours are like lead in comparison."[70]

The preferred wood used in the construction of karakoras was molave because of its strength. Keels were hewn from single lengths on which were mortised serpent-like extensions, giving the vessel its characteristic half-moon shape. The length of vessels was often in excess of 25 meters. Additional layers of planks (five or six) were then added to the sides according to the size of the craft.[71] The prevalence of these crafts and the amount of wood felled for their construction is difficult to gauge. However, the Maguindanaos of Mindanao were able to muster a war fleet of a hundred such vessels to raid the Visayas in 1602, and Rajah Bongsu of Jolo apparently set out for southern Luzon in 1627 with a fleet of karakoras that carried two thousand fighting men.[72] Despite the fact that warfare was endemic in these pre- or proto-state societies, the environmental effect on the forest was likely to have been localized and limited given the weaponry available and the low population density.[73]

The first large-scale, permanent revolution in land use is usually associated with Spanish colonialism, particularly the development of a core region and the emergence of a state system in the Philippines after 1565.[74] On the one hand, this is a narrative about the construction of urban and municipal centers as sites of administration or evangelization through the process of conquest and *reducción* (population concentration). On the other hand, it is about the development of an early agricultural market and the introduction of new crops from the Americas. The erection and maintenance of this state so far from Europe also required defense from enemies both without and within. Constructing ships and forts intensified the demand for timber. However, simply equating state formation with deforestation is too crude an analysis. Not all wood serves human purposes equally well at any given time: particular woods were selected for specific purposes and felled regularly while others were viewed as worthless and largely left alone.[75]

In the Philippines, the cities and towns so characteristic of Spanish colonialism the world over were mainly built from woods. Even the capital, Manila, founded in 1571, was initially a collection of wooden structures.[76] The indigenous house, the *bahay-kubo*, was primarily constructed of bamboo (*Bambusa blumeana* Schultes F), roofed with nipa palm (*Nipa fruticans* Wurmb.), and lashed together with rattan (*Calamus maximus* Blanco).[77] They were raised on hardwood poles known as *haligues*, generally made of molave because of their termite-resistant qualities.[78] Spaniards continued to use the same materials, adapting them to the architectural forms of churches and other public buildings.[79]

Such structures were also highly flammable. Numerous reports attest to the frequency of fires in early Manila.[80] The compact nature of Spanish urbanism, which concentrated population around a central location (*plaza mayor*), inadvertently created a major fire hazard when coupled with the continuing use of highly combustible materials.[81] Already by 1588, fire had menaced Manila three or four times.[82] The conflagration of 1583 was particularly devastating, razing virtually the whole city to the ground.[83] While the Spanish citadel of Intramuros was gradually rebuilt in stone after 1587, the same was not true of its suburbs or the other towns and villages throughout the archipelago. Urban areas had to be continually rebuilt with wood taken from the forest. Spanish urbanization created a fire regime that historian Steven Pyne argues resembles rebuilt wildlands.[84]

Defense, too, required a constant source of newly cut timber. The colony needed to defend against Dutch fleets and Moro (Muslim) raiders as the Spanish presence dragged the archipelago into a wider arena of conflict and religious antagonism. The islands and surrounding seas became a battleground in the Eighty Years War that was only finally settled by the Treaty of Westphalia in 1648. Colonialism also

lent a new ferocity to the slave-raiding expeditions out of Jolo and Maguindanao, and conflict was intensified by a religious dimension after 1565.[85] The Dutch East India Company's aim was to hinder trade by blockading Manila, intercepting the bullion-loaded Acapulco galleons, and thwarting Spanish attempts at a permanent presence in the Spice Islands. During the first quarter of the seventeenth century, the Dutch East India Company dispatched no less than sixteen fleets, fought four major naval engagements, and maintained between forty and fifty armed vessels in Philippine waters during any one year.[86] War in the South was aggravated by Spanish attempts to subjugate these Muslim polities and by a colonial policy that concentrated people and wealth at coastal centers. Hostilities took the form of Moro raids and Spanish retaliatory expeditions that persisted into the nineteenth century, although their frequency and ferocity subsided after 1671.[87]

What the Spaniards needed to defend their new possessions in the East were ships, lots of them. Mindful of the need for suitable wood, early accounts of the islands were quick to appreciate their potential for shipbuilding.[88] Not only was there an "abundance of wood for all kinds of vessels," but Filipinos proved to be "very skillful in making ships and fragatas."[89] And build ships is what the Spanish did: by 1616, six out of the seven galleons stationed at Manila had been built in the islands.[90] These were not just small crafts and galleys, but many were large ships of the line: the *Santa Rosa*, began in Cavite in 1674, was considered one of the finest ships of its age, and the *San José*, launched in 1694, was reputedly the tallest ship afloat at the time.[91] These vessels also continually required regular refurbishing or replacement due to wartime repairs and losses, the need to replace timbers in tropical waters, and the frequency of shipwreck.[92]

All agreed that the qualities of Philippine timbers were especially suited to ship construction. Molave was the principal wood used for futtock timbers and stem crooks; guijo, yacal, betis, dungon, and ipil-ipil were chosen for keels and stern posts; banaba was preferred for outside planks because the wood did not rot and resisted the teredo or shipworm; lauan and tangile were employed for planking because they did not chip when hit by cannonballs and absorbed much of the impact; mangachapuy proved best as masts because of its elasticity; and palomaria made effective yardarms and topmasts.[93] Other woods were used for more specialized purposes.[94] Such was the haste with which vessels were built that unseasoned wood was often used, necessitating that "one must tear up the decks every two years and put down new ones."[95] How much timber was consumed in this frenzied construction over the decades is difficult to estimate, but there are indications that it was substantial. Some idea of the scale of the whole enterprise can be gleaned from the labor that was levied to meet these demands. As part of the *corvée* (forced labor) requirement that the colonial state demanded of indigenous people, municipalities had to provide people to work in the shipyards or cut timber, the dreaded *corte de madera*.[96] So great was the amount of labor required that it caused insurrections on more than one occasion: revolts occurred most notably in 1614 and again in 1649.[97] Molave and other valuable hardwoods soon became increasingly difficult to find. Already by 1621, Hernando de los Rios Coronel commented on how difficult it was to "find the necessary timbers of the forest" that had to be sought with great difficulties "by penetrating the thicker recesses of the woods."[98] Forest in easy reach of shipyards was particularly affected and soon exhausted. For this reason, ship construction was moved about the archipelago to where suitable stands of timber still grew.

The threat, however, was not only external. Spanish control over the archipelago remained tenuous in many areas right into the nineteenth century. Most of Mindanao, and even extensive mountainous areas of Luzon, lay beyond the effective reach of the colonial administration. Especially in the Cordilleras of central Luzon, frontier communities evolved based on forts and military garrisons, a *presidio* (fort) society. The mountains were home to a number of ethno-linguistic groups that Spaniards called *infieles* (pagans). Subject to missionary contact and irregular military expeditions since the sixteenth century, governor-generals did not try to impose colonial order on upland peoples until the nineteenth century.[99] Even then, the Spanish presence remained primarily a military occupation based on garrison towns and forts, dependent on lowland sources for provisions and guns to enforce compliance.[100]

Like the naval craft that defended the colony from the sea, the forts that straddled the highlands were also constructed of timber. Wooden palisades and fortifications of various types built by both the indigenous peoples and the Spaniards had long been an aspect of warfare in the archipelago.[101] Often these forts were elaborate affairs, palisades with parapets protected by moats, earthworks, and outer stockades.[102] Given the number of presidios situated at strategic locations and important transit points all over the Cordillera, as well as in other parts of the archipelago, the amount of timber required in their construction and maintenance was considerable. Primarily valuable hardwoods were cut for this purpose, "heavy timbers" required for strength and protection.[103] Again the use of selected timber further contributed to the reproductive erosion of certain species, reducing the genetic diversity of the forest by leaving only less desirable individuals to produce seed. A report on the state of the forest in 1877 blamed the unregulated activities of woodcutters for a scarcity of "valuable trees of large

dimensions" and the preponderance of "juvenile ones" that had led to the "impoverishment" of the forest.[104] Moreover, even the hardest woods buried underground had to be constantly replaced because of the white ant.

All this amounted to a very changed landscape in many parts of the archipelago by the late nineteenth century. The extent of deforestation is difficult to reconstruct. An initial attempt to describe the remaining timber stands was made by Ramón Jordana y Morera in 1871–72.[105] Those provinces nearest Manila were already extensively deforested. Abra and Laguna, too, had lost much of their cover while Cebu and Bohol were virtually denuded of trees. Agriculture was encroaching on the woodlands of Batangas, Isabela, Panay, and the Ilocos region. Tayabas was the main timber-producing area at the time. Primary forest was only found in central Luzon, parts of the Visayas, some of the smaller districts and island chains, and on Mindanao. In the last quarter of the nineteenth century, the first statistics on the scale of this deforestation were compiled. A detailed provincial breakdown of forest cover was published by the Spanish forestry department in 1875 on the occasion of the Philadelphia Universal Exposition. According to this estimate, 70 percent of the islands was still forested after more than three hundred years of Spanish rule. This percentage, however, is based on the total land area of the present nation-state and not on the territories under effective colonial administration. Until the early twentieth century, much of the largely untouched forests of Mindanao, the second-largest island in the archipelago, lay beyond the effective control of authorities in Manila. Subtracting the latter's some 9.5 million hectares from the approximate national total of 30 million hectares reveals the true extent of deforestation by the end of the nineteenth century. Using this formulation, about half the forest cover in the territory under

Spanish control had already disappeared prior to the American era.[106]

Commercialization of the Forest

What fundamentally changed the nature of the human impact on the forests of the Philippines was the commercialization of the timber trade in the second half of the nineteenth century. If this commoditization was not complete by the end of the Spanish colonial period, the process that transformed the archipelago's extensive forests from useful but valueless wood into marketable timber was well underway. Nor, after 1898, did the nature of the market substantially change. While the volume of timber cut during the American colonial period increased markedly, especially after 1918, three quarters of it still went to supply the domestic market just as it had under the previous regime. Moreover, the Spanish forest service, the *Inspección general de Montes*, was as much a modern agency informed by the principles of scientific forestry as was its successor under the American administration, the Bureau of Forestry.

Historians have long argued that the Americans introduced scientific forestry, but an official forestry service was established in the Philippines in 1863, eighteen years before the United States established its Division of Forestry.[107] Forest regulations in the archipelago long preceded the establishment of a forestry service and were based on the *Recopilación de las Leyes de Indias*, the body of colonial laws that evolved over the centuries into a comprehensive treatise for administrating the Americas including the Philippines. These laws had two objectives: protecting customary access to the forest and encouraging its conservation. Specifically, early colonial law made two provisions: first, it protected local people's right to cut timber for their own use, and second, it forbade all activities that

might impede the growth of the forest. Spaniards in the nineteenth century regarded the spirit of this legal corpus and its regard for indigenous rights as constituting "the glory" of their dominion in the archipelago, contrasting it to the profit-maximizing policies of the English and Dutch.[108] Subsequent laws recognized rights to settle "wastelands" (*baldíos realengos*) and placed limitations on Spanish alienation, forbidding grants that might disadvantage local people (1680) and confirming the *pueblo* (town/village) in its access to communal lands, waters, and pastures (1797).[109] Unfortunately, as even Sebastián Vidal y Soler, naturalist and father of Spanish forestry in the Philippines, had to admit in 1874, such laws were largely disregarded. Moreover, most new laws enacted during the first half of the nineteenth century were to encourage agricultural expansion usually at the expense of the forest.[110] It was the flagrant disregard for forest laws, the sheer scale of the destruction, the shortage of timber in many areas, and public criticism that the government had simply abandoned the forest that persuaded the Spanish colonial administration to establish a forestry service in 1863.[111]

Other forces were at work in the forests of the Philippines by then, too, not least the emergence of a commercial market for wood and the perceived need to manage the remaining stands in a scientific manner. Certainly a timber market had emerged in the archipelago by midcentury. Joseph Burzynski's study of local shipping records shows how what began as a fragmented, poorly ordered, and inefficient trade in 1864 developed into a more coherent, better structured, and increasingly specialized one by the late nineteenth century—a trade, moreover, increasingly synchronized and responsive to the forces of supply and demand.[112] The stimulus for this market was the growth of Manila and, to a lesser extent, other urban centers.[113] The rapid urbanization of the capital generated a strong demand for timber that

soared in the aftermath of major disasters such as the earthquakes of 1863 and 1880, and the fire of 1870. Owners with substantial houses to repair needed timber; prices rose and local merchants seized the opportunity to make substantial profits.[114]

Along with the growing demand for timber and the increasing problems of supply was the realization that the forests of the Philippines had to be managed in a more scientific way, both to encourage production and to meet future demand. The forest question was perceived as inextricably bound to the development of the colony, especially its agriculture and export markets, and a lack of wood was seen as impeding progress.[115] The model that Vidal y Soler and other Spanish foresters had in mind was a program of artificial reforestation (planting nursery-grown trees or seeds and saplings gathered in the wild) and selective logging that took account of the growth rate of each species.[116] To implement such a program, foresters first needed to conduct surveys to determine which areas were to be logged and which were to be kept as forest.[117] Land deemed suitable for agriculture was to be cleared while less productive soils were to retain their tree cover. Forest was also to be conserved around watersheds, on steep slopes, and as a protection against typhoons, landslides, erosion, floods, and droughts.[118]

Foresters in the *Inspección general de Montes* may have been trained in German and French silvicultural principles, but they adjusted European forestry to meet the particular conditions of tropical forests. The service began modestly in 1863 and grew to be a sizable agency.[119] The primary legislation the service operated under was the provisional forestry regulations of February 8, 1873, that classified all forest lands into those available for agricultural development and those that should remain permanently timbered because of their environmental sensitivity. Ramón Jordana y Morera,

author of the most definitive account of forestry in the Spanish Philippines, considered that the regulations expressed the most advanced scientific principles of the times and had the best interests of state and country at heart. However, even he had to admit they had been formulated with "little knowledge on how best to achieve these aims and [in ignorance] of the customs and necessities of the inhabitants."[120] The forestry service continued to operate right up until the end of the Spanish colonial period, although its effectiveness was hampered by a gradual reduction in the number of staff after 1881. Unfortunately, its historical legacy has suffered much from the fire of 1897, which destroyed its extensive library, forest maps, natural history collection, and the entire archives.[121] This blaze ensured that the achievements and successes of Spanish forestry have largely gone unrecorded and the agency's effectiveness has been greatly underestimated.

The United States occupied the archipelago as part of the Spanish-American War in 1898. Pacification, however, was only finally realized in 1907 after nearly a decade of conflict that involved the destruction of crops and the "reconcentration" of population.[122] However, there does not appear to have been any appreciable loss of forest cover as a result of the fighting. Nevertheless, the new US administration was soon to realize the real extent of deforestation in the more populated areas of the archipelago. George Ahern, first director of the US Bureau of Forestry, noted in 1900 the scarcity of good timber and how lumbermen were "obliged to go quite a distance from this city in order to find a suitable tract."[123] Dean Worcester, who rarely missed an opportunity to condemn the shortcomings of Spanish colonialism, noted the "incalculable damage" that had already been done.[124] Americans assessed this damage, however, more in terms of lost revenue and were struck by the amount of primary forest that still remained. "The

Philippine forests," wrote Worcester on another occasion, was "like money in the bank."[125]

By the beginning of the twentieth century, Americans were fast exhausting even their own prolific domestic forest reserves; foresters talked with urgency of an impending "timber famine."[126] Americans looked on their new colonial possession as a source of timber, impressed by the amount of primary forest that was commercially exploitable. In his article "Philippine Forest Wealth," Worcester extolled the myriad uses for the different types of timber and nontimber products. Molave and the other strong hardwoods, when properly seasoned, were virtually resistant to time and white ant. Numerous others timbers produced handsome and durable finishes or made desirable cabinet woods. Palma brava produced fine fishing rods while the use of bamboo was multifarious. Dye wood, too, was in abundance. There were good stands of gutta-percha, a profusion of valuable gums and resins, extensive mangroves suitable for firewood, and tan bark along shorelines. Even forest nuts were valuable in the production of paint and varnish, or simply just good to eat.[127] A flow of publications detailing knowledge about the forest and the commercial usefulness of Philippine timber was a hallmark of the early decades of the American era.[128]

The period from 1898 to World War II witnessed an enormous expansion of commercial logging around the archipelago with exports to the United States, Japan, China, and Europe.[129] To meet this demand, operations were modernized with logging engines and railways largely replacing axes and carabaos.[130] The number of sawmills expanded from 8 in 1916 to 115 by 1936. Total annual lumber production rose from 94,000 to 2.5 million cubic meters between 1901 and 1940. In particular, the volume of timber cut from lesser quality dipterocarp hardwoods (such as apitong, lauan, and tangile) rose by over 1,000 percent while

demand for non-dipterocarp hardwoods (like ipil, molave, or narra) remained constant.[131] A moving timber frontier embraced the whole archipelago for the first time with the inclusion of extensive logging activities on Mindanao.[132] A displaced and rapidly expanding population, moreover, sought new land to cultivate that was literally hacked out of the forest, with or without official consent. This encroachment only accelerated after the establishment of internal self-rule in 1935.[133] Again, the overall figures on forest cover do not properly reflect the magnitude of this loss. The inclusion of Mindanao into the colonial state in 1898, an island "almost entirely covered in timber," effectively increased the extent of forest cover in the archipelago by a third. Yet by 1932, forest covered only 57 percent of the total land area, a fall of a further 9 percent since 1903.[134] The Great Depression of the early 1930s provided only a temporary respite.

The need for both timber and food intensified with the Japanese invasion and the harnessing of the archipelago's forests for wartime purposes. After a systematic bombing of Philippine defenses, Japanese troops landed on December 10, 1941, at several points on Luzon and rapidly overran the less well-equipped and much smaller American and Filipino forces. The military potential of timber was recognized by all combatants.[135] But for the Japanese, the forest represented an essential component in their overall war effort. According to Major General Yoshihide Hayasi, director-general of the Japanese Military Administration, the greatest mission imposed on the Philippines in 1942 was "To develop the resources for defense for the purpose of meeting the demands in the Greater East Asia War."[136] The Japanese were determined to make full use of the archipelago's forest resources, not only the wood but also nontimber products such as rattan, resins, gums, tannin, oils, and medicinal plants. However, timber production during the occupation

was only a fraction of its prewar level.[137] Many factors explain this poor performance: wartime damage to mills, a shortage of draught animals, unrealistically low fixed timber prices, and the uncooperativeness of Filipinos, as well as widespread sabotage by guerrilla fighters.[138]

Despite plummeting production figures, however, the damage inflicted on the archipelago's forests during the occupation was substantial.[139] Food shortages led to an unregulated explosion of slash-and-burn agriculture and to the clearance of much woodland.[140] The Japanese military's demand for timber resulted in the extensive destruction of forest habitats including trees in national parks and forest reserves.[141] Moreover, intense fighting occurred in many forested areas, first in early 1942 and again as a result of the scorched earth policy practiced by the Japanese Army in the months following the American landing in October 1944. The sheer scale of the destruction and the random indiscriminateness of the damage inflicted on the forest separate the Japanese occupation from all previous wartime experiences in the Philippines.

In the decades following World War II, wholesale commercial exploitation of the forest began in earnest, especially during the presidency of Ferdinand Marcos (1965–86).[142] These years were characterized by cronyism, corruption, and corporate logging as the archipelago's forests were plundered on an unsustainable basis.[143] Forest cover further declined from 50 percent of land area to a little over 22 percent between 1950 and 1987.[144] The rate of deforestation peaked at 300,000 hectares per year in the decade from 1965 to 1975.[145] The rapid decline in forest cover was not due solely to intensive logging (both legal and illegal) but also resulted in part from an expanding agricultural frontier to accommodate the archipelago's rising number of people. Population increased from 19.3 million to

over 48 million between 1948 and 1980.[146] If prewar forest production had still been mainly for domestic consumption, the decades following 1945 saw the Philippines emerge as the major producer of tropical hardwoods in Southeast Asia for international markets. National log exports peaked at a high of 8.7 million cubic meters in 1969, generating over $300 million per annum in foreign exchange earnings, or 33 percent of total exports, before falling back to 5 percent by 1987. Remaining primary forest stands rapidly disappeared from the landscape.[147]

After the overthrow of the Marcos regime and the restoration of constitutional government in 1986, more progressive forest policies were introduced that included social forestry programs. Provincial and local logging bans were instituted and forest reserves created including the Northern Sierra Madre National Park. The latter's approximately 400,000 hectares constitute the largest protected area in the country and is the richest in genetic diversity, number of species, and range of habitats. Moreover, reforestation projects and spontaneous tree planting contributed to the rise of 0.7 million hectares in forest cover between 1988 and 2003. This modest recovery stands in marked contrast to a deforestation rate over the previous two decades that was five times that of the average area replanted.[148]

Since 1995, too, there has been greater official understanding that conservation and reforestation projects can only succeed with the direct involvement and participation of forest users. Community-based forestry management agreements that recognize local communities as forest managers are now acknowledged national strategy. Such agreements allow organized communities to harvest timber from plantations and second-growth forest. In return, communities ensure that remaining old-growth forests are protected and that other woodland areas are administered according to the principles

of sustained-yield management. By 2006, some 6 million hectares of forest lands were under some form of community forest management.[149] However, it may be rather premature to conclude that this trend represents a new phase in the relationship of humans to the forest. Indeed, such statistics often lack robustness, and illegal logging and forest clearance continue apace in many areas, often cloaked in the rhetoric of community empowerment and poverty alleviation.[150] By the end of the twentieth century, too, the Philippines had become a net importer of tropical hardwoods.

Conclusion

Adopting a deep forestry approach, a history of the Philippines that combines the biocentric with the anthropocentric may not really allow one to think more like a forest, but it does help reveal the dynamics that govern the nature, composition, and extent of the forest in the Philippines over time. It has significance for the historiography of the forest as well as policy implications for forestry governance and practice.

In the first place, deep forestry offers a more inclusive understanding of the archipelago's woodlands: how they changed over time, who or what were the agents that precipitated such modifications, and what have been the consequences of their actions. Climate, soil, fire, and nonhuman animal actors were significant factors not only in determining the nature and composition of the forest but also in influencing human decision making. As a result, any historiography of the forest needs to encompass an extended time span that includes all these actors in the narrative. Seeing the forest as more than simply its constituent trees highlights its real value not only as a resource but also as an important stabilizing element in the environment. The tragedies of Ormoc in November 1991 when tropical storm

waters inundated the provincial city drowning more than 5,000 people within minutes, and the flash floods that affected more than 300,000 people in northwestern Mindanao in December 2011, were very far from being natural disasters. They were as much caused by the extensive deforestation of surrounding slopes as to heavy and prolonged rainfall.[151]

Taking a more biocentric approach shows how forest history is more than a mere chronicle of human actions. The sheer scale of forest clearance since 1946 has dwarfed most other considerations, but people have always acted with and within a forest ecosystem. The full impact of fire and the white ant has been synergistic with human agency while the soil and even the climate are nowadays also the product of a close interaction with people. Climate change, in particular, is set to become a major determinant of future agricultural yields as well as the health of the archipelago's remaining forests. Forest historiography needs to reflect these complex and dynamic processes.

Deep forestry also has important implications for policy. On the one hand, it links forest conservation with the preservation of wildlife. The health of the forest depends on all its biota. Preserving the forest not only protects animal habitats, but, by doing so, it maintains agents that are integral to the proper functioning of its ecosystems. The welfare of one depends on the well-being of the other, a reciprocal dynamic often overlooked in reforestation projects that plant only a single exotic species such as *Gmelina arborea*, mahogany, or eucalyptus.[152] And then there is the forest's human population, both its first peoples, who live within its confines, and those who dwell about its fringes, for whom forest resources constitute an important part of their livelihoods. The place of people in the forest and therefore in the conservation of the latter remains a contested issue and

one that has changed in recent times. The history of state intervention in the forest after 1565 has sought to confine, restrict, and even exclude their activities. More recently, however, the presence and even the rights of local populations have been recognized, and their involvement in the formulation of forest policy has been increasingly deemed essential. Governments and international conservation agencies now accept the need for local peoples' cooperation in the running of parks and reserves and in the sustainable management of remaining forests. That is, people whose existence until recently was denied, whose presence was unwanted, and whose activities were prohibited have been converted over a few decades into the guardians of wildlife, the custodians of the forests, and the stewards of the peace.

Finally, thinking more like a forest is a reminder to all that the forest has always acted as a community's first line of defense against climatic vicissitudes and terrestrial extremes. The Philippines are one of the most disaster-prone nations on earth with an average of twenty typhoons every year and an earthquake of varying magnitudes occurring somewhere in the islands every day.[153] The deleterious effects of flash flooding and landslides are frequently aggravated, if not precipitated by, the severe deforestation of upland areas and watersheds. Similarly, denuded slopes increase the incidence and severity of landslides in the aftermath of earthquakes or tropical storms. As global warming upsets all prior calculations about the frequency and magnitude of climatic hazards, the important role of forests in mitigating their worst impacts will become even more manifest. Moreover, tropical forests have a critical role to play in carbon sequestration and as a bulwark against the worst excesses of global warming.[154] A deep forestry approach appreciates this contribution and the significant part that forests have to play in mitigating the potentially destructive power of natural forces in an increasingly less predictable world.

Footnotes

1 Norman L. Christensen, "Landscape History and Ecological Change," *Journal of Forest History* 33, no. 3 (1989): 116–25.

2 Roderick Nash, "American Environmental History: A New Teaching Frontier," *Pacific Historical Review* 41, no. 3 (1972): 362–72.

3 Donald Worster, "History as Natural History: An Essay on Theory and Method," *Pacific Historical Review* 53, no. 1 (1984): 1–19

4 Donald Worster, *Nature's Economy: A History of Ecological Ideas* (New York: Cambridge University Press, 1994), ix–xi. Gordon G. Whitney, *From Coastal Wilderness to Fruited Plain: A History of Environmental Change in Temperate North America from 1500 to the Present* (Cambridge: Cambridge University Press, 1994), 4. See also Jeanine Rhemtulla and David Mladenoff, "Why History Matters in Landscape Ecology," *Landscape Ecology* 22, no. S1 (2007): 1–3, and the entire special issue.

5 It is noteworthy in this respect that Michael Williams actually advocates "a series of place-stories." Michael Williams, "The Relations of Environmental History and Historical Geography," *Journal of Historical Geography* 20, no. 1 (1994): 15. On historical forest ecology, see Whitney, *From Coastal Wilderness to Fruited Plain*; Nancy Langston, *Forest Dreams, Forest Nightmares: The Paradox of Old Growth in the Inland West* (Seattle: University of Washington Press, 1995); Michelle M. Steen-Adams, "White Pine in the Northern Forests: An Ecological and Management History of White Pine on the Bad Rivers Reservation of Wisconsin," *Environmental History* 12, no. 3 (2007): 595–

629; and Brian Donahue, “Another Look from Sanderson's Farm: A Perspective on New England Environmental History and Conservation,” *Environmental History* 12, no. 1 (2007): 9–34.

6 Lars Östlund, Olle Zackrisson, and A-L Axelsson, “The History and Transformation of a Scandinavian Boreal Forest Landscape since the 19th Century,” *Canadian Journal of Forest Research* 27 (1997): 1198–1206; Lars Östlund, Olle Zackrisson, and Greger Hörnberg, “Trees on the Border between Nature and Culture: Culturally Modified Trees in Boreal Sweden,” *Environmental History* 7, no. 1 (2002): 48–68; Rikard Andersson, Lars Östlund, and Erik Törnlund, “The Last European Landscape to Be Colonised: A Case Study of Land-Use Change in the Far North of Sweden 1850–1930,” *Environment and History* 11 (2005): 293–318.

7 On the history of forest exploitation in the region, see, for example, Charles Lee Keeton, *King Thebaw and the Ecological Rape of Burma: The Political and Commercial Struggle between British India and French Indochina in Burma, 1878–1886* (Delhi: Manohar Book Service, 1974); Nancy Peluso, *Rich Forests, Poor People: Resource Control and Resistance in Java* (Berkeley: University of California Press, 1992); Peter Boomgaard, David Henley, and Manon Osseweijer, eds., *Muddied Waters: Historical and Contemporary Perspectives on Management of Forests and Fisheries in Island Southeast Asia* (Leiden: KITLV Press, 2005). On the political ecology of forestry in Southeast Asia, see Raymond L. Bryant, *The Political Ecology of Forestry in Burma, 1824–1994* (London: C. Hurst & Co., 1997); Jeyamalar Kathirithamby-Wells, *Nature and Nation: Forests and Development in Peninsular Malaysia* (Honolulu: University of Hawaii Press, 2005). A notable exception to this political approach is S. Robert Aiken and Colin H. Leigh,

Vanishing Rain Forests: The Ecological Transition in Malaysia (New York: Oxford University Press, 1992).

8 Frederick L. Wernstedt and J. E. Spencer, *The Philippine Island World* (Berkeley: University of California Press, 1967), 9–16.

9 Laurie Lee Junker, *Raiding, Trading, and Feasting: The Political Economy of Philippine Chiefdoms* (Honolulu: University of Hawaii Press, 1999), 61, 100.

10 William Lytle Schurz, *The Manila Galleon* (New York: E. P. Dutton, 1939); Benito Legarda Jr., *After the Galleons: Foreign Trade, Economic Change and Entrepreneurship in the Nineteenth-Century Philippines* (Quezon City: Ateneo de Manila University Press, 1999).

11 Alfred W. McCoy and Francisco A. Scarano, eds., *Colonial Crucible: Empire in the Making of the Modern American State* (Madison: University of Wisconsin Press, 2009).

12 Ramachandra Guha, "Radical American Environmentalism and Wilderness Preservation: A Third World Critique," *Environmental Ethics* 11 (1989): 74.

13 Arne Naess, "The Shallow and the Deep, Long-Range Ecology Movement: A Summary," *Inquiry* 16 (1973): 95–98. As such, it draws inspiration from a number of sources including Eastern philosophies and the religion of first peoples, as well as minority intellectual traditions within the West such as Francis of Assisi and his "democracy of all God's creatures," the biocentric egalitarianism of Spinoza, and, more recently, the writings of Rachel Carson.

14 Bill Devall, “The Deep Ecology Movement,” *Natural Resources Journal* 20 (1980): 302–3.

15 Aldo Leopold, “Some Fundamentals of Conservation in the Southwest,” *Environmental Ethics* 1 (1979): 131–48.

16 Wernstedt and Spencer, *The Philippine Island World,* 41.

17 Ibid., 58–62.

18 Donald Matthews, *Silviculture for the Philippines* (Los Baños: College of Agriculture, University of the Philippines, 1914), 3.

19 Wernstedt and Spencer, *The Philippine Island World*, 53–57.

20 Other species that grow best in areas without seasonal variations in rainfall include tuai (*Bischofia javanica*), tamayuan (*Strombosia philippinensis (Baill.)* Rolfe), liusin (*Maranthes corymbosa* Blume), catmon (*Dillenia philippinensis*), supa (*Sindora supa* Merrill), batete (*Ficus benjamina*), and kamatog (*Sympetalandra densiflora*). Trees that prefer no seasonal variation also include amugis (*Koordersiodendron pinnatum*), palo maria (*Calophyllum inophyllum* Guttiferae), calumpang (*Buchanania latifolia*), dungonlate (*Heritiera littoralis*), dapdap (*Erythrina variegate*), tindalo (*Afzelia rhomboida*), acle (*Albizia acle*), and ipil (*Instia bijuga*). The botanical name of species is only given at the first mention.

21 Matthews, *Silviculture for the Philippines*, 3–5. Typhoons affect all islands of the archipelago apart from the central and southern parts of Mindanao and are highly destructive of saplings and less mature trees. Wernstedt and Spencer, *The Philippine Island World,* 50–52.

22 Trees that require moderate soil depth include bagtican (*Shorea* and *Parashorea*), malugay (*Pomentia pinnata*), malaikmo (*Celtis philippensis Blanco*), balobo (*Diplodiscus paniculatus*), tuai, and yacal. Species that need deep soils include almon (*Shorea almon*), tiaong (*Shorea* sp.), mayapis (*Shorea polsapis*), paloapis (*Anisoptera thurifera*), lauan, apitong, and tanguile.

23 Matthews, *Silviculture for the Philippines*, 9–14.

24 Species that outcompete other trees in shallow soil include lanete (*Wrightia pubescens*), dungon (*Tarrietia sylvatica*), and palo maria.

25 The botanical names of trees not mentioned so far are apitong (*Dipterocarpus grandiflorus* Blanco) and calumpit (*Terminalia edulis* Blanco).

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27 Harry Whitford, *The Forests of the Philippines, Part I: Forest Types and Produce* (Manila: Bureau of Printing, 1911), 17–32.

28 Ibid., 17.

29 David Kummer, *Deforestation in the Postwar Philippines* (Chicago and London: University of Chicago Press, 1992), 186.

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31 Gifford Pinchot, "Philippine Islands," Library of Congress, Pinchot Papers, Box 640, File: Philippine Islands, 13, 15, 40, 56; Gifford Pinchot, "Lecture on Forests and

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33 Pinchot, "Philippine Islands," 12, 16, 26, 65.

34 Pinchot, "Philippine Islands." See also Greg Bankoff, "First Impressions: Diarists, Scientists, Imperialists and the Management of the Environment in the American Pacific, 1899–1902," *Journal of Pacific History* 44, no. 3 (2009): 261–80.

35 Barrington Moore, "Forest Problems in the Philippines," *American Forestry* 16, no. 2 (1910): 76.

36 Arthur Fischer, *Annual Report of the Director of Forestry of the Philippine Islands for the Fiscal Year Ended December 31, 1924* (Manila: Bureau of Printing, 1925), 22.

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