

Until the ascendancy of fossil fuels, wood has been the principal fuel and building material from the dawn of civilization. The abundance or scarcity of wood greatly shaped, as A Forest Journey ably relates, the culture, demographics, economy, internal and external politics, and technology of successive societies over the millennia. This excerpt shows how it shaped all of those in the Atlantic world during the Age of Discovery and after European settlement of the New World. The book has received recognition as a Harvard Classic in Science and World History and as one of Harvard's "One Hundred Great Books." The new paperback edition adds a prologue and an epilogue to reflect the current situation in which forests have become imperative for humanity's survival.

MADEIRA, THE WEST INDIES, & AMERICA

EXCERPT FROM A FOREST JOURNEY

Europeans had come to believe, according to Thomas Pownall, an eighteenth-century writer on American natural history, that the globe “in its natural state [was] universally covered with woods.” This pristine ideal differed sharply with the deforested state of eighteenth-century Europe. In contrast, a country whose

forests seemed untouched was considered “yet a new world to the [people] of Europe,” Pownall concluded.

By Pownall's definition, the island of Madeira, discovered by the Portuguese in 1420, was where the New World began, even though it was only about 150 miles west of the African coast. A “great wilderness of sundry sortes of trees” grew on the island, according to Thomas Nicols, an Englishman who visited in 1550. Madeira was so thickly wooded when the Portuguese first set foot there that they named it “isola de Madeira,” or “island of timber.”

THE MAGIC OF ITS FORESTS

People who came to the island in the fifteenth and sixteenth centuries agreed that the Madeira well deserved its name. “When first discovered,” Cadamosto, a Venetian, wrote in a chronicle about his voyage to the island forty years after the arrival of the first Portuguese, “there was not a foot of ground that was not entirely covered with great trees.” The island was so well forested that another early visitor, Diego Gomes, complained that he “could not see what was on the ground because it was completely covered

BY JOHN PERLIN



MAP BY KIRSTEN ZECHER, FROM A FOREST JOURNEY

The heavily forested island of Madeira, only 150 miles west of Africa, was the first stop for European explorers. The wealth and size of the trees found there changed the course of western history.

by trees, by cedars and other species.” The trees growing on Madeira attained such height that another early chronicler commented, upon seeing the island, that they “seem to touch the sky.”

From the moment of discovery, Madeira’s opulent forests enchanted its visitors, coming as they did from the Old World where trees had not grown so densely, so thick, or so tall in living memory. One member of the original exploration party reportedly reminisced that the island’s magnificent display of vegetation “filled our minds with unspeakable delight.” Camoes, the great Portuguese epic poet, probably best articulated the magic everyone felt when he wrote that Madeira “was like a gem and the gem was its trees.”

Those who settled the island did not come to Madeira just to gaze upon its beauty. They were in search of opportunities that the natural resources of the island could offer and found that the forests had given them a land with rich soil, full of springs, rivers, and streams. Sugarcane, the Portuguese decided, would flourish on such a warm, fertile, and well-watered land. Prince Henry the

Navigator, the impetus behind Portuguese colonization efforts, sent for cane stalks from the mainland. He also had experts in the preparation of sugar brought over from the continent to teach the islanders the trade.

PROCESSING THE CANE

Madeira’s sugarcane had to be processed before being sold as sugar. This meant that much of Madeira’s wood would be used. First, planters needed wood to build sugar mills. Carpenters made the mills’ machinery out of the tallest, thickest, and best trees available. In Madeira, the axle was usually made from white wood because of its hardness. Most often a wooden waterwheel turned the axle which engaged gears, no doubt also of white wood, to move a pair of cedar rollers. Cane was passed between the rollers, which crushed the stalks, forcing out their sweet juice.

Workers poured the extracted liquid into kettles. A fire, rarely extinguished, burned underneath each pot. The wood from



COURTESY OF BURNDY LIBRARY FROM A FOREST JOURNEY

Sugar-mill workers, center background, pour the extracted cane juice into kettles. A fire, rarely extinguished, burns beneath each pot.

linden trees furnished much of the fuel. No doubt cedar was also used, being the most common wood on Madeira; a sixteenth-century traveler visiting a neighboring island with the same type of vegetation observed, "it is the wood that with them is least esteemed, by reason of the great quantity thereof."

Sugar workers aptly called the room in which the cane juice was boiled "the sweet inferno." It was compared to the workplace of Vulcan. The writer who coined the analogy wrote, looking in, "you see large and continuous fires by which means the sugar is solidified and refined. And the men who watch over them are so exhausted, covered with smoke, soot, dirt and clay that they resemble demons..."

The juice continued boiling until judged ready for removal to an area where it would solidify into sugar. Once congealed, it was carried by ship to Europe. But it could not leave the island unless placed in some type of container. Planters in Madeira built casks from the same trees they principally burned for fuel, lindens.

In 1494, the island's sugar industry needed about sixty thousand tons of wood just for boiling the cane. Four of the sixteen mills operating on Madeira consumed eighty thousand pack animal loads per year. Mill owners brought most of their fuel down the rivers during the rainy season. During the dry period, woodsmen went up to the hills and mountains to cut the trees. When the rains came, the woodsmen returned to where they had cut the wood, and rolled or threw the felled logs into Madeira's principal river. Timber crowded the river. Lumberjacks hopped on

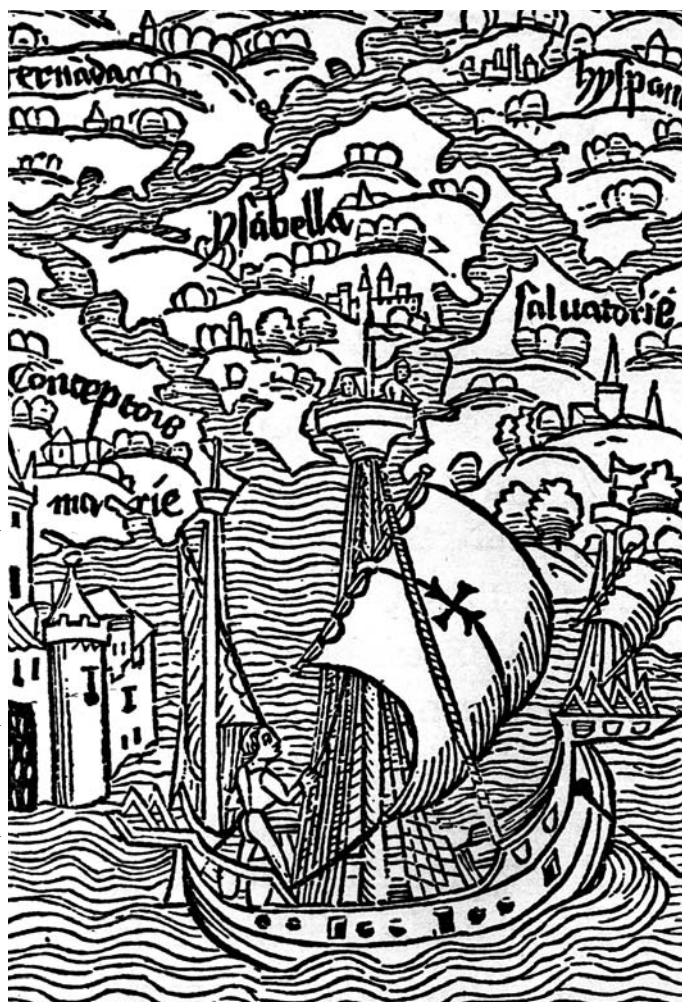
some of the floating logs and guided them downstream, constantly breaking up logjams with jabs from their iron hooks.

BUILDING SHIPS FOR OCEANIC TRAVEL

The loggers also supplied Madeira's sawmills, which were powered by water from the island's eight largest streams. Cadamosto viewed the mills at work and reported that they continually turned out plank, mostly from cedars. The size of the plank was prodigious. An examination of samples in 1506 found many measuring almost five feet wide.

Portugal drew large quantities of lumber from these sawmills. Spain also received cedar wood from Madeira "in great plenty," the geographer Sebastian Munster reported. The influx of great amounts of wood could not have come at a better moment for Portugal. Portuguese ambitions for long oceanic voyages began to stir in the late 1400s with the desire to establish sea trade with the Indies. The tiny ships that comprised its merchant fleet did well on relatively short ocean journeys. As the Portuguese headed down the African coast in their little crafts, they learned the limitations of the ships. It was imperative, for safety's sake, to stay near shore. By hugging the coast, sailors had to fight the winds much of the way.

A larger ship, in contrast, could head out onto the ocean safely and catch the prevailing winds. The record size and quantity of timber arriving at Portuguese dockyards from Madeira gave

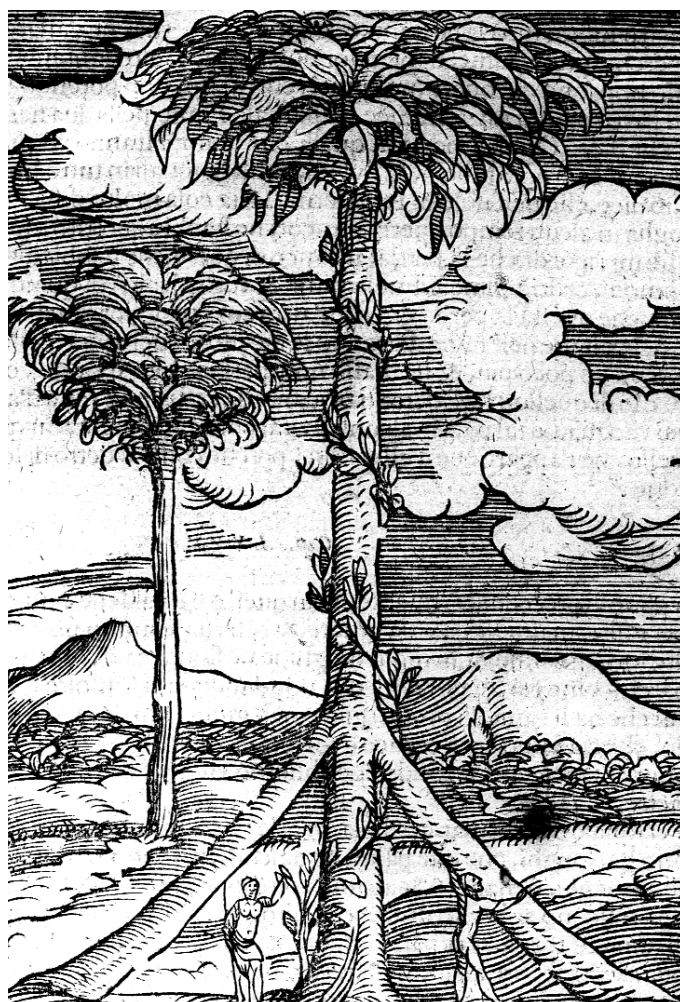


A 1493 depiction of the *Santa Maria*. Notice its foremast and crow's nest. Two sailors stand on the crow's nest above the main mast.

shipwrights, according to the chronicler Jeronimo Dias Leite, enough material to fashion a fleet of larger ships. The first change they made was to enhance the size of the entire vessel, making it many times larger than earlier ships. The enlargement was done for safety considerations as well as for comfort. On its prow, the builders placed a superstructure called a foremast. Here the crew could enjoy more spacious and drier quarters, adding to their comfort on the long voyages they would have to endure. The new type of ship was also provided with a mainmast of great size and height and a crow's nest attached near its top.

Vasco da Gama opened up the eastern route to India in vessels of this sort. Access by ship to the East Indies gave Portugal the competitive edge over traditional caravans in the lucrative East Indian trade. Previously, the Venetians had picked up rich cargoes from Asia on the eastern shore of the Mediterranean and then marketed them to the rest of Europe. By the 1500s, thanks to the sailing capability of Portugal's large ships, spices and other luxury goods from the east arrived at Portuguese ports. Breaking the Venetian monopoly on commerce from Asia helped tip the balance of wealth from the Mediterranean to Europe's Atlantic coast.

Europeans sailed to the New World mostly in such larger ships, which became the maritime workhorses of the sixteenth century. Columbus's flagship, the *Santa Maria*, was one of them.



A depiction from a seventeenth-century travel book of a giant tree growing in the West Indies.

COLUMBUS DISCOVERS AMERICA

Only a month after Columbus began his first voyage to the New World, he sensed that land was near. He interpreted as sure signs the pieces of plants and wood covered with barnacles floating past his ship. Columbus urged his crew to watch from the foremast for land. When they finally sighted land, the islands they saw were as lavishly wooded as Madeira. The vegetation on the island Columbus named Española, now called Hispaniola and occupied by Haiti and the Dominican Republic, especially impressed him. It was "full of a thousand varieties of trees," he wrote in his first account of the historic voyage, "growing so high that they seemed to reach the sky."

Explorers who followed in Columbus's footsteps were similarly impressed by the New World's rich vegetation. A member of the first crew to land in what is now Brazil recounted that "the number, size and thickness of ... the trees and the variety of the foliage" growing where the party first set foot "beggars calculation." In fact, the great number of brazilwood trees sighted by adventurers on the coast of Brazil provided the South American nation with its name just as Madeira's name was derived from its woodlands.



UNIVERSITY OF CALIFORNIA, LOS ANGELES, RESEARCH LIBRARY, SPECIAL COLLECTIONS, FROM A FOREST JOURNEY

European explorers seem ready to snare a monstrous beast that lives in the forests of the West Indies.

READING ABOUT AMERICA

People in Europe learned of the new Eden from numerous books written about the New World. The English read, for example, that on the other side of the Atlantic “woods are so many and great, that it hath been needful (passing through some parts of the Indies, especially where they were newly entered) to make their way, in cutting down trees and pulling up bushes, so that they could not sometimes have passed above a league a day. One of our brothers,” the priest-author continued, “a man worthy of credit, reported unto us, that being stayed in the mountains... he fell upon such thick bushes that...to see the sun, or to mark some way in the thick forest full of wood, he was forced to climb to the top of the highest tree to discover” exactly where he was.

Another author told of forests where there “are trees in the New World of such bigness that sixteen men joining hands together and standing in compass, can scarcely embrace some of them.” Even more captivating was an account of the forests’ alleged inhabitants: “among these trees,” people in the Old World were informed, lives “that monstrous beast with a snout like a fox, a tail like a marmosette, ears like a bat, hands like a man, feet like an ape, bearing her whelps about her in an outward belly much like unto a great bag or purse.” No doubt Shakespeare read

these lines and when he wrote *The Tempest*, set in the West Indies, he fashioned his beast character Caliban from the description.

People read of other amazing animals which thrived in forests of the New World. In *The Present Prospect of the Famous and Fertile Island of Tobago*, the reader discovered a land abounding in mammals and birds never before imagined. On Tobago, according to the book, there were “quantities of...armadillo that [are] armed with armor on their backs...then there’s the opossum...who [is] so affected with mankind in general, that he follows [people], comes to [them] and delights to gaze on [humans].” But according to the author of *Present Prospect* it was the birds of the island that made it a paradise for Englishmen. The blue-headed parrot, for example, “may be taught to talk any dialect [being] naturally affected with the vanity of tattle.” Nature made the main parrot even more beautiful than just providing it with a lively yellow head and breast. It “coated him through in green.” But of all fowls, the flamingo “is the fairest,” the author argued. Watching the bird, he swore, led him “to contemplate the Creation: whose outside, because most beautiful, interprets a more glorious inside.”

Equally stunning and more numerous were the trees that provided shelter and food for these amazing birds and mammals. The island of Barbados, for instance, was so full of wood and trees in the early seventeenth century that an English military

man complained that he “could not find any place where to train forty musketeers.” Woods of the West Indies, “being green at all times, John Davis informed the public in the book *The History of the Caribby Islands*, “afford a very delightful prospect and represent a perpetual summer.”

From the many species of trees covering the islands, visitors picked their favorites. Richard Ligon came to Barbados in the 1640s and immediately fell in love with the palmetto royal. In his *True and Exact History of the Island of Barbados*, he told the English reader that there was “not a more royal or magnificent tree growing on earth, for beauty and largeness not to be paralleled.” Ligon seemed truly smitten by the tree’s beauty, writing, “if you had ever seen her, you could not but have fallen in love with her...”

The European intruders did not make their admiration of the exotic flora and fauna a habit. The beauty they lavishly praised was no more than a momentary lapse. They assumed the same pragmatic stance as their Portuguese predecessors at Madeira. The writer on the natural history of Tobago, who described endearingly and with rapture its armadillos, opossums, parrots, and flamingos, could in his next breath recommend them for consumption in equally glowing terms. The main parrot he found to be “a rich food to feed on.” As for the blue-headed variety, “roast or boil them, you’ll commend the diet.” He judged that the one failing of the parakeet was its size since one would get a very small meal. Only his beloved flamingo did he keep from the dinner table even though, the author admitted, others “call them good food.”

Trees also were judged for their service to human needs. Richard Ligon’s reverence for the palmetto royal did not extend to any other species. The locust tree, Ligon suggested, may be cut for beams. He was willing to sacrifice the cedar for all types of building “by reason it works smooth and looks beautiful.” Although Ligon did not complain about these and other trees being cut down for lumber, he could not hide his satisfaction that the extremely hard and tough wood for the palmetto royal broke the woodsmen’s axes as they tried to fell them. It served the lumberjack right “for cutting down such beauty,” Ligon staunchly maintained.

GROWING SUGARCANE

Underneath the felled trees settlers found extremely fertile soil. Visitors to the Indies in the early years frequently remarked favorably on the potential for cultivation. Columbus called the soil of Española “fertilísimo.” Captain John Smith judged those parts of the West Indies he explored as extremely “capable to produce.” If anyone had any doubts, “the prodigious growth of mass[ive] and ponderous timber trees” proved, beyond question, the islands’ fecundity.

Almost immediately after the discovery of the West Indies, Europeans recognized that the islands offered the same ideal conditions for growing and processing sugar as existed on Madeira. For this reason a Spaniard carried over some sugarcane stalks and planted them on Española soon after Columbus’s first journey to the New World. As expected, the cane flourished and by the end of the sixteenth century forty sugar mills were operating on the island. The Portuguese, after the success on Madeira, did not wait long to establish sugar plantations after taking possession of Brazil. Before the close of the sixteenth century, a visitor reported seventy sugar mills at work in the Pernambuco region and forty in the area of Bahia.

It was no different in other parts of the Indies and sugarcane proliferated and became the area’s chief source of revenue.

Enormous quantities of wood were consumed in building the many sugar mills and converting the cane into sugar. Mills failed if their owners did not have access to large amounts of timber because, as Gonzalo Fernandez de Oviedo, who spent many years on Española, observed, “You cannot believe the quantities of wood they burn without seeing it yourself.” Experts in West Indian sugar production estimated that from six to eight slaves had to be constantly employed in cutting fuel in the forest and transporting it to the mill for optimum efficiency. To provide fuel for one mill stripped about ninety acres of forest land each year.

THE EFFECT OF THE SUGAR MILLS ON THE FORESTS OF MADEIRA AND THE WEST INDIES

Such large-scale consumption of wood took its toll on the forests of the New World. Two hundred and forty years after the Portuguese set foot on Madeira, it had become the island of wood in name only; Richard Ligon was the first to report its deforested state. En route to Barbados, he sailed by Madeira and observed it to be “so miserably burnt by the sun...we could perceive no part of it...that had the appearance of green nor any tree bigger than a small hawthorn, and very few of these.” Years later another traveler confirmed Ligon’s bleak assessment: “the Cedar tree, once a denizen of the island, is no longer found; and only the ceilings of the cathedral and of old houses, which are constructed of this costly material show the magnitude which this noble tree formerly attained in this island. Of the Dragon tree which was once the ornament of the forests of Madeira, there are at present, in the whole island, only six or seven specimens in existence, which are shown as curiosities to strangers.”

Destruction of the trees that once covered the West Indian islands followed the pattern set at Madeira. Oviedo came to the island of Española very early in its history and knew many of the original settlers, including Columbus. People on the island reported to him many great changes in the landscape since Columbus’s landing there fifty years before. Everyone agreed that “as the region became more controlled and pacified and the Spanish succeeded in dominating both the indigenous people and animals, the island became more opened.”

The pace of deforestation on Barbados exceeded that on Española or Madeira. In little more than twenty years, the representatives of the planters admitted to having used and destroyed all the timber on the island. Brazil seemed headed in the same dangerous direction in the late seventeenth century, but authorities took ameliorative action just in time. They prohibited the construction of new sugar mills unless they were set up at least one and a half miles from an existing one. Maintaining such distances between mills allowed each one enough room to grow sufficient amounts of wood to maintain operations. If the placement of mills were left to the whims of individuals, the regent and governor of Portugal argued in establishing the rule, soon there would not be enough fuel for any mill and the whole industry would be ruined.

In other areas where government did not intercede, greed blinded the planters and they suffered from their lack of foresight not too long after opening their mills. On the island of Española, when the sugar mills were first built, their owners “were

accustomed to having wood right at their doorsteps,” according to Oviedo. After the passing of several decades, he observed, “they have to go great distances looking for wood and each day it becomes more scarce and farther from the sugar mills....”

Oviedo saw other changes as well. The clearance of its tropical forest, Oviedo observed, caused a decrease in moisture. John Evelyn reported the same occurrence in Barbados: “Every year [it becomes] more torrid,” as plantations grew at the expense of the island’s forest cover. Nowhere could the change in hydrology be better seen than on Madeira. At the time of the island’s discovery, its most important river was so deep that lumberjacks were able to float logs from the interior of the island to its mouth. After the loss of most of Madeira’s original vegetation, the volume of water in the river dropped dramatically. “At present [1851] this river is quite insignificant,” a naturalist observed, “and almost dried up.”

Alexander von Humboldt, an important figure in late-eighteenth- and early-nineteenth-century science, was one of [Charles] Darwin’s heroes. Von Humboldt and his companion, the French naturalist Aime Bonpland, brilliantly explained why deforested lands, especially in the Tropics, experienced such catastrophic desiccation. Trees “affect the copiousness of springs ... because by sheltering the soil from the direct action of the sun, they diminish the evaporation of water produced by rain,” they wrote in their *Personal Narrative of Travel to the Equinoctial Regions of America*. “When the forests are destroyed, as they are everywhere in America by European planters, with imprudent precipitancy, the springs are entirely dried up, or become less abundant,” they continued. “The beds of rivers, remaining dry during a part of the year, are converted into torrents, whenever great rains fall.” The reason: “As the [grass cover] and the moss disappear with the brushwood ... the waters falling in rain are no longer impeded in their course; and instead of slowly augmenting the level of the rivers by progressive filtrations ... [they] form ... sudden and destructive inundations.” Humboldt and Bonpland thereby concluded that “the clearing of forests, the want of permanent springs, and the existence of torrents, are three phenomena closely connected together.”

Planters discovered additional changes in the land on account of deforestation. For one thing, the soil rapidly lost its fertility after its original cover was cleared. After fewer than thirty years of cultivation, the governor of Barbados complained that the land now planted “renders not by two-thirds its former production by the acre.” Furthermore, during heavy rains, the soil, now opened to violent bombardment by tropical storms, tended “to run away,” a term coined by planters experiencing extreme soil slippage after the rains. It was not uncommon for tracts of land planted with sugarcane to slide from sides of hills into valleys. “As the soil upon these hills is commonly not above eight or ten inches deep, and of an oozy and soapy nature underneath,” an observant visitor to Barbados in the early eighteenth century wrote, “it easily separates from the next immediate substratum.” Planters sometimes lost considerable land in this manner. In one instance an entire field slid from its hillside into the adjacent valley belonging to a different planter. Another time, a landholder watched in dismay as the greater part of his land, along with its crops, broke and then fell over cliffs into the ocean. But just as he believed that everything was lost, the land above his, covered with cane, tumbled onto his property, replacing the soil that only a few hours before had washed away.

THE INTRODUCTION OF SLAVERY

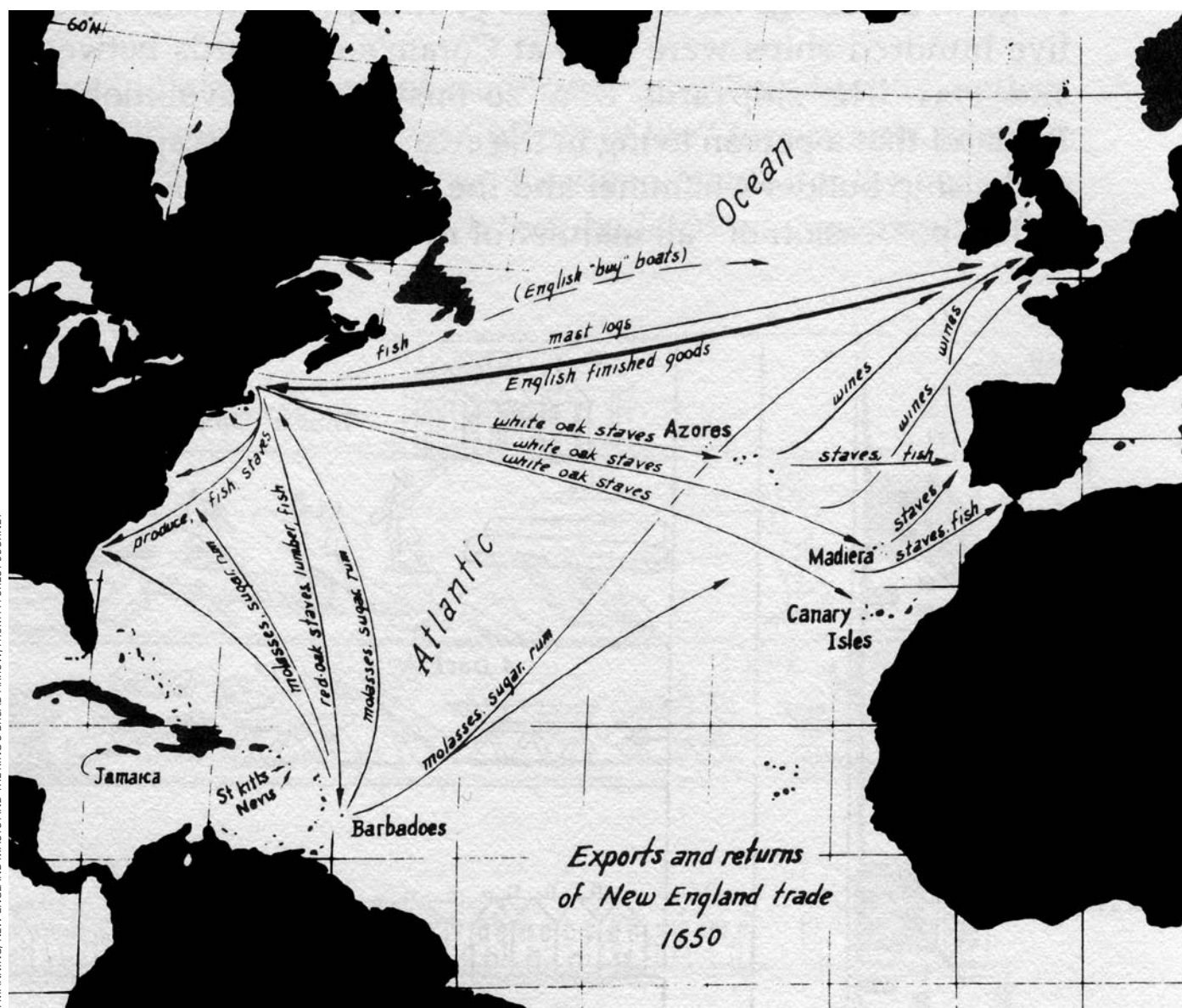
The Europeans rid the Indies of their native populations with the same violence that they employed to clear the forests of their trees. The Spanish chronicler Juan Acosta informed the world that by 1588 “there have remained few natural Indians.” He blamed the genocide on “the inconsiderations of the first conquerors that peopled” the Indies. With the Indians gone, the planters lacked hands to work their sugar mills, making it “more requisite to send over Blacks,” according to Antonio de Herrera’s sixteenth-century work *The General History of the Vast Continent and Islands of America*. To fill this vacuum, Herrera reported, the Portuguese found it very profitable “fetching many [slaves] from Guinea.” So the slave trade developed. After a hundred years of “Negroes carried continually to the West Indies,” “near a million slaves” had been sent from Africa to make sugar. Slavers like Sir John Hawkins, who loaded “Negroes in Guinea” for the West Indian trade, earned great quantities of “gold, pearls, and emeralds.”

With such profits to be made, what rational person would have second thoughts about engaging in the slave trade, even though, once off the ship, the surviving blacks were “reckoned to live long if they [held] out seven years ... the labor so hard ... the sustenance so small.” Nor were consumers of sugar or planters bothered by the number of forests or human lives destroyed in order to produce the commodity. Europeans worshipped sugar. When new sources became available, people, such as Lucca Landucci, a fifteenth-century Florentine, rushed to buy some. In their opinion, sugar far exceeded its nearest rival, honey, “as a pippin [apple] does a crab,” judging sugar to be “the cleanest and best sweet in the universe.” The taste of Madeira sugar was favored over the type produced in Europe, and by the end of the fifteenth century Portuguese ships from Madeira could be seen with greater frequency at ports such as Venice, unloading thousands of cases. Most Europeans applauded the increased availability of sugar from Madeira, the West Indies, and Brazil. The export of large quantities caused the price of sugar to drop considerably and brought it within reach of many households. Sugar was in such demand that by the late 1600s a spokesperson for the industry could justly declare, “the noble juice of the cane, which next to that of the vine, exceeds all the liquors in the world.”

Sugar, being “a commodity in mighty esteem,” enriched those who grew it. It was “one of the richest crops that any province or kingdom” could possess, according to Oviedo. The production of sugar rendered Barbados the “most valuable [colony] to Great Britain for its size that it ever possessed,” in the opinion of an eighteenth-century economic historian. Furthermore, England’s domination of the commerce in sugar by the 1690s brought more wealth than any other commodity Great Britain traded or manufactured. The many “very fair and beautiful” buildings on Barbados, including “houses like castles,” demonstrated how well sugar plantation owners fared.

NEW ENGLAND SUPPLIES THE WEST INDIES WITH WOOD

Plantation owners in the West Indies earned such large profits from producing sugar that they sought new ways to maintain operations rather than allow growing wood scarcities to drive them out of business. On Barbados, they replaced worn-out



This map illustrates the trade between New England and the Atlantic community in the middle of the seventeenth century.

wooden rollers with iron ones. They also burned bruised cane in the furnaces, although it made "a weak and uncertain fire, much inferior to wood," according to one expert.

Although the sugar mills could use wood substitutes in certain portions of the sugar-making process, they would have had to shut down unless new sources of timber were found. To their good fortune, they found a permanent supply from New England.

The West Indian planters received from New England timber to construct and repair sugarworks, staves for casks in which sugar was packed and exported, and "houses ready framed." When Bridgetown, the capital of Barbados, burned down in 1668, a flotilla sailed to New England "to fetch timber" for rebuilding the city. So dependent had Barbados become on wood from New England that its representatives in England informed Parliament's Committee of Trade in 1673 of the island's "necessity of a trade with New England for boards, timber, and ... staves. Without which," they contended, the island's growers "could not maintain their buildings nor send home their sugars." Parliament members no doubt listened since Barbados produced about 70 percent

of the sugar in the British West Indies. In fact, most analysts agreed that without the trade in wood from New England, the sugar-producing islands "could not make [sugar], at least, not cheap enough and in sufficient quantities to answer the markets in Europe."

RUM AND THE DEVELOPMENT OF NEW ENGLAND

Statistics compiled in the late eighteenth century revealed that the British West Indies received from North American forests, primarily those in New England, 77 million feet of boards and timber, 60 million shingles, and 58 million staves between 1771 and 1773. Woodsmen had to cut far in excess of 240,000 trees to provide the West Indian market with the lumber. In exchange for the wood, Yankee traders, mostly Quakers and Puritans, obtained 3 million gallons of rum. With their cargoes of liquor, they headed to Africa to trade the rum for slaves or sell it to European slave merchants. They then returned to the West Indies with their human freight, and they bartered the slaves for sugar.

The New Englanders shipped the sugar to England and traded it for manufactured goods which they sold in America. The money earned from those sales went to purchase more timber for another round in this trade loop.

Yankee traders also bartered timber for thousands of gallons of molasses to ship to Boston, where they were distilled into spirits "of the American proof." Traders exchanged the American-made rum for pelts from Native Americans. Furs brought a high price in England and New Englanders came home with a bevy of manufactured goods to sell in their province and the rest of the colonies. The rum, in turn, killed more Indians than all wars and diseases.

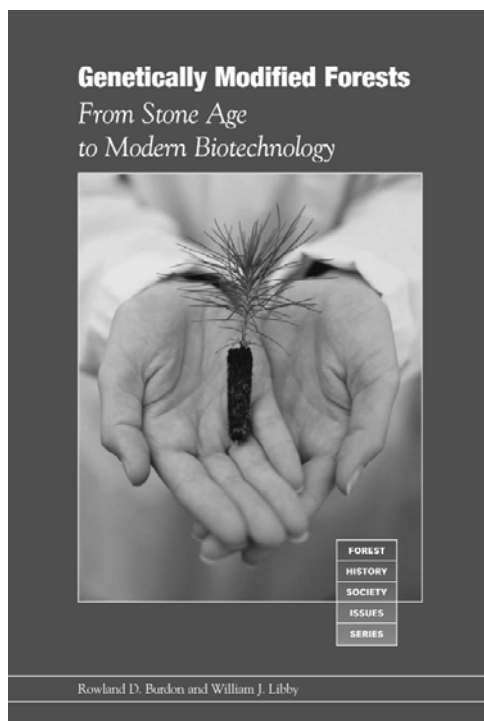
Merchants from New England also found lucrative markets for their timber in other recently deforested areas. The island of Madeira relied on New England for its supply of staves to build casks in which it shipped its wine. At one time the islanders had sufficient wood of their own that could have done the job. By the late 1600s, however, most of the island was covered with vines rather than the great cedars and other trees of large dimensions of earlier times.

Portugal and Spain also became regular stops for New England's wood-carrying ships since imports of great timber from Madeira, of course, had ceased. "Many young [English] men...bred to the sea" took part in the trade, reported Joshua Gee, an early-eighteenth-century writer on matters of trade and commerce. Most shared a common profile: they could not find work at home but somehow could obtain financial backing. With a shipload of manufactured items, they sailed to New England and sold them at a good price. The seamen-merchants used the money to build more ships and purchase timber, and they sailed for Portugal or Spain, where they sold the timber and their ships, too, so needy were the Spanish and the Portuguese for wood. Then back to England to buy another cargo, and off to New England to begin another cycle. □

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Genetically Modified Forests: From Stone Age to Modern Biotechnology

by Rowland D. Burdon and William J. Libby



ISBN: SOFTCOVER: 978-0-89030-068-8 **\$8.95**

The term biotechnology came into common usage in the 1980s. Broadly defined, it is anything that combines biology and technology, but it commonly refers to genetic manipulation of plants and animals. And it has a long history; the genetics of many tree species have been purposefully modified for more than 5,000 years. During the last century, the use of conventional breeding techniques has allowed humans to improve tree growth on some lands and to preserve forests on others. Most recently, genetic engineering has accelerated this potential.

But biotechnology has become more controversial during the last few decades as the level of technology has increased. Few would question the use of genetic engineering if it is used to protect the environment and improve living standards, but there are proper concerns about unintended consequences.

In *Genetically Modified Forests*, authors Rowland D. Burdon and William J. Libby trace the history of tree improvement, helping the reader to understand both human effect on tree genetics and the real and imagined concerns of genetic engineering.

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