

The Atlantic: "1491" – Ch. C. Mann

The plane took off in weather that was surprisingly cool for north-central Bolivia and flew east, toward the Brazilian border.

Clark Erickson and William Balée, the archaeologists, sat up front. Erickson and Balée belong to a cohort of scholars that has radically challenged conventional notions of what the Western Hemisphere was like before Columbus. When I went to high school, in the 1970s, I was taught that Indians came to the Americas across the Bering Strait about 12,000 years ago, that they lived for the most part in small, isolated groups, and that they had so little impact on their environment that even after millennia of habitation it remained mostly wilderness. My son picked up the same ideas at his schools. One way to summarize the views of people like Erickson and Balée would be to say that in their opinion this picture of Indian life is wrong in almost every aspect. Indians were here far longer than previously thought, these researchers believe, and in much greater numbers. And they were so successful at imposing their will on the landscape that in 1492 Columbus set foot in a hemisphere thoroughly dominated by humankind.

Given the charged relations between white societies and native peoples, inquiry into Indian culture and history is inevitably contentious. But the recent scholarship is especially controversial. To begin with, some researchers—many but not all from an older generation—deride the new theories as fantasies arising from an almost willful misinterpretation of data and a perverse kind of political correctness. "I have seen no evidence that large numbers of people ever lived in the Beni," says Betty J. Meggers, of the Smithsonian Institution. "Claiming otherwise is just wishful thinking." Similar criticisms apply to many of the new scholarly claims about Indians, according to Dean R. Snow, an anthropologist at Pennsylvania State University. The problem is that "you can make the meager evidence from the ethnohistorical record tell you anything you want," he says. "It's really easy to kid yourself."

More important are the implications of the new theories for today's ecological battles. Much of the environmental movement is animated, consciously or not, by what William Denevan, a geographer at the University of Wisconsin, calls, polemically, "the pristine myth"—the belief that the Americas in 1491 were an almost unmarked, even Edenic land, "untrammelled by man," in the words of the Wilderness Act of 1964, one of the nation's first and most important environmental laws. As the University of Wisconsin historian William Cronon has written, restoring this long-ago, putatively natural state is, in the view of environmentalists, a task that society is morally bound to undertake. Yet if the new view is correct and the work of humankind was pervasive, where does that leave efforts to restore nature?

Like a Club Between the Eyes

By the time the Pilgrims arrived on the *Mayflower*, Europeans had been visiting New England for more than a hundred years. English, French, Italian, Spanish, and Portuguese mariners regularly plied the coastline, trading what they could,

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occasionally kidnapping the inhabitants for slaves. New England, the Europeans saw, was thickly settled and well defended. In 1605 and 1606 Samuel de Champlain visited Cape Cod, hoping to establish a French base. He abandoned the idea. Too many people already lived there. A year later Sir Ferdinando Gorges—British despite his name—tried to establish an English community in southern Maine. It had more founders than Plymouth and seems to have been better organized. Confronted by numerous well-armed local Indians, the settlers abandoned the project within months. The Indians at Plymouth would surely have been an equal obstacle had disease not intervened.

Faced with such stories, historians have long wondered how many people lived in the Americas at the time of contact. "Debated since Columbus attempted a partial census on Hispaniola in 1496," William Denevan has written, this "remains one of the great inquiries of history." (In 1976 Denevan assembled and edited an entire book on the subject, *The Native Population of the Americas in 1492*.) The first scholarly estimate of the indigenous population was made in 1910 by James Mooney, a distinguished ethnographer at the Smithsonian Institution. Combing through old documents, he concluded that in 1491 North America had 1.15 million inhabitants. Mooney's glittering reputation ensured that most subsequent researchers accepted his figure uncritically.

That changed in 1966, when Henry F. Dobyns published "Estimating Aboriginal American Population: An Appraisal of Techniques With a New Hemispheric Estimate," in the journal *Current Anthropology*. Despite the carefully neutral title, his argument was thunderous, its impact long-lasting. Dobyns's estimate proved to be one of the opening rounds in today's culture wars.

Dobyns began his exploration of pre-Columbian Indian demography in the early 1950s, when he was a graduate student. At the invitation of a friend, he spent a few months in northern Mexico, which is full of Spanish-era missions. There he poked through the crumbling leather-bound ledgers in which Jesuits recorded local births and deaths. Right away he noticed how many more deaths there were. The Spaniards arrived, and then Indians died—in huge numbers, at incredible rates. It hit him, Dobyns told me recently, "like a club right between the eyes."

It took Dobyns eleven years to obtain his Ph.D. Along the way he joined a rural-development project in Peru, which until colonial times was the seat of the Incan empire. Remembering what he had seen at the northern fringe of the Spanish conquest, Dobyns decided to compare it with figures for the south. He burrowed into the papers of the Lima cathedral and read apologetic Spanish histories. The Indians in Peru, Dobyns concluded, had faced plagues from the day the conquistadors showed up—in fact, before then: smallpox arrived around 1525, seven years ahead of the Spanish. Brought to Mexico apparently by a single sick Spaniard, it swept south and eliminated more than half the population of the Incan empire. Smallpox claimed the Incan dictator Huayna Capac and much of his family,

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setting off a calamitous war of succession. So complete was the chaos that Francisco Pizarro was able to seize an empire the size of Spain and Italy combined with a force of 168 men.

Smallpox was only the first epidemic. Typhus (probably) in 1546, influenza and smallpox together in 1558, smallpox again in 1589, diphtheria in 1614, measles in 1618—all ravaged the remains of Incan culture. Dobyns was the first social scientist to piece together this awful picture, and he naturally rushed his findings into print. Hardly anyone paid attention. But Dobyns was already working on a second, related question: If all those people died, how many had been living there to begin with? Before Columbus, Dobyns calculated, the Western Hemisphere held ninety to 112 million people. Another way of saying this is that in 1491 more people lived in the Americas than in Europe.

His argument was simple but horrific. It is well known that Native Americans had no experience with many European diseases and were therefore immunologically unprepared—"virgin soil," in the metaphor of epidemiologists. What Dobyns realized was that such diseases could have swept from the coastlines initially visited by Europeans to inland areas controlled by Indians who had never seen a white person. The first whites to explore many parts of the Americas may therefore have encountered places that were already depopulated. Indeed, Dobyns argued, they must have done so.

So many epidemics occurred in the Americas, Dobyns argued, that the old data used by Mooney and his successors represented population nadirs. From the few cases in which before-and-after totals are known with relative certainty, Dobyns estimated that in the first 130 years of contact about 95 percent of the people in the Americas died—the worst demographic calamity in recorded history.

Inventing by the Millions

On May 30, 1539, Hernando de Soto landed his private army near Tampa Bay, in Florida. According to Charles Hudson, an anthropologist at the University of Georgia who spent fifteen years reconstructing the path of the expedition, Soto crossed the Mississippi a few miles downstream from the present site of Memphis. It was a nervous passage: the Spaniards were watched by several thousand Indian warriors. Utterly without fear, Soto brushed past the Indian force into what is now eastern Arkansas, through thickly settled land—"very well peopled with large towns," one of his men later recalled, "two or three of which were to be seen from one town." Eventually the Spaniards approached a cluster of small cities, each protected by earthen walls, sizeable moats, and deadeye archers. In his usual fashion, Soto brazenly marched in, stole food, and marched out.

After Soto left, no Europeans visited this part of the Mississippi Valley for more than a century. Early in 1682 whites appeared again, this time Frenchmen in canoes. One of them was René-Robert Cavelier, Sieur de la Salle. The French passed through the

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area where Soto had found cities cheek by jowl. It was deserted—La Salle didn't see an Indian village for 200 miles. About fifty settlements existed in this strip of the Mississippi when Soto showed up, according to Anne Ramenofsky, an anthropologist at the University of New Mexico. By La Salle's time the number had shrunk to perhaps ten, some probably inhabited by recent immigrants. Soto "had a privileged glimpse" of an Indian world, Hudson says. "The window opened and slammed shut. When the French came in and the record opened up again, it was a transformed reality. A civilization crumbled. The question is, how did this happen?"

The question is even more complex than it may seem. Disaster of this magnitude suggests epidemic disease. In the view of Ramenofsky and Patricia Galloway, an anthropologist at the University of Texas, the source of the contagion was very likely not Soto's army but its ambulatory meat locker: his 300 pigs. Soto's force itself was too small to be an effective biological weapon. Sickneses like measles and smallpox would have burned through his 600 soldiers long before they reached the Mississippi. But the same would not have held true for the pigs, which multiplied rapidly and were able to transmit their diseases to wildlife in the surrounding forest. When human beings and domesticated animals live close together, they trade microbes with abandon. Over time mutation spawns new diseases: avian influenza becomes human influenza, bovine rinderpest becomes measles.

Unlike Europeans, Indians did not live in close quarters with animals—they domesticated only the dog, the llama, the alpaca, the guinea pig, and, here and there, the turkey and the Muscovy duck. In some ways this is not surprising: the New World had fewer animal candidates for taming than the Old. Moreover, few Indians carry the gene that permits adults to digest lactose, a form of sugar abundant in milk. Non-milk-drinkers, one imagines, would be less likely to work at domesticating milk-giving animals. But this is guesswork. The fact is that what scientists call zoonotic disease was little known in the Americas. Swine alone can disseminate anthrax, brucellosis, leptospirosis, taeniasis, trichinosis, and tuberculosis. Pigs breed exuberantly and can transmit diseases to deer and turkeys. Only a few of Soto's pigs would have had to wander off to infect the forest.

Indeed, the calamity wrought by Soto apparently extended across the whole Southeast. The Coosa city-states, in western Georgia, and the Caddoan-speaking civilization, centered on the Texas-Arkansas border, disintegrated soon after Soto appeared. The Caddo had had a taste for monumental architecture: public plazas, ceremonial platforms, mausoleums. After Soto's army left, notes Timothy K. Perttula, an archaeological consultant in Austin, Texas, the Caddo stopped building community centers and began digging community cemeteries. Between Soto's and La Salle's visits, Perttula believes, the Caddoan population fell from about 200,000 to about 8,500—a drop of nearly 96 percent. In the eighteenth century the tally shrank further, to 1,400. An equivalent loss today in the population of New York City would reduce it to 56,000—not enough to fill Yankee Stadium. "That's one reason whites think of Indians as nomadic hunters," says Russell Thornton, an

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anthropologist at the University of California at Los Angeles. "Everything else—all the heavily populated urbanized societies—was wiped out."

Could a few pigs truly wreak this much destruction? Such apocalyptic scenarios invite skepticism. As a rule, viruses, microbes, and parasites are rarely lethal on so wide a scale—a pest that wipes out its host species does not have a bright evolutionary future. In its worst outbreak, from 1347 to 1351, the European Black Death claimed only a third of its victims. (The rest survived, though they were often disfigured or crippled by its effects.) The Indians in Soto's path, if Dobyns, Ramenofsky, and Perttula are correct, endured losses that were incomprehensibly greater.

One reason is that Indians were fresh territory for many plagues, not just one. Smallpox, typhoid, bubonic plague, influenza, mumps, measles, whooping cough—all rained down on the Americas in the century after Columbus. (Cholera, malaria, and scarlet fever came later.) Having little experience with epidemic diseases, Indians had no knowledge of how to combat them. In contrast, Europeans were well versed in the brutal logic of quarantine. They boarded up houses in which plague appeared and fled to the countryside. In Indian New England, Neal Salisbury, a historian at Smith College, wrote in *Manitou and Providence* (1982), family and friends gathered with the shaman at the sufferer's bedside to wait out the illness—a practice that "could only have served to spread the disease more rapidly."

Indigenous biochemistry may also have played a role. The immune system constantly scans the body for molecules that it can recognize as foreign—molecules belonging to an invading virus, for instance. No one's immune system can identify all foreign presences. Roughly speaking, an individual's set of defensive tools is known as his MHC type. Because many bacteria and viruses mutate easily, they usually attack in the form of several slightly different strains. Pathogens win when MHC types miss some of the strains and the immune system is not stimulated to act. Most human groups contain many MHC types; a strain that slips by one person's defenses will be nailed by the defenses of the next. But, according to Francis L. Black, an epidemiologist at Yale University, Indians are characterized by unusually homogenous MHC types. One out of three South American Indians have similar MHC types; among Africans the corresponding figure is one in 200. The cause is a matter for Darwinian speculation, the effects less so.

In 1966 Dobyns's insistence on the role of disease was a shock to his colleagues. Today the impact of European pathogens on the New World is almost undisputed. Nonetheless, the fight over Indian numbers continues with undiminished fervor. "Most of the arguments for the very large numbers have been theoretical," Ubelaker says in defense of low counters. "When you try to marry the theoretical arguments to the data that are available on individual groups in different regions, it's hard to find support for those numbers." Archaeologists, he says, keep searching for the settlements in which those millions of people supposedly lived, with little success. "As more and more excavation is done, one would expect to see more evidence for

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dense populations than has thus far emerged." Dean Snow, the Pennsylvania State anthropologist, examined Colonial-era Mohawk Iroquois sites and found "no support for the notion that ubiquitous pandemics swept the region." In his view, asserting that the continent was filled with people who left no trace is like looking at an empty bank account and claiming that it must once have held millions of dollars.

The low counters are also troubled by the Dobynsian procedure for recovering original population numbers: applying an assumed death rate, usually 95 percent, to the observed population nadir. Ubelaker believes that the lowest point for Indians in North America was around 1900, when their numbers fell to about half a million. Assuming a 95 percent death rate, the pre-contact population would have been 10 million. Go up one percent, to a 96 percent death rate, and the figure jumps to 12.5 million—arithmetically creating more than two million people from a tiny increase in mortality rates. At 98 percent the number bounds to 25 million. Minute changes in baseline assumptions produce wildly different results.

"It's an absolutely unanswerable question on which tens of thousands of words have been spent to no purpose," Henige says. In 1976 he sat in on a seminar by William Denevan, the Wisconsin geographer. An "epiphanic moment" occurred when he read shortly afterward that scholars had "uncovered" the existence of eight million people in Hispaniola. *Can you just invent millions of people?* he wondered. "We can make of the historical record that there was depopulation and movement of people from internecine warfare and diseases," he says. "But as for how much, who knows? When we start putting numbers to something like that—applying large figures like ninety-five percent—we're saying things we shouldn't say. The number implies a level of knowledge that's impossible."

To Elizabeth Fenn, the smallpox historian, the squabble over numbers obscures a central fact. In the long run, Fenn says, the consequential finding is not that many people died but that many people once lived. The Americas were filled with a stunningly diverse assortment of peoples who had knocked about the continents for millennia. "You have to wonder," Fenn says. "What were all those people *up* to in all that time?"

Buffalo Farm

Samuel Eliot Morison, the winner of two Pulitzer Prizes, closed his monumental *European Discovery of America* (1974) with the observation that Native Americans expected only "short and brutish lives, void of hope for any future." As late as 1987 *American History: A Survey*, a standard high school textbook by three well-known historians, described the Americas before Columbus as "empty of mankind and its works." The story of Europeans in the New World, the book explained, "is the story of the creation of a civilization where none existed."

Alfred Crosby, a historian at the University of Texas, came to other conclusions. Crosby's *The Columbian Exchange: Biological Consequences of 1492* caused almost as

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much of a stir when it was published, in 1972, as Henry Dobyns's calculation of Indian numbers six years earlier, though in different circles. Human history, in Crosby's interpretation, is marked by two world-altering centers of invention: the Middle East and central Mexico, where Indian groups independently created nearly all of the Neolithic innovations, writing included. The Neolithic Revolution began in the Middle East about 10,000 years ago. In the next few millennia humankind invented the wheel, the metal tool, and agriculture. The Sumerians eventually put these inventions together, added writing, and became the world's first civilization. Afterward Sumeria's heirs in Europe and Asia frantically copied one another's happiest discoveries; innovations ricocheted from one corner of Eurasia to another, stimulating technological progress. Native Americans, who had crossed to Alaska before Sumeria, missed out on the bounty. "They had to do everything on their own," Crosby says. Remarkably, they succeeded.

When Columbus appeared in the Caribbean, the descendants of the world's two Neolithic civilizations collided, with overwhelming consequences for both. American Neolithic development occurred later than that of the Middle East, possibly because the Indians needed more time to build up the requisite population density. Without beasts of burden they could not capitalize on the wheel (for individual workers on uneven terrain skids are nearly as effective as carts for hauling), and they never developed steel. But in agriculture they handily outstripped the children of Sumeria. Every tomato in Italy, every potato in Ireland, and every hot pepper in Thailand came from this hemisphere. Worldwide, more than half the crops grown today were initially developed in the Americas.

Maize, as corn is called in the rest of the world, was a triumph with global implications. Indians developed an extraordinary number of maize varieties for different growing conditions, which meant that the crop could and did spread throughout the planet. Central and Southern Europeans became particularly dependent on it; maize was the staple of Serbia, Romania, and Moldavia by the nineteenth century. Indian crops dramatically reduced hunger, Crosby says, which led to an Old World population boom.

Along with peanuts and manioc, maize came to Africa and transformed agriculture there, too. "The probability is that the population of Africa was greatly increased because of maize and other American Indian crops," Crosby says. "Those extra people helped make the slave trade possible." Maize conquered Africa at the time when introduced diseases were leveling Indian societies. The Spanish, the Portuguese, and the British were alarmed by the death rate among Indians, because they wanted to exploit them as workers. Faced with a labor shortage, the Europeans turned their eyes to Africa. The continent's quarrelsome societies helped slave traders to siphon off millions of people. The maize-fed population boom, Crosby believes, let the awful trade continue without pumping the well dry.

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Back home in the Americas, Indian agriculture long sustained some of the world's largest cities. The Aztec capital of Tenochtitlán dazzled Hernán Cortés in 1519; it was bigger than Paris, Europe's greatest metropolis. The Spaniards gawped like hayseeds at the wide streets, ornately carved buildings, and markets bright with goods from hundreds of miles away. They had never before seen a city with botanical gardens, for the excellent reason that none existed in Europe. The same novelty attended the force of a thousand men that kept the crowded streets immaculate. (Streets that weren't ankle-deep in sewage! The conquistadors had never heard of such a thing.) Central America was not the only locus of prosperity. Thousands of miles north, John Smith, of Pocahontas fame, visited Massachusetts in 1614, before it was emptied by disease, and declared that the land was "so planted with Gardens and Corne fields, and so well inhabited with a goodly, strong and well proportioned people ... [that] I would rather live here than any where."

Smith was promoting colonization, and so had reason to exaggerate. But he also knew the hunger, sickness, and oppression of European life. France—"by any standards a privileged country," according to its great historian, Fernand Braudel—experienced seven nationwide famines in the fifteenth century and thirteen in the sixteenth. Disease was hunger's constant companion. During epidemics in London the dead were heaped onto carts "like common dung" (the simile is Daniel Defoe's) and trundled through the streets. The infant death rate in London orphanages, according to one contemporary source, was 88 percent. Governments were harsh, the rule of law arbitrary. The gibbets poking up in the background of so many old paintings were, Braudel observed, "merely a realistic detail."

The Earth Shall Weep, James Wilson's history of Indian America, puts the comparison bluntly: "the western hemisphere was larger, richer, and more populous than Europe." Much of it was freer, too. Europeans, accustomed to the serfdom that thrived from Naples to the Baltic Sea, were puzzled and alarmed by the democratic spirit and respect for human rights in many Indian societies, especially those in North America. In theory, the sachems of New England Indian groups were absolute monarchs. In practice, the colonial leader Roger Williams wrote, "they will not conclude of ought ... unto which the people are averse."

Pre-1492 America wasn't a disease-free paradise, Dobyns says, although in his "exuberance as a writer," he told me recently, he once made that claim. Indians had ailments of their own, notably parasites, tuberculosis, and anemia. The daily grind was wearing; life-spans in America were only as long as or a little longer than those in Europe, if the evidence of indigenous graveyards is to be believed. Nor was it a political utopia—the Inca, for instance, invented refinements to totalitarian rule that would have intrigued Stalin. Inveterate practitioners of what the historian Francis Jennings described as "state terrorism practiced horrifically on a huge scale," the Inca ruled so cruelly that one can speculate that their surviving subjects might actually have been better off under Spanish rule.

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I asked seven anthropologists, archaeologists, and historians if they would rather have been a typical Indian or a typical European in 1491. None was delighted by the question, because it required judging the past by the standards of today—a fallacy disparaged as "presentism" by social scientists. But every one chose to be an Indian. Some early colonists gave the same answer. Horrifying the leaders of Jamestown and Plymouth, scores of English ran off to live with the Indians.

As for the Indians, evidence suggests that they often viewed Europeans with disdain. The Hurons, a chagrined missionary reported, thought the French possessed "little intelligence in comparison to themselves." Europeans, Indians said, were physically weak, sexually untrustworthy, atrociously ugly, and just plain dirty. (Spaniards, who seldom if ever bathed, were amazed by the Aztec desire for personal cleanliness.) A Jesuit reported that the "Savages" were disgusted by handkerchiefs: "They say, we place what is unclean in a fine white piece of linen, and put it away in our pockets as something very precious, while they throw it upon the ground." The Micmac scoffed at the notion of French superiority. If Christian civilization was so wonderful, why were its inhabitants leaving?

Like people everywhere, Indians survived by cleverly exploiting their environment. Europeans tended to manage land by breaking it into fragments for farmers and herders. Indians often worked on such a grand scale that the scope of their ambition can be hard to grasp. They created small plots, as Europeans did (about 1.5 million acres of terraces still exist in the Peruvian Andes), but they also reshaped entire landscapes to suit their purposes. A principal tool was fire, used to keep down underbrush and create the open, grassy conditions favorable for game. Rather than domesticating animals for meat, Indians retooled whole ecosystems to grow bumper crops of elk, deer, and bison. The first white settlers in Ohio found forests as open as English parks—they could drive carriages through the woods. Along the Hudson River the annual fall burning lit up the banks for miles on end; so flashy was the show that the Dutch in New Amsterdam boated upriver to goggle at the blaze like children at fireworks. In North America, Indian torches had their biggest impact on the Midwestern prairie, much or most of which was created and maintained by fire. Millennia of exuberant burning shaped the plains into vast buffalo farms. When Indian societies disintegrated, forest invaded savannah in Wisconsin, Illinois, Kansas, Nebraska, and the Texas Hill Country. Is it possible that the Indians changed the Americas more than the invading Europeans did? "The answer is probably yes for most regions for the next 250 years or so" after Columbus, William Denevan wrote, "and for some regions right up to the present time."

When scholars first began increasing their estimates of the ecological impact of Indian civilization, they met with considerable resistance from anthropologists and archaeologists. The disagreement is encapsulated by Amazonia, which has become *the* emblem of vanishing wilderness—an admonitory image of untouched Nature. Yet recently a growing number of researchers have come to believe that Indian societies had an enormous environmental impact on the jungle. Indeed, some

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anthropologists have called the Amazon forest itself a cultural artifact—that is, an artificial object.

Green Prisons

In college I took an introductory anthropology class in which I read *Amazonia: Man and Culture in a Counterfeit Paradise* (1971), perhaps the most influential book ever written about the Amazon, and one that deeply impressed me at the time. Written by Betty J. Meggers, the Smithsonian archaeologist, *Amazonia* says that the apparent lushness of the rain forest is a sham. The soils are poor and can't hold nutrients—the jungle flora exists only because it snatches up everything worthwhile before it leaches away in the rain. Agriculture, which depends on extracting the wealth of the soil, therefore faces inherent ecological limitations in the wet desert of Amazonia.

As a result, Meggers argued, Indian villages were forced to remain small—any report of "more than a few hundred" people in permanent settlements, she told me recently, "makes my alarm bells go off." Bigger, more complex societies would inevitably overtax the forest soils, laying waste to their own foundations. Beginning in 1948 Meggers and her late husband, Clifford Evans, excavated a chiefdom on Marajó, an island twice the size of New Jersey that sits like a gigantic stopper in the mouth of the Amazon. The Marajóara, they concluded, were failed offshoots of a sophisticated culture in the Andes. Transplanted to the lush trap of the Amazon, the culture choked and died.

Then Anna C. Roosevelt, the curator of archaeology at Chicago's Field Museum of Natural History, re-excavated Marajó. Her complete report, *Moundbuilders of the Amazon* (1991), was like the anti-matter version of *Amazonia*. Marajó, she argued, was "one of the outstanding indigenous cultural achievements of the New World," a powerhouse that lasted for more than a thousand years, had "possibly well over 100,000" inhabitants, and covered thousands of square miles. Rather than damaging the forest, Marajó's "earth construction" and "large, dense populations" had *improved* it: the most luxuriant and diverse growth was on the mounds formerly occupied by the Marajóara. "If you listened to Meggers's theory, these places should have been ruined," Roosevelt says.

Meggers scoffed at Roosevelt's "extravagant claims," "polemical tone," and "defamatory remarks." Roosevelt, Meggers argued, had committed the beginner's error of mistaking a site that had been occupied many times by small, unstable groups for a single, long-lasting society. The dispute grew bitter and personal. Meanwhile, Roosevelt's team investigated Painted Rock Cave. On the floor of the cave what looked to me like nothing in particular turned out to be an ancient midden: a refuse heap. The archaeologists slowly scraped away sediment, traveling backward in time with every inch. When the traces of human occupation vanished, they kept digging. ("You always go a meter past sterile," Roosevelt says.) A few inches below they struck the charcoal-rich dirt that signifies human habitation—a culture, Roosevelt said later, that wasn't supposed to be there.

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For many millennia the cave's inhabitants hunted and gathered for food. But by about 4,000 years ago they were growing crops—perhaps as many as 140 of them, according to Charles R. Clement, an anthropological botanist at the Brazilian National Institute for Amazonian Research. Unlike Europeans, who planted mainly annual crops, the Indians, he says, centered their agriculture on the Amazon's unbelievably diverse assortment of trees: fruits, nuts, and palms. "It's tremendously difficult to clear fields with stone tools," Clement says. "If you can plant trees, you get twenty years of productivity out of your work instead of two or three."

Planting their orchards, the first Amazonians transformed large swaths of the river basin into something more pleasing to human beings. In a widely cited article from 1989, William Balée, the Tulane anthropologist, cautiously estimated that about 12 percent of the nonflooded Amazon forest was of anthropogenic origin—directly or indirectly created by human beings. In some circles this is now seen as a conservative position. "I basically think it's all human-created," Clement told me in Brazil. He argues that Indians changed the assortment and density of species throughout the region. So does Clark Erickson, the University of Pennsylvania archaeologist, who told me in Bolivia that the lowland tropical forests of South America are among the finest works of art on the planet. "Some of my colleagues would say that's pretty radical," he said, smiling mischievously. According to Peter Stahl, an anthropologist at the State University of New York at Binghamton, "lots" of botanists believe that "what the eco-imagery would like to picture as a pristine, untouched Urwelt [primeval world] in fact has been managed by people for millennia." The phrase "built environment," Erickson says, "applies to most, if not all, Neotropical landscapes."

"Landscape" in this case is meant exactly—Amazonian Indians literally created the ground beneath their feet. According to William I. Woods, a soil geographer at Southern Illinois University, ecologists' claims about terrible Amazonian land were based on very little data. In the late 1990s Woods and others began careful measurements in the lower Amazon. They indeed found lots of inhospitable terrain. But they also discovered swaths of *terra preta*—rich, fertile "black earth" that anthropologists increasingly believe was created by human beings.

Terra preta, Woods guesses, covers at least 10 percent of Amazonia, an area the size of France. It has amazing properties, he says. Tropical rain doesn't leach nutrients from *terra preta* fields; instead the soil, so to speak, fights back. Not far from Painted Rock Cave is a 300-acre area with a two-foot layer of *terra preta* quarried by locals for potting soil. The bottom third of the layer is never removed, workers there explain, because over time it will re-create the original soil layer in its initial thickness. The reason, scientists suspect, is that *terra preta* is generated by a special suite of microorganisms that resists depletion. "Apparently," Woods and the Wisconsin geographer Joseph M. McCann argued in a presentation last summer, "at some threshold level ... dark earth attains the capacity to perpetuate—

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even *regenerate* itself—thus behaving more like a living 'super'-organism than an inert material."

In as yet unpublished research the archaeologists Eduardo Neves, of the University of São Paulo; Michael Heckenberger, of the University of Florida; and their colleagues examined *terra preta* in the upper Xingu, a huge southern tributary of the Amazon. Not all Xingu cultures left behind this living earth, they discovered. But the ones that did generated it rapidly—suggesting to Woods that *terra preta* was created deliberately. In a process reminiscent of dropping microorganism-rich starter into plain dough to create sourdough bread, Amazonian peoples, he believes, inoculated bad soil with a transforming bacterial charge. Not every group of Indians there did this, but quite a few did, and over an extended period of time.

When Woods told me this, I was so amazed that I almost dropped the phone. I ceased to be articulate for a moment and said things like "wow" and "gosh." Woods chuckled at my reaction, probably because he understood what was passing through my mind. Faced with an ecological problem, I was thinking, the Indians *fixed* it. They were in the process of terraforming the Amazon when Columbus showed up and ruined everything.

Scientists should study the microorganisms in *terra preta*, Woods told me, to find out how they work. If that could be learned, maybe some version of Amazonian dark earth could be used to improve the vast expanses of bad soil that cripple agriculture in Africa—a final gift from the people who brought us tomatoes, corn, and the immense grasslands of the Great Plains.

Novel Shores

Hernando de Soto's expedition stomped through the Southeast for four years and apparently never saw bison. More than a century later, when French explorers came down the Mississippi, they saw "a solitude unrelieved by the faintest trace of man," the nineteenth-century historian Francis Parkman wrote. Instead the French encountered bison, "grazing in herds on the great prairies which then bordered the river."

To Charles Kay, the reason for the buffalo's sudden emergence is obvious. Kay is a wildlife ecologist in the political-science department at Utah State University. In ecological terms, he says, the Indians were the "keystone species" of American ecosystems. A keystone species, according to the Harvard biologist Edward O. Wilson, is a species "that affects the survival and abundance of many other species." Keystone species have a disproportionate impact on their ecosystems. Removing them, Wilson adds, "results in a relatively significant shift in the composition of the [ecological] community."

When disease swept Indians from the land, Kay says, what happened was exactly that. The ecological ancien régime collapsed, and strange new phenomena emerged.

March, 2002

The Atlantic: "1491" – Ch. C. Mann

In a way this is unsurprising; for better or worse, humankind is a keystone species everywhere. Among these phenomena was a population explosion in the species that the Indians had kept down by hunting. After disease killed off the Indians, Kay believes, buffalo vastly extended their range. Their numbers more than sextupled. The same occurred with elk and mule deer. "If the elk were here in great numbers all this time, the archaeological sites should be chock-full of elk bones," Kay says. "But the archaeologists will tell you the elk weren't there." On the evidence of middens the number of elk jumped about 500 years ago.

Passenger pigeons may be another example. The epitome of natural American abundance, they flew in such great masses that the first colonists were stupefied by the sight. As a boy, the explorer Henry Brackenridge saw flocks "ten miles in width, by one hundred and twenty in length." For hours the birds darkened the sky from horizon to horizon. According to Thomas Neumann, a consulting archaeologist in Lilburn, Georgia, passenger pigeons "were incredibly dumb and always roosted in vast hordes, so they were very easy to harvest." Because they were readily caught and good to eat, Neumann says, archaeological digs should find many pigeon bones in the pre-Columbian strata of Indian middens. But they aren't there. The mobs of birds in the history books, he says, were "outbreak populations—always a symptom of an extraordinarily disrupted ecological system."

Throughout eastern North America the open landscape seen by the first Europeans quickly filled in with forest. According to William Cronon, of the University of Wisconsin, later colonists began complaining about how hard it was to get around. (Eventually, of course, they stripped New England almost bare of trees.) When Europeans moved west, they were preceded by two waves: one of disease, the other of ecological disturbance. The former crested with fearsome rapidity; the latter sometimes took more than a century to quiet down. Far from destroying pristine wilderness, European settlers bloodily *created* it. By 1800 the hemisphere was chockablock with new wilderness. If "forest primeval" means a woodland unsullied by the human presence, William Denevan has written, there was much more of it in the late eighteenth century than in the early sixteenth.

Guided by the pristine myth, mainstream environmentalists want to preserve as much of the world's land as possible in a putatively intact state. But "intact," if the new research is correct, means "run by human beings for human purposes." Environmentalists dislike this, because it seems to mean that anything goes. In a sense they are correct. Native Americans managed the continent as they saw fit. Modern nations must do the same. If they want to return as much of the landscape as possible to its 1491 state, they will have to find it within themselves to create the world's largest garden.