

# Humanized Landscapes Before 1492

## Husbandry Extent

**Husbandry Extent.** Previous maps of humanized landscapes often depicted the "Limits of Agriculture." For two reasons, we instead use "Extent of Husbandry," where the term husbandry reaches beyond agriculture (cultivation of fully domesticated plants) to propagating and tending wild and semi-domesticated plants. First, "limits" can connote areas where climatic or soil conditions make food-growing impossible. But indigenous Americans developed so many techniques to overcome environmental obstacles that the borders defining areas in which husbandry was practiced were more often cultural than physical. Second, we use "husbandry" because they grew large quantities of food with methods not typically identified as agriculture, such as managing forest succession (see Agro-Forestry). Here "Extent of Husbandry" is used to mean areas in which husbandry occurred, not areas under continuous cultivation.

## Earthworks

**Earthworks.** Before 1492 Americans raised large areas of surface land with an enormous variety of earthworks. Marshes and wetlands, frequently considered by Westerners to be inhospitable, were converted into rich agricultural land by draining and channeling the water and by piling up the earth into raised fields or settlement mounds. Because native peoples developed many techniques for moving large quantities of earth productively, "earthworks" is a catch-all category that includes raised fields, settlement mounds, polders and dikes, *chinampas*, causeways, levees, and other forms. Most earthworks are tropical or subtropical, though raised fields are widespread in Midwestern North America. Not indicated for reasons of legibility are symbolic earthworks such as the geoglyphs of western Amazonia, the Nasca lines on coastal Peru and the ceremonial mound centers of Mississippian peoples and their predecessors.

## Irrigation

**Irrigation.** To obtain water for agriculture in dry terrain, the first Americans captured it from source areas and delivered it to their fields. For irrigation, native peoples developed the art and science of building weirs and dams to channel or retain rainfall runoff (native peoples did not use groundwater for agriculture in any widespread way). From dams and weirs water was directed to fields with canals. Typical canals in Mexico and the northern North American Southwest were short (<3 kms), shallow (<0.5 m), and narrow (<1 m). Most canals in coastal Peru and the central North American Southwest were deeper (>2 m), wider (>10 m), and longer (up to 30 kms), in at least one place they transported water between valleys. Irrigated lands varied in aerial extent from one to several thousand hectares. The map depicts not the irrigation channels themselves but the areas they water. In many cases these are misleadingly large—they have been emphasized for readability.

## Clearing by Fire

**Clearing by Fire.** Most of the hemisphere was burned to some extent by indigenous Americans. Annual low-intensity fires improved hunting by enhancing forage vegetation; drove away noxious reptiles and insects; facilitated travel; and improved visibility for defense. Occasional intensive burns were used to wage war, and drive game toward traps or hunting parties. In many places native peoples torched stands of dead plants and brush to foster the growth of more valuable species, either through natural succession or by directly sowing or transplanting "wild" plants. And throughout the Americas agriculturalists used fire to clear fields before planting and to remove weeds and recycle nutrients after harvest. Because fire was so widespread and used for so many purposes, it is difficult to delimit precisely. The scatter points on this map roughly indicate areas in which fire was used on a sufficiently widespread and intensive basis to create long-lasting ecological change.

## Terracing

**Terracing.** Unencumbered by the industrial technology that requires nearly flat land, ancient Americans had no difficulty cultivating or living on steep slopes, that they often terraced. Terraces have two components: a nearly-level surface often called the "tread," and a nearly-vertical face often called the "riser." Risers were made of pounded earth, wooden slats, or, most commonly, dry-stacked rock. Terraces were widely distributed across the American landscape, but their greatest concentrations were in the North American Southwest, Middle America, and the Andean cordillera. In this map we depict areas in which terracing was common, not the precise terracing itself.

## Agro-Forestry

**Agro-Forestry.** In many locales indigenous Americans protected and encouraged the growth of particular tree species, individually and in groves. They also cultivated trees, usually but not always by transplanting seedlings from where they were encountered in the wild to places near or around their homes, often hundreds of kilometers distant. Although they did not have "tree farms," in the sense we do today, they did replace naturally occurring forests with orchards and orchard gardens. Indeed, to one extent or another, almost anywhere there were people living in permanent settlements in reasonably humid environments, there were stands of cultivated trees. We use this symbol for areas in which humans are known to have actively manipulated forest composition.

Northern America

South America

Middle America

**THE MAPS:** Research conducted during the past two decades has overturned the "pristine myth": the long-held, still-popular notion that most American environments before the arrival of Europeans ca. AD 1500 were little affected by human activities. Native Americans were conquered by Europeans, but had themselves already conquered their landscapes. This is not to say that indigenous people were malicious agents of environmental destruction. They were not. Like people everywhere, they struggled to protect, house, and feed themselves and their families. In the process they manipulated their habitats, both intentionally and inadvertently.

As population estimates of the pre-colonial Americas have risen, estimates of the range and degree of environmental transformation have risen in concert. For example, on average it takes approximately 0.4 hectare (1 acre) of cropland to feed one person per year entirely by agriculture. Each of these tracts has to be cleared of its natural vegetation, be it forest or grass. A million people, therefore, transform the vegetation of 400,000 ha (1 million ac). Twenty or thirty million change 8 million or 12 million ha (20-30 million ac). Non-agricultural people (so-called hunter-gatherers) transform their environments less intensively, but over time also had major environmental impact. Over time, almost all American landscapes were marked by the human presence.

All too many contemporary Westerners think that indigenous people lived in harmony with nature. They did not. The separation of human beings from nature is a modern, Western way of thinking that created a false dichotomy that axiomatically results in ecological disharmony. If people are not part of nature, they cannot live in harmony with it. Elsewhere in the world and at other times people considered themselves part of nature. This alternative (to some "postmodern") way of thinking allows us to accept nature as including people who transform their environments, literally humanizing landscapes. That Europeans who came late in this process were staggered by the richness of the land demonstrates that landscape transformations need not be negative environmentally.

**DISCUSSION:** For more detailed discussion of the subjects of this map—Husbandry Extent, Clearing by Fire, Agro-Forestry, Irrigation, Terracing, and Earthworks—refer to text on the reverse side.

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Charles C. Mann, Peter H. Dana, and William E. Doolittle

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**BASED ON:** C. C. Mann, 1491: *New Revolutions of the Americas Before Columbus* (Knopf, 2005); W. M. Denevan, *Cultivated Landscapes of Native Amazonia and the Andes* (Oxford, 2001); T. M. Whitmore and B. L. Turner II, *Cultivated Landscapes of Middle America on the Eve of Conquest* (Oxford, 2001); W. E. Doolittle, *Cultivated Landscapes of Native North America* (Oxford, 2000); W. G. Garner, *Raised Field Landscapes of Native North America* (Wisconsin dissertation, 2003); K. W. Butzer, ed., *The Americas before and after 1492: Current Geographical Research*, *Annals of the Association of American Geographers* v. 82, n. 3, 1992; S. Pyne, *World Fire: The Culture of Fire on Earth* (Washington, 1995); National Geographic, *A World Transformed* (Map), 2007.

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**CARTOGRAPHY:** The three maps used here are based on an orthographic projection as though the Earth was viewed from space. Each map has a different scale: Northern America, 1:8,000,000; Middle America, 1:6,000,000; and South America, 1:12,500,000.

**AVAILABILITY:** Copies of this map can be purchased at [www.charlesmann.org](http://www.charlesmann.org)

## Humanized Landscapes of the Americas Before 1492

Charles C. Mann, Peter H. Dana, and William E. Doolittle

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**The Maps** Research conducted during the past two decades has overturned the “pristine myth,” the long-held, still-popular notion that most American environments before the arrival of Europeans ca. AD 1500 were little affected by human activities. Native Americans were conquered by Europeans, but had themselves already conquered their landscapes. This is not to say that indigenous people were malicious agents of environmental destruction. They were not. Like people everywhere, they struggled to protect, house, and feed themselves and their families. In the process they manipulated their habitats, both intentionally and inadvertently. Environmental change was an unanticipated consequence of surviving, living.

The extent and degree of environmental transformation in the pre-colonial Americas was a function of population size. On average it takes approximately 0.4 hectare (1 acre) of cropland to feed one person per year entirely by agriculture. Each of these tracts has to be cleared of its natural vegetation, be it forest or grass. A million people, therefore, transform the vegetation of 400,000 hectares (1 million acres). Twenty or thirty million people change 8 million or 12 million hectares (20-30 million acres). Non-agricultural people (so-called hunter-gatherers) transformed their environments less intensively, but over time also had major environmental impact. By 1492 almost all American landscapes were marked by the human presence.

Many people believe that indigenous people “lived in harmony with nature.” They did not; philosophically, they could not. The separation of humans from nature is a modern, Western way of thinking that created a false dichotomy resulting axiomatically in ecological disharmony. If people are not part of nature, they cannot live in harmony with it. Elsewhere in the world and at other times people considered themselves part of nature. In the Americas this (to some “postmodern”) perspective has become known as “kincentric ecology,” a term popularized by the Rarámuri anthropologist Enrique Salmón. In kincentric ecology, nature includes the people who transform it, literally humanizing the landscape. That Europeans who came late in this process were staggered by the richness of the land demonstrates that landscape transformations were not necessarily negative or degrading. Indeed, kincentric ecology recognizes that humans can affect the environment in positive ways, resulting in increased yields that are sustainable.

The ways in which the American landscapes were humanized prior to AD 1492 are numerous and varied. For heuristic purposes and simplicity, six distinctive types of human activities and their resultant alterations of vegetation, soil, slopes, and water are presented cartographically on the reverse side and discussed here.



**Husbandry Extent** A major form of environmental transformation by indigenous Americans involved the growing of food. Large groups of densely settled people practiced various types of agriculture, defined strictly to mean the growing of domesticated plants such as maize (corn), beans, squash, tobacco—plants that cannot propagate without human intervention. In contrast to the domesticated species that are few in number, a seemingly countless number of other plants that are normally thought of as “wild” were subjected to varying degrees of human intervention, or husbandry on both continents. Some species were protected (e.g., by constructing fences to keep out predatory animals), some were encouraged (e.g., pruning bushes to increase berry production), and some were cultivated—literally meaning to disturb the environments in such a way to eliminate or at least reduce the competition from undesirable plants. Under this strict definition, cultivation includes such activities as sowing the seeds of, hoeing the soil around, and hand-watering plants.

Previous maps portraying humanized landscapes of varying types typically have a line labeled “Agricultural Limits.” “Husbandry Extent” is used here in favor of that more common phrase for two reasons. First, agriculture involves plant husbandry but plant husbandry is not necessarily agriculture. Second, the term “limits” can connote a point beyond which husbandry is not possible due to some climatic condition such as being too cold. As the maps illustrate, native peoples of the Americas masterfully developed a number of techniques and strategies (see, e.g., Irrigation, and Terracing) to overcome what are normally thought of as environmental obstacles. They also manipulated the growth of many plants nearly everywhere, and, hence, transformed much of the American landscape by plant husbandry.



**Clearing by Fire** A long-prevailing popular myth holds that sometime in our distant past humans “discovered” fire and its uses. In reality, the earliest evidence of the human species comes from East Africa, a landscape dominated by volcanic activity; it seems more likely that fire has been an essential part of the human toolkit since the beginning. Indigenous Americans used fire for many purposes in addition to cooking and heating, two rather obvious activities that involve small and well-controlled flames. Fire was used away from homes on a multitude of scales for a wide number of purposes. It was used to clear undergrowth of forests in order to: enhance the growth of forage and therefore improve hunting, drive game into traps and hunting parties, eliminate noxious reptiles and insects, facilitate travel, improve visibility, and for offensive and defensive purposes in times of war. In many cases stands of dead plants and brush were burned over in order to remove those plants and encourage the growth of other species seen to be of greater value; and, to clear areas in order to sow the seeds of numerous valuable “wild” plants. Stands of various species of woody plants were also burned in order to promote hardy and straight growth of stems use for basketry fibers and arrow shafts, and to have knot-free wood for making cradleboards. Native peoples also often set fire to stands of seed- and berry-bearing plants after the harvest in order to stimulate rapid regeneration. By retarding the growth and encroachment of woody species and by rapidly returning plant nutrients back into the soil, burning helped to maintain and even increase the production of a stand, to expand the area of the natural populations, to prolong the bearing period, and to produce a juicier crop, all of which resulted in an increase in the supply of plant products. Cultivated fields were similarly often burned over after harvest to remove weeds and recycle nutrients.

Large sections of forests were cleared for the construction of houses, towns, and agriculture. Trees were felled by axes and fire was used to remove debris. Because removing trees with stone axes was arduous, pre-Columbian agriculture rarely, if ever involved the kind of temporary fields associated with slash-and-burn shifting cultivation. If farming exhausted the soil, native peoples cleared adjacent land and let semi-domesticates and medicinal plants take over the fallow areas. Rather than permitting trees in those areas to re-grow indiscriminately, blocking the sun from the new fields, they kept the land open by burning it year after year in a form of permanent cultivation. Finally, grasslands of various sizes, from small alpine meadows to vast prairies and savannas, were burned for multiple reasons, such as to encourage the growth of valued species of herbs and grasses. Although not as frequent and common as the burning of small patches, huge grassland areas were sometimes burned over to drive large game animals such as bison to their deaths. Large tracts of grassland were also burned for military purposes. In addition, many low-intensity burns must have got out of hand and burned greater amounts of land than was intended.

To be sure, fires were also caused by non-human factors, especially lightning. But anthropogenic fire was much more common than lightning fire in humid environments such as the eastern part of North America, where rainfall tended to extinguish most flames. Lightning fires were rare in tropical environments, though fire was not.

Overall, most if not the entirety of the American landscape was transformed by fire to one degree or another prior to 1492.



**Terracing** An iconic image of farming is that of amber waves of grain. A nice image to be sure, but one predicated on agricultural land being nearly flat, at best, or gently rolling, at worst. It is also an image that grew out of the mechanization of farming. Tractors, after all, cannot operate on steeply sloping land. Prior to 1492, and more than three centuries before the Industrial Revolution, agriculture in the Americas involved human labor almost exclusively, the exception being in the Andes where llamas were used as beasts of burden. Unencumbered by industrial technology ancient Americans had no difficulty cultivating slope lands, and often did so by means of planting surface. Terraces have two components, the nearly-level planting surface often called the “tread,” and the nearly-vertical face often called the “riser,” or wall. Risers can be made of earth, wood, or, most commonly, dry-stacked rock. Depending on the degree of slope, terraces can have high risers and narrow treads, low risers and wide treads, or some variation in between. They can also be short or long, depending on if they are built across a channel or along a slope. Given the unlimited possibilities in terms of dimensions it should come as no surprise that terraces were widely distributed across the American landscape. Their greatest concentrations, however, were in mountainous areas such as the Greater North American Southwest, Middle America, and the Andean cordillera of South America.

Depending on the circumstances in which they are situated, ancient terraces served at least five agriculturally-related functions: create nearly level planting surfaces; increase soil depth; control soil erosion; manage the flow of water; and prevent frosts. As discrete as these functions may be, they are not necessarily singular or mutually exclusive. Although some terraces may have served only one specific function, more often than not terraces served a multitude of purposes simultaneously. For example, some terraces in the Andes not only had more level surfaces and deeper soils than surrounding non-terraced land, they were also irrigated.

Finally, it should not be overlooked that not all terraces served agricultural functions. In some cases it is well documented that terraces were constructed as building platforms, most frequently for houses and ceremonial purposes, as at the famous Andean site of Machu Picchu. In some locales terraces were constructed for defensive and military purposes. In sum, although they are characterized by steep slopes and rugged terrain, mountainous areas were not exempt from being transformed by humans prior to 1492.



**Agro-Forestry** Trees have always been valued by people. They have both aesthetic and economic qualities. People like trees around their homes, many of which are made of trees. But there is more to trees and forests than simply appearances and timber. Non-timber forest products include fruits, nuts, vegetables, fungi, condiments, oils, waxes, gums, latex, incense, flosses, fibers, cordage, ornamentals, dyes, medicines, insecticides, and poisons. These products do not involve cutting down trees and hence deforestation. Accordingly, their harvest has been dubbed “sustainable,” in present-day parlance. In many locales indigenous Americans protected and encouraged the growth of various tree species, individually and in stands or groves. They also cultivated trees, often by transplanting seedlings from where they were encountered in the wild to places near or around their homes, often hundreds of kilometers distant. Although they did not have “tree farms,” in the same sense as we do today, they did have orchards and orchard/gardens. Indeed, to one extent or another, almost anywhere there were people living in permanent settlements in reasonably humid environments, there were stands of cultivated trees. Of course, some places had greater amounts of agro-forestry than other places. The most well studied places are the homeland of the Maya and the island of Hispaniola in Middle America, and the banks of the Orinoco and Amazon rivers in South America.



**Earthworks** The excavation of earth and subsequent piling into mounds is an ancient human activity. Before 1492 Americans raised large areas of surface land with an enormous variety of earthworks. Pyramids, platforms, house mounds, roads, causeways, levees, ditches, embankments, enclosures, and features that from the air look like gigantic animals (effigy mounds), were constructed across the Americas from the valleys of the Ohio and Mississippi rivers of Northern America to the southern Amazon Basin of South America. Some of the more notable earthworks are Serpent Mound, Cahokia, and Poverty Point in Northern America; Cholula, and La Venta in Middle America; and the ditched-and-banked enclosures of lowland western Amazonia, and settlement platforms on Marajó Island in South America.

Many such features appear in swamps, marshes, and wetlands in general, areas frequently considered by present-day Westerners to be inhospitable environments in large part because of the prevalence of hostile creatures including venomous reptiles and insects. Defined by the presence—abundance—of water, these environments are also envisioned as being unsuitable for agriculture. For many indigenous Americans, however, just the opposite is true. The humid tropics of Middle and South America are home to hundreds of thousands of people today, and archaeological evidence is continuing to show that these peoples’ ancient ancestors were not only more numerous than their descendants, but grew an abundance of food. These people constructed thousands of elevated house mounds, causeways, and embankments. They cultivated wetlands by means of draining via ditches, and by building “raised fields.”

The premise of raised fields is quite simple. The excavation of trenches in wetlands resulted in “spoil” that was then deposited in such a way as to construct artificial earthen islands, the surfaces of which were above the standing water. Repeated dredging of the canals resulted in the collection of organically-rich “muck” that was continually applied to these islands, thereby creating a very fertile and highly productive agro-ecosystem.

Before 1492 Americans constructed raised fields in wetlands everywhere. Most were constructed in low-lying areas, notably various parts of the Amazon Basin of South America, and the Maya lowlands of Middle America. They were also built in highland areas such as in Lake Titicaca, Perú-Bolivia of South America, and in the highland Basin of México—the famed *chinampas*. In these latter locales the water in the canals between the raised fields ameliorated the cooler highland temperatures, creating a “heat envelope” over the fields, thereby preventing frosts from damaging or destroying crops either early or late in the growing season. In Northern America, particularly in the upper Midwest, raised or “ridged” fields were often constructed in locales other than wetlands. Some of these have been found through experimentation to have been built to promote “cold-air drainage.” That is, cold air is heavier than warm air and flows off of raised fields into adjacent ditches. Temperatures on the field surfaces are, therefore, warmer than surfaces and less prone to both early and late frosts. These raised fields helped extend the growing season between 30 and 60 days each year. Other Northern American raised fields provided other advantages including improved soil fertility, and slowing soil erosion.

Finally, in addition to excavating canals as part of raised field construction efforts, ancient Americans excavated hundreds of kilometers of canals to drain wetlands and connect river systems, often for ease of transportation by boat.



**Irrigation** Dry lands are some of the best agricultural lands on earth. Because of the paucity of rainfall, soils are usually not leached of their minerals and nutrients. Dry lands also have sparse vegetation, thereby making field clearance a relatively easy task. What arid lands need for agriculture, however, is water. In many locales, water was below the surface of the earth, in aquifers as groundwater. This water was inaccessible however, as Americans prior to 1492 did not have the technology to extract it (e.g., wells and pumps). Indeed, they might not have known it even existed. In other places, however, water was available. It just was not where it was needed when it was needed. The problem then was one of delivery.

Delivering water to a field first involves capturing it from a source area and retaining it. To do this, indigenous Americans developed the art and science of building dams to retain surface water collected as rainfall runoff. In many cases they simply constructed weirs across streams. From dams and weirs water was carried overland in canals. Most canals were rather short (2-3 kilometers), shallow (<0.5 meter), and narrow (<1 meter), as was the case throughout most of México and the northern portion of the Greater North American Southwest. In some places, however, such as the central portion of the Northern American Southwest, and in the coastal valleys of Perú in South America, canals were deep (>2 meters), wide (>10 meters), and long (<30 kilometers), and in at least one place were intended to carry water from one valley to another. Irrigated lands varied in aerial extent from as small as 1 hectare (2.5 acres) to as large as several thousand hectares.

In addition to developing sophisticated technologies to capture and deliver water to fields, indigenous farmers in various arid regions of the Americas also used some relatively simply methods of irrigation. Locating their fields in the down slope and downstream ends of small drainage basins farmers easily diverted seasonal runoff in a form of “water harvesting.”

Cultivators could not know precisely when and where it might rain in the drainage basin, and hence where to locate their fields, but they could always count on at least some water flowing through the bottom of the basin. This water could then be diverted into adjacent fields. In other places, particularly in Northern and Middle America, large rains often produced seasonal floods. Rather than planting prior to the onset of the rainy season and possibly losing a crop to flooding, farmers simply waited for the flood waters to recede and then they planted in the fertile and wet soil, a form of agriculture known as “flood recession farming.” All told, multiple forms of irrigation were practiced throughout the arid portions of the Americas.