The Americas before and after 1492: An Introduction to Current Geographical Research

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Abstract. The controversy over the Columbian Quincentenary identifies two broad issues of fundamental interest to geography: (a) the declination and displacement of indigenous peoples, leading to creation of new human and cultural landscapes; and (b) the relative ecological impacts of indigenous and Colonial land use, as a prelude to the global environmental transformation introduced by the Industrial Revolution. This introductory essay outlines the contributions of ten critical or syncretic reviews, setting them in a wider context of contemporary research, as a web of related themes focused on the Americas before and after 1492. These themes include: (a) pre-Columbian population densities, environmental impact, and the myth of the Indian as Ecologist; (b) the labor intensity and technological sophistication of pre-Columbian agriculture in many areas; (c) the human implications and landscape impact of catastrophic indigenous depopulation; (d) the process of Spanish settlement and landscape transformation; (e) diffusion, continuity, and syncretism in the residual indigenous landscapes; (f) the divergent policies and impacts of French and British colonization, and the comparatively limited attention given to Native American and African contributions to the North American cultural landscape; and (g) the different perceptions, cartographies, and geographies of the explorers, the indigenous peoples, and the European scholars engaged in the Columbian Encounter. The final discussion identifies themes that can not yet be adequately reviewed, especially the impact of Colonial settlement upon the environment, as distinct from the consequences of the Industrial Era, its technology, and its demand for raw materials. The debate raised by the encounter can and should refocus geographical research on related cultural and environmental questions that require fresh attention.

Key Words: Precolumbian agriculture, indigenous landscapes, environmental impact, ecological myths, European perceptions, the Quincentenary.

From Polemics to New Research Perspectives

Celebration and anti-celebration. For several years the media have played up the polemic of the Quincentenary, pitting Columbus the icon against Columbus the symbol of New World genocide and environmental destruction. While one group celebrates the Columbian voyage and the creation of a new Euro-American world, the other laments the depopulation and deculturation of the Americas. Pickets, mainly organized by American Indian organizations, greet visitors at museums displaying artifacts or maps from the period of 1492, or interact with the smallish crowds watching the arrival of replicas of Columbus's ships in Miami or Galveston. But there is little evidence of a groundswell...
of American interest in the ongoing debate, let alone of any emerging position as to whether the "Discovery" was a good thing or not. Perhaps the continuing media hype has led to a premature sense of fatigue. Perhaps, too, the issues raised do not seem relevant for Americans today, since Columbus was an Italian and the arguments seem to concern Spaniards and Native Americans. In contrast to the hoopla of 1892, which Chicago, somewhat misguidedly, celebrated as the birthday of the New World, contemporary Anglo-Americans may have scaled back their historical horizons to Plymouth Rock and 1776, leaving 1492 for Hispanics to contemplate.

But the Quincentenary cannot be dismissed so that conveniently. The year 1492 dramatically changed intellectual conceptions of the world. It brought the peoples of two semi-isolated hemispheres into confrontation, creating new "realities," the moral implications of which cannot be ignored indefinitely. It also opened the way for biological and technological transfers on a vast scale, creating novel cultural, economic, and biotic configurations in the "New" World, with significant repercussions on the "Old." In an increasingly integrated and connected world system, the growing momentum of intercontinental energy flows favored the Industrial Revolution, with its once almost unimaginable impact on the quality of global environments. The Columbian Encounter set in motion immense social and environmental changes that will continue in the future, and which affect the lives of all Americans, whether they are aware of them or not.

Amid the flurry of ideological controversy, glossy popular books, and surrealistic media events, a different current of analytical studies has begun to emerge. This is reflected in the publications accompanying the museum exhibits Seeds of Change (reviewed in this volume) and Clica 1492 (Levenson 1991), or in the special issue of Newsweek entitled When Worlds Collide (Fall 1991). It is also documented in the Smithsonian trilogy Columbian Consequences (Thomas 1989-91), sponsored by the Society for American Archaeology, a special issue of Historical Archaeology (Vol. 26, No. 1, 1992), and in the Islamic perspective of Columbus and the interaction between the Americas (Vol. 26, Nos. 1, 2, 1992).

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of the 1992 scientific symposium of SCOPE—an international agency dominated by biologists—devoted to the global legacies of the Columbian Encounter (Turner 1992).

Not surprisingly, historians have been prominent in revaluation of stereotyped and en¬

trenched ideas (Axtell 1992). Anticipating the current disgrace of inaccurate high school textbooks, Axtell (1987) reviewed the mass of half-truths about "other" Europeans, Indians, and the Age of Discovery that mark such books. A comprehensive study the historical legacy of Columbus (Phillips and Phillips 1992) offers a welcome antidote to both the acid and the saccharine (mis)representations of that ambiguous figure now in circulation.

Contrary to what one might assume, the Quincentenary has also prompted sober introspection among Spanish historians, and a recent congress in Sevilla focused on the social context of growing intolerance for ethnic diversity on the Iberian peninsula during the century before 1492 (Benito et al. 1991). Throughout the U.S., students are engaged in public debate, and panels of invited speakers argue among themselves or try to address searching questions from the floor. Critical classroom screenings of films such as Dances with Wolves and Black Robe are heightening awareness of the value of cultural diversity. In anthropology, geography, and history departments, existing course listings are being coopted to hold seminars or give courses on the Columbian Encounter. The themes discussed are not about the Columbian diaries or landfalls on some obscure island, but about cultural diversity or transformation of the world we now live in.

It is commonplace that the controversy and debate raised by important issues serve to refo¬
cus research on questions that require new or renewed attention. That is precisely what the contributors to this volume have attempted to do in writing twenty-five historical essays related to the impact of 1492 on human landscapes of the Americas. The focus of the collection is on principles, processes, and perceptions. One pertinent question is the myth or reality of a pristine American wilderness before the arrival of Columbus; the resulting discussion brings together a body of contemporary research on Prehispanic demography, agro¬
technology, and resource management. A sec¬

tion on the confrontations and conflicts in the Encounter; here attention focuses on the demographic collapse that followed the introduction of Old World epidemic disease, which demands attention to the scale of the human tragedy it represents, as well as an examination of its implications for settlement discontinuity and transformation of the human and cultural landscape. A third category centers on the new societies that emerged in the Colonial world; how did they shape and manage their diverse cultural landscapes? A fourth and final question comprises the narratives, cartographies, car¬
tographs, and geographies—of the explora¬
ers, of the Native Americans, and of the scholars engaged in the Encounter. Geography encompasses a broad spectrum of environmental and cultural, as well as interconnective and integrative concerns. We hope that the papers will prove innovative and provocative to other disciplines as well as our own.

Constraints of space and time have set limits to the number of authors, to the temporal focus, and to the depth at which specific problems could be explored. Within these constraints, the individual papers form a web of interlinked contributions, selected as examples from a wide spectrum of current research. They address, often in unconventional ways, conceptual issues underemphasized in the specialist literature. They also illustrate research methodologies and implicitly identify potential resources in libraries, in archives, or in the field. The authors represent American, Canadian, and German universities, and include one anthropologist. Finally, the bibliography is broad and current, and includes works in languages other than English.

This introductory essay attempt to set a wider context of contemporary research for the individual papers, in addition to highlighting their contributions. Themes that could not be covered by our collection of essays are sketched out in the accompanying discussion to facilitate a broader overview of the Americas before and after 1492. Some basic questions, such as the environmental impact of European settlement, cannot yet be resolved, because the requisite database is not available; they will require many more research projects in the coming years. Long after the polemics have died down, the search to understand the questions raised will go on.

A Persistent Myth: The Indian as Ecologist

One of the fundamental questions brought into focus by the Columbian controversy con¬
cerns what William Denevan (this volume) calls the myth of a pristine New World landscape in 1492. The idea goes back at least as far as the romantic primitives of the nineteenth century, but has recently been given new meaning. Sale (1992) notes that New World peoples lived in harmony with nature and refrained deliberately from altering their environments, to the degree that they somehow able to maintain an idyllic ecological equilibrium. Europeans, by contrast, had a ruthless land ethic, were driven only by materialistic goals, and introduced an agrosystem that was, by definition, harmful. Sale believes the result was environmental de¬
struction of apocalyptic proportions.

The central issues thus are twofold: (a) whether Native American peoples did or did not alter or degrade their environment's and (b) whether or not European settlers had an im¬
mediate and drastically negative impact on the environment (Butzer and Butzer 1992). The first entails an assessment of aboriginal technology, land use, and population levels, as prerequisite for evaluating their environmental impact.

The New World was not an empty land. As Denevan argues, the Americas at the end of the 1400s supported a population of 43-65 million inhabitants distributed as follows: close to four million people from the North American Great Lakes to the Mississippi; almost 20 million in Mexico and Central America; three million on the Caribbean islands, and 24 mil¬
lion in South America, two-thirds of whom lived in the Andean region. Most of these de¬
depend on agriculture of varying degrees of technical sophistication. Prehispanic built envi¬
ronments remain conspicuous in the landscape today, ranging from the great cities and monumental ceremonial centers, to field pat¬
terns in eastern North America or Amazonia and traces of road systems in New Mexico or Peru. Some of the most convincing evidence to this effect are the extremely extensive agricultural landforms such as raised fields or terraces in now-uncultivated areas, has been compiled by ge¬
Denevan, Turner, and others have shown that prehistoric abandonment can lead to fundamental biotic change and frequently to significant soil erosion. These open questions notwithstanding, the criteria proposed by Doolittle imply a measure of intensification as well as permanent clearances in at least some areas, an argument consonant with the botanical and pollen evidence from the Little Tennessee River Valley (Delcourt et al. 1986). Since the ethnographic record is finite, Doolittle urges considerably more field research devoted to recording agricultural landscapes so as to add detail to the map. More paleobotanical studies are also needed, both within and outside of archaeological excavations (see Hastorf and Popper 1988), as are analyses of soils nutrients (see Sancier 1992). These may eventually afford a fuller understanding of cropping practices, of the spatial extent and permanence of clearance and cultivation, or the degree to which cultivation was practiced in every other year, for example, may have been sustainable indefinitely. Attention must also be paid to possible erosion, potentially preserved in the record of slope and stream deposits along North American valley floors.3

3 Whitmore and Turner employ criteria similar to the two-year cycle of crops and fallow, with productivity maintained by animal manure, that accumulated during four-six months of grazing on stubble, grass, and weedy plants (Sworz 1965). This trend implies an efficient system of improved productivity in some areas during the Middle Ages, resembling a rotation of legumes, which helped reduce soil nitrogen.

What remains uncertain in the New World is the range of after-effects of land use to maintain productivity without manure. For example, ridding or hilling, which involves removal of topsoil that was piled up on linear or round surfaces, is equivalent to deep mixing by a plow, and it can double the thickness of topsoil. Household wastes and night soil are also limited, but permanent intercropping of beans with maize may have been practiced on a large scale during late prehistoric times, a method that would retard soil depletion.1

1 One study in central Mexico suggests that the size of house gardens, supposedly devoted to complex intercropping, ranged from 0.3-0.9 ha per household during the prehistoric periods (see Hoots and Plopper 1988), as are analyses of soil nutrients (see Sancier 1992). These may eventually afford a fuller understanding of cropping practices, of the spatial extent and permanence of clearance and cultivation, or the degree to which cultivation was practiced in every other year, for example, may have been sustainable indefinitely. Attention must also be paid to possible erosion, potentially preserved in the record of slope and stream deposits along North American valley floors.3

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To those of Doolittle, but they focus on three mesoscale environmental transects in Mexico and Guatemala. The "Cor tes transect," following that conquistador's route from the coast at Veracruz to Mexico City on the high plateau, is an obvious choice. For the tropical lowlands, these authors single out raised fields, ditches, and canals preserved in the coastal wetlands, and the subtle but visible patterning of fields and embankments on higher ground. Ethnohistorical analogy is used to infer a complementarity of rain-fed and seasonal wetland cultivation, in addition to household gardens and orchards of fruit trees or cacao, at or before the time of Conquest. On the piedmont of the plateau escarpment, there are terraces and remains of dams; at higher levels, less permanent forms of agriculture are posted in the cloud forest ecozone. The semiarid climate and storm hazards of the plateau favored a patchwork of rain-fed cultivation on slopes modified by rock-faced terraces or vegetated berms (metepantli), interspersed with irrigated tracts, fed by floodwaters, small dams, or canals. Wetlands in the basin centers were partly converted into elaborate hydraulic systems, with cultivation on raised chinampa surfaces. The "Alvarado transect" cuts across Guatemala from the humid Pacific coast to the tierra fría of the highlands. Agriculture in the uplands was intensive, with evidence of terracing, hillside and possibly raised fields, while the piedmont was used for irrigated gardens and cacao plantations.

Spanish intrusion and depopulation by disease left the tropical lowlands of the Cortés and Alvarado transects empty; the Gulf Coast was converted to Spanish livestock raising, the Pacific sector to small-scale Spanish commercial plantations. In the high country as well as on the plains of Yucatan, the Spanish introduced the plow and Old World livestock, and the extent to which specific environments were humanized or even degraded. But the diachronic perspective remains important. Theoretical historical studies, such as the evolution of irrigation technology (e.g., Doolittle 1990), or detailed local studies of smaller areas over time, such as the work of Veblen (1975) on the forests of Totonicapan, draw attention to processes such as incremental change, longer-term adaptation, and response to crises. Such historical monitoring of land use and landscape change can provide a critical tool to examine the long-term impacts of traditional agriculture or to articulate the hidden costs of high-technology development (Butzer 1992a).

Depopulation and Discontinuity

The conquest of one society by another is inevitably brutal, whether it be the Spanish subjugation of the Taíno or Aztecs, or the furious elimination of the Requed. The conquered are traumatized and the conquerors dehumanized, both by the killings and by the subsequent uprooting of people and the violations of human dignities and freedoms. Hundreds of culture groups disappeared in the aftermath of 1492, and dozens of other societies were significantly changed. Displacement or elimination did not even end with the Colonial era, as the expulsion of the Cherokee or the shoving of women and children at Wounded Knee remind us, without the need to invoke similar atrocities in independent Latin America. But no purpose is served by special pleading or assessing culpability. Conquest is horrible and all participants are guilty of excess, Spanish or British, European or Native American.

The human tragedy of the European conquest, however, was unprecedented in scale, not because of its unquestionable brutality, but primarily through the spread of epidemic disease. By an accident of geographic isolation, the pathogens that evolved in the Old World, and which repeatedly wreaked havoc there, were excluded from the New World for millennia. This battery of Old World epidemic diseases had several origins, but most were the result of coevolution of people and domesticated livestock. Early European contacts with the New World introduced new epemics, in rapid succession, to populations without immunity. As George Lovell shows in his paper, Influenza, smallpox, measles, mumps, and pneumonic plague arrived first, followed by typhus, diphtheria, malaria, and yellow fever. The result of each pandemic was disastrous, and before a population could rebound demographically, a new epidemic struck, so that the "die off" became cumulative, eventually leading to demographic collapse (Whitmore 1991).

Lovell deals with both the demographic and human dimensions of the tragedy, as documented in five representative areas: Hispaniola, central and southwestern Mexico, Guatemalan, and Peru. He evaluates a vast body of literature to demonstrate (a) the scale and universality of the disaster; (b) the trauma and significance of the first pandemic in each area, either in destroying an entire population or in breaking the resistance of indigenous peoples; (c) the advance of disease, even ahead of the invading Spaniards; and (d) the persistent problems of diagnosing exactly what diseases were responsible.

Lovell employs an unusual body of medical writings to show that clinical diagnoses are difficult at best. Disease symptoms change over time, e.g., hemorhagic smallpox or pneumonic, rather than bubonic plague. Compound epidemics also cannot be excluded.

Butzer (1992a) offers an alternative perspective, anchored as they are in more reliable population data of the late 1500s, and predicated on contemporary epidemiological indices, flexible demographic profiles, and further mortality through postepidemic famine. For the Basin of Mexico, Whitmore (1991) arrives at an 89 percent reduction from 1.59 million inhabitants in 1519 to 180,000 in 1607. Denovan (this volume) estimates a 74 percent decline in North America, 1492-1800, and 89 percent for the Hemisphere as a whole from 1492-1650.

The numbers do matter, as Lovell contends. They matter, above all, because they set parameters for a demographic disaster that remains unparalleled in human history. Whether we favor the lower or upper part of Denovan's estimates for a New World population in 1492, we must still deal with the appalling implications of between 40-60 million people succumbing to disease and famine as a result of the Columbian Encounter. Lovell suggests that this disaster contributed to the military defeat of the indigenous peoples of the New World. Some entire societies, such as the Taíno, disappeared as a result. But numbers do provide only an unsatisfactory surrogate for the scale of the human tragedy involved. Lovell is keenly aware of this and introduces a sampling of poignant human testimony from the period. This allows us to appreciate, in some small way, the horror of what transpired.

The conquests matter from an environmental perspective, because they have to be reasonable for an overwhelmingly agricultural population, given the technology, communications, and limited sources of fertilizer in 1492. For the Basin of Mexico, the 1.6 million figure of Whitmore is a third higher than the 0.8-1.2 million estimate of Sanders (1981), based on
subjugation of the Taino or Aztecs, or the Puritan elimination of the Pequot. The conquered are traumatized and the conquerors dehumanized, both by the killings and by the subsequent uprooting of people and the violations of human dignities and freedoms. Hundreds of culture groups disappeared in the aftermath of 1492, and dozens of other societies were significantly changed. Displacement or elimination did not even end with the Colonial era, as the expulsion of the Cherokees or the shooting of women and children at Wounded Knee remind us, without the need to invoke similar atrocities in independent Latin America. But no purpose is served by special pleading or assessing culpability. Conquest is horrible and all participants are guilty of excess, Spanish or British, European or Native American.

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overstocking of dormant winter pastures, reflecting recurrent frost and drought, was mitigated by well-organized transhumance patterns, as sheep were driven to public lands in the tropical low country or to the semi-arid north (Butzer and Butzer 1992).

Beyond the hearthland of central Mexico, regional settlement histories were very different (Butzer and Butzer 1992). Second nucleus of Spanish agriculture developed in the Bajío lowlands, with livestock economies dominant further north. The Gulf lowlands included large tracts dominated by Spanish cattle raising, while transhumant sheep were grazed on winter pastures primarily on the piedmont. At the same time, old centers of Indian agriculture in Michoacán, Oaxaca, and along the plateau escarpment northeast of Mexico City remained overwhelmingly in Indian hands. For the administrative region of New Spain, which excludes the west and north of Mexico, Spaniards controlled about 25 percent of the land in the 1640s; they farmed some 4000 km² and ran perhaps 6–8 million sheep and 1.5–2 million cattle (Butzer and Butzer 1992). The Indian autonomic and transhumant patterns probably represented about 45 percent of New Spain, with the remaining 30 percent constituting what by Spanish law was public land.

In sum, there was a considerable degree of continuity in terms of Indian ownership. But the large or small modes of central settlement, the new market orientation for wheat and animal products, the introduction of domesticated stock as a major element of the rural landscape, the recasting of Indian settlement in the form of new Spanish towns, and the partial elimination of dispersed settlement, all serve to highlight a fundamental discontinuity. New Spain had also become a dual society, with separate Spanish and Indian towns, and residential segregation in the cities—not in order to "exclude" the Indian population, but to preserve a degree of Indian local autonomy and avoid intrusion by Spaniards into the Indian domestic sphere (Butzer 1992b).

This new cultural landscape of Colonial Mexico is evident, attendant to change. By the 1700s, great estates dominated much of the countryside, and palatial residences were built on some of them. A century later, most rural Indians lived in new satellite hamlets around such haciendas. But the great estates only reached their zenith on the eve of the Mexican Revolution, in 1910. By then, most rural Mexicans, Indian and mestizo alike, had been reduced to a dependent class (Nickell 1978).

This overview of Spanish colonization outlines discontinuity and change in the cultural landscape of New Spain. Many of the principles and processes are also applicable, in general terms, to other parts of the Spanish Americas. Yet each region provided to be less component, enlightened, or incorruptible. As a result, some colonies had a sorry history of abuse, and others were totally dominated by entrenched Colonial elites. These differences in socioeconomic evolution during three centuries have contributed significantly to the fragmentation of Latin America after independence.

Diffusion, Continuity, and Syncretism in the Indigenous Landscape

Our focus now shifts from the active role of the Spaniards to that of the indigenous people. Native American languages continue to be prominent in the highlands of Middle America and the Central Andes, and a wealth of Prehispanic cultural traits has been reported from some areas by anthropological investigations. Do such cultural landscapes reflect continuity into the present from a Tarascan, Zapotec, Mayan, or Inca past? Daniel Gade (this volume) examines that proposition for the seemingly intact Indigenous society still ensconced in the mountain redoubts of the Central Andes. Instead of emphasizing the negative impacts of the Conquest, he examines the ability of Andean peasants to manipulate and incorporate elements of Spanish culture into their lifeways. Diffusion of information evidently evolved from the Columbian Encounter, but rudimentary lists of plants or animals transferred from one hemisphere to another convey little information and also do injustice to the complexity of cultural screening or ecological adaptations. Studies of diffusion should therefore consider how new traits were tested, and accepted or rejected, and what the consequences of incorporation were.

Spanish introductions had their greatest impact in accessible valleys and basins at intermediate elevations of 2500–3500 m, where the climate was temperate and the ecology analogous to that of upland Spain. Gade distinguishes between the many Spanish traits introduced, the new settlers and the limited selection of such traits that found approval among the indigenous people. This second repertoire is of interest here. Wheat, barley, fowl, beans, and a number of condiments, including onions and garlic, were tested and found to be advantageous plants to incorporate within the existing agrosystem. Mediterranean fruit trees did not do well in the montane climate, but Old World bananas and oranges or Mexican capuli cherries did.

Spanish livestock gave greater subsistence security and proved to be more important than the Old World plants. In the wake of depopulation and increasing labor shortage, they provided food with relatively little work or facilitated transport and plowing. Donkeys, as well as cattle, were initially used to plow, but later were used as beasts of burden. Sheep were acquired by 1560, with large flocks verified by the 1590s; they provided meat and sometimes milk, and their soft wool could be interwoven in textiles. Unlike in Mexico, distinctive transhumance patterns did not develop on a large scale. Goats proved to be versatile grazers on very steep slopes, just as pigs became waste processors in the villages. Castilian chickens were good producers of eggs, and displaced the domesticated muscovy duck. But grazing sheep and goats could also lead to soil erosion, and their intrusion into fields of standing crops periodically led to damages. The light Andean llama, pulled by oxen, provided distinct advantages over traditional spades or digging sticks to cultivate relatively level terrain and less stony soils. With only one plow team and plowshare per village, collective or open-field cultivation of crops was introduced. Wheat was threshed by means of animal trampling. Simple Spanish tillers were also incorporated, while ovens replaced baking pits. Construction with adobe or tapia, a puddled-mud technique, expanded greatly because of the Spanish introduction of wooden molds to preshape adobe bricks, while a mix of lime-rich mud and straw could now be poured, as tapia, into box-like wooden frames. Jointed beams simplified roof construction, roof tiles were more durable than thatching, and wooden doors set in wood frames provided greater security.

As in Mexico, the Spaniards tried to remodel the indigenous settlement pattern, moving people from scattered farmsteads or loose hamlets next to their fields, into new gridiron towns. The native population again resisted nucleation, so avoiding assimilation to Spanish urban living.

Gade argues that the indigenous people of the central Andean world selected ideas and material traits that served to enhance family security, reduce subsistence risk, and offer a broader and more versatile diet. Spanish traditions were simplified and then recombined within the Inca agrosystem. Such syncretism is evident in the agricultural components, diet and folk medicine, settlement patterns and clothing, as well as in spheres such as religion and language that are beyond the scope of Gade's paper. Taking its present shape about 1650, this modified and enriched Andean lifestyle has remained basically stable across three centuries, presenting an increasingly archaic cast over time. Many originally Spanish components today are perceived to be indigenous. But they demonstrate that the visible cultural landscape is not a simple legacy of the Inca past.

The selective acculturation described here was limited to a particular vertical ecozone. At lower elevations, Spanish transformation was more or less complete, while at higher elevations indigenous patterns of land use and settlement proved their competitive value and still persist. This is an exemplary study of information diffusion and adaptive change, that suggests a methodology to examine persistence and change in the cultural landscape. The evidence for selective acceptance of Spanish crops, animals, and management techniques among the indigenous peoples of Mexico implies a similar pattern of qualified acculturation (Butzer 1992b).

The Conquest of 1492 was a two-way street. A number of New World plants were disseminated in the Old World rapidly, others more slowly. Maize promptly displaced several species of millet, becoming a key fodder crop in southern Europe, and a major source of human nutrition in West Africa, India, and China. Po-
... become a staple in many parts of Europe during the 1700s. Cassava roots (manioc) spread through West Africa and southern Asia. These three food sources remain a cornerstone for the livelihood of more than a billion people in the eastern hemisphere.

Other New World colonies also enjoyed success overseas: sunflowers, for the oil and chewiness of their seeds; several varieties of beans; the tomatoes, without which Italian cuisine would be flat; the popular vices of cacao and tobacco; as well as chili peppers, pineapple, vanilla, peanuts, and quinine. European colonists in the New World adopted the same plants and many of their initial traits, but in meaning the Columbian Exchange (Crosby 1972), the beginning of a global migration of foods that has generally improved the quality of human life (see Langer 1975; Lunde 1992, 47-55).

The scope of this exchange requires a second look at the implications of adopting new plants and management techniques into an existing agrosystem, or new foods into a traditional cuisine. Do wheat, sheep, and garlic make the Inca more Spanish, or do tomatoes and maize make Italians more Mexican? Such cultural interpretations are lost when foods. They carry additional levels of meaning in the symbolic and ideological sphere. Such cultural interpretations are lost when they become part of an alien cultural repertoire, in which they may or may not acquire new symbolic meaning. The acceptance of isolated new traits also differs from acceptance of a "package" of traits. Testing and eventual acceptance of a single new food plant at a particular time requires a perceived equivalence in form or function, and perhaps substitution for an indigenous "equivalent" with little or no symbolic significance. The acceptance of a whole array of new traits at once is another matter. In the Andean example, it would certainly require considerable structural readjustment in terms of work scheduling, resource management, and dietary strategies, if not also in perception, social norms, or cultural values. The modern Andean conviction that their adopted elements are ciento, or autochthonous, underscores the point.

Andean or Mesoamerican syncretism does indeed suggest a reduction of cultural distance between Indian and Spaniard (see Graham et al. 1989), as does the Spanish acceptance of maize, adobe housing, Indian mates and early marriage patterns, or a large indigenous vocabulary (Butzer 1992b). Such changes argue for a degree of acculturation.

**British and French Colonization**

France and Britain had little experience in colonization when they entered the American theater a century later than Spain. By then, epidemic disease in North America had taken a heavy toll. Agriculture had retracted in some areas and indigenous populations had been generally thinned, so that there was little immediate conflict over land. But French and British policies and expedients for settlement differed, as they also differed from those of Spain, reflecting particular circumstances and historical precedents.

Although the Immense estuary of the St. Lawrence River invited exploration as a potential water route to Asia (see Allen, this volume), control over the fur trade may have been a key motive for French engagement in 1605; there also were fishing rights to secure (Harris and Warkentin 1974; also Harris 1967). Settlement was initially placed in the hands of seigneurs, who played a similar role in the French countryside to an English squire. The seigneurs assigned land to groups of colonists as permanent leases in return for a variety of rents and tithes on production. Beyond providing some minimal services such as a gristmill, the seigneurs normally lived in a larger settlement and played no direct role in the development of land use patterns (Harris 1984). Distinct regional solutions were found, tuned to the local ecology, and based on French and central European experience (Harris and Warkentin 1974, chap. 2).

In Acadia, coincident with the later Canadian maritime provinces, soils were more exposed in the coastal valleys. The high tides of the Bay of Fundy generate diurnal surges of water far upstream, converting the valleys into wetlands. These were reclaimed by French settlers who built dikes to restrain the tidal power, while profiting from the fresh increments of fertile flood silt to create a kind of mini-polder landscape along the valley bottoms (Harris and Warkentin 1974, 28-29).

Another remedy was found along the St. Lawrence River and its main, south bank tributaries, in present-day Quebec. Here clusters of farms were aligned along Pleistocene shoreline ridges, immediately above the floodplain meadows and along the western banks of the river or on lakeshore sites in the American Midwest. By about 1800, the striking long lots began to intersect with irregularly-shaped properties measured by the British and (Spanish) meters and bounds system along the Mississippi River (Harris 1990). The imprint of France remains visible today in field patterns that record the properties and the toll of its pioneer settlers across the interior of North America (also Walthall 1991).

Given the initial abundance of land and weak market demand for land, French settlers in the New World abandoned familiar labor-intensive forms of agriculture, such as three-course rotation of crops, heavy manuring, and improved stockbreeding (Harris 1984). Tree stumps were left to rot in the ground, manure was rarely used, and a two-course crop rotation substituted. Such extensive agriculture gave mediocre yields, but disintensification with respect to European antecedents also characterized the Thirteen Colonies.

The British settlement experience, outlined by Carville Earle (this volume), was more complex than that of France, reflecting distinct but homogenous socioeconomic groups of immigrants from different parts of England (ethnocultural pluralism). The first tentative probing of the Atlantic Seaboard were linked to sixteenth-century piracy ("privateering") on Spanish shipping. Reluctant to engage directly in American settlement, the British Crown awarded concessions ("monopolies") to chartered companies, who sought new investments on the Atlantic Seaboard, where the Haktury had pronounced the "mediterranean latitudes" of Virginia and North Carolina optimal for settlement. This decentralized strategy spawned semi-autonomous colonies, each centered on a key town that served as administrative center and economic entrepôt. Each colony also drew on a different reservoir of immigrants: Puritans from East Anglia in New England, Quakers from northern England in Pennsylvania, aristocratic planters from southern England around Chesapeake Bay. The first two areas attracted immigrants with the capital and the incentive to bring in single males, too poor to pay for the voyage, as indentured servants.

Reflecting the immigrants and their economic goals, continuing rural economies developed on the Western Seaboard: (a) small-scale agriculture, primarily designed to meet household subsistence needs in New England and various market crops in the Middle colonies; and (b) commercial agriculture, successively emphasizing tobacco, indigo, tidewater rice, sugar cane, and ultimately cotton, from Chesapeake Bay to Charleston. The northern sector experienced population growth and urban expansion, benefiting from immigrant surges from several dissenting groups from Great Britain and later, Germany. By 1700, Boston had close to 7000 inhabitants. New York 4500, and Philadelphia 3000, while the largest town in the southern sector, Charleston, had only 200.

With little female immigration and a less healthy climate, demographic expansion was slow in the south, and labor scarce. Indians were enslaved, but they were quickly displaced by white indentured servants and, after 1680, by African slaves imported from the West Indies and Africa. Planters and merchants, in turn, collected the produce of these bonded laborers and rice, tobacco, and indigo were exported directly to England and the Continent—all of which accorded nicely with the Crown’s mercantilist aims. Plantation crops gave out north of the Chesapeake, and farmers there turned toward mixed farming systems which accentuated wheat and corn for export in the Middle Colonies and localized subsistence in the less hospitable environment of New England. Northern merchants directed grain exports among the various markets in the Atlantic economy and, led by Bostonians, assumed control of the intercolony trade linking the various economic sectors and regions. These vigorous coastal enclaves were filling up by the early 1700s, and soon after Scots-Irish, Germans, English, and Welsh settlers spilled over into the...
less desirable piedmont to the rear of the plantations around the Chesapeake estuary. The rapid pace of interior expansion between 1700–50 tested the Empire, occasioning, among other things, hostile Indian responses, French fears of British colonial pretensions, confusion over titles to land, and sectional strife between interior settlements and colonial administrations based along the coast.

Characteristic of the decentralized and multiethnic British colonial enterprise was its diversity, reflected not only in its varied economic pursuits, but also in its imprint on the landscape (see Mitchell and Groves 1977). River-front, long-turn field patterns are mainly found in New England and other patterns of long lots around Philadelphia; these generally date to the initial settlements. Meters-and-stands surveying became dominant, however, and town plans increasingly regular. Subsistence-oriented agriculture disintensified, with two-course crop rotation increasingly common. The German settlers retained their threeculture, while the Finns and Swedes on the Delawares followed a more familiar shifting pattern of clearance and bush fallow, akin to that of the local indigenous peoples; this was subsequently adapted by the Scots-Irish settlers that spearheaded settlement beyond the Appalachian periphery (Jordan and Kaups 1989).

Further south, tobacco producers also deployed shifting cultivation for maintaining soil fertility in the Chesapeake, while rice planters in the Carolina low country engaged in microreclamations of estuarine marsh (Hilliard 1978).

Although latercomers to the colonial process, the British colonies on the mainland enjoyed spectacular, if often cyclical, advances. Fueled by the export of plantation crops and grains to eager Atlantic markets, population and economy on the seaboard grew by more than three percent per annum, the area of settlement by more than two percent. The infrastructure of trade and commerce which sustained these advances, in turn, enabled these colonies to take the lead in movements of independence and industrialization during the Age of Revolution (1770–1830).

Rates of immigration were by no means proportionate to the subsequent size of European populations in the New World. Table 1 compares Spanish, French, and British colonization, using the first century of immigration and settlement as a reference point. Caribbean settlement evidently met with little demographic success, as a result of disease, low birth rates, and low life expectations (see Gernay 1980; Curtin 1969). Surprisingly, many more British and French emigrants went to the Caribbean than to mainland North America. New England had greater demographic success than the Chesapeake region or the tidewater south. Spanish population growth with respect to immigration was twice that of its British counterpart. Although Spanish regions of immigration are obscured by a lack of separate data for Central America, and by a steady stream of transmigrants from Mexico and Central America to Peru, demographic growth was greatest on the Mexican Plateau and in the dry, temperate lowlands of Peru.

A notable difference between the different colonial systems is that 48 percent of the Spanish settlers lived in towns with more than 2500 Europeans at the end of the first century (Butzer 1992b), while only 5 percent of the population in the British colonies would qualify for such a definition of "urban" in 1700. This not only reflects different social preferences, but also the limited opportunities for small freeholders in Spanish Colonial agriculture. The colonies of these three powers evidently were very different. Although there finally are two good historical texts on the Caribbean world (Watts 1987; Richardson 1992, chaps. 2–3), that region tends to fall between the tracks for American historical geographers and their Latin American counterparts. But as Table 1 suggests, North America was at first little more than an adjunct to the British and French colonial enterprises in the Caribbean, at least in regard to financial returns (see Mainland 1986). The southern Atlantic Seaboard bugs to be studied in conjunction with the Caribbean. It also bears mention that the African role in the circum-Caribbean plantation complex (Curtin 1990) has been comparatively neglected by geographers. For example, Historical Archaeology recently devoted an issue to Southern plantations that examines the cultural record and livelihood of African slaves (Vol. 24, No. 4, 1990). The volume of involuntary African Immigration (Table 2) consistently exceeded that of European colonists. Some 8.8 million African slaves were imported to the New World by 1810 (Rawley 1985), compared with roughly 1.8 million European emigrants. But death outnumbers births among African slaves, as a result of epidemics, famine, malnutrition, suicide, a deficit of women, and high infant mortality. Consequently their numbers had to be constantly replenished through "imports," even when the plantation economy was not expanding. More attention needs to be devoted by historical geographers to the links between Africa and the New World as manifest in the cultural imprint. The integration of Native American themes into the repertoire of American historical geography is more advanced, but it remained for a historian, William Cronon (1983), to highlight the interactions and implications of European American and Native American subsistence ecologies. Some examples of related research by geographers can be cited. Ray and Freeman (1978, 231–60) illustrate how the "frontier" can be seen as an arena of interaction, even beyond the confines of the Euro-American settlement. Similarly, Altvater and Ray (1987, 1989) advocate a startling alternative scenario for the Native American landscape by showing that indigenous peoples had a remarkable capacity for multiethnic coexistence. Contrary to the stereotypic view, a sizeable number of early settlers did take Indian mates, as Jordan and Kaups (1989, 87–92) argue from historical and contemporary evidence. The large French-speaking minority of the Canadian Plains, the Metis, are mixed-blood descendants of French fur traders (Brown 1983). There also were smaller and little known multicultural communities among the transplanted who began the settling of the Mount St. Mary (Lecompte 1978, 62–67, 231). Beyond the genetic contribution to American bloodlines, there are good grounds to posit that Indian women facilitated frontier expansion and shaped its society. As European settlers moving inland from the coast, and their descendants crossing the mountain passes to the interior, continued to encounter settled or recently-abandoned agricultural landscapes, aided by Indian guides and surviving on Indian foods, the pioneers at the head of the Euro-American advance followed the signposts of cleared fields and orchards that recorded the long experience of Native Americans in selecting good soils and managing local ecologies with a similar technology (Butzer 1990). As the Spaniards in another time and place, British and American settlers followed readily in the tracks of indigenous farmers, only to be frustrated where these gave way to mobile hunters or foragers. A new cultural landscape was built on the traces of an older one, regardless of whether abandoned or functional. These perspectives of interaction, ecologies, and cultural imposition imply a less ethnocentric vision of America's past, they do need to be investi-

Table 1. Demographic Patterns of Key European Colonies during the First Century of Settlement

<table>
<thead>
<tr>
<th></th>
<th>Population (in thousands)</th>
<th>Immigrants</th>
<th>Europeans</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spanish Colonies to 1700</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mexico</td>
<td></td>
<td>90</td>
<td>92</td>
</tr>
<tr>
<td>Central America</td>
<td></td>
<td>22</td>
<td>10</td>
</tr>
<tr>
<td>Caribbean</td>
<td></td>
<td>63</td>
<td>7</td>
</tr>
<tr>
<td>South America</td>
<td></td>
<td>175</td>
<td>249</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>377</td>
<td>293</td>
</tr>
</tbody>
</table>

Sources: Based on Boyd-Bowman (1976), Butzer (1990b), and Groves (1977).

Table 2. African Slave Imports to the European Colonies during the First Century of Settlement

<table>
<thead>
<tr>
<th></th>
<th>Number of Imports (in thousands)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thirteen Colonies (to 1700)</td>
<td>29</td>
</tr>
<tr>
<td>British Caribbean (to 1700)</td>
<td>264</td>
</tr>
<tr>
<td>French Caribbean (to 1700)</td>
<td>156</td>
</tr>
<tr>
<td>Dutch Caribbean (to 1700)</td>
<td>130</td>
</tr>
<tr>
<td>Spanish Colonies* (to 1600)</td>
<td>75</td>
</tr>
<tr>
<td>(1600–1700)</td>
<td>295</td>
</tr>
<tr>
<td>Portuguese Brazil (to 1600)</td>
<td>50</td>
</tr>
<tr>
<td>(1600–1700)</td>
<td>560</td>
</tr>
<tr>
<td>Total to 1700</td>
<td>1,553*</td>
</tr>
</tbody>
</table>


*Primarily for mining in Mexico and Colombia and for agriculture in lowland Peru and the Caribbean region.

Includes 4000 to Danish Antilles.
by the early 1500s, maps can also be seen as media to present the New World as a "theater" for European colonization. Indeed, a second level of symbolic intent can be inferred. The imposition of European place-names and the engraving of a Christian, European landscape with churches and a Europeanized environment can be viewed as a means of cultural appropriation and transfer. In order to attract settlers or console emigrants with memories of the Old World, such maps, deliberately or not, projected a new geographical "reality." Maps became tools with which Europe could impose its own image, values, and aspirations on the newly discovered world. Finally, maps based on exploration could precede actual colonization, thus anticipating and even shaping government policy. This explicitly revisionist stance shatters ethnocentric preconceptions, allowing us to see the Age of Discovery in a more objective light (see also Axtell 1992).

At the same time, Harley raises the matter of indigenous cartographies, noting that histories of cartography and published collections of historical charts tend to ignore Native American maps. Such maps of indigenous origin, mainly dating to the early Colonial period, are well-represented in Mexico. Harley explores this arena briefly, arguing that, like some Medieval maps, their Middle American counterparts projected space and time onto the same two-dimensional plane, to create "spatial histories" that combine geographical perceptions, ancestral migrations, and dynastic histories. On a much broader level, Indian geometrical knowledge was also incorporated into European maps of the period. It is known that explorers used Indian guides, that some Europeans commented on Indian mapping abilities, and that a few mapmakers of European origin specifically acknowledged Indian contributions to their charts. Finally, on more tenuous grounds, Harley suggests that Indians may have reappropriated European cartographic traditions as tools of resistance.

The three maps added after Brian Harley's sudden and premature death are accompanied by an addendum by Karl Butzer and Barbara Williams that explains and suggests a first level of interpretation of the superimposed perceptual and conceptual landscapes the maps illustrate. These maps, dating from ca. 1580, suggest a transition between indigenous and European cartographic traditions and therefore serve to introduce the reader, in stages, to the unfamiliar form of spatial representation discussed by Harley.

Integrating the two main thrusts of his paper, Harley reveals the coexistence and dialectic of indigenous and European cartographies. The purpose of his revisionism is not to denigrate the feats of the individuals central to the Age of Discovery, nor to impugn the strength of intellect and will reflected in the European achievements of the period. Rather, it is to open our vision to a broader context that allows greater analytical facility. Only by removing the inviolated blinkers imposed by ethnocentrism—an adaptive feature of all culture—can we appreciate the wealth of skill and experience embodied in another cartographic tradition or even hope to understand the perceptions of Native Americans in 1492.

The intellectual confrontation of Europeans with the environment and the peoples of the New World posed a similar problem, compounded by dogmatic world views inherited from a Classical and Medieval past. That particular encounter provoked novel methods of empirical description, organization, analysis, and synthesis that many historians have been unable to fully appreciate. As a result the impact of the Encounter on science in general, and geography in particular, has been understated and overlooked or largely forgotten. The paper by Karl Butzer (this volume) examines seven methodological spheres: observational skills, environmental analysis, classification of biota, ethnohistory, town planning, geographical synthesis, and a scientific framework for the natural history and peoples of the New World. The presentation centers on exemplary individuals, who illustrate the diverse backgrounds, abilities, and interests of the period. Many came from rural backgrounds and had little formal education, but this may have been advantageous in examining New World phenomena, both in their own right and in comparison with similar categories in the Old World. Geography itself was the unifying theme for these diversified strands of scientific analysis, which illustrate the intellectual prowess of Spain during the century from 1492-1590.

A comparative study of the observational skills and geographical sophistication of indigenous Americans must await further research along promising avenues for investigation. The opportunities identified by Harley represent...
one such window, and a comprehensive study of the environmental and cultural content of the maps accompanying the *relaciones geográficas* of Mexico (see Butzer, this volume) is a must. But proper symbolic and historical interpretation require special skills, as Rinkín-Mautner (1990) points out, in studying the *pinturas* preserved in villages of the Mixteca. A second window is suggested by Barbara Williams's examination of Aztec soil taxonomy and comprehension, measured against contemporary folk soil taxonomies (B. Williams and Oxlíx Sólito 1991; B. Williams 1992). Yet another window is suggested by the first land indigenous information recorded in the sixteenth century by Bernadino de Sahagún (see Butzer, this volume). His linguistic analyses allowed him to recognize the links between the world of appearances and the cognitive structures underlying it. A study of indigenous conceptualization of culture and landscape in somatic terms is indeed possible, based on Sahagún's rich materials.

In such a context the Renaissance myth of the American Noble Savage and its latter-day counterpart, the Indian as Primitive Ecologist, appear grossly reductionistic. Donvan's quotation from shelter envisions Native Americans as "transparent" in the landscape, "living as natural elements of the ecosphere." This is a perception as tenacious and just as ridiculous as the British view of North America as a "howling wilderness" (Bowden 1992). Such myths are pejorative to Native Americans by reinforcing an image of technologically primitive aborigines, blending into the forest. Conservationist attitudes toward resources and nature do not guarantee that "working with nature" will be possible in practice (Teague 1988), especially in the face of subsistence stress.

**A Devastated Colonial Landscape and Other Open Questions**

From the myth of the Indian as Ecologist, we come full circle to the issue of a "Devastated Colonial Landscape." That question has little direct connection with the concerns of contemporary ecologists about deforestation, endangered species, and air or water pollution. A global Industrial Revolution intervened between the twentieth century and the landing at Plymouth Rock, and from 1776-1821 the New World colonies moved to independence. The parameters and perspectives for what transpired after 1776 are different, reflecting a spate of technological innovations, accelerating demand for distant raw materials, rapid population growth, and a more complex global network, integrating raw materials, industrial production, and markets.

The precise question in regard to a hypothetical Devastated Colonial Landscape centers on: (a) the livestock, domesticated plants, and weeds introduced by Colonial settlers; (b) whether or not European land use and resource management were exploitative and destructive; (c) whether the introduction of European livestock as an agent of soil erosion was a major factor, and whether any evidence for degradation is limited to old areas of Indian agriculture (Butzer and Butzer 1992). Along the watersheds of the Basin of Mexico, despite extensive documented cutting of timbers for construction, mountain streams continue to provide reliable sources of water not only for irrigation, but also for the operation of grist and fulling mills, at least until the 1630s (Butzer and Butzer 1992). None of the available pollen profiles from Mexico show evidence of active deforestation or weed explosion during the Colonial era, although resolution is low, and livestock grazing may have slowed forest regeneration in the wake of Indian depopulation. There is conspicuous evidence of Prehispanic soil erosion in central Mexico (Werner 1985, but little to support a Colonial counterpart. At Tula, Hidalgo state, the rate of valley sedi­mentation was cut by 75 percent following Indian depopulation, although at some later point the river did cut down its channel (Butzer 1972a). Near San Miguel Allende, north of the Bajío, there were no extreme flood events from well before 1500 until after about 1750, when flood events began to accumulate. The Rio Laja floodplain (Charles Frederick 1992) that matches the absence of historical records for destructive floods in the Bajío between 1750. In the Mixteca of Oaxaca, cited by Lovell (this volume) as an example in point, landscape devastation is better correlated with the denudation and channel trenching which followed somewhat later than an increase in stream alluviation during early Colonial times (Rincón-Mautner 1992). Such examples warrant much greater caution in drawing intuitive conclusions.

The continuing absence of evidence for at least a general trend to environmental disturbance in Mexico before the mid-1700s probably has an explanation. Livestock were deliberately managed in a highly mobile fashion; based on older European experience, overstocking on confined dry-season pastures was avoided by long-distance transhumance for sheep and medium-distance mobility for cattle (Butzer and Butzer 1992). This goes to the heart of Sale's (1950) indictment of the European land ethic. Such examples warrant much greater caution in drawing intuitive conclusions. Livestock were deliberately managed in a highly mobile fashion; based on older European experience, overstocking on confined dry-season pastures was avoided by long-distance transhumance for sheep and medium-distance mobility for cattle (Butzer and Butzer 1992). This goes to the heart of Sale's (1950) indictment of the European land ethic.
and modification, is of singular importance and deserves a new round of attention by geographers, especially in North America. Demand- 
good temporal controls for observed change, and distinguishing processes before and after 1776—for example—is not at all 
specific: the methods and motivations of con-
current land use must be understood. The 
complexity of deforestation and forest regen-
eration, with different plant successions and 
dominants, is illustrated by the Harvard Forest 
Program (Schoonmaker and Foster 1991; Fos-
ter forthcoming). Does the closing of a forest 
process in human use taxk, with inhibition of 
forest fires, promote a different species 
composition from that of 1750 or 1400 (Heinsel-
man 1981)? Environmental dynamics have im-
portant implications for contemporary eco-
logical management, and simplistic myths, 
however appealing, can only muddy the waters 
-at a time when critical conservationist deci-
sions must be made for the future.

In closing, two basic issues stand out as the 
challenge of the Columbian Encounter to ge-
ographers: (1) the changing history of land use 
and histories, as reflected in the envi-
ronmental history of the Americas and the 
New World during the last millennium or so; 
and (2) the interactive role of Native Ameri-
cans, European settlers, and Africans in shap-
ing the human and cultural landscapes of the 
Americas. The myths and polarities proposed 
by some of the revisionists lack conviction or 
reality, but they do make the case that there is 
much more to be learned by examining the 
record more closely, and by paying greater at-
tention to the indigenous peoples as well as to 
the Africans, as important participants in the 
the drama and contributors to the outcome. 
The implications go well beyond an understanding 
of the past, by placing contemporary questions of 
ecology, traditional land use, and cultural 
diversity in sharper focus.

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Professorship of Liberal Arts at the University of Texas 
covered the substantial, cumulative costs of multiple 
copies, redesign, telephone calls, faxes, postage, 
and express mail.

Notes

1. Available analyses of stable isotopes (carbon and 
nitrogen) from human bone suggest that boas 
were not yet an important dietary component dur-
ing the thirteenth century (Schwarz et al. 1988).

2. In the case of a preagricultural site in Illinois, 
human disturbance on an adjacent slope com-
pounded of erodible loess led to a substantial in-
crease in sedimentation rates during the two 
major periods of site occupation, about 8900 and 
5200 years ago (Butzer 1977).

3. Smallpox, measles, mumps, diphtheria, and 
influenza, which emerged in the thirteenth cen-
tury, which emerged as deadly human infections 
among prehistoric animal-breeder in the Near 
East or Europe. They probably evolved, exam-
innoculating in prehistoric times, slowly 
spreading and accelerating the decolonization pro-
cess. The implications of such a scenario, perhaps 
more prominent on the Western “intervention” in China 
(1841–1949), are provocative.

4. Congregation was designed to (a) replace Indian 
population centers with planned, gridiron 
towns (see Butzer, this volume), a goal that was a hind-
rance to some diagnosticians, as a way to eliminate dispersed 
Indian settlement, by nucleation in such new 
towns. Success or failure of the latter can be 
estimated from the prominence or absence of small 
farm clusters or hamlets shown on the 1:50,000 topographic maps that cover the tradi-
tional agricultural domain of central and southern 
Mexico. Swarms of small farms or hamlets remain 
conspicuous in the Otomi areas of Hidalgo state, 
among the Nahua-speaking mountain settle-
ments of northern Hidalgo or the adjacent 
tropical lowlands belonging to San Luis Potosí, 
and in many parts of Oaxaca. By contrast, the 
explicitly rural heartland of central Mexico gener-
ally lacks dispersed settlement, as does most of 
the former Huastec domain in the Panuco low-
lands. Thus, it must be gauged whether high num-
eries of settlement dispersal help identify areas 
where Indian settlement retained a degree of con-
tinuity or whether such landscapes were remodel-
ed after the European invasion, in the wake of 
inguinean resistance to congregate. A study of 
Nahuatl (Aztec) toponyms in the area northwest 
of Puebla suggests that many, if not most, of these 
place names are “new,” i.e., younger than the mid-1500s (Dyckhoff 1984). For a detailed analy-
ices of the process of congregate, see 
lowell (1999).

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Addendum: Three Indigenous Maps from New Spain Dated ca. 1580

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Three indigenous maps were selected from the pictorial maps (pinturas) that accompany the official geographical reports (relaciones geográficas) prepared in Mexico in 1577-85 (see Robertson 1972; also Butzer, this volume). Of the seventy-five extant pinturas, thirty-seven are now at the University of Texas, and they illustrate a wide range of European, mixed, and indigenous cartographic techniques. The three chosen here represent a spectrum, suitable to introduce the reader by stages to the several levels of meaning embodied in Mesoamerican cartographies.

The heuristic advantages of the pinturas attached to the relaciones are several: (a) They were all drawn at about the same time, and their date is known. (b) Each was commissioned for the same purpose, with explicit instructions to draw a town plan and illustrate the "site" and "situation" of such a town (Robertson 1972, 246). (c) The text of the relación provides information on the indigenous officials and elders who were the source of much or most of the information collated in response to the various questions posed, and older indigenous maps were sometimes presented in evidence. (d) The information given by a...
Figure 2. 1580 Map of Zempoala, Hidalgo. South at top. After Benson Latin-American Collection, University of Texas at Austin, Map JG1-XXV-10-4, with permission.

Figure 1. 1579 Map of Atengo and Mixquiahuala, Hidalgo. East at top. After Benson Latin-American Collection, University of Texas at Austin, Map JG1-XXIII-12-3, with permission.
relación helps explain the features represented on the corresponding pintura (see Acuña 1958a, b). Although drawn in Indigenous style, the pinturas are not prehistoric. Rather, they were devised to meet European objectives. But they are ideal as introductions to an unfamiliar cartography, precisely because the content combines so many variables of numbers that would otherwise make interpretation unduly difficult.

The sectional maps are reproduced and analyzed below. The first appears to be strictly a monumental map that delineates a visible landscape. The second shows a combination of perceptual and conceptual components (see Robertson 1972, 256–57)—an historical, symbolic, and contemporary cultural landscape. The third is primarily a chieftain map, which stems to express a different idiom. Yet all three are valid and informative cartographic representations of the visible landscape that have been verified in the field.

Misantla

Misantla is located 112 km north-northwest of Veracruz, in the state of the same name. When the pictorial map (Fig. 1) of this administrative district was drawn in 1579, the town had an almost exclusively Indian population, speaking the Tonotan language. The relación was drawn up by the resident Spanish magistrate, with the participation of the parish priest, the administrator of the land (or encomienda) and his officials (see Acuña 1958b, 181–94). The accompanying map is done in black ink on European tag paper, and with European grid lines. In the same script as the relación, but the representational part is replete with indigenous symbols and was drawn by an Indian.

The center of the map is dominated by a schematic, free-hand grid of four streets (cañadas) at right angles, with the church, the governor’s building (casa rea) and the market (indicated only by the gloss “plazuela”) found in the same relative positions today. The complete urban grid (of “Indian” origin) no longer exists. Footpaths mark the roads leading out into the countryside to three dependent villages, symbolized by thatched roof chapels: Misanlla (now Poxtlan), Pilapa, and Nanacanca, the last two of which are now “lost.”

Within its jurisdiction, the town of Misantla is shown adjacent to a series of hills to the west (left side). To the north (top), a broad plain (izquierda) is indicated, then two rows of hills, and finally three small Spanish cattle estancias, on the Gulf coastal plain known as the Llanos de Améfia. Two rivers frame the map to the east and west; the river on the right is identified as the Rio de Palmas (Rio Colipt), while that on the left is described in the text as the Rio de las Peñitas. The same map also includes with the Gulf coastline. The frame, in other words, corresponds to the natural features demarcating the jurisdiction.

The tepetl hill glyphs along the southern margin are similar to those used in the map of Atengo (Fig. 3), and follow strict Indigenous conventions. The trees cannot be identified, although the text of the relación mentions a tropical genus (mamey and persea) in addition to a few other (non-tropical) trees. Most of the hills in the north approximate European conceptions of “mountain.” They are marked by standing symbols of tropical trees. Comparison of the various zones represented on the map shows that some are “decorated” by stylized natural symbols, that are sometimes used to indicate a cultivated or an uncultivated area. The cross-hatching may mean uncultivated. The groups of light, elliptical lines between the hills and west of Misanlla are also not decorative but symbolic of some environmental characteristic; these areas would probably have been forested. What appears, then, to be an impressionistic topography is in fact rendered by symbols with specific meaning.

The Misantla map differs from that of Zempoala (Fig. 2) or Atengo (Fig. 3) in that it lacks images of indigenous rulers, or toponyms rendered by indigenous glyphs. It appears to be a perceptual map, with no overt reference to the past.

Zempoala

Zempoala lies 22 km south of the mining center of Pachuca, in the district south of the Aztec capital of Tenochtitlan. It was documented in 1580 by a scribe for the Spanish magistrate, in the presence of four Aztec governors and many Indian scribes. The map is drawn in blue and yellow, in the same script as the relación, but the representational part is replete with indigenous symbols and was drawn by an Indian.

The map is subdivided by red lines, drawn with a straight edge, that, following the escarpments near the site of Moctezuma’s residence, elaborately decorated with the blue line to a blue circle and to a blue octagon within the margin, at “Zempoala.” The escarpment canal fed a spring, leading to the market (the only conspicuous frame in the text) and finally three “houses” living coiled upon it. And, as noted in the text, the rapidly flowing landscape looks much the same today; and the vegetation cover has not changed unduly. Thus, the visible landscape was intended to serve as a framework for a higher order of representation, namely the conceptual aspect of the map, as an historical record.

The only conspicuous frame to the Zempoala map is the schematic row of trees along the lower margin (right), which suggest the wooded mountains near Pachuca. However, the outermost “property” lines demarcate a jurisdicción iskaltin of that of modern Zempoala.

Atengo and Mixquihuaya

The third pictorial map selected here (Fig. 3) includes the Rio Tula, a location 262 km to the north of Tula. The relación of 1579 says little about its indigenous informants (Acuña 1958a, 23–35), who were Otomí speakers. The color map on parchment is an Indian work, although the glyphs are entered in Spanish.

The jurisdiction is sharply demarcated by a thick and continuous orange line, along which scattered, unidentified trees and schematic prickly pear are shown. The text emphasizes agaves (maguey) and mesquite (mesquite), and the former are outlined with the Roman spelling “pindora” and the latter are labelled by the South American peperpiper (pimiento). The Rio Tula cuts across the map prominently. Its conceptual landscape extends across the Rio Tula from the eroded flatland into the countryside to three dependent villages, but the toponyms are now different. The three pictorial maps are reproduced and analyzed below. The first appears to be strictly a monumental map that delineates a visible landscape. The second shows a combination of perceptual and conceptual components (see Robertson 1972, 256–57)—an historical, symbolic, and contemporary cultural landscape. The third is primarily a chieftain map, which stems to express a different idiom. Yet all three are valid and informative cartographic representations of the visible landscape that have been verified in the field.

Towards an Interpretation of the Evidence

The relationships between the pinturas of the relaciones and traditional, Prehispanic representations are clarified by the 1579 relaciones. Coyotepec is an Indian town near Texcoco, east of Mexico City. This detailed report was written by Francisco de Villagómez, the notable nahuatl scholar and historian, who supervised the construction of the royal university (Acuña 1916b, 126–27, 132). His ability in Nahualt is evident from the complex and sensitive use of a cultural landscape of the linguistic and ideological symbols that he elicited from the Indian leachers and elders, who were summoned to provide the necessary information. How his ancient data in evidence can be inferred from the text.

The explanation (for the name Coyotepec) given by the Indian elders and old people . . . and as can be seen by the old pinturas they have, which show their ancestors and former elders one on top of the other, so as to remember them. . . . And according to the elders and as is apparent from their pinturas, they used to be a large white snake . . . above that hill . . . living coiled upon it. And, according to the pinturas, that snake disappeared after the founding of the town . . . . (The origin of
its founders) is unknown except that the old pintuas which the inhabitants of the town have . . . indicate that the founders came from distant lands . . . According to these pintuas, the town was founded 415 years ago . . . (Acuña 1985b, 132-33).

It appears that the drawings in question combined genealogical histories and symbolic attributions of place with some form of geographical representation. The three maps accompanying the relation are primarily perceptual in character, except for one place (parientes), which the inhabitants of the town have prepared for Villacastín deleted all but the most important conceptual and historical aspects of their landscape, substituting a new iconography of churches and chapels.

The salient importance of the Coatepec report is that it underscores the antiquity of indigenous charts combining spatial, symbolic, and historical information. The maps with the relation and those shown in Figures 1, 2, and 3 imply that their traditional counterparts also included a variety of topographical and environmental details, together with a schematic representation of the built environment.

Abstract. What is called the Age of Discovery evokes images of voyages, nautical skills, and maps. Yet the European encounter with the Americas also led to an intellectual confrontation with the natural history and ethnography of a “new” world. Contrary to the prevailing view of intellectual stasis, this confrontation provoked novel methods of empirical description, organization, analysis, and synthesis as Medieval deductivism and Classical ontogenies proved to be inadequate. This essay demonstrates how the agents of that encounter—sailors, soldiers, government officials, and missionaries—made sense of these new lands and peoples; it highlights seven methodological spheres, by examining the work of exemplary individuals who illustrate the diverse backgrounds, abilities, and interests characteristic of the period. These examples include the observational skills of Columbus in 1492, the landscape taxonomy of his son Fernando, the biotic taxonomy of Oviedo, the cultural recording of Sahagún, the regional geography of Cieza, the pervasive role of Velasco in both geographical synthesis and town planning at the government level, and finally, the overarching scientific framework for the natural history and peoples of the New World proposed by Acosta in 1590. The evidence rates the reputation of Columbus who, like so many others with little or no formal education, had a spontaneous capacity to observe and describe. The origins of Native American stereotypes are identified, but there also were remarkable “insider” studies that, in the case of Sahagún, touched upon the semiotics of culture and landscape. Although Sahagún and Acosta had scholarly training, the confrontation with new environments and unfamiliar peoples probably put observers with rural backgrounds on an equal footing with those steeped in traditional academic curricula. Last but not least, the essay points up the enormity of the primary documentation, compiled by these Spanish contributors during the century after 1492, most of it awaiting geographical reappraisal.

Key Words: Acosta, Columbus, ethnography, geographical planning, gridiron towns, history of science, landforms, López de Velasco, natural history, New World landscapes, Oviedo, relaciones geográficas, Renaissance, Sahagún, Spanish geography.

The world is so vast and beautiful, and contains so many things, each different from the other . . .

—Francisco López de Gómara (1552)

Renaissance Science

The European encounter with the Americas in 1492 falls within what Western historians call the Age of Discovery. Humanists have long been fascinated with that encounter as a source of myths and images (Green 1968, Ill, pt. 1; Gerbi 1985; Greenblatt 1991). Historians of science in general and of geography in particular are preoccupied with navigation and cartography (Kimble 1938, chaps. 5, 9–10; Parry 1981; James and Martin 1981, 63–95; Nebenzahl 1990; Harley 1990; Buisseret 1992). The thesis of this essay is that the Spanish encounter with the New World also had a far-ranging impact on environmental and cultural understanding.

The boundless enthusiasm with which the first writers described the landscapes and biota of the New World was integral to the Renaiss-
sance, or reawakening of Western civilization. That Renaissance marked an uneasy transition from the Middle Eastern, Jewish, and Islamic world, characterized by many cross-currents of thought and expression. One hallmark of the Renaissance was the rediscovery of Classical writings during the fourteenth and fifteenth centuries and their translation from Greek into Latin, as a new source of information, ideas, and aesthetic prototypes. But the resulting humanistic resurgence did not immediately lead to more critical analysis, let alone philosophical reason. The reference once given to the Bible or Christian theological authority shifted to that of leading Classical scholars, but empirical contradictions to “new” authorities such as Aristotle were only offered with hesitation. At its worst, the rediscovery of Antiquity led to an unproductive antiquarianism that took precedence over new observations and stirred intellectual progress.

Medieval science had already included a component of empirical, practical observation, but was dominated by scholastic discussions of the finer points of older texts, hidden behind producing materials derived from personal observation. The three realms of natural history, consisting of animals, plants, and minerals, had been studied in a compartmentalized fashion, without a grasp of fundamental interconnections, except as an expression of a divine plan. In many ways it was a period of introverted reflection on the self-sufficient truths provided by theology, and the individual was part of an ahistorical cycle of life and death, of suffering in the present and anticipated reward in the hereafter.

The rediscovery of Antiquity provided a new sense of history, identifying new role models of scholars—not only soldiers or kings—who had made their mark in a secular world of the living. Renaissance scholarship included individuals who were motivated and willing to embark on a new search, with a fresh curiosity. Only a minority of these had both the talent and boldness to emphasize the empirical and the inductive, to reexamine deductive theories critically, and to consider the need for direct observation or experiment. Although time-honored religious beliefs set constraints to discussion, the Renaissance was the beginning of a spirit of free enquiry, with renewed interest in verification, accuracy, and systematic understanding.

It can be debated whether Renaissance geography was the revitalization of a Classical tradition or the spontaneous product of a new intellectual climate. Two personalities of the later Middle Ages illustrate the problem. In 1410, the French Cardinal d’Ailly (1486) wrote a world description based almost exclusively on Classical sources; it begins with a series of inferences, generalizations, and new hypotheses based on his division of the globe, but his regional chapters are a mix of old fables and obsolete toponyms, for which endless fictional or mythological explanations are offered. Quite unaffected by such ballast from Antiquity, the Venetian merchant-traveler Marco Polo (1258) left a remarkable account of his travels in Asia (1271-59) that includes vivid descriptions of landscapes and cultural patterns. 1 Pierre d’Ailly and Marco Polo represent two extremes among precursors of the Renaissance, but the pattern remained. 2 My point is not that intellectual roots are unimportant, but that the prevalent Renaissance paradigm overemphasizes the significance of Classical antiquity, to the degree that it obscures the acuity and originality of Renaissance observational skills and comprehension.

The discoverers, explorers, and observational scientists of the Renaissance were at best familiar with a very limited selection of Classical works, that were frequently cited only for effect, sometimes in the final stages of revision (see Cieza de León 1894, xxxiii, n. 12). Strabo, an available and obvious source, was barely used, and Columbus’s consultation appears to have been very selective and from a derivative fashion (c.f. 10, 20b; Harle 1996, 37, 42). More influential was Pliny’s Natural History (14050), the de facto encyclopedia of the Renaissance (Broc 1980, 15). For cartography and navigation, the tables of geographical coordinates by Ptolomy (1522), and the maps attributed to him, provided a direct or indirect datum for most large-scale charts from the mid-1300s to the early 1500s. 3 Geography during this period was a part of what was called cosmography (Waldseemüller 1566), which included astronomy and nautical science as well as the use of direct observation or experiment. Although time-honored religious beliefs set constraints to discussion, the Renaissance was the beginning of a spirit of free enquiry, with renewed interest in verification, accuracy, and systematic understanding.

The discovery of the New World initiated an unprecedented interest in geography and natural history. Somehow, earlier maritime discoveries by Europeans had failed to generate extensive reports of new lands and peoples. Even the exploration of West Africa instigated by Portugal’s Prince Henry “the Navigator” (see Fernández Armesto 1990, 105-200) led to such dreary works as the Crónica de Guiné (Beazley and Prestige 1996-98), a leaden saga of seafarers and slave hunting activities from 1434-48, punctuated by incidental comments on indigenous customs; only its commercial prospects stirred interest in Portugal. To the credit of Columbus (Cristóbal Colón), his voyage of 1492 inspired much more than additional coastlines on the portolan charts. Even though he thought he was in East Asia, Columbus recognized the novelty of the phenomena, and his perception of the other side of the ocean. However, observers were other captains or ship’s pilots of the period, they lacked his ability to describe the novel in ways that would excite academic and lay curiosity in Europe. 4 Columbus’s credentials as a scientific figure have long seemed unpersuasive to his critics. Born 1451 in Genoa under modest circumstances (his father was a weaver), he went to sea as early as age fourteen. During the mid-1470s he sailed the Mediterranean, perhaps on a galley in the service of France; about 1476-84 he was based in Lisbon and the Madeira, sailing to West Africa, probably with slaves. 5 All we have to attest to his learning are the surviving letters that have come into his possession (see Varela 1967, 111-11; Arfja 1972, versus Menéndez Pidal 1944), the emphasis is necessarily selective, and several key authors have been chosen for closer examination. This focus on individuals is not an attempt to create new icons; it is essential to elucidate the interests, abilities, and limitations of the period. The differences among the individuals selected also reveal the degree to which the evolution of sixteenth-century Spanish geography is nonlinear, not unilinear. Geography itself was the unifying theme, rather than a by-product of this scientific evolution.

Observation: Christopher Columbus

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with the making of geographically realistic maps intended for the practical world of navigation (see Campbell 1987).1

Columbus's insight and intellectual impact deserve more sympathy than has been accorded him by Carl Sauer (1966, chap. 2) and his followers (e.g., 1990, chap. 5). Whatever his motives and however amusing his use of hyperbole, Columbus attempted to inform about the new lands he saw. His descriptions of the people and their lifeways, incidental to his narratives about encounters with the indigenous inhabitants, contain much useful ethnographic information (see Sauer 1966, chap. 3) and novel insights on the physical environments of the New World.

Columbus was tutored in the sciences, and his lack of botanical knowledge frustrated him: "I believe there are many plants and trees (in the Bahamas) worth much in Spain as dyes or medicinals but I do not recognize them, which I greatly regret" (see Spanish transcription of the First Voyage diary, by Dunn and Kelley 1988, folio 15 recto, lines 25-28). But his lack of formal training did not prevent his from venturing comparisons of the New World with North Africa and the Mediterranean: "They have a great number of palms of a different kind than those of Guinea or our own, of medium height, with smooth trunks and very large fronds" (Dunn and Kelley 1988, folio 18 recto, 13-18), nor from recognizing six to eight different classes of palms (1493 letter in Varela 1983, 141). He also noted the distinctiveness of the trees, fruits, and plants of Cuba and of Hispaniola (see Varela 1983, 141). And he commented on the unusual association of pines and palms growing in one river valley (vega), whose surface alternated between level hills (montes llanos) and low plains (bajos) (Dunn and Kelley 1988, folio 29 recto, 26-28; see also Humboldt 1845-47, II, 56).

He likewise demonstrated an intuitive grasp of geomorphology. He found it remarkable that the steep slopes of tall mountains were densely vegetated and not rocky (Nov. 24 and 26, 1492), and that broad rivers debouching into the sea lacked sand or gravel bars (Nov. 27), both phenomena that we would now attribute to deep tropical weathering. On another occasion he defined a cala (a local term for drowned valleys of the Balearic Islands and Sardinia; see Butzer 1962) as "a narrow notch where sea water enters the land" (Dunn and Kelley 1988, folio 24 vuelto 45-25 recto 2). Two sources derived from the lost diary of the Second Voyage (1493-96) offer the first description of a mangrove coast on the southern shores of Cuba; it was replete with cienagas and swamps for two leagues inland, with almost impenetrable thickets of plants and trees (F. Colón 1494, 189). According to Columbus this region is completely submerged and covered with water and its coasts are marly and full of trees (Martyr 1641, 139).

Finally, there are Columbus's instructive, if debatable, climatological ideas. He explained the great heat of the Bahamas by their low elevation and the prevailing easterly winds (Oct. 29). On the daily tropical showers, he noted that late in every day a cloud bank formed on the western part of Jamaica, resulting in rain for an hour or less; this he attributed to the great forests of the island, with reference to his previous experience on the Canaries, Madeiras, and Azores (July 1494, F. Colón 1491, 193-94). He appended a remarkable ecological note. On those Atlantic islands, "they have cut so much forest and trees that hindered them [from expanding cultivation] that such clouds and rains never form as they are used to." The observation is telling because it shows that Columbus was aware of and concerned about environmental degradation on the recently-settled Madeira islands.

Much in the manner of more recent field observers, Columbus repeatedly drew analogies between the Old World and the New: a similar tree but with larger leaves than a counterpart on an Aegerian Island (Nov. 12); live oaks and arbutus (madronos) as in Castile (Dec. 7), healthy river waters as compared with pestilential ones of Guinea (Nov. 27), finely cultivated lands recalling the plains of Córdoba (Dec. 14), weather like April in Castile (Dec. 13), or mountains like those of Sicily (Oct. 28).

Some of the comparisons were motivated by natural curiosity, others by economics, and others still by sheer aesthetics. They give point to his verbal paintings of an exuberant tropical vegetation, nourished by an eternally spring-like climate, and inhabited by peaceful and naked innocents. Columbus thus created an image of an Edenic land that was at once primitive yet familiar, and in so doing his rhetorical analogies delineated a powerful theme in European humanistic thought. He demonstrated an ability to observe, compare, and describe, and there are suggestions of partial comprehension.2 It was his articulation and dissemination of his ideas, his way of putting words together, and his rhetoric that provoked scientific interest in a New World that he himself refused to believe was new. Columbus, though at times a medieval visionary and mystic, and given to Biblical metaphors and prophecies, demonstrated tenacity as an explorer and a longing for greatness and discovery that mark him as typically modern and, in thought, action, and results, unlike other of the great personages of the Middle Ages (Gerbier 1885, 13).

Landscape Taxonomy: Fernando Colón

Fernando, born out of wedlock in Córdoba in 1488, was the son of Columbus who had intellectual ambitions, and who had a profound, if little-known, impact on Spanish geography for a century. At the age of five he saw his father off at the docks of Sevilla, and aboard the Fourth Voyage he served as chronicler in 1502-04 (F. Colón 1984, 162, 288). In between, he spent his days as a student, private tutor, in part by a key historian of the voyages, the Italian humanist Peter Martyr (c. 1458-1526). At least some of the natural history observations on the Central American coasts were probably made by Fernando, including the first description of pineapples (F. Colón 1494, 317). He was on Hispaniola in 1509, after which he went to Castile to study, "because he was inclined to the sciences and had many books" (las Casas 1965, II, 370). Indeed, he spent much of 1512-16 studying at the Spanish Franciscan monastery in Rome, under the humanist Pedro de Salamanca (De la Rosa 1906; Ponsot and Drain 1966; Arranz, in F. Colón 1984, 17). Incomplete and lacking off-hand observation, results were not culled into the planned, alphabetical gazetteer (Vocabulario), from which a land use and physical map of Spain apparently was to be constructed. The notebooks of raw data were left to gather dust in the remarkable private library of 15,300 volumes and manuscripts that Fernando left behind at his death in 1539. When that library was rescued, at the end of the nineteenth century, only 4,400 of the town inventories and 5,600 of Fernando's books had survived.

Nothing like the itinerary had ever been conceived before. However abortive or premature it may have been, this sophisticated geograph-
ical survey represents the first attempt to de
velop and implement a comprehensive field ap
proach to the cultural and physical land
scape.

Without questioning the pivotal role of Fer
mando in conceptualizing his geographical sur
vey, the concepts and terminology used (Table 1) do not seem to have been his own. In his biographical account of Columbus, Fernando Colón (1964) employed a fairly sophisticated geomorphologic vocabulary, including terms such as montaña, cerro, pata de gallina, hill, pata (hilltop, hill), llanura (plain), planicie (plane), ciénaga (marsh), río (swamp), arroyo, espalda (high slope, mountain crest), perlasca (cliff), pechugosa (rocky) and quebrada (broken to

graphy), none of which are used in the itin
erary (Table 1). Only llano, cerro, and aspen
are common to both, while siera, loma, cuesta, deribadera, and doblado are exclu
sively found in the itinerary. Most important, monte in the itinerary is exclusively used in the traditional Spanish sense of scrub or woodland vegetation, whereas for Fernández it was a hill or low mountain, equivalent to cerro. This sug
ests that the vocabulary and possibly also the systematic approach should be credited to unidentified Spanish collaborators. Certainly the vegetation categories are those of Spaniards with rural backgrounds and, not sur
prisingly, none of these terms are used by Colón (1984) in his Caribbean accounts.

The only potential consultants of Fernández that can be identified are Pedro de Salamanca, whom he met in Madrid in June 1571, or Anto
nio de Nebrija, whom he consulted at the Uni
versity of Alcalá at about the same time, six
weeks before he began the itinerary (De la
Rosa 1906). Nebrija (died 1522), is better
known for first attempting to standardize Cas
tillan Spanish as a written language (Green
1968, 111, 11–18), but he also had geographical interests: he wrote on atmospheric pressure, worked on navigational instrumentation, and assembled an ambitious chart for the longit
udes of Spanish cities, based on true time
differences between them (Becker 1917, 96, 122; López Piñero 1979, 213–14). He may have stimulated or encouraged Fernández to attempt a national project, but he had no evident back
ground in geography or botany. One must assume that pragmatic Spanish rural ex
perience was critical in developing the bio-

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<th>Table 1. Land Use and Landscape Classes Utilized for the Geographical Survey of Spain (1517) by Fernando Colón</th>
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<td><strong>Arable land</strong></td>
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<td>Wheat cultivation (llanos del san lor hortas,</td>
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<td><strong>Olive groves</strong> (olivares)</td>
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<td><strong>Vineyards</strong> (viñas)</td>
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<td>Irrigated tracts (huertas)</td>
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<td><strong>Minor categories</strong>, including almond, fig, citrus, apple, etc. (ortigas or groves)</td>
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<td><strong>Grazing land</strong> and degraded woodland (monte bajo)</td>
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<td><strong>Designated pastures</strong> (dehesas)</td>
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<td>Rough grass and shrub (casterranas, monte de atalaña)</td>
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<td><strong>Sclerophyllous scrub</strong> (lentescales, santeras, matorrales)</td>
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<td><strong>Thorny scrub</strong> (montes jarales)</td>
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<td><strong>Scrub oak</strong> (chaparriles, maraños, carrascas)</td>
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<td>Palmeto scrub, possibly abandoned farm land (palmares)</td>
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<td><strong>Rocky surfaces</strong> with shrubs or herbs (berruecas)</td>
</tr>
<tr>
<td><strong>Primary or secondary forest</strong> (monte alto)</td>
</tr>
<tr>
<td>Deciduous oak (roble)</td>
</tr>
<tr>
<td><strong>Live oak</strong> (encina, carrasca)</td>
</tr>
<tr>
<td><strong>Cork oak</strong> (alcornocal)</td>
</tr>
<tr>
<td>Pine (piral, plan)</td>
</tr>
</tbody>
</table>

**Topography and landforms**

Floorplain (llanos de ribera del rio, vega) Level plain (llanos, tierra llana, campiña) Irregular plain (tierras doblada) Rough, dissected topography (tierras aspera or deribadera) Flat-topped hill (loma) Hill or peak (cerro) Mountain and valley country (sierras y valles) Escarpment (cuesta)

*Derived from F. Colón (1908–15); also De la Rosa (1966); Ponsot and Oréuf (1966); Butzer (1968).*

**Biotic Taxonomy: Oviedo**

Scientific research only began in the New World thirty years after Columbus's fateful voyag
ge, and it was initiated by an unlikely source. Gonzalo Fernández de Oviedo (1478–1557) was
a royal official with humanistic credentials who
once translated a novel of chivalrous love into
Spanish. Raised at the Spanish court, he spent three years as a soldier in Italy, where he
became an aficionado of the arts before settling in as a retainer and notary. But at age thirty
five, he was sent to Panama as royal inspector
for the gold foundries, and from 1513–47, he
spent twenty years in the New World, working in Central America, Hispaniola, and Colombia
(Pérez, in Fernández de Oviedo 1959, 1, xvi
-xxxvi). From 1522 onward he devoted a
dozens years preoccupied with natural history
for which he lacked any formal training. While
in Madrid in 1525, without his records in hand,
he wrote a "summary" volume on the natural
history of the Indies (Fernández de Oviedo 1950),
and in 1535 this was republished in ex
panded form as the cornerstone of his massive
history of Spanish exploration and conquest,
but even his derivative accounts single out im
portant geographic and biotic data, such as the
comparison of the cold-temperate biota of Patagonia and Newfoundl and (Alvares 1957).

For areas Oviedo knew first hand, his accounts are substantive as well as evocative; they
resemble with nostalgic, comparative images of town
scapes and landscapes in Spain or Italy (Gerb
1985, 188–94). In an era when academics wrote
in restrained Latin, Oviedo deliberately pre
sented his materials in Spanish, salting his text
with vignettes of Spanish abuse of the Indians,
quips about greedy clerics or armchair histori
ans, and candid personal anecdotes. His enthu
siasm for the natural world is illustrated by an
incident from his travels between Panama and
Nicaragua (August 1527). Spotting what he
took were five oak, in the mountains above
the Gulf of Nicoya, he noted that the trees had
no acorns. So he stopped his party and had
his companions search the ground around the
trees until they found a dozen acorns:

And I ate them, though they were somewhat dry;
and they were no more nor less than in Spain—the
oaks in terms of the tree and the leaf, as well as
the fruit (Fernández de Oviedo 1959, 1, 230).

It is probably fair to say that Oviedo pos
sessed modest abilities for synthetic interpreta
 tion, and that his primary contribution in natu
ral history was analytical and systematic.
Several broad themes preoccupied him:

(a) Domesticated Indigenous plants and their
utilization by the Indians (book 7);
(b) Wild food or fiber plants, manipulated and
exploited by the Indians (book 8);
(c) Taxonomic comparison of neotropical trees
and plants with those of the Mediterranean
realm, according to physiognomy, leaf ar
rangements, leaf morphology, and fruits
(b ooks 9 and 11);
(d) Recognition of those genera or families with
European counterparts, e.g., cherries, grapes,
and palm; and
(e) Inventories of the neotropical fauna, organi
ized under the categories of quadrupeds (book 12), fishes (book 13), birds (book 14), and insects (book 15), with the recognition that most, but not all, of these diverse animals belonged to families represented in the Old World.

Oviedo was the first to confront the dazzling profusion of unfamiliar plants and animals that awaited him through a taxonomy which organized life forms into morphological classes and delineated commonalities and differences with Old World forms. For unfamiliar genera or families, he applied indigenous names that, at the time, were rapidly acquiring an almost universal currency in the tropical colonies of Spain (J. D. Sauer 1976)—the "folk taxonomy" that was generally practiced before the binomial Linnaean classification. His natural history was published promptly, translated into several European languages, and had a profound scientific impact.

Oviedo modeled his taxonomy on Pliny (1940-56), whom he was familiar, rather than of Theophrastus's more sophisticated conception of plant morphology and ecology, which he did not know. But unlike Pliny, Oviedo's descriptions and organization were based on years of empirical observation, guided by two firm principles: accuracy and inductive approach. By virtue of his lack of formal training, Oviedo broke the mold of Medieval herbalists, who organized their plants alphabetically, not comparatively (Alvarez 1957). In consequence, he offered a bold, biological macro-framework for the New World as well as the first systematic study of natural history since the time of Pliny (first century A.D.).

Although Oviedo seems not to have understood the principles of ecology, his work is filled with suggestions of ecological association and knowledge of biogeography. His is the only document we have that describes the circum-Caribbean region in a relatively unmodified biotic state (Alvarez 1957). Equally important, Oviedo offered a detailed and focused account of economic botany that remains unique, and that retains its importance for the cultural geography of peoples in the region who have become extinct. In reading these sections, one repeatedly has the impression that Oviedo relied heavily on Native American informants, although he did not admit it. Oviedo's general contributions to understanding the aboriginal inhabitants and their customs also have value. He had no illusions about human nature, and was impartial in his criticism of Spaniards and Indians and their foibles (see also Gerbi 1985, chap. 19). He heaped sarcastic abuse on Pedrarias, De Soto, and certain other conquerors noted for their brutality (see also Salas 1554), and he blamed the Indian demographic collapse on Hispaniola squarely on the Spaniards: forced labor and other gross abuses, the resulting suicides, and on smallpox (Fernández de Oviedo 1959, 1, 67). His comparative analysis of Spanish exploration or conquest of different parts of the Americas not only convinced him of the common nature of human nature in both world hemispheres, but he was the first to recognize that indigenous peoples of southeastern North America, the Caribbean, and South America had varying forms and levels of human culture (i.e., cultural complexity, a concept later explicated by Acosta (1962, 6.19)). Ballesteros (1957) further detects an implicit recognition of an historical progression of culture found among the ranks of the missionaries. Like Columbus, Oviedo came to the New World as an amateur and was promptly filled with wonder by what he saw. But unlike Columbus, Oviedo became a dedicated scholar who produced the first great scientific work on the New World. No less an authority than Humboldt (1845-47, II, 298) believed that the foundations of modern physical geography were laid in the studies of Oviedo and Acosta (see below).

### Cultural Landscapes: Sahagún

The biggest challenge for the first European observers in the New World was the encounter with new peoples possessed of unfamiliar and puzzling languages, lifeways, beliefs, and values. The problem, then, has been to grasp the indigenous vision of an indigenous world, to move from description to understanding. That vision was elusive because Native American reading of the landscape was set in a different cosmological perspective (see Licate 1980), one which cast the supernatural, the individual, and the community in uncustomed interrelationships, and lent different meaning to concepts or material phenomena such as property, labor, dwelling, food, or technology.

In the unhappily tradition of European ethnocentrism, while some enlightened individuals sought to understand, many others recklessly destroyed the cultural diversity that they encountered in the New World (Alvarez 1959). Not surprisingly, perhaps, some of the most explicit acknowledgments of Native American creative capacity and achievement come from some of the men who knew them best—the conquistadors. Hernán Cortés, in his letter of 1520 to the emperor, expressed wonder at the splendors of Tenochtitlán (later, Mexico City), its markets, and the great temple in a classic description, expanded in 1532 by his biographer, López de Gómara (1966, II, 147-58); see the prose of Simpson 1964, 156-57. Indeed, most of the ethnographic materials synthesized by Fernández de Oviedo (1959) came from the chronicles of minor conquistadors or their more articulate rank-and-file. Among the latter is Clelia de León (1965), who assembled the first history of the Incas from oral testimony given by Indian informants.

The most successful students of cultural phenomena found among the ranks of the missionaries. The first of these came to the Americas with Columbus on the Second Voyage. Although working with little Christianizing success on Hispaniola 1493-96, the obscure Jeronomite friar Ramon Pané (Panet) evidently listened with great care. He was able to recount the origin myths, beliefs in the hereafter, and ritual medical practices, as well as observations on ethnic and linguistic distributions of the Taíno people (as in F. Colón 1984, 265-29; see Wilson 1910 on their culture), Even by modern anthropological standards, this account is remarkably objective, and qualifies as a first effort to record the self-perspective of another people. Pané's account is complemented by the descriptive ethnography of the Sevillano physician for the expedition, Diego Alvarez Chacón (Jane 1988, I, 20-73; Gerbi 1985, 23-26). Although Las Casas (1967, II, 178) maliciously described Pané as a Castilian who spoke Castilian poorly and was a bit simple-minded, Las Casas himself fared poorly by comparison.

Las Casas (1967) assembled a massive corpus of information during the 1540s-50s on the rituals and customs of various New World peoples in order "to demonstrate the rational capacity of the Indians." The seemingly strange behaviors can be explained, he argued, by different beliefs and world views, and in this relativist context, the New World peoples did not merit the pejorative connotation of "barbaric." But his ethnographic materials are so highly selective and sanitized that they retain little value. His dogmatic conclusions that human sacrifice and cannibalism once were universal traits and that this demonstrated "a higher concept of God" among the "most religious peoples" (Las Casas 1967, II, chaps. 157, 158) are particularly disturbing.

More solid contributions to understanding New World cultures were advanced by the early Franciscans in Mexico. Diego de la Torre controlled missionary activities in the Yucatán 1549-79, and although he was responsible for burning countless Mayan documents (see Lovell 1991), he also assembled an invaluable account of ancient Maya ethnography, history, and religion. Based on his own experiences as well as oral and written information, this account included the "first accurate knowledge of the hieroglyphic writing" (Tozzer, in Landau 1941, viii), Toribio de Benavente Motolinía (1669, 177) was one of the "first twelve" missionaries to arrive in Mexico in 1524, also authored works which include a wealth of ethnographic description on the pre-Contact Aztecs and some of their archaeological sites. Yet unlike Pané, who slips at times into an "insider" presentation, Motolinía's mode remains that of an "outsider.

The main Dominican contribution, completed in 1581 by Diego Durán (1667), reconstructed Aztec historical annals and their ritual calendar, based on indigenous informants and manuscript sources. His writings were interlinked with those of his Jesuit relative, Juan de Tovar. A specialist in three indigenous languages, Tovar was commissioned in 1576 by the Viceroy of New Spain to write the history of the indigenous peoples he was to govern, "with the assistance of the native historians and their books" (Warren 1973, 80). Although this work was lost, it was used extensively in another Jesuit study (Acosta 1962) of the indigenous civilizations of the New World. These investigations, encouraged by the government, signal a period of genuine and sensitive scholarly activity devoted to Aztec social history, one which presupposes the existence of indigenous documents which, like many of the missionary
writes, has been destroyed or "lost" in private collections.

The finest cultural research of the sixteenth century, the great Florentine Codex, was accomplished by the Franciscan friar Bernardino de Sahagún (1499-1590). Born in a small town of León, Sahagún came in 1529 to Mexico, where he occupied his next forty years with Aztec linguistic and cultural studies, materials that he attracted the attention of a century of international scholarship. Completed in final form in 1579, the thirteen-volume work (Sahagún 1950-60) constitutes an encyclopedia of Aztec culture, recorded in their Nahualan language with abbreviated Spanish translations. Ranging across cosmology, philosophy, society, natural history, economics, society, and the artistic realm, the materials stem from decades of in-depth interviewing of indigenous informants in several towns, whose responses to a structured questionnaire were transcribed in Nahual and in the cultural style of the informants. Of particular interest to geography are parts 10-12, dealing primarily with crafts and trades, markets and economy, architecture and construction methods, medicinal plants, and the Aztec perception and classification of the environment. These sections contain almost two-thirds of the 1846 indigenous illustrations (see Dahlgren and the work, but which so far have only been published as simplified sketches (Class and Robertson 1975, 190-92).

An example best illustrates the complexity of cultural information encoded in what to European perception is merely a material object. In explaining the term tecpancalli, a pre-Contact palace, Aztec respondents unraveled multiple levels of meaning as they connected function with physical description:

It means the house of the ruler, or the government house, where the ruler is, where he lives, or where the rulers of the townsman, the householders, assemble. It is a good place, a fine place, a palace: a place of honor, a place of dignity . . . . It is a fearful place, a place of fear, of glory . . . . There is buzzing, there is boasting; there are haughtiness, presumption, pride, arrogance. There is self-praise, there is a state of godliness . . . . It is a center of knowledge, of wisdom . . . . It is something embellished, a product of care, made with caution, a product of caution, a deliberate thing made with deliberation; well made, the product of carved stone, of sculptured stone, plastered . . . . It is a red house, an obsidian serpent house . . . . It has a deep footing, a deep foundation . . . . It has an entrance, vaulted, with cross beams, with a covering . . . . (Sahagún 1969, XII, 270-71).

Klor (1988) regards Sahagún as "the father of modern ethnography," and he offers an insightful discussion of Sahagún's methodology and the problems of relating indigenous conceptions to European categories. Entering Aztec culture as a participant observer, Sahagún saw the natives cultures as equal and, in some ways, superior to imported European cultures. He grasped what is now called cultural relativism, that each culture is rich in human information, and that the values embraced by the people who share that culture have merit. He "remained convinced that the conquest of the New World brought only one arguable gain: religion" (Nicolau and Cline 1973, 207; Nicolau 1987).

The Florentine Codex marks the close of sensitive research into Native American cultures in Hispanic America. In 1557 the Inquisition and the Council of the Indies barred or suppressed works in native languages by the missionaries. They ordered Sahagún's manuscripts to be turned over, but fortunately they were saved by the Inquisition's censor in Mexico who held different views (Nicolau and Cline 1973). This reversal of policy, directed from Rome, entailed fundamental changes in missionary strategies which the Archbishop of Mexico and the mendicant orders in New Spain strenuously but vainly resisted. From Motolinía in the 1520s to Sahagún in the 1580s, the goal had been conversion, not assimilation. When, in the 1590s, that benevolent Indian policy was set aside, particularly by the Franciscans, a steady erosion of cultural integrity ensued.

The Spanish observers of the sixteenth century had great difficulty in finding a model with which to view and understand the diversity of Native American cultures. Through the widely disseminated elaborations of Marty (1964), Columbus's account of the Taño of Hispaniola as generous, guileless, and backward fostered the stereotype of the American Noble Savage. In Mexico, Cortés and his soldiers stumbled upon a great civilization and created a different stereotype, a Clever and Discreet Indian gifted in art and industry (Keen 1971, 60). Las Casas, blind to the asking of the Indians, Motolinia accentuated the social inequalities and the poverty of Aztec Mexico, while Durán praised the hierarchical, class-conscious spirit of Aztec society (Keen 1971, 119-20). It remained for Sahagún to recognize the linkages between the world of appearances and the cognitive structures beneath it that influence individual and group actions, a discovery made possible by his linguistic analyses. But Sahagún himself was only rediscovered in the 1880s, and his semiotic conceptualization of culture and landscape should attract modern cultural geographers today (see Rowntree, et al. 1983, 213-14).

Regional and Synthetic Geography: Cieza de León

The talent to integrate environmental and cultural information in spatial and logical terms may be inborn rather than learned, at least if Pedro Cieza de León is taken as an example. Cieza (1864) was raised in Llerena, an Extremaduran town of 5000 inhabitants when he and his parents embarked at Seville for Colombia in 1533. At the time he was either thirteen or seventeen years old (his books give two versions), but within a year he was campaigning up and down the Andes as a common soldier. In describing the hardships, he complained of the exorbitant price of a piece of paper, implying that he was taking notes. His terse, informative, and evocative prose indicates an educated man, but that education must have been largely informal, acquired on his own and on-the-go. He died young, in 1554, just as his introductory volume to a four-volume history of Peru was published. This first book, which relates a district-by-district geography of the Andean world from Panama to Bolivia (Cieza 1864), is of particular interest here.

Again and again he describes the dramatic physical environment, its diversity, and the cultural landscapes and subsistence forms of its various ecozones. In one paragraph he sweeps the reader from the mangrove coasts and rain forests of the Pacific slope into the snow-topped high ranges, describing the semi-arid intermontane valleys in between. He directs attention to variations in rainfall and vegetation, windward and lee slopes, habitable and inhospitable regions, and the tortuous roads that bind the towering tepuis and karst landscape of Quie (Cieza 1864, chap. 40), with its descriptions of planted crops, Indian populations, livestock economy, and the surrounding network of towns, is too long to excerpt. The cogent report on Lake Titiaca is also exemplary and can be reproduced in translation:

The region of Collao has many snow-capped mountains, as large and high as ever seen. There are large ponds covered with good pastures that serve the domestic livestock wandering across them. In the middle of a lake, possibly the largest in South America, and most of the towns of Collao lie next to it. The cultivated land [and anything of value] is found on large islands within the lake, because these are deemed safer than the towns, which lie along the roads.

This region is so cold that not only does it lack fruit trees, but even the potato is not grown because it will not ripen, for the same reason. There are great numbers of birds of many kinds in the reed marshes of this lake, including large ducks and other fowl, and two or three kinds of tasty fish . . . . The lake is so large that its circumference is 330 km and its depth [according to Captain Juan Ladillero, going out with his brig] 35 fathoms or so, more in some parts, less in others. This size, and the waves raised when the wind blows, suggest an embayment of the ocean. It is not known why so much water is held in this lake or where that water comes from; although there are many streams and arroyos flowing into it, this seems inadequate, mainly because the lake is also drained [by a deep river that flows strongly] . . . . Possibly the Denver left this water behind because, as I see it, it should be salty rather than fresh if it had been part of the ocean, and furthermore the sea is 300 km away . . . .

The great lake of Collao is called Titiaca, after the temple built on it . . . . (Cieza 1864, chap. 103).

Cieza's account rivals the regional geographies of the nineteenth century, which is all the more remarkable because Cieza was untrained and had no mentors or role models. Although Classical geographers like Strabo provided good regional descriptions, they lacked the ability to shift the scale of vision, to gather so much hard observational data, to analyze interrelationships, or to systematically treat a large region according to a particular set of criteria.

A very different type of regional geography, embracing most of the New World, was attempted 1571-74 by López de Velasco (1971), whose similar lack of formal education is discussed below in relation to government geography. The Geografía y descripción universal de las Índias was assembled from reports and maps on the New World and published in the sixteenth century. With apologies to the king, and evidently intended to inform the government, Velasco tallied a total of 200 Spanish settlements in the Americas, with 32,000 Spanish households and 4000 other settlers and miners; there also were 8000 Indian
towns and 1.7 million Indian "tributaries" liable to tax or work demands as well as 40,000 African slaves, not counting people of partial black ancestry.

Velasco is a classic regional geography, a coherent work of synthesis. First the coastlines of a region are described, much in the manner of a navigational chart, followed by an outline of the topography, a description of the environment, a summary of the main cultural phenomena, and a systematic account of towns and agricultural activities. Miscellaneous points cover topics such as climatic constraints to settlement or agriculture. Historical digressions or travelers' "tales" are few. Unlike Cieza, who wrote spontaneously on the basis of direct observation, Velasco presented a more "academic" synthesis.

The work's rigor and systematics make it a volume of lasting historical scientific interest, as is shown by Menéndez Pidal's (1944) reconstruction of a New World geography for about 1570, based primarily on Velasco. The modernity of his secular and empirical synthesis, conceived at a global level through its inclusion of oceanic navigation and East Asia (López de Velasco 1971, 29–49, 273–309), contrasts with the continuing use of an obsolete Ptolemaean framework and a theological paradigm to the end of the century for presenting new geographical information in Central Europe (Menéndez Pidal 1944, 4; see also Ptolomy 1966; Münster 1588, Blücher and Birmelser 1979). Unfortunately, Velasco's prototype for synthetic geography remained unpublishad until the fourth century of Columbus's voyage. Although Velasco's work had no impact on geographical scholarship, it deserves to be considered as a precursor to Carl Ritter and Elise Reclus.

This first epoch of Spanish geographical inquiry aptly concludes with another compendium of a New World regional geography, that falls a little beyond our period of examination. The Carmelites friar Antonio Vázquez de Espinosa (c. 1570–1630) traveled through most of Hispanic America for fourteen years (1608–21), perhaps to evaluate possibilities for his order to engage in missionary work. Doubtless Vázquez (1669) had important backers because he had full freedom of movement, access to privileged information (such as the salaries of high church officials), and disposition over reams of municipal and economic statistics, which he put to good use. In the course of his travel and sojourns, he compiled a wealth of papers, maps, reports, and first-hand observations.

Vázquez came from a poor, rural background in the olive-growing country just west of Sevilla, equipped with a primarily religious education, and lacking the conceptual rigor or analytical skills of Velasco, Vázquez compensated for his shortcomings by a ready appreciation for complex landscapes and a lively interest in the rural economy. He provides, for example, unique quantitative data on wine and olive oil production in Peru; he also remains a key source for demographic data. The Compendium spans the Hispanic domains, and his regional descriptions brim with quality, systematic information. He was unsurprisingly critical of what he regarded as short-sighted and abusive administration of the indigenous peoples, by both church and state; yet his own attitude was paternalistic, and unrelieved by sophistication for other cultures. At the time of his sudden death, his manuscript was in press, and like so many others, it remained unpublished.

To the works of Cieza, Velasco, and Vázquez can be added a variety of other travel reports or regional histories, with enlightening geographical introductions. Collectively they show that synthetic as well as analytical geography was an integral part of what would now be described as scientific thinking in sixteenth-century Spain. That normative geography was espoused in government circles should therefore come as no surprise.

**Government Geography and Town Planning: López de Velasco**

The role of Spanish government policy in urban planning is relatively well known (see Stanislawski 1947), but disagreement continues on the relation of theory and practice and the origin of the Spanish gridiron plan.

The first unambiguous government decree in regard to town location and morphology dates to November 1513 (CDI 1803, vol. 39, 284–85, 295–96); it instructed Pedrarias, the governor of Panama, to choose a town site on the coast or along a river to facilitate transport, making certain that the location was healthy, near woodland (for fuel) and good soil (to cultivate), and not liable to flooding; once the site was selected, the streets, plaza, church, and house lots were to be laid out in an explicitly "regular" (ordenado) manner, from the very beginning. A geometric grid is evidently meant, but no particular arrangements are specified for the various components. Cortés (1983, 388–89) recorded similar directions in 1523, that added the caveat to avoid locations that were excessively windy, foggy, or steep.

But the details for the gridiron format were only specified in the "laws for settlement," proclaimed in 1573 (Ordenanzas 1973, 112–25). These ordinances called for towns to be organized along four main streets running at right angles to a central plaza and opening to four external gates; eight additional streets should diverge from the cardinal directions at the corners of the plaza. Diagonal alignment of the square and axial streets was thought to avoid direct exposure to unpleasant winds. The town square was to be rectangular, with a ratio of 1:1.5, varying from 60 by 90 m to 240 by 460 m, depending on the initial and expected size of the town. One ordinance specified that, according to Mediterranean custom, the church should be on the highest point and not necessarily on the plaza, with the public buildings located between the two (Ordenanzas 1973, 124). Where possible, location on a river or coast was recommended, with sanitation dictating that craft centers be located near the water.

These ordinances are remarkable in that they dictate norms for urban planning more than two centuries before the rectangular survey began to create checkerboard town plans in the U.S. The approximate grid plan for Santo Domingo (1502) was laid out without instructions to that effect (see CDI 1879, vol. 31, 17). The 1522 foundation document for Nata, Panama specified a traza ("trace"), implying a regular layout, and informs us that the principal streets of Nata converged on the church and public buildings "according to and because of the order and manner that the plaza is identified [on the ground]" (Domínguez 1977, 36). Mexico City-Tenochtitlan was first rebuilt in 1523—in a location notorious for flooding and an unhealthy environment; it was then drastically remodeled according to a strict grid plan after 1538, not in response to special instructions, but according to the plan of Vicerey Mendoza (Tovar 1985). The new City of Puebla, begun in 1534, also conforms to the ideal type of grid layout (Yáñez 1991), and many other examples in various parts of Hispanic America predate 1573.

The ordinances merely articulated and legalized a system already well established and in common use (Hardoy 1978). But the prescribed model and layout always followed. Most new towns were more or less axially oriented to the cardinal points, not at 45° to them, while the church and public buildings were always on the plaza (or on one of two plazas). Hardoy (1975) examined 292 maps for 134 Spanish Colonial towns, only 22 of which were founded before 1600; he found that only 42 percent had been planned from the outset, another 32 percent were gradually modified to conform to a regular plan, and 26 percent evolved spontaneously. In short, the ordinances were not very effective after 1600.

Some authors argue that the Hispanic American grid plan was influenced by (or even grounded in) the Roman architect Vitruvius or Classical town models, and Mendoza's remodeling of Mexico City was indeed influenced by the Italian architect and planner, Leon Battista Alberti (1404–72), who drew many ideas from Vitruvius (Tovar 1985). But most new towns in Europe founded after about 1200 already had some form of regular layout long before the delayed publication of Alberti's book in 1485 (e.g., Hardoy 1975; Kubler 1978; Benevolo 1980). Considering the inordinate role of leading conquistadors or administrators in determining the actual forms of the first planned towns in the New World, it seems more reasonable to attribute urban evolution to adaptation of already familiar Spanish prototypes to new opportunities and requirements: the availability of abundant space, the need to quickly establish a few dozen initial settlers; the priority of economic over defensive strategies, favoring level terrain and the conjunction of kitchen gardens with dwellings on a single lot; and proximity to vital colonial institutions: the government buildings, the church, and various shops (see also Hardoy 1978). Instead of an endless and inconclusive search for specific intentional antecedents, it seems more productive to explicate particular urban histories (e.g., Butzer 1988) and to explore the function of the city as an instrument of colonization (Hardoy 1978; Morse 1987).

The driving force behind the formulation of
the 1573 ordinances and the role of government in marshalling geographical information was Juan López de Velasco (c. 1530–99). He came from the remote village of Vinuesa (Soria), where his family owned some houses and irrigated fields; checks of student enrollments at the University of Salamanca and a detailed examination of high school curricula that he lacked a formal education (Pérez-Ríos 1958). According to his last will, his sister in Vinuesa lived in poverty; some of his money went to her sons that they might go to America—something that he had been unable to do. Despite such impediments, Velasco wrote respectable works on astronomy, a navigation guide to the Atlantic Ocean, and a regional geography of the New World (see below); he also became a national authority on the spelling and pronunciation of the Castilian language. Velasco probably received a rudimentary education from the parish priest in Vinuesa, and then began to work as a young government clerk in Madrid. By 1565 it appears that he was an assistant, possibly responsible for legal work at the Council of the Indies. The proverbial self-made man, Velasco had no rank in his status-conscious society nor the opportunity to travel.

His profound influence on Spanish geographical planning and policy was exerted indirectly, through the authority of his patron, Juan de Ovando y Godoy, the distinguished jurist and statesman. Appointed to revamp the government geography and policy, Ovando and Velasco seem to have provided indirect support for the ethnographic research of Durán, Tovar, and Sahagún in Mexico.

The degree to which the Renaissance spirit of rationalization pervaded this effort can be judged by Velasco’s thirty-eight questions (with twelve more for coastal locations) (see Cline 1972, 234–37). Question 4, for example, requested information as to whether land was plain or rough, open, forested, through a valley or by few streams or springs, and abundant or deficient waters; fertile or lacking in pastures; abundant or sterile in crops and sustenance. Site and location of each town was to be specified; was the site high or low, level or sloping (question 10)? Other questions asked about distance to the nearest mountains; the nature of adjacent rivers and their sources; lakes or springs serving the town; volcanoes, caves, or other notable natural phenomena in the vicinity; native trees common to the district and their potential economic use; wild animals and birds; information on mineral resources, mines, or quarries; and, for coastal locations, data on shore topography, offshore reefs, tides, and storms. These biophysical questions were complemented by requests for information on crops, soils, livestock, town plans, and the like. Ethnographic questions covered Indian languages, pre-Contact government and religion, native dress, manner of warfare, and past and present means of subsistence. The relaciones therefore solicited a broad corpus of information appropriate to the administrative needs of government policy. The reports submitted by the magistrates or clergymen were generally quite good since their accounts were based on interviews of long-term residents in Spanish towns and native elders in Indian towns. In addition, many of the relaciones included local pictorial maps, many drawn by Native Americans, that illustrate sixteenth-century cultural or symbolic landscapes, and sometimes include exquisite detail on vegetation. Collectively the relaciones provide an inestimable resource of analytical information on landscape change and indigenous cultural geography (see Edwards 1975; Bustos 1968; E. K. Butzer 1969). But that should not let us lose sight of the fundamental fact that the relaciones, like other efforts of Velasco as the first government geographer, were designed to facilitate imperial administration and policy at both the meso- and macroscales. In Madrid, by the 1570s, more complex modes of geographical understanding had begun to supersede maps as a tool of government.

Velasco’s influence on sixteenth-century scientific observation was enormous. Not only did he play a catalytic role in government, but he also challenged others to follow similar norms. Indeed, Antonio de Ciudad Real (1571), a Franciscan friar traveling through Mexico in 1584–89 as secretary to a visiting inspector, seems to have modeled his account on parts of this questionnaire, noting the environments he traversed, land use around each town, and crops grown in the various monasteries. Similarly, requests for land deeds in Mexico increasingly incorporated environmental information, so much so that the land-grant documents can be used to reconstruct the vegetation of the sixteenth century (Butzer and Butzer forthcoming). Yet Velasco was indebted to the earlier efforts of Fernando Colón: in many ways he merely implemented the initiatives of Colón’s itinerario, a concept that finally bore rich fruit sixty years later.  

A Scientific Framework: Acosta

As the intellectual ferment of the sixteenth century began to diminish with growing religious orthodoxy and censorship (Kamen 1985, chap. 5), it remained for the Jesuit scholar Joseph de Acosta (c. 1540–1600) to place the New World into a new scientific framework. The son of a merchant family in Medina del Campo, a once-prosperous town of Old Castile, Acosta studied philosophy at the University of Alcalá de Henares 1559–67. The fifteen years 1572–87 were spent in the Americas, almost exclusively in Peru, but he had close contacts with Tovar and Durán in Mexico from whom he derived most of his ethnographic information.

If in History to Learn: Acosta made significant original observations on physical phenomena, e.g., the latitudinal organization of world climates in which he recognized that the rainy seasons of the tropics were linked to the zenith of the sun (high-sun rains) (Acosta 1962, 2.7), contrary to the opposite argument of Aristotle. He not only reaffirmed Columbus and Gómara to the effect that the torrid zone was quite habitable, but explained that equatorial climates were moderated by relatively short days and abundant rainfall, especially where complemented by coastal breezes (Acosta 1962, 2.10–11). He conceptualized the systematic decrease of temperature with elevation in tropical mountains (Acosta 1962, 2.12) and thus anticipated the montane ecoczonation of Humboldt.

But his major contribution rests in his expansion of a scientific and ontological framework for the New World. The first half of his book focuses on the natural world, and there he makes two basic points (O’Gorman, in Acosta 1962, xiii–xlvii): (1) How the Americas form an integral part of the universe, in relation to the global distribution of seas and continents, and the habitable realm; (2) How the Americas are formed of the same four physical elements (earth, water, air, fire) and the same natural orders (mineral, vegetal, animal) as the other continents. The second half of his work, on the human world, is similarly structured according to two arguments (O’Gorman, in Acosta 1962): (1) That the New World peoples are an integral part of the supernatural world as well as of humankind, that is, spiritual, physical, feeling, and rational creatures; (2) That the New World peoples have their own history (in part oral), making them part of a universal history.

This all may seem self-evident today, but Acosta was the first European to explicitly recognize that New World phenomena existed in their own right. Building on ideas already expressed by López de Velasco (1971, 2), he attributed the divergence of the Old and New World peoples to migration, surmising that the
continents were connected or almost connected in unexplored Arctic latitudes: the one (world) and the other are joined and are continuous or at least approach each other and are very close... because the Arctic or North Pole has not been discovered and the full extent of the land is unknown...

the first settlers travelled to the Indies... without reflection, progressively shifting locations and territories, some occupying the lands discovered by others looking for new ones, so that in the course of time they came to fill the lands of the Indies with so many groups, peoples, languages (Acosta 1962, 1, 2).

Other, popular fables such as the Lost Tribes of Atlantis were rejected. As a creationist he was puzzled by the different degrees of divergence between the Old and New World faunas, and the absence of large mammals on the New World peoples has only been unravelled midway between unexplored Arctic latitudes: 1%2, 1.20).

It can be argued that this concept of diverging cultural horizons of Medieval Europe, see J. Phillips Col6n (1984, 66--71), and information from his research and plate 101), to fashion a self-styled chorography that was little more than a pretext to display his familiarity with Classical literature; observations become little more than a pretext to display his familiarity with Classical literature.

Reflected in the Spanish research declined long before the precipitous fall in Spanish scholarly productivity, see Las Casas 1965, 1, 63--66), were verifiable, it would date Columbus's interest in cartography and, more important, his scholarly activities, back to about 1485. It refers to these letters on seven different occasions, implying that he had them in hand. For a lucid but critical analysis of Columbus's career, see Phillips and Phillips 1992; the authoritative biography is by Taviani (1985).

It is evident that Columbus's encounter with what came to be called the New World had an immense intellectual impact on thoughtful Spaniards in many ways of life, with and without formal education. These included sailors and soldiers, clerks and clergy, and a few men of letters. They were connected less by academic links or traditions than by a spontaneous capacity to observe and describe, to compare and classify. The authors and works singled out here, together with many others, represent a wealth of original and empirical observation and analysis of new environments, and unfamiliar peoples, all within a span of three generations. Separately or in tentative forms of synthetic integration, they laid out the components of a scientific, geographical understanding of that "New" World. This was a veritable Renaissance of or justification by the same authors looking for new ones, so that in the course of time they came to fill the lands of the Indies with so many groups, peoples, languages (Acosta 1962, 1, 2).

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Capel 1982), and it did not regain its original vitality until well into the present century.

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of Columbus's mental map.

12. That Oviedo did not know the work of Aristotle, Theophrastus, or Dioscorides on plants (Butzer forthcoming [ib]), nor the late Medieval herbal literature, is readily explained by the fact that these were only used in the medical curriculum of the time (Alvarez 1957). He was also unaware of the agriculture that Velasco wrote about (Santa Cruz, Herrera 1970, published in 1513. Far more orthodox as a botanist was Francisco Hernández, Philip II's personal physician and the first to write a book on the New World to collect medicinal plants (Goodman 1980, 234-37). He spent six years (1571-77) collecting, drawing, and describing the ethnobotanical confections on Hispaniola and Cuba, and especially in Mexico (Somolinos 1960-84), but died shortly after completing the first volume. Herrera's instructions were probably drawn by indigenous artists.

13. To make his case, Las Casas (1967) pleaded an endless litany of bestial customs from the Classical authors and early church fathers, to show that Old World peoples were nothing like those of the New World. But all too many of his Old World comparative "data" are no more than ethnocentric hearsay. Even Santa Cruz and Herrera were in a number of cases the only contemporary Spanish practitioners of other religions. For a more sympathetic presentation of this complex personality, see Friede and Koen (1975). In regard to ritual cannibalism in the New World, it is appropriate to cite Phillips and Phillips (1992, 295, n. 22): "To deny that cannibalism existed, one needs to assume that a wide range of European commentators simply made up the stories, an interpretation that departs reason, logic, and the available evidence."

14. There is an extensive literature on urban planning in Colonial Latin America. Acosta (1962) and several of the above references help identify larger collections of papers, mostly in English. A wealth of translated documents relating to Pliny, the first known map of the Pacific

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