MAIZE AND GRACE

Africa's Encounter with a
New World Crop, 1500–2000

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Maize harvest, Tanganyika, 1887.
The maize plant (*Zea mays*) seems always to have been within range of my peripheral vision. When I was growing up in the American Midwest, cornfields stood behind the house and surrounded my schoolyards; sweet corn was a staple of my mother's garden and roadside stands, as integral a part of the scene as family and friends. Yet I rarely thought of cornfields as anything more than scenery. Those familiar landscapes have now long been covered by asphalt or shopping malls or the lawns of suburban tract houses. Yet corn—which I here call maize—has moved onto the global stage, especially for Africa. It is not that Africa leads the world in maize production—industrial economies like the United States and China hold that distinction—but Africa, more than any other continent, is dependent on maize as a food source. How maize achieved its current dominance in Africa's fields, in its markets, and in its myriad social expressions is my subject. Whether maize has also offered a blessing—its "grace"—is the question implicit here.

This book, with its topic of the role of maize in Africa, had its specific genesis in 1987, when I was in eastern Ethiopia interviewing farmers to evaluate the impact of the drought rehabilitation programs run by the British aid organization Oxfam. As I tried to reconstruct in interviews with farmers what crops had grown in their fields in the previous five years, I became aware of the rapidity
with which maize had become the crop of choice. At least a part of my reaction to the increasing presence of maize was annoyance, and a nostalgia for Ethiopia’s older, biologically diverse landscapes—sadly, and increasingly, a landscape of memory more than of reality. Though I think the farmers shared my longing for that bygone world, the larger question was why these farmers were rapidly abandoning older crops for this New World plant that had always played a rather small role in Ethiopian diet and agriculture before the late twentieth century.

If the visual evidence and farmers’ personal stories made the new role of maize obvious, the rationale was less clear. It was particularly perplexing when I considered that in a drought-prone area like eastern Ethiopia, farmers were favoring a plant that was more susceptible to drought stress than any other crop they could have chosen. Moreover, not only were prices for harvested maize considerably lower than those for other possible choices (such as wheat or their traditional teff or sorghum), but maize did not form a major part of their traditional diet. It was a puzzle.

What eventually became clear to me, there and in other areas of Ethiopia, was that the farmers’ deeper rationale was a response to the unstable political situation in which they were living. For them maize was a quick-maturing crop that they could eat after only a few months, at the green, milky stage. And it required much less of their labor—told only one pass of the plow, as opposed to three or four arduous plowings for other crops. After all, these farmers in the turbulent Ethiopia of the mid-1980s never knew when their spouses, sons, or daughters might be taken away from their farms by cadres of the socialist government to work on a road, construct a terrace, or, in the case of a son, forced to serve in the growing national army or some local resistance movement. Or the farmers might have the chance to join a food-for-work program of Oxfam or CARE that promised them flour or oil in exchange for a few days of labor away from their farm. In those days no one knew what tomorrow might bring. Planting maize was thus a quite ratio-

nal and political solution to a world turned upside down. Maize was a crop that promised survival at a time when plans were of necessity short-term, and solutions expedient.

A couple of years and research projects later I discovered quite a different take on the meaning of maize. Two influential agricultural economists, Carl Eicher and Derek Byerlee, had edited a book entitled *Africa’s Emerging Maize Revolution*, which presented maize’s success in southern Africa as a harbinger of an African Green Revolution to match that of South and Southeast Asia a generation earlier. In the cases outlined in their book, maize in its hybrid form seemed a triumph of the science of development, in that the crop yielded much larger harvests than did any other available grains, including the local maize types or the crops endemic to places like Ethiopia. In Eicher and Byerlee’s view, southern Africa, especially Zimbabwe, had proved the efficacy of maize as the green engine of economic development. By the mid-1980s, when Ethiopia’s farmers were broadcast-sowing local maize seeds in a sign of desperation, 100 percent of the maize sown in Zimbabwe was hybrid seed planted in fertilized rows. Zimbabwe (known until 1980 as Southern Rhodesia) had long had white-owned commercial farms, but in the first flush of independence, black farmers on the Communal Lands rushed to adopt the new vision of maize-based prosperity. In Zambia as well, from the early 1960s to the late 1980s farmers increased their maize production by 400 percent, a massive transformation. Their story too is part of this maize narrative. Were these cases models for Africa’s future economic development and food security? Eicher and Byerlee seem to think so. For them maize on a vast national scale was a blessing, a source of grace that could remedy the famine and underdevelopment that were part of Africa’s tragic recent history.

Africa’s shift to maize also reflects a broader global trend in demand. The Centro Internacional de Mejoramiento de Maíz y Trigo (CIMMYT, or International Maize and Wheat Improvement Center), the epicenter for international maize research located outside
Mexico City, estimates that by 2020 the demand for maize in developing countries will surpass that for both wheat and rice. Relative to its 1995 level, annual maize demand in sub-Saharan Africa is expected to double by 2020, to 52 million tons (as cited in P. L. Pingali, ed., CIMMYT 1999–2000 World Maize Facts and Trends). Whereas much of the world requires maize as a livestock and chicken feed to fatten meat and poultry for burgeoning urban populations whose income is on the rise, Africa’s demand is primarily for maize as food for humans. This peculiar situation of Africa by comparison with other world areas sets the continent’s romance with maize apart. Does it offer the grace of a Green Revolution? What does the history of maize in Africa tell us?

I recall as a graduate student in the early 1980s coming across a 1966 book, Maize in Tropical Africa, by a University of Wisconsin economist named Marvin Miracle. A peculiar book, I thought, in that its topic was a single crop—and a seemingly mundane one at that—a New World crop in the Old World; not even a grain, but a vegetable that people had come to think of and treat as a grain. Miracle’s book was a contradiction—in a way prophetic, but also a product of its time. The book was written in the early 1960s, when newly independent African economies were growing and the world had great expectations for these bold new nations. Maize seemed a measure of those prospects. Miracle’s data showed the growing role of maize in many of the most promising young states: Nigeria, Ghana, Uganda, Kenya, Tanzania, Ivory Coast, and Zambia. But the book ended its analysis with the mid-1960s, well before Africa’s economic reality ran into the immovable obstacles of the 1970s . . . or later.

A second book also inspired me a few years afterward, this one also about a single commodity. It was Sidney Mintz’s Sweetness and Power, a book about the substance, history, and meaning of sugar. Mintz is not an economist, but an anthropologist who regards sugar less as a measurable commodity than as a feature of life as seen from the doorway of a Puerto Rican farmhouse. From there he led his readers to see sugar as a food, a crop, a global commodity, a cultural symbol, and a window onto social change. More recently Judith Carney’s award-winning book Black Rice: The African Origins of Rice Cultivation in the Americas has revealed the role of that crop in laying the cultural and economic foundations for settlement of the New World.

Maize and Grace is in some ways an updating of Miracle’s work, though it makes its appearance in a different world and acknowledges a different Africa. Maize is now Africa’s most important cereal crop, at once sustaining subsistence and, in other places, providing the seeds of a burgeoning agro-industry, the signpost of modernity. It is at once a triumph of the science of development and the tripwire for its potential failure. Similar to Mintz’s sugar, maize is a single commodity, but at the same time it represents breadth of vision. Maize is also a metonym for the environment, in which agriculture is a central feature of the interaction of human-kind and nature, as well as being part and parcel of the dynamic landscapes of African agroecology.

This book is broadly cast geographically and thematically; it offers an overview but also looks at events and processes from the farm, fields, or roasting fire. Many of the statistical data cited here identify sub-Saharan Africa as the unit of measure—that is, the continent excluding North Africa and Egypt. None of my case examples come from North Africa, but the Nile Valley, including Egypt, is integral to maize’s percolation into the continent and is part of the story. I ask readers to forgive the inevitable oversights.

The goal here is to outline and illustrate maize’s historical encounter with the landscapes of Africa over half a millennium—that is, from its introduction in around 1500 to its current apotheosis as Africa’s dominant food crop. The implicit question throughout is whether that encounter has been a story of grace bestowed on the Old World by the New, or whether this is a more fundamental human tale of struggle for both sustenance and meaning.
Maize expresses its own history not only in its genetic makeup but in its varieties, its agronomic imperatives, its qualities as food, and its peculiar symbiosis with its human hosts and the land they inhabit. Maize is a versatile player, which both shapes and takes the shape of the societies that cultivate it. If we know the plant's genetic endowments and agronomic idiosyncrasies, we can detect in the otherwise disappointingly bare formal historical record some curious details, and even evidence of dramatic historical shifts. Maize comes in five phenotypes—sweet, pop, floury, dent, and flint—but all its forms derive from a single ancestor domesticated in central Mexico around seven thousand years ago. Though the exact date and circumstances of Zea mays's first cultivation remain a mystery, by A.D. 1500 the Aztec and Mayan civilizations had long called the descendants of that plant maize, meaning literally "that which sustains life," and claimed that the crop was flesh and blood itself. In the modern economies of the United States, East Asia, and Europe it is the ultimate "legible" industrial raw material: industry uses its starches and cellulose in fuel, fodder, paint, plastic, and penicillin. Africa's maize, however, has a different function altogether. Africa is distinctive among world regions in that 95 percent of its maize is consumed by humans rather than being used as livestock feed or industrial raw material.
Why is maize different from other crops? Unlike wheat, rice, barley, and most other cereal crops, which are self-pollinating, maize is an open-pollinating plant. In wheat, for example, the pollen that fertilizes an ovary almost always comes from the stamen of the same plant and has traveled only a few microns to reach its female partner. A maize plant’s stamen and ovaries, by contrast, are separated by a meter or more, and the plant produces massive amounts of pollen—about fifty thousand pollen grains per plant—to guarantee its propagation. Moreover, because wheat and rice plants fertilize themselves, the genetic identity of each succeeding generation is virtually identical to that of the first. Fields of wheat and rice, therefore, are for all practical purposes genetically homogeneous. With maize, however, unless humans carefully control the pollination process, the plants exchange genetic materials quite promiscuously with neighboring plants and fields. Thus, all the maize in a given field will differ from the previous generation, a trait that lends the plant a capricious and unpredictable character. Over a few millennia, humans have shamelessly sought to control the licentious tendencies of maize, in order to bend it to their will.

Metaphors aside, the sexuality of maize is, in fact, a dynamic and wonderful force. Because the plant is pollinated by wind rather than by insects, maize produces prodigious numbers of large, thin-walled pollen grains, which often travel tens of meters to adjacent plants or fields but which also may fall onto their own silk and thus fertilize their own ovaries (self-fertilize). When maize plants self-fertilize, the next generation often carries dubious traits such as low yield, susceptibility to disease, and stunted plant size. Yet when cross-pollination takes place, whether by accident or by plan, some among the new generation have quite desirable traits, including vastly enhanced yield and resistance to particular insect pests or diseases. Some plants in the new generation may emerge as very tall specimens or as dwarfs. Such preferred traits often emerge when maize breeders deliberately allow two lines to self-pollinate, and then cross-pollinate them in the next generation to create a hybrid.

Where did domesticated maize plants come from? Geneticists and agronomists have searched for decades to find a wild ancestor for maize in Central or South America with, arguably, little success. Plant geneticists have focused attention primarily on the Mexican plant teosinte, perhaps a cousin of maize but probably not its progenitor.4 Maize, it seems, has always been tended by human hands, its life cycle subject to human manipulation, whether by Meso-American women, Cape Verdean mestizos, or white Rhodesian professional plant breeders. The resulting plant biology offers distinctive insights into maize’s agronomic personality and historical workings. Like house mice, English sparrows, and Anopheles gambiae mosquitoes, maize requires the presence of humans to survive. Unlike such self-pollinating grains as wheat and rice, maize cross-pollinates and then depends on humans to collect and sow its seeds.

Within its twenty chromosomes, each maize kernel contains part of the genetic record of its long and complex history of human-induced husbandry.5 Through conscious seed selection, both farmers and professional maize breeders have cajoled the maize plant into altering the time it needs to mature, adjusting its height, increasing its yield, transforming its hard starch to soft (or vice versa), changing the color of its grains, or increasing the percentage of its kernels that will pop in a microwave oven. Each of these features can reside within the genetic makeup of a single land race (subvariety) of maize, thus making each kernel the sum of generations of human selection in corn’s American homeland—a range of microecologies that include the Caribbean, Brazilian coastal lowlands, and the Andean highlands. Each of these regions contributed a different set of traits that ultimately made certain maize land races adaptable, once they had made the transatlantic journey to particular ecologies of Africa and the Old World as a whole.

Nestled in new transatlantic ecological créches after 1500, maize possessed an exquisitely complex set of genetic possibilities that allowed Old World farmers almost immediately to tease out new ex-
pressions from its genetic palette, according to local needs, ecologies, and tastes. The terms *rustification* and *creolization* describe the process whereby farmers acquire varieties and then select seeds that suit their own needs for and perceptions of taste, color, or maturity traits. The first few hundred years after the arrival of maize in Africa were a process of farming experimentation and brought a new spate of genetic diversification adjusted to microecologies, agrarian systems, and aesthetics. In more recent times quite different ideas, derived from modern agricultural lore, have come along to reverse that diversification.

The key concept in modern maize cultivation is what plant science calls heterosis, or hybrid vigor, which is the phenomenon caused by the interaction of favorable genetic materials as manipulated by professional maize breeders to produce hybrids. Hybrids are the result of crossing, once or more commonly twice, two or more inbred (self-pollinated) genetic lines to produce heterosis, in order to increase yield or produce other desired traits. To maintain those characteristics, however, farmers must use new hybrid seed for each season’s planting or risk deterioration in the plants’ desirable traits. Depending on the process used, maize breeders call the resulting seed varieties single-cross, double-cross, top cross, or three-way. In 1960, crop scientists from colonial Rhodesia developed SR-52, the world’s first commercially viable single-cross hybrid, to benefit a particular ecology and a particular economic group, southern Rhodesian white commercial farmers. Maize breeding thus is often a political as well as an agronomic undertaking.

An alternative, less high-tech version of improved maize types is *composites* or *open-pollinated varieties* (OPVs). These are the result of selection and combination of several desired traits from self-pollinated plantings with the aim of producing a uniform improved crop. While they rarely are as productive as hybrids, OPVs can be replanted by farmers using seed from their own fields. A common metric for assessing agricultural change on African farms in the late twentieth century was the proportion of improved maize (hybrids and OPVs) used by farmers in a given place. In the 1970s and 1980s farmers in southern Africa adopted hybrid maize on a large scale. Improved varieties reach farmers via national seed enterprises, private seed companies (such as the United States–based Pioneer Hi-Bred Seed Corporation), or government agencies. Recycling is the term used when farmers attempt to replant their hybrid seeds in the following year, a practice that results in diminished yields and plant quality. In many parts of Africa the lack of farm credit and cash income has tempted farmers to recycle seeds, against the advice of extension agents and seed companies. It remains to be seen whether African farmers’ adoption of hybrid seeds is a sustainable change or a temporary blip.

As a food plant, maize has historically had a split personality, appearing in diets in some times and places as a vegetable crop from the garden and at other times cultivated in the field as a grain. On a farm it can be either, or both, being defined as much as anything by its function. People eat maize, as a household garden crop, at its green, milky stage—boiled as a snack or roasted on the cob. Farmers broadcast corn seeds for a field crop onto prepared plots and then harvest the dried ears; women grind its kernels into flour. In a strict nutritional and physiological sense, however, maize is a vegetable rather than a grain, offering vitamins A, C, and B (these vitamins being one of the ways in which a vegetable is defined nutritionally) but lacking the lower B vitamins that characterize a true grain, such as sorghum or wheat. Corn is high in carbohydrates but low in usable protein, especially the vital amino acids lysine and tryptophan; the leucine in corn blocks the human body’s absorption of niacin, a vitamin whose absence causes protein deficiency.

When sown as a field crop, however, maize assumes the mantle of a grain, often replacing true grains like wheat, rice, sorghum, or millet in the fields. In modern commodity markets maize also assumes the status of a grain; commercial farmers cultivate, harvest, process, and store it as though it were a grain. Having by the late
tenth century approached the status of a monocrop on many African farms, maize has now overwhelmingly and permanently taken on the dietary characteristics of a grain. Its flour and its kernels then serve as the raw materials for beer or porridge—the latter variously known by the names papa (South Africa), sadza (Zimbabwe), isibimi (Zambia), gunfo (Ethiopia), kenkey (Ghana), ugali (Kenya, Uganda, Tanzania), and many others. While Africans tend to view this stiff maize porridge as their own distinctive food, it is in fact the same stuff consumed in other cuisines variously as grits, polenta, or mamalinga.

African food ways, however, differ from those in other maize-growing areas of the world. Food items derived from maize in Africa are most often boiled or cooked (Ghana’s kenkey, Ethiopia’s nifro, or Kenya’s ugali), whereas in the Americas they are baked or fried (tortillas, cornbread, and hushpuppies). Moreover, the two main types of food maize, flint and dent, are used for distinct types of food. Dent maize is soft and floury and best used for soups and stiff porridges like papa and sadza. Flint maize, by contrast, contains harder starches in its endosperm and appears in local diets in the form of grits or a type of couscous that replaces rice. Industrial mills, however, invariably prefer—and insist on—the softer dent type, which grinds uniformly in their steel roller mills and causes less injury to the machinery. By contrast, in Malawi, where the urban market is smaller, women have traditionally preferred the flinty types because they suffer smaller losses in storage and give better results during hand-milling. Most African consumers still prefer the texture and flavor of flint maize flour, when they can get it. To cite a non-African example, Italian polenta is made exclusively from flint maize, which amounts to only 15 percent of Italy’s total national production.

As a grain, maize yields more food per unit of land and labor than any other. No other cereal can be used in as many ways as maize. Virtually every part of the plant—including the grain, leaves, stalks, tassels, and even roots—can be put to human use. Depending on their own views of its uses, farmers will choose their own local versions of desirable traits, colors, and textures. In Ethiopia, the especially thick stalks of the wildly popular BH660 hybrid variety make particularly good cooking fuel. In Nigeria the variations in local consumer preferences are renowned, neighboring villages having historically preferred quite different color combinations and flour textures.

Yet to those in Africa and in the nonindustrial world who are seduced by the obvious virtues maize can offer, it has also revealed a darker side. The growing plant is highly sensitive to deprivation of water, sunlight, and nitrogen; maize kernels rot easily in tropical storage. Even a few days of drought at the time of tasseling can drastically reduce the yield at harvest. Maize monocultures are thus extremely vulnerable to environmental shocks, especially drought, but even in the best of times a maize-based diet may impoverish the bodies of those who depend too heavily on it for food, and over the long haul such a diet can result in deficiency diseases such as pellagra (a disease caused by vitamin deficiency) and kwashiorkor (a disease caused by protein deficiency). The end result is that in planting maize, commercial farmers and peasant families alike (especially women—African maize is largely a woman’s crop) walk a slender tightrope of risk. Still, in the past half millennium the cultivation of corn has continued to spread across Africa, from rain forest plots to cocoa farms and from remote villages to urban vacant lots.

By the first decade of the twenty-first century a tidal wave of maize had engulfed Africa—or at least all but its driest and wettest crannies—in the process supplanting historical African food grains as sorghum, millet, and rice. The recent spread of maize has been alarmingly rapid, although the historical and social implications of that change have received scant consideration from media, social scientists, and policy makers. In southern Africa maize has become by far the most important staple food, accounting for more than 50 percent of the calories in local diets; in Malawi alone,
maize occupies 90 percent of cultivated land and represents 54 percent of Malawians' total caloric intake. Far from considering it a crop of recent origin, imported from the New World a mere half a millennium ago, Malawians of the late twentieth century stated, "Chimango ndi moyo" ("Maize is our life"), and called their favorite variety maize of the ancestors (chimango cha makola). In the modern landscapes of neighboring Lesotho the impact is even greater: Lesotho's national diet exhibits the world's highest percentage of maize consumption (58 percent of total calories), though Zambia is nearly as dependent on maize as its smaller neighbor. Like Zambia, Malawi, and Lesotho, many of Africa's agrarian and urban landscapes have come to bear the imprint of this single crop.

The consequences of having maize at the leading edge of an African agrarian transformation have been ambiguous: of the twenty-two countries in the world where maize forms the highest percentage of the national diet, sixteen are in Africa. Moreover, the top three countries on this global list are all in Africa (Zambia, Malawi, and Lesotho), surpassing even Guatemala and Mexico, the homelands of maize. In East Africa as a whole, maize accounts for 30 percent of all calories consumed; on the world list, Kenya and Tanzania are sixth and fifteenth in maize consumption, by percentage. In South Africa, maize-growing areas represent 60 percent of all land planted in cereals, and maize 40 percent of all calories consumed. Ethiopia, despite being a world center of crop genetic diversity, now produces more of this New World grain than of any other food crop, including renowned native cereal crops like teff (Eragrostis teff) and finger millet (Corcorana abyssinica).

Africa's Green Revolution?

While the Americas produce more of their native crop in total volume, the overall impact of maize globally may be greatest in Africa, where its expansion as a major food source has paralleled the con-
tinent's economic and nutritional crises. Since its first arrival with missionaries, merchants, and slave traders, the crop has expanded its domain rapidly. In the past two decades, rapid advance of maize as a major food crop in Africa has caught the imaginations of agricultural economists and international policy planners, who see this as an agricultural sea change that could rival Asia's Green Revolution of the 1970s. Entrepreneural economists see the dominance of maize in Zimbabwe, Kenya, Malawi, and South Africa as a free-market economic miracle. Nobel laureate Norman Borlaug, icon of Asia's wheat-and-rice-based Green Revolution, has also taken up the cause. He argues, through the organization Sasakawa Global 2000, that the technologies and new crop varieties to launch Africa's own Green Revolution, with maize adoption as its most visible expression, are already in existence. These bold claims suggest the need to understand maize's historical role in Africa more fully.

The story of African maize tells us a great deal about the continent's distinctive physical and cultural environments, as well as the many ways Africa has contributed to the global (and globalized) phenomenon of maize. Maize's increasing domination of Africa's agrarian landscapes has wrought a broad array of changes and conundrums. Despite Africa's enormous diversity of cultures, ecologies, and aesthetic sensibilities, in recent years Africans have seemingly reached a consensus that maize is their favorite food and that its color should be white, not yellow, red, or blue.

At the end of the twentieth century the world planted 140 million hectares of maize each year. Of that total, 96 million hectares were in developing countries, a category that includes all of sub-Saharan Africa. Although 68 percent of all land planted with maize is in the developing world, it accounts for only 46 percent of the world's six hundred million tons of production (1999). The discrepancy reflects the fact that the average maize yield in industrialized countries is eight tons per hectare, but in the developing world less than three.

Though maize is a New World plant, Africa in many ways is its ideal setting. Of the seventy million hectares of maize planted in nontemperate and tropical environments, 65 percent are in the tropical lowlands, 26 percent in the subtropics and midaltitude zones, and 9 percent in the tropical highlands. African maize farms occupy 45 percent of the world's subtropical and midaltitude

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maize-growing area, the plant's favorite habitat. This agroecological zone includes the highly commercialized agriculture of Zimbabwe, South Africa, and Zambia as well as peasant-based production in Ethiopia, Malawi, and Ghana. Sub-Saharan Africa accounts for a fourth of the world's tropical regions planted in maize. As a tropical and sub-tropical production area, Africa faces the difficulty that the miracle maize varieties that bring high yields in the temperate industrialized world are of little use in tropical and sub-tropical climates. Moreover, Africa's production is more than 90 percent white maize intended for human consumption, rather than the yellow maize used for livestock feed and industrial purposes that dominates world maize markets. On average, Africa expends more than three-quarters of its maize for human consumption (well over 90 percent if industrial South Africa is excluded). In the high-income countries of North America and Western Europe only 4 percent goes for human consumption.\textsuperscript{15}

World maize harvests grew like Topsy in the last half of the twentieth century, in both industrialized countries and the developing economies of Latin America, Africa, and Asia. The numbers are mind-numbing but tell a story of their own about the modern global economy of food. In 1973 more than half the total world area planted in maize (111 million hectares) lay in the developing world, yet those countries accounted for only a fourth of all maize produced. Of this total, Africa accounted for 17.2 percent of the area planted but less than 8 percent of the world's total maize supply.\textsuperscript{16} A quarter century later, in 1997, the world produced 580 million tons of maize in toto, almost half of which came from developing countries (259 million tons)—a major change in global agriculture. A good portion of the developing world's increasing share of the world harvest came from improving yields in Africa. In the 1960–1990 period African maize yields improved by only 1 percent annually, but in the 1991–1997 period they improved by 2.9 percent—almost twice as fast as in Asia, but slightly less than in Latin America.\textsuperscript{17} Moreover, the rates of increase for both area planted and total maize production in Africa were dramatic.

The geography of Africa's maize also broadened and shifted over the past half century. From 1997 to 1999, eastern and southern African countries produced more than 23 million tons, while central and West African farmers harvested slightly less than half that amount (11 million tons); North Africa (in this case, primarily Morocco and Egypt) produced only 6.4 million. Hidden within these cold statistics are some enigmatic trends that cry out for deeper inquiry. In the century's final decade Ethiopia raised its maize production by 12.3 percent a year, Mozambique by 14.5 percent, and Chad by 17 percent. Zimbabwe, which had raised its production by 6 percent a year in the 1950s, produced almost 1 percent less a year in the decade from 1989 to 1999. Overall, eastern and southern Africa devoted 41 percent of their total cereal-growing area to maize, but West and central Africa only 21 percent. Appendix Table 1.1 merits considerable attention for what it says about changes over time and transformation of national economies. Beneath these numbers, however, lies a still more telling set of stories about environment, politics, farm life, and the culture of farmers themselves.

Though maize arrived in Africa five hundred years ago, it is nevertheless a relative newcomer in a very old and complex environmental setting. Africa is the oldest continent in human terms, but if we go even further back, in geological terms it was the largest fragment of what was the original geological land mass, Gondwanaland. The soils and geomorphology of Africa show both its age and also recent episodes of volcanic upheavals, deposition of sediments, and the action of water and wind on the land's surface. In altitude, the extremes range from 120 meters below sea level in the Danakil depression near the Red Sea to 5,895 meters above sea level at the peak of Mount Kilimanjaro. In northeast Africa, the geological domes that extended from Ethiopia to Tanzania split open 750,000 years ago to create the Great Rift Valley; the Great Lakes formed when the Eastern Rift Dome lifted the earth's crust and left behind a series of long, deep lake basins stretching from south of the equator to (and including) the Red Sea itself. The highlands of northeast Africa form what biologist Jonathan Kingdon
calls a fractured dome. While only a small fraction of Africa’s land mass lies above 1,500 meters, half of those highlands are in the region of Ethiopia and Eritrea, a concentration that gives the continent as a whole a tilt from northeast to southwest. Forty percent of Africa’s land has a slope of more than eight degrees, resulting in the movement and redeposition of soil by rain and river systems—erosion. Erosion is not so much a recent crisis as a consistent and inexorable historical process that defines the areas where maize has found an accommodating ecological niche.

Viewed from a satellite, the continent’s major features are vast alluvial plains broken by the branching of old stream beds and living rivers. At ground level the textures and hues of the different soils are more visible. Africa’s soils vary dramatically in color, chemistry, and structure, ranging from light, sandy arenosols to heavy, poorly drained black “cotton” soils (vertisols). That something over a quarter of the continent’s tropical soils are acidic is significant, since for farmers these soils pose special problems. Not only are acidic soils deficient in phosphorus, calcium, and magnesium, but they often contain toxic levels of aluminum. Even more common in Africa are the red porous laterite soils, which are liable to lose nutrients and are low in nitrogen and phosphorus (both critical to maize plants’ yield). These soil conditions are all local phenomena that allow us to make few generalizations. Such variations, though they are a nightmare for modern industrial agriculture, which seeks uniformity and economies of scale, have encouraged African farmers to practice agriculture as a craft rather than an industry.

It is less accurate to say that Africa is losing soil than that the soils move and redeposit themselves. In placing the emphasis on soil loss, standard calculations of erosion rates, which have been grossly exaggerated for places like the Ethiopian highlands, have underestimated the historical effects of soil movement and new soil formation. Over time, farmers have adopted planting strategies and chosen crops to suit Africa’s variegated soil landscapes. Historically, African farmers sowing maize have dealt with the variation by creating patchwork plots that reflect soil and crop types—that is, by matching crops to soils and climate conditions. In the long transformation of maize from a household garden crop into predominantly a field crop, the trend has been to insist on changing the soil and agroecology through the use of agrochemicals such as nitrogen fertilizer, herbicides, and pesticides to suit the crop, rather than to conform the crop to the field. This historical evolution from local variation to homogenization has been a defining factor in the history of maize in Africa.

Beyond geomorphology and the genetic diversity in vegetation and animals, the landscapes of Africa and maize’s role there reflect changing patterns of climate. Unlike in temperate zones, where growing seasons and life cycles respond most directly to fluctuations in temperature, in Africa the rhythms of life reflect primarily the availability of moisture, especially rainfall. Africa’s annual patterns of rainy and dry seasons, humidity, soil moisture, and length of growing season result from the yearly rhythms of global cyclonic winds, ocean temperatures, and the earth’s rotation around the sun. In following the tilt of half the earth toward the sun in summer and away in winter, the anticyclonic and trade winds set the yearly cycle of rainy and dry seasons. This shifting zone of rain-bearing turbulence, which climatologists call the Inter-Tropical Convergence Zone (ITCZ), sets a bimodal (two-part) pattern of seasons, one wet and one dry, which characterizes the continent as a whole. This seasonality, however, also produces subtle variations from year to year. In certain places, elevation, topography, and global climate anomalies such as El Niño (or ENSO), La Niña, and tropical Atlantic surface circulation signal drought conditions. The wind circulation that brings moisture to the regions of Africa located north of the equator moves from south to north of the equator as the earth tilts toward the sun in the summer months (June to September). The turbulent movements north of the equator bring summer rains in the northern hemisphere. Af-
rica's annual weather cycle is predictable in broad seasonal terms, even if it is at times erratic from year to year and from locale to locale.

The onset of the rains has a remarkable effect. Within two weeks, brown, lifeless landscapes turn green, seeds germinate, and chemical reactions within soils make nutrients available to plants. From December through March, air masses from the north dominate, creating a long dry season as the rain-producing ITCZ turbulence moves south of the equator. In the dry season, fields ripen for harvest, pasture grasses shift into dormancy, and livestock migrates to pasture near water sources. The dramatic seasonal movement of wildebeest in the Serengeti is a well-documented example of this annual process. The effect on farms is more subtle: maize that was once cultivated as a part of swidden (slash-and-burn cultivation) is now commonly incorporated into permanent fields modified by inorganic fertilizer and pesticides. Seasonal cycles also affect planting times and the choice of maize cultivars to suit the normative length of growing season. But African rainfall always presents unexpected surprises. The interaction of the ITCZ with local topography results in moist slopes or rainfall shadow effects that have repercussions for local crop choices, land values, and landscape texture. The fluctuation of maize yields in southern Africa in the early 1980s shows this effect most dramatically, for the small farms on marginal lands occupied by black farmers have registered the changes first and hardest. Yet even the large commercial farms on better-watered land have eventually felt the pinch of declining yields that (while they bring high prices in the cities) force countries like Zimbabwe, Malawi, and Zambia to import maize.

The great fecundity of the maize plant in good weather conditions is as remarkable as its decline when the rains fail. Drought is the cumulative effect of several years of short or delayed rains, historically a common occurrence in much of Africa. Drought is also a climatic fact of life that greatly influences the geography of maize planting and the ecological niches in which farmers have become
dependent upon the crop. The quick maturity of some maize types allowed them to “escape” drought—that is, they did not suffer from the rains’ early cessation—and to provide food for the household in the hungry season before other crops are available. Less commonly, some types of maize cope with drought by adapting the timing of their pollination (the appearance of tassels) with the appearance of corn silk to receive the pollen.

As a continent, Africa has the world’s sharpest seasonal swings from wet to dry. Vegetation patterns, animal movements, and human economies in Africa have adjusted to this cycle over several millennia. In the larger geological time frame, Africa’s climate has been more often dry than wet and more often warm than cool. The cereal crops native to Africa, such as many varieties of sorghums and millets, or teff and elusine (finger millet) in Ethiopia, have adapted to seasonal conditions and periodic drought over a millennium or two. Exotic crops like cassava and bananas—and maize—that originated in either the New World or Southeast Asia, owe their popularity among African farmers to the success with which they have fit into the seasonal systems.

These long-term fluctuations have been significant during epochs of human history in which African social institutions and economic strategies evolved with the experience of human communities and individual farmers, hunters, and pastoralists. Historian John Iliffe generalizes that Africa’s agricultural systems were historically mobile, a strategy for adapting to the environment rather than transforming it. The original maize germplasms that came to Africa from Brazil and the Caribbean were largely short-season crops well suited to either moist forest zones or drought-prone savanna areas. By contrast, the modern agricultural preference is to alter (that is, homogenize) local soils and moisture by using inorganic fertilizer, irrigation, pesticides, and so on, to suit improved cultivars, and to manipulate local ecologies to accommodate seeds developed for use across a geographic spectrum. Only recently have large-scale investments made it possible to adapt for local African ecologies new crop varieties that are drought-resistant, say, or tolerant of particular soils.

The Ecology of the Maize Plant

Maize plants exhibit particular sensitivity to African climate patterns. Geographically and historically, rainfall has been the principal factor limiting the types of crops and the times they can be planted in Africa, but temperature imposes additional constraints. Maize grows best at temperatures ranging from 24° to 30° C (72° to 86° F). Temperatures higher than 32°C (90°F) interfere with the plant’s physiological processes. Cool periods retard germination, thereby causing a longer maturation period, delayed tasseling and silking (pollination), and late appearance of the green ears that are so welcome during the hungry season before the main cereal harvest. In many areas of the tropical lowlands, therefore, extreme temperatures—rather than moisture—set the limitations on the planting of maize. Ecologies for potential maize production in southern Africa reflect the confluence of certain characteristics of temperature, rainfall, and elevation.

Maize reflects the limitations of Africa’s physical environment most directly in the crop’s response to moisture stress. Overall, a marginal rain-fed maize environment in the tropics is one where seasonal rainfall is less than 500 millimeters, and in the highlands it is one where rainfall does not exceed 300 to 350 millimeters. In physiological terms, drought stress affects the maize plant’s grain yield at three critical stages of its growth: 1) early in the growing season, 2) at anthesis (tasseling), and 3) during grain filling, as the kernels mature on the ear. In regions of early drought stress, farmers have the option of replanting a type that requires less time to reach maturity or a different crop that matures quickly, as was done during the 2002 drought in central Ethiopia. Midseason drought can be especially devastating, since the plant is particularly vulnerable during its period of flowering, when contact between its
silk and pollen complete the cross-pollination process. Research shows that drought stress on maize plants a week before anthesis reduces grain yield by two to three times more than it would at other growth stages. In effect, drought stress on maize manifests itself primarily not in lower-than-average annual rainfall or in even seasonal variations, but rather because of insufficient moisture in the four-week period around flowering and silking. Unlike with other cereals, in hermaphrodite maize the male and female parts are separated by considerable distance (about a meter). Drought delays silking, because in underdeveloped leaves photosynthesis is reduced. For sub-Saharan Africa a strong correlation exists between average national maize yields and total rainfall during the growing season, for eastern and South Africa in particular, and somewhat less dramatically for West Africa.

In short, in Africa maize’s potential as a food source and cash crop is a function of distinctive patterns of rainfall for that continent. Drought has had quite different effects on different maize farmers and maize economies. In the Horn of Africa, drought and famine have been an omnipresent specter for subsistence farmers, particularly those far from markets and sources of off-farm income. In the mid-1980s, for example, drought in the Horn of Africa combined with radical state interventions in rural economy prompted cultivators to seek low-labor, short-season crops, and a rapid expansion in maize cultivation resulted. By contrast, in the more recent drought of 2002, farmers quickly abandoned maize in favor of traditional grain crops that could tolerate delayed and erratic rains.

Drought’s effects in southern Africa were different in kind if not in scale. There, maize cultivation on communal lands and on commercial farms emerged within a cash economy where credit was more available than in the Horn. Drought affected profit margins and overall production, but it did not cause famine, since marketing networks and the cash-based economy provided what Amartya Sen has called cash entitlements. Relative to other crops, paradoxically, maize made advances in both situations. Despite its physiological vulnerability to drought conditions, the political ecology of agriculture in the mid-1980s fostered the expansion of the crop both on Ethiopia’s peasant farms and in Zimbabwe’s capitalized agriculture. In the economic crisis of 2000 to 2004 in Zimbabwe, inflation, a currency shortage, and drought caused farmers to abandon “modern” varieties and to recycle hybrid seed or to seek less productive but more reliable types of maize seeds.

**Maize’s Long Journey**

Farmers, seed companies, and international agencies (such as CIMMYT) have spread the gospel of maize in its modern form as a grain, in hybrid and open-pollinating varieties that are products of deliberate commercial breeding programs sponsored by governments, seed corporations, and international agencies. Maize is reducible to its genetic elements, a set of building blocks for experimental recombination. Its genetic components can also be multiplied to produce plant populations that occupy huge, uniform cultivations extending to thousands of hectares, a scale that appeals to centralized state planners and corporate farms, and equally to small farmers on half-hectare plots. For better or worse, modern genetic alchemy has transformed maize from an obligingly adaptive vegetable crop to a hegemonic Leviathan that dominates regional diets and international grain markets. In contrast to early genetic selections by native Americans—who adapted maize, its colors, and its textures to the vagaries of locality—modern plant breeders choose reliability of character (especially yield) and then seek to manipulate the local ecology with nitrogen, irrigation, and herbicides to achieve uniformity. Modern human management has thus produced a plant that anticipates a predictable ambience and has only a limited ability to conform to diverse local landscapes, soil, and climate.

Maize’s metamorphosis from an exotic sixteenth-century visitor
to a thoroughly African crop was a long one, entailing a journey from vegetable to grain, from garden to field, from curiosity to staple. The next chapter picks up the historical narrative in greater detail, starting with the sixteenth century, and pursues the crop’s shift in scale from local to continental.

Naming the Stranger: Maize’s Journey to Africa

After the opening of the Atlantic basin to trade, cultural exchange, and violent exploitation, the Old World was for maize a tabula rasa. Maize arrived in Africa after 1500 as part of the massive global ecological and demographic transformation that historian Alfred Crosby called the Columbian exchange. The great irony, of course, is that the same Atlantic economy that wrenched captives from Africa to supply labor for the preindustrial economies of scale in the New World also provided Africa with new cultigens (cassava, beans, potatoes, and maize) that reinvented Africa’s food supply over the next half millennium. There is, however, little documentary evidence of what must have been a conscious process of Europeans’ or Africans’ first introducing the maize plant to Africa and of African farmers’ responding to it. The importation of maize seeds to various parts of Africa went unremarked, though it certainly was not unremarkable.

The first documentary reference to the presence of maize in Africa may be that of an anonymous Portuguese pilot who in 1540 described already well-established cultivation on the Cape Verde Islands: “At the beginning of August they begin to sow grain, which they call Subaru [zaburro], or in the West Indies meviz [sic]. It is like chick pea, and grows all over these islands and along the West African coast, and is the chief food of the people.”
much the same patterns the original namers of the new plant followed. Ample evidence exists to show that in recent times women were the namers; for example, in western Kenya, Jean Hay tells us, it was women who named crop varieties after male labor left in early migrations to the cities. In 1917 a new type of white dent maize was novel enough that Luo women called it *orobi* (for Nairobi, founded in 1901)—perhaps a sign that it marked a new era in their economic lives. When maize types, in the modern parlance for hybrids and genetic improvements produced by national seed centers and private corporations, merely take the numbers and initials of scientific trials or the location of the research station (such as Bako Hybrid 660 or Kitale 522), farmers no longer take the initiative to imagine the plant’s characteristics. Thus the bland and homogenous comes to be preferred over local aesthetic expression. By now, maize has completed its acculturation to Africa and is no longer the stranger.

Maize’s Invention in West Africa

Was the arrival of maize in Africa a watershed event in defining either the historical direction for the continent or particular historical settings? Some have made the argument in a general way that it was, and others have made a quite specific case that maize was a distinctive catalyst. What is the evidence for such determinism in Africa’s encounter with the New World crop?

Environmental geographer (and gastroenterologist) Jared Diamond has argued—persuasively, some would say—for environmental determinism over the long haul in human history. He suggests that the global distribution of natural resources, particularly in food supply, set in train the long-term development of the human economic and cultural landscape. He notes that while human intelligence and ingenuity were everywhere in evidence in world history, no level playing field existed when it came to the global distribution of environmental raw materials: not all areas of the globe were equally endowed with natural resources such as animal and plant germplasms.

Even though Diamond’s focus was global, his thesis about the inequality in endowment has specific implications for Africa. In the case of genetic types, for example, some regions of the world had a rich pool of domesticable livestock species, while others did not. Africa had only the donkey as a potential domesticate (and that...
only in the Nile Valley) and had to wait for cattle, sheep, goats, and camels to arrive from elsewhere (the New World also had to get along without these until the Columbian exchange of the fifteenth and sixteenth centuries).

The potential genetic resources for agriculture in Africa were also unbalanced. Of large-seeded grass species the Mediterranean world had thirty-two types that were potentially domesticable as cereal crops, the Americas had eleven (including, of course, maize), while Africa had only four, none of which would be one of the world’s primary food grains of the twentieth century—wheat, barley, rice, or maize. Most of the genetic stock of grain that has become global domesticates was distributed in the Northern Hemisphere and generally tended to spread along an east-west axis, rather than from north to south. In this view, therefore, Africa had to overcome an early liability, which, of course, it eventually did by adapting exotic crops, once they became available via trade, accident, and human design, to particular African ecological settings. But this process of appropriating key New World food sources in Africa took some time, and it began only half a millennium ago. Diamond’s schema is global in its sweep and not focused on specific crops; we nevertheless can ask the question How central was maize as a food source to the formation of particular types of political and social systems in the Old World, once it finally arrived?

While many or even most historians scrupulously avoid explanations based on a single cause, maize has tempted a number of writers to ascribe great power to it. The noted scholar of world history William McNeill, for example, has attributed the demographic and political domination of particular ethnic groups in the Balkans to their incorporation of maize into their agricultural and food systems:

When Greeks, Serbs, and Vlachs found that the new maize crop allowed them to live all year round in the high mountain valleys, where they were safe from the twin scourges of the plains—malaria and Turkish oppression—the political and economic balance of the Balkans began to shift... Thus one may say that what potatoes did for Germany and Russia between 1700 and 1914, maize did for the mountain Greeks and Serbs in the same period of time. In each case, a new and far more productive food resource allowed population to surpass older limits, and larger populations in turn provided the basis for the enhanced political and military power attained by the four peoples involved.

Alfred Crosby, another thoughtful historian on the grand scale, stops short of linking the appearance of maize with the rise in southern Europe’s population and political fortunes, but he nonetheless traces the crop’s central role as a new source of calories in Romania, Hungary, the Po Valley, the Danube Valley, and the Caucasus. Crosby, like McNeill, turns the assertions of that persistent pessimist Thomas Malthus on their head by arguing that the effects of new crops (such as New World maize) on food supply accounts for population increases and economic growth in the early modern period, although he does hedge his bets more than McNeill:

An entirely new food plant or set of food plants will permit the utilization of soils and seasons which have previously gone to waste, thus causing a real jump in food production and, therefore, in population. But, before we accept this statement as gospel, let us acknowledge that we are taking much for granted. How can we be sure that a population which simultaneously switches from wheat to maize and increases in size could not have accomplished the same increase without having heard of maize? Perhaps the switch to maize came not because of its greater productivity but because the people in question simply liked the way it tasted. Perhaps the increase in population stemmed from a dozen or a hundred factors having nothing to do with maize.

According to both Crosby and McNeill, the scale and nature of the changes wrought by maize were profound in parts of the Old
World, but were there similar effects in Africa? And were such transformations universal in state and social systems there?

The penetration of maize into West Africa took place in many cultural, economic, political, and ecological settings. Peoples who settled around the Bight of Biafra, the Bight of Benin (both in present-day Nigeria), the historical kingdom of Dahomey, the Gold Coast, and the Ivory Coast accepted maize with great alacrity. But the reception was far less enthusiastic in Guinea, Sierra Leone, Senegal, and Gambia (the Upper Guinea coast), where endemic African varieties of rice remained rather firmly entrenched. The factors influencing the warmth of the local welcome for maize were a product of a grab bag of conditions: local ecology, the types of maize that presented themselves, local farming systems, crop niches, and even the aesthetic sensibilities of African consumers.

To examine these factors more closely, we will look at the case of Asante in West Africa in the centuries immediately following the Columbian exchange and follow the factors into the modern period. Maize's performance, alongside other New World crops, was a catalyst in the human transformation of the forest in Upper Guinea that stretches from Sierra Leone to the Gold Coast and the Dahomey gap, then on to Nigeria. This ecological zone, which mixed humid forest with savanna and landscapes once called derived savanna, but more accurately called forest-savanna mosaic, was the home base of major state systems that emerged in the seventeenth and eighteenth centuries. These states included kingdoms, memorable for their great military, political, and artistic achievements, that straddled forest and savanna ecozones—Asante, Dahomey, Benin, Oyo.

Statecraft in the Forest: Asante

Did all African societies that welcomed maize become winners, the beneficiaries of maize's grace, or blessing? The Akan region of the Gold Coast seems to have been such a place, where ecology, local politics, and economic response to the expanding Atlantic economy joined together to generate the powerful and long-lived Asante Empire, beginning at the outset of the eighteenth century. Asante offers a particularly powerful case for the importance of maize penetration, for the empire can boast a rich set of historical sources and an insightful tradition of scholarly writing about its history, as well as a highly visible tradition of producing textile (such as kente cloth), metal objects (brass goldweights), and political institutions (the Asantehene, the queen mother, and their courts). The origins and timing of Asante's rise to power in the seventeenth and eighteenth centuries has presented a challenge to historians. The product of both internal dynamics and the opening of the trade links to the Atlantic world, Asante's rise and the introduction of maize thus offer an intriguing case for assessing maize's historical role in a humid and semihumid West African political and ecological setting and provides broad insights into the agroecology of West African political history as a whole. Maize was part of the historical conjuncture that resulted in Asante's historical prosperity and hegemonic growth—less as a causal factor than as a necessary ingredient in the historical process of population and political growth, in which food was a critical factor.

In the forest ecology of Upper Guinea, the primary food-related dilemma affecting human settlement and state-building was not a lack of protein, but the paucity of carbohydrates. Wild yams and other tubers were part of the forest's biodiversity but existed too sparsely on the ground to provide a caloric base for an army, a bureaucracy, a population of town dwellers, or nucleated villages of taxpayers. While lowland rice (Oryza glaberrima) was endemic to the northern Upper Guinea forest in Sierra Leone and Guinea, it seems not to have made an impact on the drier, semideciduous forests of central Ghana and the historical Gold Coast. Other African grains, such as sorghum and millet, which sustained most dense savanna settlements, were long-maturing, needing the sun and a long dry season to ripen into a viable food source. Cultivated yams, rich
in carbohydrates, were well adapted to shady plots and forest soils but were also a long-maturing, labor-intensive root crop that was more a prestige food than a reliable staple. Forest soils were fertile and moist on surface levels where leaf debris decomposed, but sunlight, the forest's most precious commodity, rarely reached the understory plants on the floor of the closed-canopy forest. The tallest trees won the competition for sunlight, allowing only shade-loving plants to occupy the forest floor in a mature forest. Moreover, forest soils, once cultivated, were easily leached of nutrients. Those soils then required subtle management to produce food in large amounts.

Solving the historical puzzle of the foundations of forest statecraft and population density requires a fairly bold vision, given the paucity of archaeological and historical evidence available. Historian Ivor Wilks, using tantalizing shreds of historical evidence and the botanical facts of forest ecology and crop agronomy, took such an approach. In a 1978 study Wilks linked the Akan people's historical evolution of a distinctive (forest) fallow agriculture with the emergence of the Atlantic economy. To this convincing but still speculative formula, we need to add maize as a defining ingredient.

Fundamentally, the constraints on human settlement of forests were 1) how to remove primary, high-canopy forest vegetation to allow sunlight to penetrate to food crops at ground level, 2) how to prevent vegetative regrowth from choking fields after clearance, 3) and how to mix crops to provide a sustainable food supply that did not degrade forest soils. The figures for premodern tropical forest clearance are staggering; clearing a single hectare of primary tropical forest required removing 1,250 tons of moist vegetation by using cutlasses, billhooks, and fire. It was hot, dangerous, arduous work to remove the "cumbersome growth of fibrous stems and vines, mixed with other plants of a watery nature."  

The real surprise in Wilks's equation, however, was not so much the daunting weight of biomass to be hacked, cut, uprooted, dragged away, and burned, but the fact that after the first clearance of 1,250 tons, subsequent clearance of the same plots after a fifteen-year fallow was only 100 tons! Thus, the key task had been the initial breaking of the forest canopy's monopoly on sunlight, through the first-stage removal of both the canopy and the choking understory of trees, bushes, and vines. Once the forest's primary canopy had been cleared, an agricultural economy could expand the frontier of cultivation into the forest. In later stages, labor could be released for crop cultivation, military service, construction, and so forth.

Nineteenth-century observers tell us that this ecological revolution had already taken place by the time of their arrival. At the time of Joseph Dupuis's visit in 1820 to the Asante heartland, the forest fallow system was well entrenched and much of the land clear-felled, leaving a landscape akin to "the country gardens of Europe." How was this cleared and cultivated landscape achieved, given the high initial labor costs of clearance?

Wilks answers the labor question through intriguing oral and documentary evidence that points to the fifteenth and sixteenth centuries as the time of a crucial conjuncture that drew new human populations into the central forest and provided the social mechanisms (matrilineals or abusua) to integrate them. The first European contacts with the West African coast in the fifteenth century in search of gold found an already active slave trade that brought captive labor from the Niger delta to the Ghanaian coast. As the Portuguese traders quickly learned, the easiest way to obtain gold from the mines of central Ghana was to transport slaves from elsewhere on the West African coast to the new Atlantic entrepôt (founded in 1482) at El Mina. Incorporating these new populations as slaves, fictive kin, and dependents provided both the labor and the mechanisms of social coercion that permitted state systems to evolve.

One ingredient hidden in this story points directly to the year 1500 as a takeoff point for changes in the ecosystem: the arrival from forest ecosystems of Central and South America of new food
crops ideally suited to feeding expanding forest-based polities. New World food crops—cassava (manioc), cocoyam (*Xanthosoma sagittifolium*), and above all, maize—brought by European ships to provision their coastal fortresses and island plantations, spread quickly beyond the fortress gardens via local trade networks. The infusion of these plants into the local agronomic ecology spurred an agricultural carbohydrate revolution that allowed forest peoples of the Upper Guinea to feed a dense, growing population and fostered an elite political class, royal courts, and a standing army. Maize, and cassava, were the biotic wedge of a human assault on the forest landscape to convert the forest's biomass and energy into usable carbohydrate calories. Residents of the Gold Coast (speakers of Akan languages) who cultivated these new crops clearly understood their importance from the beginning and probably were among the first African societies to recognize their value. The Akan word for maize, *aburoo*, which connotes “foreign,” has no wider usage in West Africa and does not seem to have been borrowed from any neighboring group. In fact, speakers whose first language is Akan can often provide no gloss for the term *aburoo*, though it appears in older Dutch documents in a way that clearly indicates that it meant something like “sorghum of the foreigner,” the most common gloss throughout Africa.

The formal historical sources are vague regarding dates for the arrival of maize in West Africa and the actual points of entry. Evidence of the profound nature of its economic and cultural impact comes primarily from local representations of the plant's deep cultural symbolism in personal and public ritual. It also comes from ecological inferences about how one branch of the Akan-speaking people came to transform a thinly settled forest environment into a powerful, expansive empire that fed and otherwise sustained a sophisticated state bureaucracy and military.

The primary weapon was a local forest fallow repertoire, a historically accumulated body of local knowledge combined with revolutionary plant germplasms. Observers of the forest fallow farming system described elements of it as early as the first part of the nineteenth century, but its fullest elaboration appears in the insightful fieldwork of anthropologist Kojo Amanor. What Amanor, working in the 1990s, describes as a twentieth-century adaptation, historical documents and data from other forest zones suggest was in fact a historical process that evolved over time and was the system (or a set of related localized practices) in place throughout central Ghana after the sixteenth century, when forest farmers and gatherers added maize and cassava to specialized niches within forest cultivation. Similar processes probably took place all along the Upper Guinea coast and into the coastal area of the Bight of Benin.

Ghana's Upper Guinea forest cultivation system—forest fallow—derives its rhythms from two seasons of rainfall and a season of dry wind (the harmattan) that blows dry air and dust from the Sahel toward the Gulf of Guinea. The heavy rains take place between March and early July; a second, smaller rainy season beginning in September and lasting until October allows the cultivation of a second plot. The farm cycle began with the clearing of fields for the primary farm between December and January. Farmers use cutlasses to slash and remove the understory of shrubs and ground cover. Farmers then cut major branches from large trees (a technique called pollarding) to open the canopy cover and added leaf debris as a mulch to the soil's surface.

With the beginning of rains in March farmers placed leaf debris, smaller branches, and other now dried vegetation in piles for controlled burning. Fire reduced forest biomass to ash and destroyed insects and small weeds. Burning also released phosphorus and singed the leaves and branches that fell to the ground, thus adding organic matter to soil, enhancing the layer of mulch, and increasing the penetration of sunlight to the forest floor. Clearing, burning, and pollarding, in effect, converted the energy stored aboveground in vegetation into soil nutrients to feed nitrogen-loving food crops such as maize.

During the March rains farmers also planted yams in mounds
near small trees that served as stakes for the plant’s emerging tendrils. Once the March rains were in full swing, farmers planted maize, using minimum tillage—a technique now much in vogue among development agencies—to keep mulch and soil moisture in place. The maize thus received the moisture essential for its early growth and tasseling. Two weeks later, farmers planted cassava sticks between the germinated maize plants, and cocoyam corms preserved in the soil began to sprout. As these crops grew, dense vegetation emerged, with maize leaves leading the way toward the intense sunlight they require. The leaves of the young cassava and cocoyams closer to the forest floor cooled the maize roots and protected the forest soils from the impact of rainfall and direct sun.

Understanding the dynamics of the forest fallow system’s impact on food supply requires that we interpret against the historical background the role maize played in wider change. The capacity of maize to provide two harvests within a single season gave a strategic boost to local food supply. The availability of food, in turn, released labor to extend the frontiers of forest settlement and support development of politics and statecraft. The forest fallow crop repertoire as a whole was thus part of an agricultural transformation that drew new labor into the forest and broke the knot of achieving that first clearance of the primary forest. One of the engines for the Upper Guinea forest fallow revolution was the arrival of three New World domestic plants that occupied strategic niches in forest cultivation. As a new cultigen, maize offered an advantage: it was an early-maturing food source that provided carbohydrates by the end of the rains, while exacting less work than yams did. Maize also gave a second harvest, while cassava complemented maize’s early yield and double crops by supplying another low-labor (but long-maturing) crop, which could remain stored in the ground for extended periods. It is therefore not surprising that historical sources report that in the era of the slave trade maize increasingly dominated forest and coastal cultivation.

The types of local maize found on forest and forest mosaic farms of modern Ghana may well represent the kinds of maize that originally found their way into the forest agricultural system. In turn, the maize types allow us to infer something about their role in foodways and in farm practice. Flint maizes, such as the Brazilian orange and yellow Cateto, would have matured early to supply a food that could be boiled or roasted at the milky stage. The Cateto race is the group of yellow to orange maize types occurring in Brazil and assumed to have been grown by indigenous people living along the Atlantic coast from Brazil to Guyana. Although not a high-yielding type itself, Cateto readily crosses with many other races of maize and therefore may have been the basic maize variety that West African farmers adapted to their local needs, through a technique that maize breeders call mass selection. Floury maize is also a distinctive type found among local West African varieties. When hand-milled with a mortar and pestle, floury maize also would have offered the raw material for kenkey, a polenta-like stiff porridge steamed inside the cornhusk and eaten with palm oil and vegetable or bush meat stews. Over the course of the late eighteenth and nineteenth centuries, maize continued to influence state expansion and economic growth. First, it provided a transportable forest-based food supply for Asante’s army that expanded its reach into savanna zones to the north. Second, farmers in the savanna, probably using mass-selection techniques, adapted their floury maize to the drier environments at the savanna’s edge, where the new crop slowly replaced sorghums and millets—a process that replicated itself up and down the West African coast, in various local forms, into the modern era.

From Asante to the Gold Coast

By the middle of the twentieth century, Ghana’s farmers had ingeniously bred local maizes in early- and late-maturing varieties ideally adapted to their different farming systems and to the physical environment. By the twentieth century four major zones of maize
cultivation had emerged, each reflecting its own ecological niche and place in the farming system:

Coastal savanna: Maize is intercropped with cassava and the drought risk is significant.

Forest zone: Maize is grown on scattered plots, usually as an intercrop with cassava, plantain, and cocoyam. Farmers plant most of their maize during major rains.

Transition zone between forest and savanna (forest mosaic):
Farmers use intercropping but plant most of their maize as a monocrop, sowing the crop during both major and minor rainy seasons.

Savanna: Maize in this northern zone is increasingly important, replacing millet and sorghum. Farmers often grow maize in rotation or as a relay crop with groundnuts and cowpeas. Farmers cultivate many fields permanently and frequently fertilize their maize.16

This modern geography of maize cultivation has evolved from an older pattern that seems to have reflected two lines of entry for the crop. The first was via the coast and trade contacts with Portuguese, Dutch, English, and Swedish forts along the coast in the sixteenth and seventeenth centuries. Here the word aburoo seems to indicate direct contact with foreign traders. A second set of terms found in the northern part of present-day Ghana derive from the Hausa word for maize, masar, an association suggesting either a term borrowed from other groups in the West African savanna or introduced as an innovation by Hausa speakers whose contact with maize would have included travelers on the hajj returning via Egypt.

Maize cultivation in the British Gold Coast colony evolved in increments, as a part of an overall agricultural economy. One surge came in the 1940s, when the virulent swollen shoot disease sharply reduced cocoa plantings, thereby opening up new forest lands for maize as a cash crop.17 In the early 1950s, southern rust (Puccinia polysora, or American rust) threatened the maize crop of the Gold Coast colony and West Africa as a whole, and consequently the urban food supply, but maize survived on farms and continued to play a still relatively minor role in the local and national diet.

In the years after independence, however, new transportation networks encouraged migration of farmers to savanna agricultural zones in the north, where in the late 1970s new efforts at agricultural extension and use of fertilizer inputs encouraged production of new maize types. Initially these programs met with some resistance. Farmers were concerned about inadequate husk cover in improved varieties, which invited insect and bird damage to maize in the field or in silos, when it was stored in the husk. Government maize breeders working at the Ghana Crop Research Institute began to develop new varieties based on farmers’ preferences. The breeders sought to improve grain qualities and husk cover and to
select for nitrogen efficiency and resistance to the parasitic weed *striga*, drought, and stem borers. In the late 1990s, Ghana's national government began an aggressive policy of promoting new maize types and use of chemical fertilizers and herbicides under the guidance of the Sasakawa Global 2000 program, which has promoted maize “package” programs in various parts of Africa. The results in yield and area planted were remarkable. From 1975 to 1995, the area planted in maize had more than doubled in Ghana, with yield increases of 50 percent; maize often replaced both sorghum and cocoa (Appendix Table 3.1). By the end of the twentieth century, more than half Ghana’s maize was produced in the north of the country as a monocrop, a far cry from its origins as the pioneer crop that promoted human settlement of the forest.

Whatever its origins, by the last decade of the twentieth century maize had established itself as an intrinsic part of the national diet, emerging as the most important cereal crop in Ghana, where it favorably complements other crops as the cheapest source of calories: in the south cassava, and in the north sorghum and millet. Nevertheless, unlike in southern and eastern African diets, in the average diet in Ghana maize contributes less than a fifth of the calories, whereas roots and tubers supply more than half the calories for rural households and almost two-thirds for urban households. Even where maize is the principle staple, as in the southern-central and Volta regions and parts of the northern region, it rarely contributes more than a third of the calories of the average household. Because the maize-based parts of Ghana’s national cuisine require skill to prepare, most consumers do not purchase maize as grain, but acquire it in processed form. In the late 1980s well over half the maize growers also purchased prepared maize products at the market. Prepared as kenkey, banku, or akple, maize has taken its place alongside cassava and yam as part of the national cuisine and farm economy.

The most significant recent development for maize in Ghana has been the introduction of quality protein maize (QPM), dubbed Obatumpa (mother’s milk) by the Ghana Crop Research Institute and released to farmers nationally as the primary new maize type. Ghana has thus become the first site in Africa for distribution of the new generation of maize, in what is likely to become a worldwide effort to promote the role of maize as humankind’s principal food. In Ghana’s food supply the process has thus begun of shifting the status of maize from that of a vegetable crop mixed into the biologically diverse forest ecology to that of a homogeneous monocrop which increasingly dominates the national diet.

An Alternative Outcome in Nigeria

The historical experience of Asante, the Gold Coast, and Ghana is a regional variation on the larger maize story in West Africa, which differs substantially from that in eastern and southern Africa. Since the 1970s in western Africa, maize has achieved the highest rate of increase of any major food crop. Yet within West Africa and within particular cultural and ethnic clusters, the effects of maize have differed considerably with respect to world markets, local cultural traditions, and national economies. The Africanization of maize took place first in West Africa, in fields where farmers selected from among New World-bred maize types—or land races—for characteristics of yield, timing of maturity, and adaptation to both disease and climate. It also took place in women’s market stalls, where consumers and sellers negotiated for corn with their preferred color, texture, and taste. Nigeria, which by the end of the twentieth century produced almost half the maize grown in West Africa, provides a useful contrast to Ghana’s case. As in Ghana, in Nigeria the dominant agroecological zone shifted dramatically in the late twentieth century.

As was the case with the Asante empire, for Nigeria the initial encounter with maize came with the opening of the Atlantic system after 1500, though in ways that are rather surprising. Though maize never achieved the dominance over diet it would assume in
eastern and southern Africa in the twentieth century, its history in
West Africa, particularly in Nigeria and Dahomey (now Benin),
suggests a profound impact. Presumably, the way maize fit into a
niche within forest and forest mosaic farming systems resembled
what happened in Asante. The appearance of maize in Yoruba oral
traditions, however, also indicates a strong and long-standing
engagement with maize as food and as social symbol. The core
word for maize in the Benue-Congo language family, *agbado*, and
variations recorded in the nineteenth century such as *agbade* (Da-
homey), *egbado* (Daunu), *gbado* (Eki), or *gbaye* (Mahi), reflect
the widespread cultural influence of the Yoruba culture and agri-
cultural system and their history of links in all cultures of the
Atlantic rim.21

In most cases the linguistic evidence in Nigeria follows patterns
common elsewhere in Africa, including references to the putative
provenance of maize and allusions to its resemblance to sorghum.
In northern Nigeria the term for maize in Hausa (*masar*), is found
in at least nine other local languages, an indication of either exten-
sive borrowing or a common influence from migrants who brought
the new crop. There are, however, some fascinating exceptions.
Among the most colorful are the glosses in Piti (sorghum with a
hat), Mala (sorghum that carries a child), Izere (musical horn sor-
ghum), and Ikulu (sorghum like a *borass* palm sprout).22

Most historians and maize specialists have assumed that the
main point of arrival for maize was the west and the Atlantic coast
(as was the case in the Gold Coast evidence), probably via Portu-
guese and other European trade contacts with the southwestern
Yoruba and Beni peoples.23 The impressive lexical evidence assem-
bled and analyzed by the Oxbridge group of Roger Blench, Kay
Williamson, and Bruce Connell, however, offers a stunningly dif-
f erent view. They looked at both the places mentioned within
maize names and the evidence of borrowing and the sound shifts
within words. Virtually all the names for maize within the Nige-
rian panoply and the geography of their distribution refer directly
or indirectly to a northern origin for maize. There were two means
of diffusion, farmer-to-farmer exchanges and long-distance trade
along an east-west axis (and sometimes from the northwest or
northeast via the savanna empire of Bornu and the Niger River).
The word *masar* and its variations suggest that the Bornu route
that linked to the Nile Valley and the pilgrimage to Mecca via
Egypt was perhaps the most significant. In southern areas the ap-
pearance of the *agbado* and *-kpa* clusters of terms for maize indi-
cate arrival and diffusion from the northeast and also arrival from
the west via the old area of Dahomey and expansion within that
empire.

Surprisingly, the language evidence from Nigeria indicates only a
minimal role for the Portuguese, and then only in the southwest, at the Bight of Benin. Only one language there, Isekiin, seems to use a word of Portuguese derivation, *iniyo*, a term that Blench, Williamson, and Connell link to the Portuguese *milho*.

The history of maize as a forest vegetable crop cultivated alongside root crops and legumes (including New World beans and squash or African cowpeas) dominated its early tenure in West Africa. But as in Asante and Ghana, the geography and agroecology of maize changed inexorably throughout the colonial period and during the final quarter of the twentieth century.

By the middle of the twentieth century, Nigerian farmers, processors, and consumers had established an elaborate repertoire of tastes and aesthetic preferences. Dutch maize researcher C. L. M. Van Eijnatten describes the intricate geography of preferences in color and type that had evolved in Nigeria by the mid-twentieth century:

In northern Nigeria most of the maize cultivated is of the pale yellow colour and is flinty, although white flinty varieties do occur quite regularly. Around larger towns white floury varieties are regularly cultivated, but these only on a small scale and invariably only for sale to “southern” inhabitants of these towns. In the northern and eastern parts of this region the occurrence of dark brown, red or blue coloured grains is quite common.

In the whole of southern Nigeria the people have a strong aversion towards brown, red, or blue grains. A definite preference for white colour does exist in Oyo, Abeokuta, and Ijebu provinces of Western Nigeria and in the eastern part of Eastern Nigeria, both of which produce mainly white varieties. It is in these areas that type and colour preferences are very pronounced, especially in the Yoruba communities of Western Nigeria. In most other areas colour preference is of little importance. Either of the two colours, white or yellow, will be acceptable, provided the grain type is suitable for the preparation of the foodstuffs. The preference for flinty or floury grains is less pronounced than the colour preference even in the “white floury” areas of Western and Eastern Nigeria. When colour preferences were plotted on a map of Nigeria a mosaic is obtained, of intermingled preferences, varying from one town to the other. Outside of these areas flinty grains were normally judged more acceptable than soft, floury types, apart from Niger province. In Ilorin province just north of the distribution area of white floury maize varieties, the white floury “Yoruba maize,” as it is called, was definitely not acceptable.24

In the last quarter of the twentieth century, Nigerian and West African maize continued to evolve within local ecologies and national economies. In the early 1970s the humid forest and forest mosaic zones accounted for 60 percent of maize production, the savanna ecozone for only 25 percent of it. By 1983–1984, savanna ecology accounted for more than 50 percent and the humid forest and forest mosaic for just 23 percent. Most of this reversal is the result of growing improved varieties in monoculture.25

The release of a new maize type called TZZ by the International Institute for Tropical Agriculture in Ibadan was a major breakthrough, as it offered an increase in yield to six times that of sorghum and millet and seven times that of cotton. In Nigeria’s northern savanna zone, group interviews conducted by a research team in the late 1980s indicated that maize, considered a backyard crop in the mid-1970s, had emerged in 1989 as the lead crop in 90 to 100 percent of the villages surveyed in the northern Kaduna and Katsina districts. As in Ghana, maize offers a higher return on expenditure in land, labor, and cash than all competing crops except cotton (which remains a minor crop because of instability in the world market). Sorghum is only about a third as responsive to fertilizer as maize.

The trend in West Africa’s maize economies to move from growing the crop in a biodiverse forest ecology to virtual monocropping in savanna agriculture may be an increasingly fragile one, as farm-
ers calculate risks of their economic position. It is interesting that the economic collapse of Nigeria in the early 1990s that brought on structural adjustment programs from the International Monetary Fund and other international donors resulted in the loss in government import subsidies for fertilizer and an almost immediate decline in maize production. Farmers reverted quickly to sorghum and cassava in drier areas and to local rice in wetter zones. This pattern stands in substantial contrast to that in two imperial systems which we will now examine.

 Seeds of Subversion in Two Peasant Empires

The initiation of sustained contact across the Atlantic Ocean at the end of the fifteenth century set in motion a number of significant exchanges in politics as well as ecology, including the reframing of cultural universes throughout the greater Atlantic world. The Mediterranean “lake” of the classical world quickly lost its pivotal position and became a part of the periphery, marginalized in both economic and intellectual terms. Part of the fallout from that change was a weltanschauung that had to accommodate the entire New World, along with changes in material life wrought by the transfer of new elements of political economy, by the foundation of empires of extraction (that is, the forcible removal of natural and human resources, from gold or spices to slaves), and by the exchange of organisms, which would find new ecological niches when they crossed the Atlantic basin. The changes comprised a conglomeration of new ideas, new economies of labor, and possibilities inherent in new foods, new crops, and their transformation of Old World agrarian systems. If the struggles were human, the weapons were often technological, and they embodied new possibilities for agriculture.

It is instructive to examine the ways in which two Old World agrarian systems responded to the effects of Zea mays, the food crop that had arrived as a deus ex machina at the opening of the