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Pieter Bruegel the Elder, *The Harvesters*, 1565

The domestication of what?

A political economy of grains

a corpus constituted by Gaëtan Thomas

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SUMMARY

1. Introduction

Guidelines for the readings:

- How does a nation's social and political context influence scientific production? What about the political orientations of scientists? And what about their claims of being apolitical?
- Could a scientific discourse miss (voluntarily or not) some parameters of an on-ground situation?
- How do the scientific institution, society and public authorities interact? What is the place left to individuals in these institutions?
- How could you characterize power relationships between scientific institutions, states and private companies?
- Could science reproduce traditional forms of domination (of a part of the world over another, for example)?
- What is at stake behind studying social phenomena such as famines through an interdisciplinary approach (bringing together biosciences, economics, history, sociology, anthropology)?
- Can such a phenomenon be solved using tools coming from only one of these disciplines?
- What is the role of institutions in creating, analyzing and/or solving social, political and economic issues?

First the Seed

In : Jack Ralph Kloppenburg Jr., First the seed, the political economy of plant biotechnology, 1492-2000, Madison, The University of Wisconsin Press, 2004 (1. Ed. 1988)

The plant is the irreducible core of crop production on the farm and the most fundamental agricultural input. As the motto of the American Seed Trade Association has it: "First - the Seed." But while scholars and political analysts representing a wide variety of theoretical positions have long recognized that technological advance is a principal factor contributing to structural change in agriculture, the role of new plant varieties in this process has gone largely unexamined. […]

The paucity of critical analysis devoted to plant breeding reflects prevailing perceptions that it is one of the most unambiguously beneficial of scientific endeavors. The product of plant breeding, the seed, is regarded as a uniquely benign input in both environmental and structural terms. As a natural product, seed is perceived as "ecologically positive" (Teweles 1976:66). And according to economists, the perfect divisibility of seed makes it scale neutral (Dorner 1983:77). Seed thus embodies yield-enhancing genetic improvements without damage to the environment and without a biasing effect on farm structure. In a widely used text, the well-known breeder N. W. Simmonds (1979:38) asserts that "plant breeding, in broad social terms, does indeed generate substantial benefits and is remarkably free of unfavourable side-effects (the economists' 'externalities')." Simmonds concludes, "As plant breeding, per se, is a wholly benign technology, any enhancement of it must be welcomed as being in the public good, no matter who does it."

That plant breeding might have managed to avoid "unfavourable side-effects" is all the more remarkable given the scale of what are regarded as its positive impacts. Since 1935, yields of all major crops in the United States have at least doubled, and at least half of these gains are attributable to genetic improvements. Indeed, plant breeders have been responsible for what the United States Department of Agriculture (USDA) considers the "food production story of the century": the development of hybrid corn (U.S. Congress, House of Representatives 1951:2).

In the twenty years following the commercial introduction of hybrid varieties in 1953, corn yeld doubled. And in 1985 the average yield for corn stood at about six times the Depression-era figure of 20 bushels per acre. Certainly corn breeders themselves have done little to dispel the notion that they are indeed the "prophets of plenty." Testifying on science legislation before the Senate Committee on Military Affairs, L. J. Stadler credited the increased production attributed to hybrid corn varieties with paying for the development of the atomic bomb (Shull 1946:550). Paul Mangelsdorf went still further, asserting that hybrids had contained the spread of communism after World War II by ensuring an adequate food supply for a decimated Western Europe.

The 700 percent annual social return on research investment that economist Zvi Griliches (1958) calculated for hybrid corn remains the paradigmatic example of the large benefits society enjoys from agricultural research. In his 1982 presidential address to the American Society of Agronomy's diamond jubilee convocation, C. 0.Gardner (1983) still could find no more fitting example of the contributions made by plant scientists than to cite once more the "success story" of hybrid corn. Even now, in the brave new world of recombinant DNA transfer, the National Academy of Sciences (NAS) sees the "spectacular success" hybrid corn had in increasing yields as the model of achievement to which the new biotechnologists should aspire.

But have the development and deployment of new crop varieties in the United States really been the unalloyed good they are made out to be? The superlatives attached to hybrid corn reflect an obsessive preoccupation with yield increases. Can such yield increases have been achieved without a complex constellation of far-reaching socioeconomic changes rippling throughout the agricultural sector? Is yield increase the only objective to which the agricultural plant sciences should be directed? What realities are masked by the language of "success" and the prevailing ideology of the benevolence of plant breeding?

That the role of new plant varieties in contributing to transformations in the structure of agriculture and in the natural environment has not been systematically addressed in the United States is curious, since it is this very connection that has so interested social scientists engaged in study of the international " Green Revolution" of the I 960s and I 970s. Both critics and defenders of the Green Revolution recognize that, whatever the benefits, the introduction of the "miracle" wheats and rices developed at the Ford- and Rockefeller-funded international agricultural research centers (IARCs) played a crucial role in galvanizing not just substantial yield increases, but a wide range of negative primary and secondary social and environmental impacts as well. These include the exacerbation of regional inequalities, generation of income inequalities at the farm level, increased scales of operation, specialization of production, displacement of labor, accelerating mechanization, depressed product prices, changing tenure patterns, rising land prices, expanding markets for commercial inputs, agrichemical dependence, genetic erosion, pest-vulnerable monocultures, and environmental deterioration.

The introduction of hybrid corn in the 1930s touched off an American precursor of the international Green Revolution. Can we have passed through our own domestic Green Revolution without having experienced profound transformative social change? I think not. And, if one listens care- fully, plant scientists occasionally admit as much.

In an unusually frank invitational paper read at the 1977 annual meeting of the American Society of Agronomy (ASA), University of California- Berkeley plant physiologist Boysie E. Day implicated the plant sciences as important contributors to social upheaval:

> I begin with the proposition that the agronomist is the moving force in many of the social changes of our time. I include under the title " Agronomist" all crop production scientists of whatever discipline. He has brought about the conversion of a rural agricultural society to an urban one. Each advance has sent a wave of displaced farm workers to seek a new life in the city and a flood of change throughout society. This is true in all of the developed nations but is particularly evident in the United States where the changes have been greater than elsewhere. Be assured that at the 1977 ASA annual meeting, as in the past, there were enough new findings disclosed to render many thousands of American farms economically superfluous and cause the displacement of many farm workers from the country to the city. Probably, no meeting in 1977 of politicians, bureaucrats, social reformers, urban renewers, modern-day Jacobins, or anarchists will cause as much change in the social structure of the country as the ASA meeting of crop and soil scientists.

2. Grains states

In : James C. Scott. *Against the Grain: A Deep History of the Earliest States*. New Haven, Yale University Press, 2017: 173-196

The subsistence bases of all the earliest, major agrarian states of antiquity—Mesopotamia, Egypt, Indus Valley, Yellow River—bear a remarkable resemblance to one another. They are all grain states: wheat, barley, and, in the case of the Yellow River, millet. Subsequent early states follow the same pattern, although irrigated rice and, in the New World, maize are added to the list of staple crops. A partial exception to this rule might be the Inka state, which relied on maize and potatoes, although maize seems to have predominated as the tax crop. In a grain state, one or two cereal grains provided the main food starch, the unit of taxation in kind, and the basis for a hegemonic agrarian calendar. Such states were confined to the ecological niches where alluvial soils and available water made them possible. Here the emphasis should be again on Lucien Febvre's concept of "possibilism"; such a niche was necessary for state formation (and could be expanded by landscape management such as canals and terracing), but it was not sufficient. And in this case, population concentration must be distinguished from state making; wetlands abundance, as we have seen, could lead to incipient urbanism and commerce, but did not lead to state formation without grain growing on a large scale.

Why, however, should cereal grains play such a massive role in the earliest states? After all, other crops, in particular legumes such as lentils, chickpeas, and peas, had been domesticated in the Middle East and, in China, taro and soybean. Why were they not the basis of state formation? More broadly, why have no "lentil states," chickpea states, taro states, sago states, breadfruit states, yam states, cassava states, potato states, peanut states, or banana states appeared in the historical record? Many of these cultivars provide more calories per unit of land than wheat and barley, some require less labor, and singly or in combination they would provide comparable basic nutrition. Many of them meet, in other words, the agro-demographic conditions of population density and food value as well as cereal grains. Only irrigated rice outclasses them in terms of sheer concentration of caloric value per unit of land.

The key to the nexus between grains and states lies, I believe, in the fact that only the cereal grains can serve as a basis for taxation: visible, divisible, assessable, storable, transportable, and "rationable." Other crops—legumes, tubers, and starch plants—have some of these desirable state-adapted qualities, but none has all of these advantages. To appreciate the unique advantages of the cereal grains, it helps to place yourself in the sandals of an ancient tax-collection official interested, above all, in the ease and efficiency of appropriation.

The fact that cereal grains grow above ground and ripen at roughly the same time makes the job of any would-be taxman that much easier. If the army or the tax officials arrive at the right time, they can cut, thresh, and confiscate the entire harvest in one operation. For a hostile army, cereal grains make a scorched-earth policy that much simpler; they can burn the harvest-ready grain fields and reduce the cultivators to flight or starvation. Better yet, a tax collector or enemy can simply wait until the crop has been threshed and stored and confiscate the entire contents of the granary. In practice, in the case of the medieval tithe, the cultivator was expected to assemble the unthreshed grain in sheaves in the field, from which the tithe collector would take every tenth sheaf.

Compare this situation with, say, that of farmers whose staple crops are tubers such as potatoes or cassava/manioc. Such crops ripen in a year but may be safely left in the ground for an additional year or two. They can be dug up as needed and the remainder stored where they grew, underground. If an army or tax collectors want your tubers, they will have to dig them up tuber by tuber, as the farmer does, and then they will have a cartload of potatoes which is far less valuable (either calorically or at the market) than a cartload of wheat, and is also more likely to spoil quickly. Frederick the Great of Prussia, when he ordered his subjects to plant potatoes, understood that, as planters of tubers, they could not be so easily dispersed by opposing armies.

The “aboveground” simultaneous ripening of cereal grains has the inestimable advantage of being legible « and assessable by the state tax collectors. These characteristics are what make wheat, barley, rice, millet, and maize the premier political crops. A tax assessor typically classifies fields in terms of soil quality and, knowing the average yield of a particular grain from such soil, is able to estimate a tax. If a year-to-year adjustment is required, fields can be surveyed and crop cuttings taken from a representative patch just before harvest to arrive at an estimated yield for that particular crop year. As we shall see, state officials tried to raise crop yields and taxes in kind by mandating techniques of cultivation; in Mesopotamia this included insisting on repeated ploughing to break up the large clods of earth and repeated harrowing for better rooting and nutrient delivery. The point is that with cereal grains and soil preparation, the planting, the condition of the crop, and the ultimate yield were more visible and assessable. Compare this, for example, with the attempt to assess and tax the commercial activity of buyers and sellers in the market. One reason for the official distrust and stigmatization of the merchant class in China was the simple fact that its wealth, unlike that of the rice planter, was illegible, concealable, and fugitive. One might tax a market, or collect tolls on a road or river junction where goods and transactions were more transparent, but taxing merchants was a tax collector’s nightmare.

For purposes of measuring, dividing, and assessing, the simple fact that the cereal harvest consists ultimately of small grains, husked or unhusked, has enormous administrative advantages. Like grains of sugar or sand, cereal grains are almost infinitely divisible, down to smaller and smaller fractions and precisely measurable by weight and volume for accounting purposes. Units of grain served as standards of measurement and value for trade and tribute against which the value of other commodities was calculated—including labor. The daily food ration of the lowest class of laborers in Umma, Mesopotamia, was almost exactly two liters of barley measured out in the beveled bowls that are among the most ubiquitous archaeological finds.

But why is there not a chickpea or lentil state? After all, these are nutritious crops that can be grown intensively, and their harvest consists of small seeds that can be dried, keep well, and can as easily be divided and measured out in small quantities as rations as the cereal grains. Here the decisive advantage of the cereal grains is their determinate growth and hence virtually simultaneous ripening. The problem with most of the legumes, from a tax collector’s perspective, is that they produce fruit continuously over an extended period. They can be, and are, picked right along as they ripen—like beans or peas. If the tax collector arrives early, much of the crop will not yet have ripened, and if he arrives late, the taxpayer will probably have eaten, hidden, or sold much of the yield. One-stop shopping on the part of the tax collector works best for determinate-ripening crops. The cereal crops of the Old World were, in this sense, preadapted for state making. The New World—save for the mixed case of maize, which can be picked right along or left to mature and dry in the field—has few if any determinate, whole-field, simultaneously ripening crops, hence none of the harvest festival tradition that so dominates the Old World agricultural calendar. It leaves one to speculate whether determinate ripening was selected for by early Neolithic cultivators and if so, why, say, determinate ripening of chickpeas and lentils could not have been similarly selected for.

Even so, grain taxation is not foolproof. Though a given cereal crop, once planted, ripens simultaneously, the seasonality often allows for varying planting dates, so different fields may mature at slightly different times. It is also not uncommon for a tax-avoiding cultivator to harvest surreptitiously some of the grains before they are fully ripe in order to escape the tax. Archaic states endeavored, whenever possible, to mandate a planting time for a given district. In the case of irrigated wet rice, all adjoining fields are flooded at roughly the same time, and this alone dictates the (trans)planting schedule, not to mention the fact that rice is the only crop that will grow under these conditions.

Cereal grains also lend themselves well to bulk transport. Even under archaic conditions a cartload of grain could be drawn at a profit greater distances than almost any other food commodity. And where water transport was available, large quantities of grain could be shipped considerable distances, thereby greatly expanding the agricultural heartland an early state might hope to dominate and from which it could extract taxes. One account of the Third Dynasty of Ur (Ur III late third millennium BCE) claims that « barges carried fully half of the entire barley harvest of the Ur region to royal depots. Again, for the tax collector of early Mesopotamia and, for that matter, until the nineteenth century, the combination of an agrarian state and a navigable river or coastline was a marriage made in heaven. Rome, for example, found it cheaper to ship grain (usually from Egypt) and wine across the Mediterranean than to ship it overland by cart more than one hundred miles.

Grain, because it has higher value per unit volume and weight than almost any other foodstuff, and because it stores comparatively well, was an ideal tax and subsistence crop. It could be left unhusked until it was needed. It was ideal for distributing to laborers and slaves, for requiring as tribute, for provisioning soldiers and garrisons, for relieving a food shortage or famine, or for feeding a city while resisting a siege. It is hard to imagine the early state without grain as a basis for its sinew and muscle.

Where grain, and therefore agrarian taxes, stopped, there too did the state's power begin to degrade. The power of the early Chinese states was confined to the arable drainage basins of the Yellow and Yangzi Rivers. Beyond this ecological and political heartland of fixed-field and irrigated rice farming lay the hard-to-tax, mobile pastoralists, hunter-gatherers, and shifting cultivators. They were defined as "raw" barbarians, who had "not yet entered the map." The territory of the Roman Empire, for all its imperial ambitions, did not extend much beyond the grain line. Roman rule north of the Alps was concentrated in what archaeologists term, after the Swiss site at which its artifacts were first found, La Tène zone, where population was denser, agricultural production more robust and towns (oppida culture) larger; outside this zone lay "Jastorf Europe," thinly populated and characterized by pastoralism and swiddening.

This contrast is a salutary reminder that outside the earliest grain state lay most of the world and its population as well. The grain states were restricted to a narrow ecological niche that favored intensive agriculture. Beyond their horizon were a variety of what might be called non appropriable subsistence practices, the most important of which were hunting and gathering, maritime fishing and collecting, horticulture, shifting cultivation, and specialized pastoralism.

Looked at from the perspective of a state tax collector, such forms of subsistence were fiscally sterile; they could not repay the cost of controlling them. Hunters and gatherers and maritime foragers were so dispersed and mobile, and their “takings” so diverse and perishable, that tracking them, let alone taxing them, was well-nigh impossible. Horticulturalists, who may well have domesticated roots and tubers well before grain was first planted, could hide a small plot in the forest and leave much of their harvest in the ground until they needed it. Swidden cultivators often planted some grain, but a typical swidden contained dozens and dozens of cultivars of differing maturity. Moreover, swiddeners moved their fields every few years and, occasionally, their dwellings as well. Specialized pastoralism, seen as an outgrowth of agriculture, confronts the would-be tax collector with a similar problem of dispersal and mobility. The Ottoman Empire, founded by pastoralists, found it exceptionally difficult to tax herders. They tried taxing them at the one moment of the year when they stopped to attend to lambing and shearing, but even this was logistically difficult. As Rudi Lindner, a student of Ottoman rule, concluded, “The Ottoman dream of a sedentary paradise with its predictable revenue from pacific farmers had no place for pastoral nomads.” “The nomads followed small scale changes in climate to maximize their access to good pasture and sweet water; consequently they were always on the move.”

In one way or another, nongrain peoples—that it to say most of the world—embodied forms of livelihood and social organization that defeated taxation: physical mobility, dispersal, variable group and community size, diverse and invisible subsistence goods, and few fixed-point resources. It was not as if they were worlds apart, however. Quite to the contrary, as we have noted, exchange and trade flowed vigorously between them. The exchange, however, was uncoerced and depended on bartering and trading desirable goods from one ecological zone to another to mutual advantage. Those practicing a particular form of subsistence often came to be seen as a different kind of people, despite trading partnerships. To Romans, for example, a key defining characteristic of barbarians was that they ate dairy products and meat and not, as Romans did, grain. To the Mesopotamians, the “barbarian” Amorites were beyond the pale because they purportedly “know not grain . . . eat uncooked meat and « and do not bury their dead.”

The various forms of subsistence described above should not be seen as self-contained, impermeable categories. Groups can and did move between subsistence practices and often concocted hybrid practices that defied easy categorization. Nor should we discount the possibility that the choice of subsistence practices was often a political choice—a decision about positionality vis-à-vis the state.

Walls make state: protection and confinement

Most towns in the Mesopotamian alluvium were, by the middle of the third millennium BCE, walled. The state, for the first time, had grown a defensive carapace. Although the sites were generally modest—anywhere from ten to thirty-three hectares on average—building and maintaining such a defensive perimeter, though it might be erected piecemeal, was labor intensive. A wall, in the crudest sense, tells us that there is something valuable being protected or held away from those outside. The existence of walls was an infallible proxy for the presence of permanent cultivation and food storage. And, as if to further confirm the association, when such a city-state collapsed and its walls were permanently breached, permanent cultivation was also likely to disappear from the area. It was common practice for a conquering city to tear down the walls of the town it had defeated. The existence of concentrated, valuable, lootable, fixed-point resources created, self-evidently, a powerful incentive to defend them. Their spatial concentration made it easier to protect them, and their value made the effort worthwhile. There is every reason why a peasantry would do what it could to hold on to its fields and orchards, its homes and its granaries, and its livestock as a matter of life and death. No wonder, then, that the Epic of Gilgamesh, a founding king, erects the city walls to protect his people. On that premise alone, might one see the creation of the state as a joint creation—a social contract, perhaps?—between cultivating subjects and their ruler (and his warriors and engineers) to defend their harvests, families, and livestock from attacks by other statelets or nonstate raider?

But the matter is more complicated. Just as a farmer may have to defend his crops against human and nonhuman predators, so state elites have an overwhelming interest in safeguarding the sinews of their own power: a cultivating population and its grain stores, its privileges and wealth, and its political and ritual powers. As Owen Lattimore and others have observed for the Great Wall(s) of China: they were built quite as much to keep Chinese taxpaying cultivators inside as to keep the barbarians (nomads) outside. City walls were thus intended to keep the essentials of state preservation inside. The so-called anti-Amorite walls between the Tigris and Euphrates may also have been designed more to keep cultivators in the state “zone” than to keep out the Amorites (who were, in any case, already settled in substantial numbers in the alluvium). The walls were, in the view of one scholar, a result of the vastly increased centralization of Ur III and were erected either to contain mobile populations fleeing state control or to defend against those who had been forcibly expelled. It was, in any event, “intended to define the limits of political control.” The control and confinement of populations as the reason and function of city walls depends in large part on demonstrating that the flight of subjects was a real preoccupation of the early state.

Writing makes states: record keeping and legibility

To be governed is to be at every operation, at every transaction, noted, registered, counted, taxed, stamped, measured, numbered, assessed, licensed, authorized, admonished, prevented, reformed, corrected, punished.
—Pierre-Joseph Prudhon

Peasantries with long experience of on-the-ground statecraft have always understood that the state is a recording, registering, and measuring machine. So when a government surveyor arrives with a plane table, or census takers come with their clipboards and questionnaires to register households, the subjects understand that trouble in the form of conscription, forced labor, land seizures, head taxes, or new taxes on croplands cannot be far behind. They understand implicitly that behind the coercive machinery lie piles of paperwork: lists, documents, tax rolls, population registers, regulations, requisitions, orders—paperwork that is for the most part mystifying and beyond their ken. The firm identification in their minds between paper documents and the source of their oppressions has meant that the first act of many peasant rebellions has been to burn down the local records office where these documents are housed. Grasping the fact that the state saw its land and subjects through record keeping, the peasantry implicitly assumed that blinding the state might end their woes. As an ancient Sumerian saying aptly puts it: “You can have a king and you can have a lord, but the man to fear is the tax collector.”

Southern Mesopotamia was the heartland of not one but several related state-making experiments between roughly 3,300 and 2,350 BCE. Like China’s Warring States period or the later Greek city-states, the southern alluvium was the site of rivalrous city-polities whose fortunes waxed and waned. Among the best known were Kish, Ur, and, above all, Uruk. Something utterly remarkable and without historical parallel was taking place here. On one hand, groups of priests, strong men, and local chiefs were scaling up and institutionalizing structures of power that had previously used only the idioms of kinship. They were creating for the first time something along the lines of what we would call a state, though they could not possibly have understood it in those terms. On the other hand, thousands of cultivators, artisans, traders, and laborers were being, as it were, repurposed as subjects and, to this end, counted, taxed, conscripted, put to work, and subordinated to a new form of control.

It is at roughly this time that writing makes its first appearance. The coincidence of the pristine state and pristine writing tempts one to the crude functionalist conclusion that would-be state makers invented the forms of notation that were essential to statecraft. But it would not be too strong to assert that it is virtually impossible to conceive of even the earliest states without a systematic technology of numerical record keeping, even if it took the Inka form of strings of knots (quipu). The first condition of state appropriation (for whatever purpose) must be an inventory of available resources—population, land, crop yields, livestock, storehouse stocks. This information is, however, like a cadastral survey, a snapshot soon out of date. As appropriation proceeds, continuous record keeping is required—of grain deliveries, corvée labor performed, requisitions, receipts, and so on. Once a polity comprises even a few thousand subjects, some form of notation and documentation beyond memory and oral tradition is required.

A powerful case for linking state administration and writing is that it seems to have been used in Mesopotamia essentially for bookkeeping purposes for more than half a millennium before it even began to reflect the civilizational glories we associate with writing: literature, mythology, praise hymns, kings lists and genealogies, chronicles, and religious texts. The magnificent Epic of Gilgamesh, for example, dates from Ur’s Third Dynasty (circa 2,100 BCE), a full millennium after cuneiform had been first used for state and commercial purposes.

What can one infer from the trove of cuneiform tablets that have been recovered and translated about actual governance on the ground in Sumer? They reveal, at a minimum, the massive effort through a system of notation to make a society, its manpower, and its production legible to its rulers and temple officials, and to extract grain and labor from it. Surely we know enough about even quite modern bureaucracies to realize that there is no necessary relation between the records on the one hand and the facts on the ground on the other. Documents are forged and fiddled for private advantage or to please superiors. Rules and regulations laid out meticulously in the documents may be a dead letter on the ground. Land records may be corrupt, absent, or simply inaccurate. The order of the records office, like the order of the parade ground, too often masks rampant disorder in actual administration and on the battlefield. What the records can tell us, however, is something about the utopian, Linnaean order in statecraft that is implicit in the logic of record keeping, its categories, its units of measurement, and, above all, in the things it pays attention to. The « The "gleam in the eye" of what I think of as the "quartermaster state"—is most instructive. As a mark of this aspiration, the very symbol of kingship in Sumer was the "rod and line," almost certainly the tools of the surveyor. We can see this state imagination at work in a brief examination of Mesopotamia and early Chinese administrative practice.

The earliest administrative tablets from Uruk (Level IV), circa 3,300–3,100 BCE, are lists, lists, and lists—mostly of grain, manpower, and taxes. The topics of the surviving tablets in order of frequency are barley (as rations and taxes), war captives, male and female slaves. A preoccupation at Uruk IV and later in other centers is the population roll. As in all ancient kingdoms, maximizing population was an obsession that usually superseded the conquest of territory per se. Population—as producers, soldiers, and slaves—represented the wealth of the state. The city of Umma, a dependency of Ur, where a huge trove of tablets has been found dating from about 2,255 BCE, was especially precocious, occupying one hundred hectares and having between ten thousand and twenty thousand inhabitants—a large population to administer. At the core of Umma's project of legibility was a census of population by location, age, and gender as the basis for assigning the head tax and corvée labor, and for conscription. It was the "immanent" project, never realized in practice except perhaps for the temple economy and dependent labor force. Landholdings, apparently both temple and private, were designated by their size, the quality of their soil, and the expected crop yield, which served as the basis for a tax assessment. Some of the Sumerian polities, especially Ur III, look like command-and-control economies, heavily centralized (on paper—or, rather, on tablet), militarized, and regimented, resembling what we know of militarized Sparta among the Greek city-states. One tablet records 840 rations of barley, meted out, in all probability in the (mass produced?) beveled bowls holding two liters of barley. Other rations mention beer, groats, and flour. Labor gangs, whether of war captives, slaves, or corvée laborers, seem ubiquitous.

The entire exercise in early state formation is one of standardization and abstraction required to deal with units of labor, grain, land, and rations. Essential to that standardization is the very invention of a standard nomenclature, through writing, of all the essential categories—receipts, work orders, labor dues, and so on. The creation and imposition of a written code throughout the city-state replaced vernacular judgments and was itself a distance-demolishing technology that held sway throughout the small realm. Labor standards were developed for such tasks as ploughing, harrowing, or sowing. Something like "work points" were created, showing credits and debits in work assignments. Standards of classification and quality were specified for fish, oil, and textiles—which were differentiated by weight and mesh. Livestock, slaves, and laborers were classified by gender and age. In embryonic form, the vital statistics of an appropriating state aiming to extract as much value as possible from its land and people is already in evidence. How formidable this regimentation looked on the ground is another matter.

Writing appears in early China more than a millennium later along the Yellow River. It may have begun in the Erlitou cultural area, though no evidence survives. It is most famously known in the Shang Dynasty (1,600–1,050 BCE), through the finds of oracle bones used for divination. From then and on through the Warring States period (476–221 BCE), it was continuously in use, particularly for purposes of state administration. Only with the famous, reforming, and short-lived Qin Dynasty (221–206 BCE), however, does the nexus between writing and state making become clearest. The Qin, rather like Ur III, was a systematizing, order-obsessed regime that laid out a rather comprehensive vision of the total mobilization of its resources.

On paper, at least, it was even more ambitious. Neither in China nor in Mesopotamia was writing originally devised as a means of representing speech.

A precondition of the standardization and simplification the Qin aimed at was a reformed and unified script that eliminated a quarter of the ideograms, made it more rectilinear, and applied it throughout its territory. Since the script was not a transcription of a speech dialect, it had, inherently, a kind of universality.36 As with other early precocious states, the process of standardization was applied to coinage and to units of weight, distance, and volume for, among other things, grain and land. The intention was to eliminate a host of local, vernacular, and idiosyncratic practices of measurement so that, for the first time, the ruler at the center could have a clear view of the wealth, production, and manpower resources at his disposal. It aimed at creating a centralized state rather than merely a strong city-state that was content to extract occasional tribute from a constellation of quasi-independent satellite towns. Sima Qian, a court historian under the Han, looked back favorably on Qin Emperor Shang Yang's accomplishment in fashioning his kingdom into an austere war machine: "For the fields, he opened up the qian and the ma (horizontal and vertical pathways), and set up boundaries." "He equalized « the military levies and land tax and standardized the measures of capacity, weights and length." Later, work norms and tools were standardized as well.

In the context of regional military rivalry with competing statelets, it was important to squeeze as much as possible from the realm. This meant creating and updating as complete an inventory of resources as possible, given the available techniques. Meticulous household registration to facilitate the head tax and conscription was a sign of power, as was a large and growing population. Captives were settled near the court, and regulations restricted population movement. One of the hallmarks of early statecraft in agrarian kingdoms was to hold the population in place and prevent any unauthorized movement. Physical mobility and dispersal are the bane of the tax man.

Land, happily for the tax collector, does not move. But as the Qin recognized private landholding, it conducted an elaborate cadastral survey connecting each piece of cropland with an owner/taxpayer. Land was classified by soil quality, crops sown, and variation in rainfall, which allowed tax officials to compute an expected yield and arrive at a tax rate. The Qin tax system also provided for estimates of standing crops on an annual basis, permitting, at least in theory, for tax adjustments according to actual harvests.

We have thus far concentrated on the intention of state officials, through writing, statistics, censuses, and measurement, to move beyond sheer plunder and to more rationally extract labor and foodstuffs from their subjects. This project, while perhaps the most important, is hardly the only policy by which a state attempts to sculpt the landscape of the polity to make it richer, more legible, and more amenable to appropriation. Though the early state did not invent irrigation and water control, it did extend irrigation and canals to facilitate transport and enlarge grain lands. Whenever it could it increased both the numbers and legibility of its productive population by forced resettlement of subjects and war captives. The "equal field" concept of the Qin was in large part to make sure that all subjects had enough land to pay taxes and to provide a population base for conscription. « Under the Qin, reflecting the importance of population, the state not only forbade flight but instituted a pro-natalist policy, with tax breaks to women and their families who gave birth to new subjects. The late-Neolithic resettlement camp was the kernel of the earliest states, but much of early statecraft was an artful political landscaping to facilitate appropriation: more grain land, a larger and more concentrated population, and the information software made possible by written records that could make it all more accessible to the state. Efforts at root and branch political landscaping may have been the undoing of the most ambitious early states. The superregimented Third Dynasty of Ur lasted barely a century and the Qin only fifteen years.

If early writing is so inextricably bound to state making, what happens when the state disappears? What little evidence we do have suggests that without the structure of officials, administrative records, and hierarchical communication, literacy shrinks greatly if it does not disappear altogether. This should not be surprising inasmuch as in the earliest states, scriptural literacy was confined to a very thin veneer of the population, most of whom were officials. From roughly 1,200 to 800 BCE, Greek city-states disintegrated in an era known as the Dark Age. When literacy reappeared it no longer took the old form of Linear B but was an entirely new script borrowed from the Phoenicians. It was not as if all Greek culture disappeared in the interim. Instead, it took oral forms, and we owe both the Odyssey and the Iliad, later transcribed, to this period. Even the fragmentation of the Roman Empire, with its more extensive literary tradition, in the fifth century CE led to the near disappearance of literacy in Latin outside a few religious establishments. One suspects that in the earliest states, writing developed first as a technique of statecraft and was therefore as fragile and evanescent an achievement as the state itself.

What if we were to think of literacy in the earliest societies as one technology of communication, just as crop planting is one among many techniques of subsistence? The techniques of planting were known long before they found widespread use, and then only in particular ecological and demographic circumstances. In the same sense, it is not as if the world were “dark” until writing was invented, after which all societies adopted or aspired to adopt literacy. The first writing was, as well, an artifact of state building, concentration of population, and scale. It was inapplicable in other settings. One student of early writing in Mesopotamia suggested, admittedly speculatively, that writing was elsewhere resisted because of its indelible association with the state and taxes, just as ploughing was long resisted because of its indelible association with drudgery.

> [Why did] every distinctive community on the periphery reject the use of writing with so many archaeological cultures exposed to the complexity of southern Mesopotamia? One could argue that this rejection of complexity was a conscious act. What is the reason for it? . . . Perhaps, far from being less intellectually qualified to deal with complexity, the peripheral peoples were smart enough to avoid its oppressive command structures for at least another 500 years, when it was imposed upon them by military conquest. . . . In every instance the periphery initially rejected the adoption of complexity even after direct exposure to it . . . and, in doing so, avoided the cage of the state for another half millennium.

3. Taming the grain

Simplifying

In : James Scott, *Seeing Like a State*, New Haven, Yale University Press, 1998: 264-270

Cultivation is simplification. Even the most cursory forms of agriculture typically produce a floral landscape that is less diverse than an unmanaged landscape. The crops that mankind has cultivated have, when fully domesticated, become dependent for their survival upon the management of cultivators - such activities as making a clearing, burning brush, breaking the soil, weeding, pruning, manuring. Strictly speaking, a crop in the field is not an artificial landscape, inasmuch as all fauna, not excluding human beings, modify their environment in the course of food gathering. What is certain, however, is that most of Homo sapiens's cultivars have been so adapted to their altered landscape that they have become "'biological monsters' " which could not survive in the wild. Millennia of variation and conscious human selection have favored cultivars that are systematically different from their wild and weedy cousin. Our convenience has led us to prefer plants that have large seeds and are easy to germinate, have more blossoms and hence more fruit, and whose fruits are more easily threshed or shelled. Cultivated maize thus has a few large ears with large kernels whereas wild or semidomesticated maizes have very small cobs with small kernels. The difference is most starkly captured by the contrast between the huge, seed-laden commercial sunflower and its diminutive woodland relative.

Beyond the question of the harvest itself, of course, cultivators have also selected for scores of other properties: texture, flavor, color, storage quality, aesthetic value, grinding and cooking qualities, and so on. The breadth of human purposes has led not to a single, ideal cultivar of each species but rather to a great many varieties, each distinctive in some important way. Thus we have the varieties of barley grown for porridge, for bread, for beer, and for feeding livestock; and thus “sweet sorghum for chewing, white-seeded types for bread, small, dark, red-seeded types for beer, and strong-stemmed, fibrous types for house-construction and basketry.”

The greatest selection pressure, however, came from the dominant anxiety of cultivators: that they not starve. This most basic of existential concerns also led to a great variety of cultivars, termed the “landraces” of the various crops. Landraces are genetically variable populations that respond differently to different soil conditions, levels of moisture, temperature, sunlight, diseases and pests, microclimates, and so forth. Over time, traditional cultivators, operating as experienced applied botanists, have developed literally thousands of landraces of a single species. A working knowledge of many, if not all, of these land- races provided cultivators with enormous flexibility in the face of environmental factors that they could not control.

For our purposes, the long development of so many landraces is significant in at least two respects. First, while early farmers were transforming and simplifying their natural environment, they also had a surpassing interest in fostering a certain kind of diversity. A combination of their wide interests and their concern about the food supply impelled them to select and protect many landraces. The genetic variability of the crops they grew provided some built-in insurance against drought, flooding, plant diseases, pests, and the seasonal vagaries of climate. A pathogen might affect one landrace but not another; some landraces would do well in a drought, others in wet conditions; some would do well in clayey soil, others in sandy soil. Placing a large number of prudent bets, finely tuned to microlocal conditions, the cultivator maximized the dependability of a tolerable harvest.

The variety of landraces is significant in another sense. All modern crops of any economic significance are the product of landraces. Until about 1930 all scientific crop breeding was essentially a process of selection from among the existing landraces. Landraces and their wild progenitors and "escapes" represent the "germ plasm" or seed-stock capital upon which modern agriculture is based. In other words, as James Boyce has put it, modern varieties and traditional agriculture are complements, not substitutes.

Twentieth-Century Agriculture

Modern, industrial, scientific farming, which is characterized by monocropping, mechanization, hybrids, the use of fertilizers and pesticides, and capital intensiveness, has brought about a level of standardization into agriculture that is without historical precedent. Far beyond mere monocropping on the model of scientific forestry explored earlier, this simplification has entailed a genetic narrowing fraught with consequences that we are only beginning to comprehend. One of the basic sources of increasing uniformity in crops arises from the intense commercial pressures to maximize profits in a competitive mass market. Thus the effort to increase planting densities in order to stretch the productivity of land encouraged the adoption of varieties that would tolerate crowding. Greater planting densities have, in turn, intensified the use of commercial fertilizers and therefore the selection of subspecies known for high fertilizer (especially nitrogen) uptake and response. At the same time, the growth of great supermarket chains, with their standardized routines of shipping, packaging, and display, has inexorably led to an emphasis on uniformity of size, shape, color, and "eye appeal." The result of these pressures was to concentrate on the small number of cultivars that met these criteria while abandoning others. The production of uniformity in the field is best grasped, however, through the logic of mechanization. As factor prices in the West have, since at least 1950, favored the substitution of farm machinery for hired labor, the farmer has sought cultivars that were compatible with mechanization. That is, he selected crops whose architecture did not interfere with tractors or sprayers, which ripened uniformly, and which could be picked in a "once-over" pass of the machine.

Given the techniques of hybridization being developed at roughly the same time, it was but a short step to creating new crop varieties bred explicitly for mechanization. "Genetic variability," as Jack Ralph Kloppenberg notes, "is the enemy of mechanization." In the case of corn, hybridization-the progeny of two inbred lines-produces a field of the genetically identical individuals that are ideal for mechanization. Varieties developed with machinery in mind were available as early as 1920, when Henry Wallace joined forces with a manufacturer of harvesting equipment to cultivate his new, stiff-stalked variety with a strong shank connecting the ear to the stalk. An entire field of plant breeding, termed "phytoengineering," was thus born in order to adapt the natural world to machine processing. "Machines are not made to harvest crops," noted two proponents of phytoengineering. "In reality, crops must be designed to be harvested by machine." Having been adapted to the cultivated field, the crop was now adapted to mechanization. The "machine-friendly" crop was bred to incorporate a series of characteristics that made it easier to harvest it mechanically. Among the most important of these characteristics were resilience, a concentrated fruit set, uniformity of plant size and architecture, uniformity of fruit shape and size, dwarfing (in the case of tree crops especially), and fruits that easily break away from the plant.

The development of the "supermarket tomato" by G. C. (Jack) Hanna at the University of California at Davis in the late 1940s and 1950s is an early and diagnostic case. Spurred by the wartime shortage of field labor, researchers set about inventing a mechanical harvester and breeding the tomato that would accommodate it. The tomato plants eventually bred for the job were hybrids of low stature and uniform maturity that produced similarly sized fruits with thick walls, firm flesh, and no cracks; the fruits were picked green in order to avoid being bruised by the grasp of the machinery and were artificially ripened by ethylene gas during transport. The results were the small, uniform winter tomatoes, sold four to a package, which dominated supermarket shelves for several decades. Taste and nutritional quality were secondary to machine compatibility. Or to put it more charitably, the breeders did what they could to develop the best tomato within the very sharp constraints of mechanization.

The imperatives of maximizing profits and hence, in this case, of mechanizing the harvest worked powerfully to transform and simplify both the field and the crop. Relatively inflexible, nonselective machines work best in flat fields with identical plants growing uniform fruits of perfectly even maturity. Agronomic science was deployed to approximate this ideal: large, finely graded fields; uniform irrigation and nutrients to regulate growth; liberal use of herbicides, fungicides, and in- secticides to maintain uniform health; and, above all, plant breeding to create the ideal cultivar.

The Unintended Consequences of Simplification

Reviewing the history of major crop epidemics, beginning with the Irish potato famine in 1850, a committee of the United States National Research Council concluded: "These encounters show clearly that crop mono-culture and genetic uniformity invite epidemics. All that is needed is the arrival on the scene of a parasite that can take advantage of the vulnerability. If the crop is uniformly vulnerable, so much the better for the parasite. In this way virus diseases have devastated sugar beets with 'yellows,' peaches with yellows, potatoes with leaf roll and X and Y viruses, cocoa with swollen shoot, clover with sudden death, sugarcane with mosaic, and rice with hoja blanca." After a corn leaf blight had devastated much of the 1970 corn crop, the committee had been convened in order to consider the genetic vulnerability of all major crops. One of the pioneer breeders of hybrid corn, Donald Jones, had foreseen the problems that the loss of genetic diversity might bring: "Genetically uniform pure line varieties are very productive and highly desirable when environmental conditions are favorable and the varieties are well-protected from pests of all kinds. When these external factors are not favorable, the result can be disastrous . . . due to some new virulent parasite."

The logic of epidemiology in crops is relatively straightforward in principle. All plants have some resistance to pathogens; otherwise they and the pathogen (if it preyed upon only that plant) would disappear. At the same time, all plants are genetically vulnerable to certain pathogens. If a field is populated exclusively by genetically identical individuals, such as single-cross hybrids or clones, then each plant is vulnerable in exactly the same way to the same pathogen, be it a virus, fungus, bacterium, or nematode. Such a field is an ideal genetic habitat for the proliferation of precisely those strains or mutants of pathogens that thrive and feed on this particular cultivar. The uniform habitat, especially one in which plants are crowded, exerts a natural selection pressure, as it were, that favors such pathogens. Given the right seasonal conditions for the pathogen to multiply (temperature, humidity, wind, and so on), the classic conditions for the geometric progression of an epidemic are in place.

In contrast, diversity is the enemy of epidemics. In a field with many species of plants, only a few individuals are likely to be susceptible to a given pathogen, and they are likely to be widely scattered. The mathematical logic of the epidemic is broken. A monocropped field, as the National Research Council report noted, increases vulnerability appreciably inasmuch as all members of the same plant species share much of their genetic inheritance. But where a field is populated by many genetically diverse landraces of a given species, the risk is vastly reduced. Any agricultural practice that increases diversity over time and space, such as crop rotation or mixed cropping on a farm or in a region, acts as a barrier to the spread of epidemics.

The modern regime of pesticide use, which has arisen over the past fifty years, must be seen as an integral feature of this genetic vulnerability, not as an unrelated scientific breakthrough. It is precisely because hybrids are so uniform and hence disease prone that quasi-heroic measures have to be taken to control the environment in which they are grown. Such hybrids are analogous to a human patient with a compromised immune system who must be kept in a sterile field lest an opportunistic infection take hold. The sterile field, in this case, has been established by the blanket use of pesticide.

Corn, as the most widely planted crop in the United States (85 million acres in 1986) and the first one to be hybridized, has provided nearly ideal conditions for insect, disease, and weed buildup. Pesticide use is correspondingly high. Corn accounts for one-third of the total market for herbicides and one-quarter of the market for insecticide. One of the long-term effects, which is readily predictable according to the theory of natural selection, has been the emergence of resistant strains among insects, fungi, and weeds, necessitating either larger doses or a new set of chemical agents. Some pathogens, again predictably, have developed what is termed "cross-resistance" to a whole class of pesticide. As more generations of the pathogen are exposed to the pesticide, the likelihood that resistant strains will emerge is correspondingly greater. Above and beyond the troubling consequences of pesticide use for the organic matter in the soil, groundwater quality, human health, and the ecosystem, pesticides have exacerbated some existing crop diseases while creating new ones.

Just prior to the corn leaf blight in the South in 1970, 71 percent of all acreage in corn was planted to only six hybrids. The specialists investigating the blight stressed the pressures of mechanization and product uniformity that led to a radically narrower genetic crop base. *"Uniformity,"* the report asserted, "is the key word." Most of the hybrids had been developed by the male-sterile method using "Texas cytoplasm." It was this uniformity that was attacked by the fungus *Helminthosporium maydis;* those hybrids created without Texas cytoplasm suffered only trivial damage. The pathogen was not new; in its report, the National Research Council committee imagined that it was probably in existence when Squanto showed the Pilgrims how to plant corn. While *H. maydis* may have from time to time produced more virulent strains, "American corn was *too variable* to give the new strain a very good foothold." What was new was the vulnerability of the host.

The report went on to document the fact that "most major crops are impressively uniform genetically and impressively vulnerable [to epidemic]. Exotic germ plasm from a rare Mexican landrace proved to be the solution to breeding new hybrids that were less susceptible to the blight. In this and many other cases, it was only the genetic diversity created by a long history of landrace development by nonspecialists that provided a way out. Like the formal order of the planned section of Brasilia or collectivized agriculture, modern, simplified, and standardized agriculture depends for its existence on a "dark twin" of informal practices and experience on which it is, ultimately, parasitic.

The construction of a planned seed-economy

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Considering the technocratic and modernist aspects of wartime food and agricultural policy does not only allow for a richer perspective on postwar agricultural modernization. It opens the way to a more comprehensive understanding of the nature of the Vichy regime and the role scientists played in its construction. The scarcity of basic goods, the destruction of infrastructures, and the economic demands of the Germans combined to create the conditions for the emergence of a state-led agricultural economy, and for a shift in the state's vocation, from the mere regulation of commercial exchanges to an effective orientation and rationalization of agricultural production itself.

A key aspect of this shift was the constitution of seeds as an object of state policy and the rise of a planned seed-economy. A new biopolitical connection between state and seeds emerged, with the following defining features: (1) Seeds were considered a priority target for state intervention because they were seen as the easiest and fastest way to transform agricultural practices at large. (2) The state acquired the power of life and death over plant genomes in the nation's landscapes. Owing to the support of the seed business's corporative organization, it became the commanding arm of a phyto-eugenics that was both positive (aiming to encourage the diffusion of varieties deemed healthy or higher yielding) and negative (aiming to suppress varieties deemed obsolete). (3) The ontology of "genetic modernism" considered living beings as having an intrinsic genetic identity, sealed from the vagaries of the environment, and favored serial forms of life, in Baudrillard's meaning of the term, which were achieved materially through genetic purity, i.e., the production of plant populations composed of individuals with exactly the same genetic composition (clones, pure lines, F1 hybrids). (4) Such pure line ontology, planned seed-economy practices, and phyto-eugenic visions combined in a biopolitics geared towards superseding a nexus of biocultural crop evolutionary processes, under farmers' management, with centralized planning for the genetic improvement of French agriculture. (5) The discourse of genetic modernization established a sharp divide between landraces as "genetic resources" and the elite cultivars crafted by science, between past and present, between farmers and scientists, thus justifying a division of labor between breeders, in charge of controlling *reproduction*, and farmers, in charge of operating *production*.

Michel Foucault coined the term "biopolitics" for all government techniques emerging after the eighteenth century (statistics, demography, public health, etc.) that address individuals as components of a population rather than as individual subjects within a hierarchical framework. This notion, which Foucault originally applied to the management of human beings, is also useful in understanding how the genetic quality of livestock and crop plant populations became an object of state policies in the twentieth century to transform peasant societies. […] In the same vein as Karl Polanyi's thesis on the reaction of European societies to the social dislocation established by an unrestrained free market, many historians have documented a continuous rise of interventionist economic policies, from the early 1930s up to the postwar years, through the Vichy regime and the Popular Front, regardless of these governments' diverse political orientations. A "technocrat" movement, made up of an heterogeneous mix of social Catholics, business executives, socialists, corporatists, and high-ranking civil servants graduated from the Grandes Ecoles, emerged after the Great Depression advocating a post-liberal planned economy. Its influence resulted in new schemes, measures, and institutions under the left-wing Popular Front, the proto-fascist Vichy regime, and post–World War II governments.

Vichy's ruling elite was dominated by senior military personnel and conservative Catholics. Only a few of the Third Republic's members of Parliament were part of the first Pétain government, and all of them were dismissed in December 1940. Under the motto "Work, Family, Homeland" instead of "Liberté, Egalité, Fraternité," the regime was the revenge of the armed forces and the authoritarian conservatives over the republic. But it was also a "triumph of administration over politics," as Yves Bouthillier put it. Bouthillier, the finance minister, was part of Vichy's young modernist guard. This included Pierre Pucheu, a graduate of the École normale supérieure and top manager of the Worms Bank, who became Minister of the Interior under Vichy; François Lehideux, a graduate of Sciences Po and Director General of Renault, who headed Vichy's newborn Plan administration (Délégation à l'Équipement national) […] and so on. Along with the old-fashioned agrarian conservative discourses of Maréchal Pétain, the Vichy government gave key positions to this new type of expert willing to modernize the French economy and merge the state and big business under the banner of technical progress. Under the shadow of the Pétainist old guard, these technocrats seized power and used the "Révolution Nationale" and wartime challenges as an opportunity for a "rational" ordering of French society and economy. All economic sectors were assigned a corporative organization endowed with vast powers, headed by representatives from major companies and state technicians, united under the banner of alleged apoliticism and the pressing needs of the nation. Vichy's authoritarian ideology, as well as wartime penury, demanded a central allocation of manpower, raw materials, and energy, which provided an opportunity to expand the power of the administration, unchecked by democratic parliamentary control, over French society.

The same pattern applied to agricultural policy: forms of intervention inaugurated by the Popular Front were not discarded but rather reinforced under Vichy. For instance, partly inspired by Soviet, Italian, and colonial experiences, the Popular Front government established a Wheat Board (Office du Blé) to protect farmers from market forces. The Wheat Board gained monopolistic control over foreign and domestic wheat trade. Initially spurned as "statist" by corporatist leaders of the agrarian right, it was eventually reinforced and expanded into a Cereal Board by the Vichy government, to address the difficulties of food provisioning.

The Corporation Paysanne (Peasant Corporation), established in August 1940, took over the role of farmers unions. This was an institutionalization of a corporatist ideology, born in the 1930s in the agrarian right, which was partly and selectively inspired by German and Italian fascist experiences. This French agrarian corporatist ideology postulated a single social group of farmers, organized into a single economic/moral/political organization, and promoted peasants autonomy from both the market and the state. In practice, however, as in other fascist regimes, the corporative system, rather than an instrument of farmers' autonomy, quickly became an instrument for the state to keep a firmer grip on food production. […]

Henri Dorgères, former leader of the Greenshirts fascist movement, was appointed as Corporation Paysanne's delegate-general for propaganda. He coined the term "the peasant Marshal" for Pétain. From his first speeches, Pétain indeed asserted peasantism as his regime's official creed. There were certainly many Vichyites—Pétain himself heading the list—whose ideal was a pre-industrial traditional and docile peasantry as a social basis for the Regime. But this was not the dominant view. Most men who gained positions of influence in the Department of Agriculture and Food Supply, the Cereal Board, and the Corporation Paysanne were trainees of the Grandes Ecoles engineering schools, owners of mid-size or large advanced farms, or both. […] Far from Pétainist bucolic pastorals, they represented the interests of "advanced," specialized farmers, an elite advocating change, advance, and reform. In March 1941, Caziot's law on the regrouping of lands (*remembrement*) endeavored to tackle the problem of fragmented farmholdings. […] Lehideux's Plan administration (Délégation à l'Équipement national) and the services of the Ministry of Agriculture also launched "a war against waste-land." [...] They set out to develop "sterile" hectares through irrigation and drainage works. More generally Vichy officials envisioned to "sanitize" infested areas, "improve" the nation's territory, and "regenerate" the French population (youth movement camps operated on some of these works). One of the largest projects endeavored to turn the marshes of the Crau (Camargue, near Marseille) into 35,000 hectares of fields devoted to rice cultivation, so as to replace imports from Indochina.

As problems of food supply intensified, Corporation Paysanne officials and civil servants of the Ministry of Agriculture and Food Supply attempted to increase their control over agricultural production. As early as mid-1940, the food situation had become worrisome due to several converging factors: a shortage of manpower in farms; the 1939–1940 winter had been particularly cold, resulting in a poor harvest; transportation was disorganized; and France had been divided into annexed, prohibited, occupied, and "free" zones, etc. Furthermore, the Collaboration agreements stipulated the German requisition of French production for the war. By mid-1940, the German authorities forced the French government to set the official food ration lower that the food ration in Germany and at a level below human physiological needs (a daily intake of 1,500 calories, instead of the recommended 2,000–2,500). The Nazi authorities also forced the French administration to set agricultural prices at low levels so that produce could be bought cheaply by German traders, either through official transactions or on the black market, which they actively encouraged. Food supply problems only worsened from 1940 to 1944, due to an increasing quantity of produce bought or confiscated by the Germans, the fact that France was cut from its colonies, and the rise of the black market. In the fall of 1940, widespread discontent began to be felt among the population, sometimes expressed as labor or housewives' protests. Securing food supply became a critical political legitimacy problem for the regime. […]

A new corporative organization, the GNIS (Groupement National Interprofessionnel des Semences), under the leadership of major firms such as Desprez and Vilmorin, took over the management of the seed sector in October 1941. This forced seed-producing farmers, seed traders, and breeders into a compulsory organization whose decisions were binding on their members. All seed companies and seed producers had to be "French" and to be registered with the GNIS, although some applications could be rejected if certain technical standards (including purity) were not met. In February 1942, a technical standing committee for the seed sector was created, the Comité Technique Permanent de la Sélection des plantes cultivées (CTPS, Permanent Technical Committee for Plant Breeding).This committee, made up of private breeders, seed-producing farmers cooperatives' representatives, public plant geneticists, and civil servants, became the commanding arm of a planned seed-economy.

It was in this directed economy that plant geneticists won an unequaled position. They became the conductors of a planned seed-economy. In 1942 a seed bureau was set up at the State Secretariat of Agriculture. In 1943, Charles Crépin (1874–1976) was nominated as head of the Research and

Experimentation Service, coordinating governmental laboratories and agricultural stations. […] As he was closely acquainted with certain top civil servants of the Ministry of Agriculture as well as with leaders of the Corporation Paysanne, Crépin exerted a growing influence from 1940 on. As a conservative who had been wounded in during World War I, he was highly esteemed in the Vichy environment thanks to his wooden leg, his *légion d'honneur*, and his military medal, while also commanding respect from German representatives. If, in 1943, Crépin was chosen as the head of the Research and Experimentation Service instead of the soil scientist, Albert Demolon, who had better academic credentials, it was because he embodied a technocratic model of state intervention over agricultural production and distribution which corresponded to the state-controlled style of the time. Furthermore, amid the penury of other inputs such as manpower, pesticides, fertilizers, and machinery, the improvement of seed input for farmers appeared as the most workable option to increase agricultural production.

There were two other plant geneticists besides Crépin who played a key role in the new emerging seeds biopolitics: Bœuf and Jean Bustarret. […] While other agricultural scientists were joining the Resistance, Bustarret, Bœuf, and Crépin took over the reins of French agronomic research, called upon to fuel production for the food supply services and for the Reich. The organization of potato production was one of the first fields in which these geneticists advanced their position. Potatoes were at the time a staple food source both for the French and for the Germans. In early 1941, the Vichy government accepted to deliver 600,000 tons of potatoes to the Reich. The shortage this created, as well as the disorganization around its production and transportation, meant that this food was sorely missed […]. Under the Corporation Paysanne's management, an increasing number of farmers were obliged to enter into "crop contracts," which forced them into handing over their entire output, in exchange for a small premium over the very low set national price. […] Farmers under such contracts were promised to have priority access to seeds and fertilizers, but in 1941 seed potatoes were often delivered to farmers too late (seed potatoes aren't literally seeds). Moreover, they were of a poor quality or from varieties unsuitable for the regions there were distributed in. Finally, the Bureau National de Répartition de la pomme de terre, a para-administrative corporative supply organization controlled by traders, was accused of serving a few wholesalers' private interests rather than ensuring an efficient supply system. […] In July 1941, the State Secretary of Food Supply, former leader of the sugar-beet growers' interest group and close to business interests, was forced to resign. This political crisis created a window of opportunity for some groups within the administrative apparatus, enabling them to reclaim a more state-led, rather than business-led, management of potato production and supply. Together with civil servants of the Ministry of Agriculture, Crépin and Bustarret were involved in this movement and provided technical arguments in favor of it. […] This scheme envisioned the development of a seed chain (breeders to seed producers to farmers) so as to increase the use of certified seeds, and planned their distribution over the territory.

A key technical rationale for the scheme was to provide healthy seeds to farmers, free from viruses causing the "degeneration of potatoes." While some soil scientists and agronomists including Demolon—Crépin's unlucky challenger for the leadership on agricultural research—observed that fertilizers could lessen the virus-related yield losses, Bustarret argued that "the only effective way to fight" was to use virus-free seed potatoes. The production of such "seeds" required "a certain number of rules, which together are known as 'sanitary selection' (*sélection sanitaire*)" including pedigree breeding of healthy strains, multiplication under isolation rules, recurrent "cleansing" (*épuration*) of infected plants in the fields, and so on. Schemes for the production and distribution of virus-free potato "seed" were already underway in

Western Europe in the interwar years, and about 20,000 tons of such "seeds" were produced in France in 1939. But the scaling-up of purification practices to mass-produce virus-free potato "seed" really took in wartime years through the impetus of Bustarret, up to 356,000 tons in 1943 […]. There was more than a kind of semantic appeal in constructing a "French seeds" chain: it was an autarky issue. The government had to pay a high price for seeds bought from the Germans while being forced to sell potatoes at low prices. Building a larger professional group of seed growers—from 3,000 seed producers in 1939 to 25,000 in 1945—was a way to ensure that the added value of seed production would benefit French agriculture.

Bustarret's scheme also instigated an extensive experimental network. In 1941–1942 he spent most of his time visiting Brittany and southwest France to supervise seed distribution and production and variety trials. In 1943 Bustarret was at the head of ninety-eight field trials set up with him by the Corporation Paysanne to test the performance of different cultivars in different environments. It was in this nationwide network that he could experiment with some of his recent crosses and observe the promising behavior of his cultivar *BF 15*, which would be released by INRA, the newborn National Institute for Agricultural Research, in 1947 to great commercial success. […] Bustarret's fieldwork and these nationwide variety testing trials resulted in the publication of the July 5, 1943 Circular as a way to control the circulation of seeds and plant varieties on a national scale. It listed the administrative districts (*départements)* authorized to produce seed potatoes, which meant that in many *départements*, seed potatoes were not allowed to be produced at all. While the potato cultivar register had contained 117 varieties in 1937, the Circular also established a list of a dozen "authorized varieties." All other cultivars were not allowed to be grown for seed production. Among the cultivars sentenced to disappearance, the famous *Rosa* cultivar, still appreciated by cooks today, was discarded for insufficient yields.

In designated *département*s and for "authorized varieties," farmers' groups could act as seed producers. If certified, their potato production would be paid at the national fixed price plus a 20–25 franc premium per quintal. From the planting of the potatoes to their harvest, these seed producers had to comply with the instructions of the controllers supervising multiplication. Surface areas under controlled multiplication by seed producers amounted to no less than 40,000 hectares in 1943 (of which only 25,000 were accepted), supervised by a thousand controllers. In order to achieve this, a growing service of inspection and certification developed within the corporative organization of the seed sector (GNIS), to which authority was given to enforce technical norms, thus building a professional group of seed growers, whose identity was constructed not in the image of peasants but rather in that of bearers of a technical knowledge organized around purity practices. This scale of intervention was no longer a matter of sporadic control over the seed trade; by using corporatist professional discipline enforcement, and providing the technical ideology that legitimized it, Crépin and Bustarret established a regime of ongoing control over seed-producing farmers and tightly controlled state (and professional) technocratic planning of the distribution of plant genotypes throughout the national territory. [… It was only in a wartime context, under the proto-fascist regime of Vichy, that the dream of centralized manipulation of the agricultural landscape's genetic composition could take shape, making it possible to "cleanse" France of a host of varieties deemed to be worthless, and to replace them with "healthier" and more productive varieties.

4. Are There too Many People to Feed?

Famines and Grain Markets

In : Bill Winders. *Grains*, Polity Press, 2016: 66-74

Hunger and the Geopolitics of Grains in History

One fundamental link between grain markets and hunger lies in the grain trade. On the one hand, the grain trade can obviously help to alleviate hunger by providing needed imports for nations or populations that have low food supplies. On the other hand, the grain trade exists in the context of a capitalist world economy where grains and other commodities flow in the direction of profits rather than need. At various points in history, nations have actually exported grains during periods of food crisis or food insecurity. Mike Davis examined the great famines in the late 1800s in countries such as India, China, and Brazil, which led to more than 30 million deaths. He showed how these deaths were, to a significant extent, the result of market dynamics that led to exports, even in times of hunger. [. . .]

The broader context of the world economy of the late 1800s set the stage for such famines. Britain was the dominant world power in the late 1800s, and it constructed the rules of the world economy to support – or compel – free trade, including in agriculture. By the middle of the 1800s, Britain began to invest its surplus capital around the globe, particularly in the construction of railroads. Britain helped finance railroads in the US, continental Europe, Africa, India, Latin America, China, and elsewhere. One of the justifications for doing so was that railroads would help to alleviate periodic famines that might result from shortfalls in production. The argument was that the newly constructed railroads would allow for grains to be brought quickly into famine-struck areas. Britain built extensive railroad lines in India, but this new extensive transportation did not facilitate the arrival of grains for famine relief. Instead, it did just the opposite: the extensive railways helped Indian wheat make its way to Britain, even if the local area was suffering from lack of food. For regions of the globe such as India, Africa, and China, this was part of their incorporation into the world economy. The extraction of resources, including food and labor, went hand-in-hand with the expansion of railroads.

Most germane for our purposes, these regions became important sources of grains for Britain and other European countries. The British food regime rested on the principle of free trade. And throughout the second half of the nineteenth century, Britain imported more and more grain, particularly wheat. British wheat imports increased from 0.6 MMT in 1855 to 1.6 MMT in 1870 to 3.1 MMT in 1885. By 1905, Britain imported about 5 MMT of wheat per year. The growing Indian wheat exports helped to feed this expansion of British wheat imports.

Karl Polanyi also recognized the significance of the market in creating these famines, and his analysis and arguments are worth revisiting here because they ultimately foreshadow many of the underlying dynamics of hunger and food security found today. Polanyi noted, “The actual source of famines in the last fifty years was the free marketing of grain combined with the local failure of incomes. . . . In former times small local stores had been held against harvest failure, but these had been discontinued or swept away into the big market." That is, the grain reserves of the past were eliminated as these regions became incorporated into the world economy. The market and the political forces behind its expansion pushed for the elimination of the reserves for the sake of greater profits through their sale, often through exports.

We can see these dynamics at work in the series of famines that struck India in the 1870s and 1890s. In an ironic twist, India's agricultural production expanded significantly during this period. As Davis notes, "the cotton-and wheat-producing regions . . . were both dynamos of India's late- Victorian export economy and epicenters of mass mortality in the famines of the 1870s and 1890s." That is, the famines struck hardest in the most productive agricultural regions in India. The fruits of agriculture were exported to Britain and elsewhere at low prices. This both reduced the supply of food in the regions and reduced incomes. At the very moment that India's agriculture expanded production to export to Britain, India was struck by famine. The supply of food that had been available for India in the past went to feed the mass of workers in Britain.

While these examples of grain markets exacerbating periods of hunger and famine may seem like the "ancient history" of the nineteenth century, we should consider what they suggest about our current era. Perhaps we should reflect on how changes in the world economy might also facilitate hunger in particular nations or regions. In doing that, we are likely to see that there are indeed similar processes continuing today.

World Hunger and the Recent Geopolitics of Grains: The Food Crisis of 2008

In 2007 and 2008, world grain prices increased substantially, with prices for wheat and rice rising by more than 200 percent. Maize prices saw "similar though less dramatic price increases" at that time as well. This rise in prices made food less accessible for millions of people, and world hunger increased. For example, in Pakistan in 2008, 77 million suffered from hunger, representing almost half of that country's population and a 28 percent increase from March 2007 when 60 million people suffered from hunger. The FAO estimated that more than 840 million people worldwide were hungry each year between 2009 and 2011. And at one point, the FAO estimated that more than 1 billion people in the world were hungry in 2009, in the wake of the global food crisis.

As food prices rose and the threat of hunger spread, more than 30 countries were struck by mass protests and riots. These protests contributed to political instability in dozens of countries. In January 2007, for example, protests erupted in Mexico in response to rising maize prices. Known in the press as the "Tortilla Riots," these protests involved tens of thousands of people and were in response to tortilla prices increasing by 70 percent nationally and as much as 400 percent in some parts of Mexico. The protests prompted the government to control prices and increase food security. […] High grain prices were fueling food riots and general protests across the globe, some of which contributed to policy shifts, violent confrontations, and even changes in political regimes. In this way, grains have the power to transform societies.

While world hunger has steadily declined over the past 50 years, periodic global food crises – such as in 1972 and 2008 – have led to brief increases in the number of undernourished people. Such food crises have not generally resulted from significant changes in the food supply or sharp increases in demand. Instead, dynamics in world grain markets have contributed to food crises in fundamental ways. Several factors contributed to the spike in grain prices that drove the food crisis in 2008: restrictions imposed on rice exports, greater use of grains (especially maize) in biofuels, and the financialization of agriculture. Each of these factors demonstrates how the geopolitics of grains is essential to understanding such crises.

First, several countries imposed restrictions on rice exports in 2007 and 2008, and this was an important factor in the crisis in the global rice market. One might assume that these restrictions were put in place because of a shortage of rice. But as C. Peter Timmer and David Dawe point out, “The actual price panic that resulted, however, had little rationale in the fundamentals of supply and demand.” Between 2000 and 2008, world rice production increased by about 74 MMT, from 594 MMT to 668 MMT. Rather than being caused by low rice production or stocks (that is, rice carried over from previous years), the crisis in the world rice market can be seen as “due in large part to national” policy responses to a broader global context of uncertainty in grains, particularly wheat. That is, because of the instability in the world economy, rice became perceived as being in short supply. The policy responses of different nations reinforced that belief. India and Vietnam, each an important rice exporter, imposed restrictions on rice exports in 2007 and 2008, respectively. […] Even though only a small portion of rice produced worldwide is exported, these national policies limiting exports contributed to the spike in the price of rice. Countries imposed these restrictions in an attempt to stabilize both the domestic supply and the price of rice.

Second, in the years leading up to the global food crisis, several countries implemented national policies that expanded biofuels production. […] This shift toward biofuel production in the US is especially important because it is the world’s leading exporter of maize. Other countries, such as Brazil, also increased biofuel production, but they often used different agricultural commodities, such as sugar or oil palms. The EU also issued targets for increasing biofuels, much of which it gets through imports. The concern in cases like Brazil and the EU is that the expansion of biofuel production will reduce the land devoted to food production. This shift to biofuels, then, contributed to the global food crisis by (1) making world maize prices higher and less stable, and (2) encouraging some countries to shift away from food grains production.

Third, in the decades leading up to the global food crisis, agriculture experienced greater financialization, which is increasingly treating food as a commodity and source of profits. While finance has played a role in agriculture and food for centuries, this has increased over the past few decades. One primary example of financialization can be seen in the commodity futures markets, which were created in Britain and the US in the 1800s to offer protection from market instability and price volatility. Basically, commodity futures are a way to set a price for a specified amount of wheat, for example, to be delivered on a particular date in the future. In the US, various regulations on futures trading were created in the 1920s and 1930s to limit price speculation and attempts to manipulate prices, and the Commodities Futures Trading Commission (CFTC) enforced these regulations. Over the past 30 years or so, however, these regulations have weakened. In the 1980s, banks became permitted to sell commodity investment funds (CIFs) outside of the futures markets, and the CFTC removed some of the regulations and oversight on banks’ trading activities in CIFs in 1991. […] Consequently, a substantial amount of capital flowed into commodities markets, buying up different kinds of grains and other foods. Investments in CIFs increased from US$15 billion in 2003 to US$200 billion in 2008, and CIF “investment soy, corn, wheat, cattle, and hogs ballooned to US$47 billion in 2007, up from US$10 billion just a year earlier.” Because commodities markets actually sell quantities of grains, this influx of investment capital drove up world grain prices. […]

[...] The liberalization of agriculture in the world economy beginning in the 1970s created greater instability in market prices as the national and international policies that helped to stabilize grain production, prices, and trade during the US food regime were weakened. The increased financialization of agriculture, especially regarding futures markets, was part of a broader effort to reduce or eliminate restrictions on finance capital. The large shift of US grains into biofuels was facilitated by the elimination of production controls, which required farmers to stick with a particular commodity to remain eligible for subsidies. Thus, these secular processes – the expansion of liberalization and the end of supply management – laid the foundation for the world economic context in which the global food crisis occurred in 2008.

Food Security and the Geopolitics of Grains

Just as food crises are linked to grain markets, so too is the more general issue of food security. While food crises are periodic disruptions in access to food in the world economy, the concept of food security is about the ongoing and continual access to food, or lack thereof. A variety of factors – including wars, natural disasters, and extreme weather – may reduce food security by decreasing a population's access to food or by reducing the supply of food. Food security and world hunger, however, are more complex than simply increasing the aggregate food supply. [. . .] Even with increased use of agricultural technologies, increased agricultural production in the world, and increased food aid, the supply of food in many countries still declined. Thus, we need to ask what other factors lay behind the availability, accessibility, and even the supply of food. In particular, we need to examine grain markets and the geopolitics of grains.

Agricultural Exports and Food Security

Food security is frequently seen as an issue of food production and food imports. The export of grains, for example, is generally not seen as a detriment to food security. Rather, the export of grains or other food is seen as having a couple of important benefits. First, such exports help to facilitate the development of agriculture by drawing resources in the form of investments, since export agriculture generates revenues. Second, agricultural exports increase national income and allow for greater food imports. In this perspective, Brazil is often held up as a model of development. Brazil has substantially increased its agricultural production and exports at the same time that food insecurity has decreased within the country. This perspective on food exports, however, has significant problems. In the case of Brazil, for example, food security was improved through the Fome Zero (Zero Hunger) policy initiated by President Luiz Ignácio Lula da Silva in 2003, during a period when Brazil's GDP per capita increased by 3.5 percent per year (2003–8) and there were significant improvements in incomes for the poorest people in Brazil. Therefore, specific poverty-reducing policies were put into place to help facilitate the redistribution of income and reduce poverty in Brazil.

Furthermore, we have already seen instances in history in which nations have exported wheat and rice, even while their own populations suffered from hunger. Yet, we can also find several instances of such patterns today, as well. Although many grain-exporting nations (particularly, rice-exporting) put restrictions on exports in 2008 and thereby exacerbated world price increases, in other instances nations have actually exported grains during periods of food crisis or food insecurity. Therefore, food exports can contribute to hunger in important ways, as research has found that "export-oriented production causes food cultivation and access to be geared away from meeting local consumption needs."

We see similar dynamics still at work today in South Asia, a region that is among the most food insecure in the world, with a Global Hunger Index [GHI] rating similar to that of much of Sub-Saharan Africa. [...] India and Pakistan have each exported substantial quantities of rice during the past 20 years. And while these two countries were experiencing "alarming" levels of food insecurity, they also exported increasing amounts of rice during the 2008 food crisis. In fact, Pakistan also exported substantial amounts of wheat, as well. [...] Furthermore, India's rice exports increased substantially in 2010, even though it had a GHI rating of "alarming" at that time. Again, the role of export-oriented agriculture is fundamentally important to understanding issues of food security and hunger. Therefore, food insecurity and hunger are not primarily about the production of food. Rather, market processes and state policies – that is, the political economy of grains – must be considered to understand these issues.

The case of Pakistan is especially illuminating. Wheat is the central grain in Pakistan, and the country had a good wheat harvest in 2008 with more than 20 MMT. [. . .] Why did Pakistan, a country that for almost 20 years had its food security situation labeled "serious" according to the GHI, decide to increase its wheat and rice exports significantly at the very moment that a global food crisis was emerging?

The short answer, of course, centers on grain prices. Certainly for rice, Pakistan had been an exporting nation for several years – again, despite having a high GHI rating. Pakistan was one of the few rice-exporting nations not to restrict exports in 2008. In fact, in 2008 the government instituted minimum export prices to encourage exports. More interesting, though, is the explanation for increased wheat exports, especially since wheat is the primary grain in Pakistan. Saadia Toor notes that the food crisis in Pakistan "manifested itself as a wheat shortage in 2008 . . . [but] the problem was not a shortfall in wheat production."28 Toor highlights a couple of factors that contributed to the crisis in Pakistan. First, the IMF and World Bank encouraged Pakistan to sell its wheat reserves to take advantage of rising world prices in 2007. Second, the government in Pakistan reduced subsidies to wheat farmers, thereby encouraging a shift to other crops such as sugar cane or rice. Together, these factors pushed wheat prices in Pakistan higher by reducing the overall supply. Most importantly for our purposes, the high world prices for wheat and the IMF and World Bank all encouraged Pakistan to sell its wheat reserves through the export market, even though prices were rising, food insecurity remained high, and hunger was spreading within that nation.

Again, this is not to say that grain markets or exports cause hunger. The point is to understand the role of grain markets and the political economy of exports, especially during times of hunger and food crisis. There are important examples of nations exporting food – as Pakistan did in 2008 – despite rising hunger within their population. The frequent emphasis on agricultural production as a solution to hunger, then, is misplaced, at least in some cases. The issues of world hunger and food security are far more complex than the amount of food produced. Just because a country increases its agricultural production does not necessarily mean that hunger will decrease and food security will increase. That increase in food production may well be sent to where profits are highest, thereby leaving perhaps even more people suffering from hunger. Yet, grain markets can affect hunger and food security in more ways than just facilitating exports. Grain markets can also affect what farmers produce.

Biotechnology for the Poor?

In : Glenn Davis Stone 2005 A Science of the Gray: Malthus, Marx, and the Ethics of Studying Crop Biotechnology. In *Embedding Ethics: Shifting Boundaries of the Anthropological Profession*, ed. L. Meskell and P. Pels, Oxford, Berg: 197-217.

"Crop biotechnology" encompasses a wide range of technologies, but most of the vexing ethical issues concern the technology of genetic modification (genetic engineering, recombinant DNA). […] My first engagement with genetically modified agriculture was when I bought a Flavr Savr tomato—the first genetically modified organism marketed in the United States—at a Manhattan greengrocer's in 1995. The connection between this tomato (engineered to rot slowly) and my research activity (then focused on conflict, population, and agricultural change in Nigeria) seemed remote. Yet by 2000 I was not only conducting field research on genetically modified crops but taking a leave from university teaching to participate in the modification of crops. This change in research focus confronted me with a set of ethical problems I had never faced in my previous work on the social aspects of nonindustrial agricultural systems. In fact, it was partly stimulated by ethical issues: as much as anything else, it was the biotech industry's ethical self-justifications that led me to take up this research. Crop biotechnology took a remarkable turn in the late 1990s, when the collapse of its market in the United Kingdom and continental Europe was followed by a corporate media campaign claiming an ethical high ground by promising to feed the Third World. Claims by anti–genetic modification activists also gravitated toward ethical grounds for blocking the technology from the Third World (and elsewhere, for that matter). […]

Crop biotechnology lies at the intersection of a remarkably wide set of important concerns, and it can be (and is being) condoned or condemned on widely varying grounds. Biotech discourse is aptly described as "a patch quilt of neighborly and competing factions". But from the jungle of arguments, claims, and predictions emerge a few key positions that we may call ethical platforms—rationales for prioritizing or privileging concerns, "big-picture" meta-arguments that often appeal to high-level implicit propositions. My concern in this chapter is with the interplay among ethical platforms: the proponents' case, based on neo-Malthusian claims by industry and allies, an opposing case, based on issues in political economy (best developed by Marxist writers), and the responsibilities of an anthropologist entering such contested terrain.

The Proponents' Ethical Platform: Biotech Neo-Malthusianism

Pioneering experiments in genetic modification began in the early 1970s, and by 1983 plants were being genetically modified. The first commercial genetically modified product sold in the United States was the tomato mentioned above, and by 1996 genetically modified cotton, soy, and maize seed had begun to penetrate American farming while genetically modified ingredients were spreading throughout the American food supply. Soon after this, genetically modified crops encountered disastrous opposition in Europe and particularly in Britain. The main resistance was triggered not by the first genetically modified food in British stores (tomato paste, clearly labeled, which sold well) but by the arrival of American genetically modified soya, which went into countless processed food products. Various reasons for the subsequent British aversion to genetic modification have been cited, including different attitudes toward government regulation, a stronger and more mainstream green movement, and exquisitely bad timing in relation to the mad cow disease scandal. It did not help that the corporation behind the soya (and also the world leader in crop biotechnology) was Monsanto, a bête noire of the European green movement. In 1997 the smoldering opposition to genetically modified products burst into flame, and by 1998 British grocery chains were removing genetically modified products from their shelves.

The closing of European markets did much more than hurt U.S. exports. The European backlash also provided—and continues to provide—inspiration and support to the opposition to genetically modified organisms worldwide. […]

One of the themes of Monsanto's "Let The Harvest Begin" campaign was the need for crop biotechnology to feed the hungry in developing countries. In 2000 Monsanto and six other biotech firms jointly formed the Council for Biotechnology Information (CBI), a public relations consortium with an initial war chest of $250 million for TV and newspaper ads, web sites, and even coloring books. From the outset, the driving theme was the promise of and need for genetically modified crops in developing countries. This was hardly an obvious issue to campaign on, since over 99 percent of the acreage devoted to genetically modified crops were in the United States, Canada, and Argentina as of 1999 (and the number is still over 95 percent). But it was an issue that the CBI partners could agree on (whereas insecticide reduction was not—some of the biotech companies were still in that business), and it seemed to resonate reasonably well with the American public (if somewhat less so with the Europeans).

Genetic engineers were interested in the developing world not only for its rhetorical value. By 1999, genetically modified crops were available to farmers in China, Mexico, and South Africa, test plots were growing in India, and *Science* published an article entitled "Crop Engineering Goes South". Actually, the crop leading genetic modification into the south was not a subsistence crop but cotton, and while cotton farmers did offer interesting fodder for the public relations mill, the industry campaign focused mainly on the malnourished masses.

The CBI campaign was also provided with a very timely poster child in the form of "Golden Rice," which appeared on the cover of *Time* in July 2000 as a plant that "could save a million kids a year." Developed as part of the Rockefeller Foundation's Asia Rice Initiative, Golden Rice was a prototype that contained genes for producing beta carotene in the endosperm. Its aim was to mitigate vitamin-A-deficiency blindness in poor children on rice-based diets. The CBI soon flooded the U.S. television and print media with ads touting Golden Rice. Although the corporate sector had refused to fund development of Golden Rice, it was not long before the industry had apparently spent more advertising it than Rockefeller had spent developing it (much to Rockefeller's dissatisfaction).

This rhetorical move south was a response to an increasingly polarized public debate in which negative biotech coverage was just reaching its peak in the United Kingdom. Its intent was to establish for the biotech debate an ethical platform based on a neo- Malthusian dogma tailored to the situation. […] The particular variety of neo-Malthusianism holding sway at the time (particularly in North America) did not suit biotechnology's public relations problem: it focused on environmental security problems rather than hunger. Filling the political space left by the collapse of the Soviet Union and the cold war paradigm, “environmental security neo-Malthusianism” emphasized conflicts and societal breakdown as results of resource scarcity ultimately driven by overpopulation. The biotechnology industry and its academic allies, backed by a media budget such as no previous neo-Malthusianism had enjoyed, refocused attention on the crude balance between mouths and mouthfuls, much as had Paul Ehrlich’s (1968) neo-Malthusianism of the late 1960s and 1970s. However, this “biotech neo-Malthusianism” parted with Ehrlich’s in touting agricultural technology as a solution. It has come to assume a dominant role in the debate and has become a predictable mantra at the opening of presentations advocating genetically modified crops. It can be decomposed into several dogmas, concerning demography, agriculture, and investment.

1. *Demography*. The primary dogma is that the various problems posed by biotechnology are trumped by the specter of population outstripping food supply. This follows Malthus’s explicit argument that unchecked population increases geometrically while subsistence increases arithmetically. Prominent biotechnologists have claimed demographic trends to be heading toward “Malthus’s worst predictions”. […]

Biotech neo-Malthusianism routinely presents assured projections of future population levels, reflecting popular notions sufficiently entrenched that no plus-or-minus factor or source seems to be needed. Indeed, the causal link between population and famine often goes unstated: trained to perceive the world as a place of food shortages rather than surpluses, the public readily makes the causal link between population growth and malnourishment when provided with numbers of hungry.

2. *Agricultural growth*. Biotech neo-Malthusianism depicts existing agriculture as already maximized, with further increases generally being impossible without biotechnology. This is a remarkable reversion to Malthus’s late-eighteenth-century understanding of agricultural inelasticity. […] Biotech neo-Malthusianism also stresses agricultural inelasticity, but not as an inevitability: it depicts production as expandable by (and only by) technological means. For instance, in “Without Biotechnology, We’ll Starve,” the director of an industry-supported university biotechnology program warned that “the human population continues to grow, while arable land is a finite quantity. So unless we will accept starvation or placing parks and the Amazon Basin under the plow, there really is no alternative to applying biotechnology to agriculture”. […]

These two dogmas are combined in the claim that only through biotechnology can starvation be averted in less developed countries. […]

3. *Incentives to capital.* A key feature in biotech neo-Malthusianism is the explicitly capitalist veneer it adds to the model of overcoming overpopulation through technology. It holds that corporate investment is vital to the scientific and technological advances needed for agricultural growth; strong incentives to capital are needed to feed the poor. […] But stressing the need for agricultural investment to feed developing countries is important because of the high levels of investment required by biotechnology and because industry has been put on the defensive by publicity surrounding gene-use restriction technologies (GURTs): nicknamed “Terminator” by genetic modification opponents, these are technologies for creating sterile seeds. Although reviled by various parties that support and even practice genetic modification for developing countries (including the Rockefeller Foundation and the network of international agricultural research labs), it is staunchly defended by biotech neo-Malthusians :

> Supporters see in Terminator a possible solution to Third World hunger and poverty, which could become more widespread in coming years as populations expand and farmlands are lost. […] Henry Shands, assistant administrator for gene resources at the USDA's ARS [Agricultural Research Service], said foreign farmers need to recognize that biotech companies are not going to export their best-engineered varieties to parts of the world where patent protection is weak unless they can be assured farmers won't resell or replant harvested seeds. GURTs, he and others said, will give poor farmers access to better seeds.

4. *Asserting ethical priorities.* In the 1970s, Paul Ehrlich used to cut off critics who sought to raise other issues in response to his demographic catastrophism by saying, "There are other problems, but if you don't solve this one you won't be around to solve the others." Biotech neo-Malthusianism is used in the same way: to put the biotechnology issue on an emergency footing that diminishes objections based on longer-range and more synthetic criteria. For instance, the head of an industry-backed foundation recently lashed out at genetic modification critics: "To turn a blind eye to 40,000 people starving to death every day is a moral outrage. . . . We have an ethical commitment not to lose time in implementing transgenic technology". […]

Similarly, the Washington Legal Foundation (2002) writes, "So why is it that so many professional activist groups and special interest radicals have no appetite for genetically enhanced foods? How can they attack dramatic technological advances that could end world hunger?"

The theme is sounded most indignantly by the Kenyan biotechnologist Florence Wambugu, who asserts: "The biggest risk in Africa is doing nothing. I appreciate ethical concerns, but anything that doesn't help feed our children is unethical". The academic biotechnologist C. S. Prakash (2000) writes that "anti-technology activists accuse corporations of 'playing God' by genetically improving crops, but it is these so-called environmentalists who are really playing God, not with genes but with the lives of poor and hungry people." Critical opposition is even branded as crime. One biotech executive said, "We're talking about the food security of the world. . . . When people talk about crimes against humanity—wouldn't it be a crime if political narcissism delayed things to the point where there were major food shortages in the Third World?". Ingo Potrykus (Golden Rice's lead developer) announced at the 2000 World Food Prize conference that Golden Rice critics were potentially guilty of murder.

The primary target of this invective may be professional activists, but the relevance to social science research on genetically modified crops is obvious. This ethical platform demands that objections to the central role of corporations in developing the technology be outweighed by considerations of raising food output in the Third World and, indeed, that that role be embraced.

Biotech neo-Malthusianism is, of course, by no means the only rationale for promoting genetically modified crops (cases are also made on the basis of free trade and environmental advantages, for instance). I have isolated it here because it offers the most developed and influential ethical argument for crop genetic modification and because it directly concerns issues that an agrarian anthropologist may be obliged to confront.