Carolyn Deuschle and Lauren Elachi

Landrace: Zea Mays and the NAFTA Landscape

The cultivation of maize (Zea mays)**, or corn, has defined the lifestyle, legacy, and landscape of the Mexican territory for thousands of years. But after NAFTA passed in 1994, corn from the United States—genetically modified, mechanically produced, and heavily subsidized—began to flood Mexico's markets and the country's maize agricultural system was gradually dismantled. Mexican producers simply could not compete with cheap American corn.[1] Today, a small number of large-scale farms in the lowlands dominates the export agricultural economy, leaving millions of small-scale** mestizo **and indigenous farmers jobless, unable to compete in an economy ravaged by trade liberalization. Perhaps more than any other land-intensive operation, corn cultivation in Mexico embodies the ecological, cultural, and economic fallout of the polarized, NAFTA-generated landscape.**

Domesticated over 9,000 years ago in the Balsas River drainage in the Mexican state of Guerrero, corn evolved from teosinite (Zea)**, an tall, annual grass, through the natural and artificial selection and cultivation of its key mutations—rows of kernels rotating along a central axis (i.e., cob), a sealed seed head (i.e., husk), and high nutrient content.[2]** Milpa, chinampa, **and other symbiotic agricultural systems were developed in tandem by indigenous farmers, whose breeding practices propelled at least 59 landraces adapted for climatic and altitudinal conditions from 0 to 2700 metres above sea level.[3] Today, over 50 percent of arable land in Mexico is used for the production of corn, and of this approximately 75 percent is produced by indigenous or local farmers. Over 90 percent of corn producers are classified as small-scale farmers, with plots on average of 2.5 hectares or less, and which do not produce a yield large enough to export to market. Because the corn crop of most farms doesn't make it to market, policy makers in Mexico and the United States predicted that NAFTA would not greatly affect the corn production sector in Mexico, but rather enhance it—resulting in benefits for the consumer.[4] In reality, exports from the United States tripled from the institution of NAFTA through 2008, while prices in Mexico were cut in half for the sale of corn, despite steady gross production at a national scale.**

Mexico's preference for small-scale farming can be traced back to the 1917 institution of ejido **land tenure, which returned property that had been appropriated by large** haciendas **to the hands of peasant communities and allowed for farming under collective ownership, or the individual use the land in usufruct.[5] Ejidos was nullified through the revocation of Article 27 of the Mexican Constitution in 1992, allowing for foreign companies to buy land within the country. Not only did this set the stage for NAFTA, but it also signalled a change within the Mexican agricultural mindset, which had largely privileged the communal negotiation and tending of land since the Mexican Revolution. This change in regulations had major social implications, as well as impacts on the ground throughout the country. Before the privatization of land after NAFTA, only 16 percent had formalized irrigation structures in place, and the majority of arable land within the country was still being cultivated under the** ejido **system—encompassing 28,000 different communities and plots of land.[6] [See Fig. 1]**

The increase in corn demand and new irrigation techniques that allow for expanded production have shaped the post-NAFTA

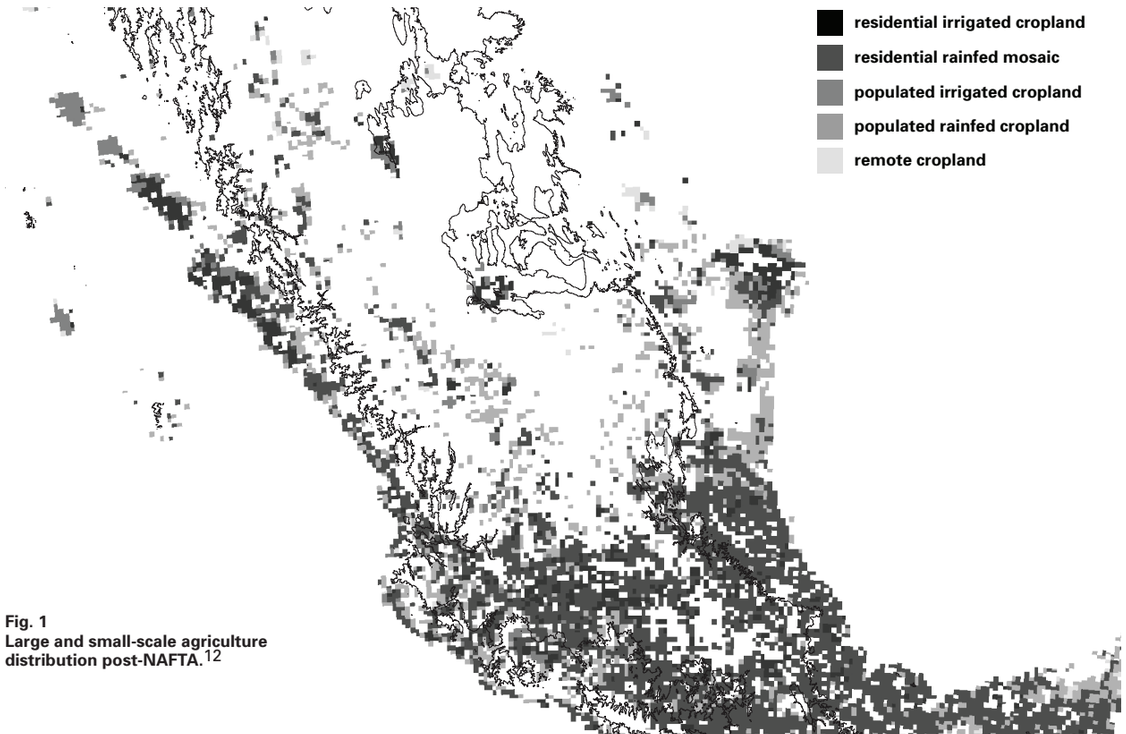


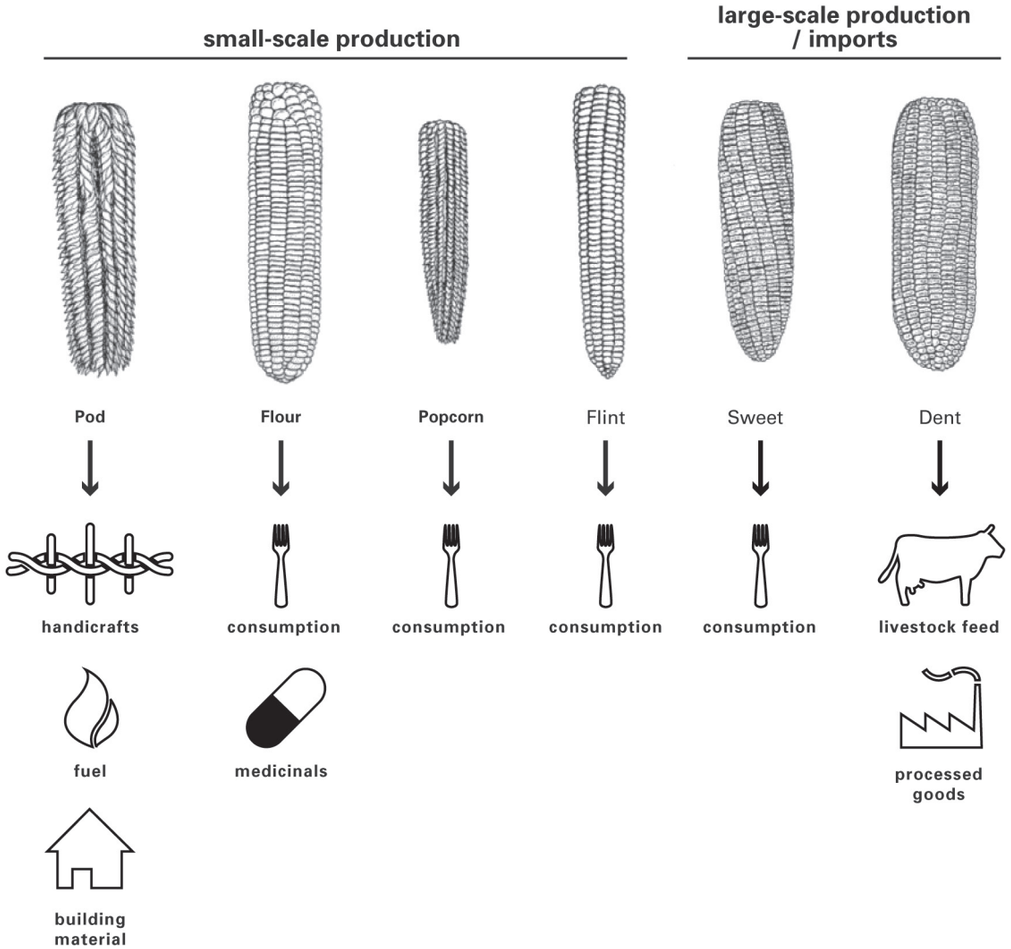
Fig. 1
Large and small-scale agriculture distribution post-NAFTA.[12]

economies of former ejido farmers in many rural regions. Rain-fed land produces less than half as much corn per year on average (1 ton per hectare) as does irrigated land (2.1 tons per hectare). Studies conducted by the Mexican Secretariat of Agricultural Reform show that the most determining factor for whether a farmer is a market seller is their access to formalized irrigation.[7] **Additionally, commercial irrigation is more widely available in lower-lying areas of Mexico with poorer, rockier soils such as xerosol and regosol, so fertilizer is also necessary. This makes market exportation commercially non-viable for small-scale farmers in the face of larger commercial production.**

Indigenous agricultural practices are traditionally designed to strengthen the genetic resources from which new landraces of maize may draw.[8] In situ **conservation—that is, the dynamic process of seed bank cultivation on site (i.e., mostly through peasants' fields) through the movement and interchange of seeds on a scale exceeding the field itself (from migratory pollination to seed selection and exchange among farmers)—is considered to be the most effective method for safeguarding biodiversity, according to the World Trade Organization's Convention of Biological Diversity.**[9] **These landscapes, often patch-cuts in the rich and diverse rainforest ecology, function as agents and canvases for seed dispersal, promoting and nurturing spontaneous plant growth.**

However, the shrinking number of small-scale plots due to trade liberalization has undermined maize species' capacity to adapt to environmental impacts by drawing on a gene pool to strengthen and fortify its lot. [See Fig. 2] Since NAFTA and the dissolution of the economic viability of most corn agricultural practices in Mexico, farmers are relying more and more on wild, edible plants, or quelite **(such as** Brassica rapa, Chenopodium, **and** Amaranthus**), for more than just species diversification. Instead, they're relying on them as a new commodity, primarily as livestock feed but also for medicinal uses.**[10]

The consolidation of agricultural fields in Mexico shifted the ground from communally tended and spontaneous vegetation dependent to privately operated and heavily controlled. By allowing for the privatization and neo-liberalization of this communal resource, the move from state-led to market-led agrarian reform within the country has marked a societal and ecological move within the territory. The landscape articulates the relationship between formal and informal environments, notions of efficiency, and cultural associations and social relations with the land. Embedded in the ground of the Mexican maize field is a culturally specific meaning of land tenure, as well as representations of the dynamic between human and non-human agents in the process of generating landscape material.[11]



Notes

1
On the importance of Mexico to global agriculture, Carl O. Sauer writes: "The northern hearth of plant domestication, where the process was done by seeds and therefore by sexual selection, lies in southern Mexico and northern Central America. The wild relatives of the cultivated plants grow here; the cultivated forms are here in greatest diversity. Consensus favors this area and I know no reason to disagree," in Agricultural Origins and Dispersals: The Domestication of Animals and Foodstuffs (Cambridge, Mass.: MIT Press, 1952), 130.

2
For more on the origins of maize, see Yoshihiro Matsuoka, Yves Vigouroux, et al., "A Single Domestication for Maize Shown by Multilocus Microsatellite Genotyping," Proceedings of the National Academy of Sciences of the United States of America 99, no. 9 (30 April 2002): 6080–66084. Also, for a beautifully detailed description on maize reproduction, see Paul C. Mangelsdorf, Corn: Its Origin, Evolution, and Improvement (Cambridge, Mass.: Harvard University Press, 1974), 6–9.

3
Milpa is a crop-growing system, based on Mayan agricultural practices, which simultaneously produces maize, beans, and squash within the same plot of land. The squash covers the ground and beans climb up corn stalks. The system protects the plants from detrimental water erosion and efficiently utilizes sunlight and rain. The milpa cycle utilizes a plot for two years followed by eight years of letting the area lie fallow. Chinampa is a technique to create artificial islands in order to cultivate agriculture in the Valley of Mexico, which was formerly a shallow lake bed.

4
See Anjali Browning, "Corn, Tomatoes, and a Dead Dog: Mexican Agricultural Restructuring after NAFTA and Rural Responses to Declining Maize Production in Oaxaca, Mexico," Mexican Studies/Estudios Mexicanos 29, no. 1 (Winter 2013): 85–119.

5
For more on the history and shifting community struggles associated with ejido policies, see Eric P. Perramond, "The Rise, Fall, and Reconfiguration of the Mexican Ejido," Geographical Review 98, no. 3 (July 2008): 356–371.

6
See Alain de Janvry, et al., "NAFTA and Mexico's Maize Producers," World Development 23, no. 8 (August 1995): 1349–1362.

7
Ibid., 1354.

8
"The important thing is that we clean out and plant the fields but don't break the connection to the surrounding ecosystem. These fields are part of the natural system; they're not apart from it," says an indigenous farmer quoted in Peter Canby, "A Retreat to Subsistence," The Nation, 5 July 2010, 32. Also, see "Maize and Biodiversity: The Effects of Transgenic Maize in Mexico," a report prepared in 2004 by the Commission for Environmental Cooperation.

9
"In fact, the Convention recognizes in situ conservation as the primary approach for biodiversity conservation," Lyle Glowka, Francoise Burhenne-Guilmin, and Hugh Synge, A Guide to the Convention on Biological Diversity (Gland, Switzerland: IUCN, 1994). In addition to in situ practices, ex situ conservation methods such as seed banks are also being utilized in the country in an attempt to preserve all known strains of corn.

10
"In Mexico, agriculture traditionally has incorporated spontaneous plants in its production systems—for food, forage, medicine, ornament, household implements, construction material, and rituals," Leticia Vieyra-Odilon and Heike Vibrans, "Weeds as Crops: The Value of Maize Field Weeds in the Valley of Toluca, Mexico," Economic Botany 55, no. 3 (July–September 2001): 427.

11
See Jon Unruh, "Land Tenure and the 'Evidence Landscape' in Developing Countries," Annals of the Association of American Geographers 96, no. 4 (2006): 754–772.

12
Agri-business is found in the populated cropland grid, and most extensively in the remote cropland areas. For more information on how land-use layers are defined, visit the Laboratory for Anthropogenic Landscape Ecology's website: http://ecotope.org/anthromes/v1/guide/croplands/default.aspx. Large-scale corn production operations generally are situated below 1,200 m. The 1,200-metre contour line is highlighted. Sources: S.B. Brush, Hugo R. Perales, "A Maize Landscape: Ethnicity and Agro-Biodiversity in Chiapas Mexico," Agriculture, Ecosystems, and Environment 121 (2007): 211; and Earl C. Ellis, Navin Ramankutty, "Putting People in the Map: Anthropogenic Biomes of the World," Frontiers in Ecology and the Environment 6 (2008): 441, Fig. 2.

13
Sources: Charles H. Greathouse, Index to the Yearbooks of the United States Department of Agriculture, 1911–1915. Washington, DC: G.P.O., 1922; USDA Foreign Agricultural Service, Commodity Intelligence Report, 2012.