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Importing corn, exporting labor: The neoliberal corn regime, GMOs, and the erosion of Mexican biodiversity

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Abstract. When genetically modified (GM) imported corn was found growing in Oaxaca and the Tehuacán Valley of Puebla, Mexico (2000–2002), it intensified the debate between activists, academics, and government officials about the effects of trade liberalization on Mexican corn farmers and maize biodiversity. In order to understand the challenges faced by corn farmers and in situ diversity, it is important to contextualize GM corn within the recent neoliberal corn regime and its regional manifestations. This essay offers a case study of how indigenous corn farmers from the southern Tehuacán Valley have adapted to such neoliberal reforms and economic crisis by combining local corn production with US-bound labor migration.

Key words: GM corn, Maize under NAFTA, Neoliberal policies, Rural Mexico, Transnational households

Abbreviations: Bt – Bacillus Thuringiensis; CBD – Convention for Biological Diversity; CEC – North American Commission for Environmental Cooperation; CECCAM – Center for the Study of Change in the Mexican Countryside; CIBIOGEM – Inter-Ministerial Commission on Biosafety; CONACYT – National Council for Science and Technology; CNBA – National Agricultural Biosafety Committee; DGSV – General Directorate of Plant Health GM – genetically modified; GMO – genetically modified organism; INE – National Ecology Institute; LMO – living modified organism; NAFTA – North American Free Trade Agreement; UN – United Nations

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Introduction

Known as the "cradle of corn," the Tehuacán Valley in southeastern Puebla, Mexico, is considered one of the possible sites of maize domestication some 5,000 years ago (MacNeish, 1972; Salvador, 1997). It is also one of the sites where recent Mexican government tests confirmed the finding of transgenic varieties in producers' landrace cornfields in early 2002. It is most likely that GM corn, imported from the United States to serve as animal feed, grain for tortillas, or for industrial processing, made its way to regional markets where small-scale. Mexican cultivators unknowingly purchased and then planted the grain (INE-CONABIO, 2002). This finding (among others) amplified an international debate about the extent to which corn imports from the United States pose a threat to maize biodiversity in the crop's center of origin, domestication, and biological diversity. More generally, such contamination raises the question as to whether the expansion of neoliberal globalization and the resulting free trade agreements, coupled with economic restructuring in the global south, grant an unfair advantage to transnational corporations and large-scale northern farmers. The latter often enjoy hefty government subsidies for the production of basic grains (Bartra, 2004).

I propose, as have some activists and academics in the recent maize debates, that it is not simply the lack of sufficient regulation on transgenic corn imports that poses a risk to in situ conservation of maize landraces, the gene reservoir upon which the development of future corn varieties depend. Rather, the increasing hardships and out-migration of small-scale corn cultivators who are struggling to adapt to economic crisis and neoliberal reforms also jeopardize in situ maize biodiversity. I focus here on the **social** aspect of biodiversity, defined as a dynamic process in which maize landraces are maintained through exchanges between fields and between

cultivators (Takacs, 1996; Serratos et al., 1997). While "modern" corn varieties, or "cultivars," refer to those varieties developed by plant breeders, "landraces," in contrast, are those "crop populations that have become adapted to farmers' conditions through natural and artificial selection" (Aguirre Gómez et al., 1998: 7). The storage of landraces *ex situ* in seed banks is a crucial means of protecting corn biodiversity, but is often viewed as an insufficient measure on its own. The UN Convention on Biological Diversity, for instance, considers in situ conservation the best approach for safeguarding biodiversity (Glowka et al., 1994).

This paper will examine how rural households have adapted to and been affected by the neoliberal corn regime, based on a year and a half of fieldwork (2001–2002; 2005) and some 60 interviews in the southern Tehuacán Valley town of San José Miahuatlán. I use the term the "neoliberal corn regime" to refer to the series of recent policies associated with the ideology of neoliberal globalization, including NAFTA, which prioritize market liberalization, trade, agricultural "efficiency," and the reduction of state services over domestic corn production. GM policy also constitutes part of this regime (Otero et al., 1997). In San José, as in much of the Mexican countryside, maize production is central to the survival of the rural household. However, in the absence of sufficient or sufficiently remunerative local or regional employment, households combine corn production with US-bound migration and other off-farm income. This local strategy to adapt to economic crisis (as well as local water shortages) is remaking agriculture and social relations in significant ways. Although maize has become a more significant share of local agricultural production since the 1980s, agriculture and agricultural land use have decreased. Older residents have switched from other crops to corn production, but such producers face increasingly difficult economic and environmental conditions. Additionally, younger residents tend to prefer non-agricultural wage labor. While young *Sanjosepeños* (residents of San José) may of course take up corn production as they age, many claim that they will not simply because there is "no money to be made in the *milpa*" (or cornfield) (Fitting, 2004b). Before turning to examine how residents have adapted to such conditions, I will first discuss the neoliberal corn regime and the maize debates.

The neoliberal corn regime: From self-sufficiency to imports

While agricultural and trade policies from the administrations of Miguel de la Madrid (1982–1988) to Vicente Fox (2000–2006) have varied, throughout this period a commitment to the neoliberal agenda has deepened and affected corn production and consumption in Mexico. After the debt crisis of 1982, austerity measures and a restructuring of government agricultural extension services, marketing agencies, and the rural credit system exacerbated the long-standing difficulties faced by Mexican agriculture.

Previous administrations had pursued the goal of national self-sufficiency in maize and a related commitment to support small to medium producers, while importing corn to meet an increase in demand (Austin and Esteva, 1987; Appendini, 1992; Otero, 1999). Under neoliberal reform, however, the goal of self-sufficiency was replaced by a series of policies that focused on providing urban consumers access to cheap tortillas through grain imports "which enjoyed low, subsidized international prices and could be obtained with cheap credit" (Appendini, 1994: 148). After more than 50 years, the tortilla consumer subsidy was also eliminated in late 1998. Rural areas that practiced small-scale, rain-fed agriculture were classified as zones of "low productive potential" and viewed as areas of rural poverty in need of social welfare assistance (de Teresa Ochoa, 1996).

In the 1990s, Article 27 of Mexico's 1917 Constitution was amended to allow for the rental and sale of *ejidos* (land grants resulting from the agrarian reform process) and NAFTA was implemented as part of a strategy to restructure the agricultural sector (de Grammont, 1996; de Janvry et al., 1997; Cornelius and Myhre, 1998; Otero, 1999). Under NAFTA, Mexico was to gradually open its doors to corn imports in exchange for guaranteed access to the market for horticultural products and other labor-intensive crops in Canada and the United States. The assumption was that, according to neoclassical international trade theory, Mexico has a comparative advantage in producing such crops because of its surplus in labor and lower production costs.

The agreement changed the previous tariff and import permit system into a tariff rate quota regime that would be phased out during a 15-year transition period. Price support mechanisms that had been in place for 40 years were eliminated. According to Alejandro Nadal (2000: 5),

> The planned fifteen-year transition period was actually compressed into 30 months. Between January 1994 and August 1996 domestic corn prices fell by 48%, thereby converging with the international market some twelve years earlier than provided for under NAFTA, and forcing the Mexican corn producers into rapid adjustment.

Corn imports far surpassed the agreed upon level and prices dropped. The drop in grain prices however was not passed on to the consumer through lower tortilla prices. In an effort to stabilize tortilla prices, the government exempted imports from the tariff payment and increased subsidies to the corn flour industry, but prices soared (Nadal, 2000).

White corn is popular for making tortillas and other foods in Mexico because of its high flour content and fine texture. NAFTA, however, treats yellow corn grown in the United States (for industrial use or animal feed) and Mexican white corn as equivalent commodities even though there is a price differential between the two: the latter is on average 25% more expensive on international markets (Ibid.).

In San José and the more marginalized areas of rural Mexico, at least two assumptions that informed the design and rhetoric of NAFTA are incorrect. A first assumption was that a national market flooded with imported corn and lower prices would not adversely affect subsistence producers. In San José and elsewhere, however, subsistence producers are also petty corn sellers who tend to sell at a disadvantage after the harvest when there is an abundance of low-priced local and imported corn (imports have been counter-cyclical). These same producers are then obliged to purchase corn when their stored grain supply has run out and prices are higher (Nadal, 2000).

A second line of rhetoric about NAFTA was that it would generate off-farm employment for non-competitive, displaced rural producers (Nadal, 2000). While clothing and poultry factories have expanded in the valley, many positions are not sufficiently remunerative. The remaking of a flexible labor force in the valley has been a gendered process with many such positions considered "women's work." To make a better wage, young residents, predominately men, migrate to Mexican or US cities, supplementing this income when back in the valley with short-term stints in factory, construction, and agricultural work. Connected to this rhetoric, then, is the notion that the Agreement would displace a large number of rural producers. But in San José, while migrant remittances and off-farm wages contribute to the reproduction of rural households and corn production, this strategy simultaneously takes young, often male, laborers away from corn production for long periods and remakes agricultural practices.

The maize debates

One of the most significant effects of NAFTA in Mexico was the increase in corn imports from the United States, the world's largest producer and exporter of the crop. Between 1994 and 2000, imports from the United States grew from 14% to 24% of the total consumption of corn in Mexico. In 2000, Mexico was the second largest importer of US corn and 21% of corn grown in the United States was Bt corn, a transgenic variety with genes from the soil bacterium Bacillus Thuringiensis. This bacterium produces insecticide toxins which kill the European and Southwestern corn borers (Ackerman et al., 2003). Mexico imports roughly six million metric tons of US corn annually, up to one third of which is transgenic (Dyer and Yuñez-Naude, 2003).

The campaigns against GM crops have exposed a regulatory gap between GM crop field trials and the import of GM corn for food, feed, and industrial uses. While scientific field trials of GM crops have been regulated in Mexico since the late 1980s, GM corn has been imported in recent years without adequate regulation or monitoring. The United States does not require its distributors to separate GM corn from other varieties so that, once in Mexico, imported corn has been difficult to track or control due in part to the nature of informal seed exchange between cultivators and gene flow between cornfields.

The debate over GM corn began in the scientific and government regulatory community after the General Directorate of Plant Health (DGSV) of Mexico's Ministry of Agriculture started to grant permits in 1988 for scientific field trials of GM crops in Mexico. The Directorate was advised by the National Agricultural Biosafety Committee (CNBA) – now the Specialized Agricultural Subcommittee – which consisted of scientists from various disciplines and government agencies. The bulk of requests to plant experimental plots were authored by universities and corporations like Monsanto, the most frequent applicant between 1988 and 1999 (Alvarez-Morales, 1999). Maize was the most tested crop in Mexico (CONACYT-CONABIO, 1999). In late 1998, the Directorate imposed a de facto moratorium on GM corn trials because the traits most commonly tested were not of any particular benefit to Mexico (Alvarez-Morales, 1999; Serratos, personal communication, 2000). There were also concerns about the possibility of GM corn mixing with and displacing landraces and wild relatives.

As the center of maize biodiversity, Mexico is home to at least 41 racial complexes and many landraces, as well as to its closest wild relative, teosinte (Turrent Fernández, 2005). There is little known about the effects of GM corn on maize landrace diversity. Like modern varieties generally that displace biological diversity if widely adopted, GM corn also poses risks; but the potential risks of GM varieties also include the development or intensification of weeds, plant tolerance to herbicides, or pest resistance to transgenic plants (Serratos, 1999). The moratorium on trials, however, is not without criticism among those who argue for strong regulation. Some scientists argue that research on GM corn which could further our understanding of gene flow between such varieties, landraces, and wild relatives is also on hold under the moratorium; and that field trials are unlikely to release GM corn into the environment if properly monitored, isolated, and small in area.

Environmental groups from Mexico and abroad launched a campaign against the field trials and the import of GM corn in the late 1990s and were later joined by

peasants, indigenous rights groups, and international NGOs (Greenpeace Mexico, 2001; Esteva and Marielle, 2003; Ribeiro, 2004). For instance, in 2002, a coalition of 14 peasant groups opposed to NAFTA and neoliberal policy came together under the banner "El Campo No Aguanta Más (The Countryside Can't Take it Anymore)" and organized a series of protests that took over the center of Mexico City. Included in its list of demands was not only the renegotiation of NAFTA, but the immediate halt of GM corn imports.

Due to mounting pressure and concerns, the government created an Inter-ministerial Commission on Biosafety (CIBIOGEM) in 1999 to oversee the regulation of GMOs. CIBIOGEM, however, has been embroiled in internal disputes and problems. Amidst the growing international controversy, CIBIOGEM announced in late 2003 that it was going to lift the de facto moratorium on scientific field trials of transgenic corn (Enciso, 2003). The moratorium was eventually lifted, but as of 2005 no field trials have been conducted because of the need within CIBIOGEM, in accordance with the recently implemented Biosafety Law, to both clarify procedures for such trials and identify regions of "lower risk" in Mexico where such trials could be conducted.

In a 2001 study by Dr Ignacio Chapela and David Quist from the University of California at Berkeley, genes from transgenic corn were found in Mexican maize fields in the Sierra Norte de Oaxaca (Chapela and Quist, 2001). Their study sparked an international debate about their findings and the validity of their methods, intensifying the maize debates in Mexico. Regardless of how Chapela and Quist's particular study is judged, GM corn has found its way into rural markets and peasants' cornfields (McAfee, 2003). For instance, in order to verify the Berkeley findings, the Mexican National Ecology Institute (INE) and Biodiversity Commission (CONABIO) took samples from different localities in Oaxaca and Puebla for testing. Their tests confirmed the presence of the same 35S cauliflower mosaic virus (CaMV) promoter sequence as the Berkeley findings, prompting the Director of INE to call for a reconsideration of biosafety measures in Mexico (Enciso, 2002; INE-CONABIO, 2002; McAfee, 2003). They also found GM corn among the grain from some of the government's own rural DICONSA supply stores. Since that time, DICONSA began to restrict its purchase of corn to domestic grain only (Acevedo et al., n.d.). In late 2003, a group of rural NGOs presented their own study which suggested that the presence of GM corn was not confined to the states of Oaxaca and Puebla, but was much more widespread (CECCAM et al., 2003). In the first peer reviewed follow up to Chapela and Quist's research, a joint US and Mexican study, led by Dr. Allison Snow, concluded that "transgenic maize seeds were absent or extremely rare in the sampled fields [of Oaxaca]" (Ortiz-García et al. 2005). The significance of these results has been interpreted disparately by difference voices in the maize debates (see Chapela and Quist, 2005; Prakash, 2005).

While the anti-GM campaign and other participants in the maize debates applied pressure on the government to strengthen regulation, the adoption and ratification of the Cartagena Protocol on Biosafety helped to close the gap between imports and field trials. Mexico was a signatory to the Cartagena Protocol, which was adopted in January 2000 as part of the UN Convention on Biological Diversity (CBD). The Protocol was designed to help the safe transfer and use of "living modified organisms" (LMOs) and contains the "precautionary principle" which enables a country to ban the import of GMOs until such products are proven safe for human health and the environment. It also enables countries to demand that such products be labeled as GMOs (Consejo, 2003). Mexican groups pressured the Senate to quickly ratify the Protocol, which was done in April 2002. The Protocol became legally binding in the international legal system in September 2003.

In 2004, Mexico implemented an import ban on some types of GM corn, specifically biopharmaceutical corn engineered for non-agricultural purposes, and now requires that shippers identify cargoes that are known to include GMOs. While some see this as the closing of the regulatory gap between the moratorium on field trials and the unmonitored and unlabelled import of GM corn, others argue that this measure does not go far enough for two main reasons. First, shipments that contain less than 5% of GMOs are considered equivalent to a non-GMO shipment and do not require identification. Up to 5% of approximately six million metric tons annually is an unacceptably large quantity of unlabelled GM corn. Second, under this measure the shippers are not to be held accountable for unknowingly transporting GMOs. Mexico finally passed a law on Biosafety and Genetically Modified Organisms in December 2004, but the legislation contains contradictions and does little to remedy the problems of the 5% rule (see Bartra et al., 2005).

In other countries and in the international regulatory community, genetically modified organisms (GMOs) are often evaluated according to a framework of "risk" that prioritizes gene flow as its main concern. Non-risk frameworks that focus on ethics, food quality, rural livelihoods, or other factors are often marginalized by a focus on risk alone (Heller, 2002; Wynne, 2001). In the Mexican maize debates, however, critics of GM corn often link evaluations of risk to the larger context of trade liberalization and the problems facing small-scale rural producers (Esteva and Marielle, 2003). When the affected communities of the Sierra Norte de Oaxaca requested an investigation of the effects of GM corn in

Mexico by NAFTA's Commission for Environmental Cooperation of North America (CEC), the CEC set up a series of consultations and published a report that was submitted to the environment ministers of all three NAFTA signatory countries. The report argues that GM corn is unacceptable in Mexico largely because of social and cultural reasons, rather than for known risk factors for gene flow or human health (CEC, 2004). This is an example of how the debates about GM regulation have focused on maize because of its importance to the national diet, rural livelihoods, and the environment. Moreover, corn is a powerful symbol of the Mexican nation (Warman, 1988; Pilcher, 1998). More recently, among critics of NAFTA and GM corn imports, corn has come to represent Mexican sovereignty under attack in an age of neoliberal globalization (Fitting, 2004a).

The question of what effects GM corn has on landraces and wild relatives, and how to regulate GM corn imports and field trials appropriately, is an on-going debate. Critics argue that the import of such corn to Mexico and the gene flow between GM varieties and landraces is a form of genetic pollution, while the biotech industry and the official government position counter that this is evidence, not of pollution, but of a natural and even beneficial process of hybridization (Cleveland et al., 2003). Although critics have successfully influenced the government to address issues of regulation, some regulatory problems remain. Additionally, the wider question of how to preserve in situ corn biodiversity when small corn producers face impoverishment and out-migration also remains a concern. This is the case even while there has been a rise in the area devoted to domestic, rainfed corn production under the neoliberal regime, contrary to policy predictions and intentions (Nadal, 2000; Barkin, 2002, 2003; Dyer and Yuñoz-Naude, 2003). Several studies have suggested that a ''corn subsistence – labor migration'' strategy has developed in poorer, largely rainfed, agricultural regions of south-central Mexico (de Janvry et al., 1997; Nadal, 2000). While small-scale corn production offers a rural safety net in times of hardship, it also increasingly depends on remittances and other off-farm income for the purchase of needed agricultural inputs (Hewitt de Alcántara, 1994).

This increase in the area devoted to corn is considered by some to be evidence that landraces are not being displaced or threatened by GM or modern varieties. Around 70%–80% of all Mexican cornfields continue to be grown with *criollos* (Aquino, 1998; Turrent, 2005). In Spanish, both landraces and creolized varieties are referred to as criollos but the latter are the outcome of an intentional or accidental mix of landraces with improved varieties. In the Tehuacán Valley, while criollo-based maize production has risen in recent years, it has also interacted with GM corn in some areas. Most types of corn grown in the valley are landraces and creolized varieties adapted to the local climate and soil conditions. Hybrids are unpopular in the southern valley because they do not grow well and when replanted the second generation shows a considerable reduction in yield. But like elsewhere in Mexico, cultivators experiment with new seed when it appears in markets or neighbor's fields (see also Louette, 1997). Although no Sanjosepeño farmers with whom I spoke in 2001–2005 had heard of *maíz transgénico* (transgenic corn), they explained that when they see a new hybrid corn they buy some and plant it to see how it fares. When experimenting with the occasional hybrid, cultivators could unknowingly plant GM corn. As the INE-CONABIO findings suggest, the exchange of genetic information between transgenic varieties and landraces may take place even in those regions relatively inhospitable to hybrids, where cultivators prefer landraces or creolized varieties. GM varieties can be introduced into fields through seed purchases at the market, exchange between neighbors, producers' experimentation with new seed, or by pollination between fields unbeknownst to the cultivator. Let us now turn to examine the case of corn production in the southern Tehuacán Valley.

The Tehuacán valley

The semi-arid valley of Tehuacán is located in the southeastern end of Puebla state in south-central Mexico. The valley descends from north to southeast continuing toward Teotitlán, Oaxaca. The city of Tehuacán, the valley's mid-point, was once home to spring bath resorts that made the city a destination for Mexican tourists in the mid-twentieth century. Today the region is better known for its spring water bottling plants and its blue jeans manufacturers. The area has a mixed heritage of Popoloca, Mixteca, Chocho, and Mazateca peoples, although Nahuatl became the common language of the valley through migration and domination prior to the Spanish conquest (Alguirre Beltrán, 1986).

In the semi-arid, rural environs of the city, an irrigation system of water springs and underground tunnels and chain wells (*galerías filtrantes*) is central to agricultural production (Henao, 1980; Enge and Whiteford, 1989). Corn and beans are the most widely grown crops in the region. Like many other areas of Mexico, rain-fed white corn is largely grown for human consumption. As mentioned earlier, white corn is distinct from industrial, hybrid yellow corn. In the valley, irrigated white corn is grown for sale as corn on the cob, called *elote*. Other commercial crops include alfalfa, tomato, squash, garlic, melon, flowers, and sugarcane. Besides agriculture, significant activities include goat herding and the production of construction materials (bricks, cinder blocks) and artisanal products such as baskets and embroidered fabric

for clothing. The region is home to a large aviculture industry and to *maquiladora* workshops.

The county of San José Miahuatlán, population 11,675, is located in the southern end of the valley in Puebla. The head town where I focused my interviews makes up just over half of this population (INEGI, 2000). Landholdings tend to be small – two to five hectares – and are private, communal, or land grants (ejidos). In comparison to the neighboring sierra, San José is well off with a major road, electricity, and potable water, and is classified as an indigenous area of "less marginalization." However, San José is one of the poorest counties of the valley and has suffered spring water scarcity. Local residents took up elote production and became US-bound migrant laborers later than their valley neighbors.

Flexible agriculture

The household strategy that combines labor out-migration with corn production manifests certain specificities in the southern valley, where maize is cultivated both for grain consumption and for sale as elote. While residents without irrigation water cultivate rain-fed subsistence corn, those with access to water resources try to sell their elote through intermediaries to regional markets and Mexico City. The valley has an advantage cultivating elote during the fall-winter cycle when other regions suffer from frosts. In the town of San José, elote became a more important part of agriculture during the 1980s. Although residents and Ministry of Agriculture officials report that agricultural production overall has been on the decline since the 1980s, it was precisely at that time that elote production expanded. In a town faced with both diminishing irrigation water and rising inflation, it is counterintuitive that the irrigation-dependent elote would become popular. Irrigated elote costs more to cultivate than rain-fed corn because of higher labor requirements – which translate into the hiring of extra-household workers – and the purchase of expensive inputs like irrigation water. However, this increase is explained by the fact that elote is a particularly flexible type of maize which commands a much higher price than grain. Although the price for elote can vary greatly and cultivators do not always make a profit, elote cultivation enables residents to use their corn even when the crop's market price is not profitable. If the market price is too low the elote is left to dry for household consumption. For those who feel it is worth the risk or can afford it – those who have the water resources, income, or family members to provide the milpa labor – elote can generate profit if harvested at the right time of year. Moreover, if prices decline, farmers leave the elote to dry in the field, reducing the household's need to buy corn grain for tortillas.

In San José, farmers plant a "six-month" criollo (a landrace or creolized variety) of irrigated maize that has a narrow kernel preferred for elote, called *chicuase*. After 5 months they may harvest the crop for elote, but if the price is not high or there are no interested buyers, the crop is left to grow for another month (including another round of irrigation) and then dried for grain to be sold in small amounts locally or consumed in the household. The other main corn is a "four-month" rainfed variety (*nahuitzi*), that can be harvested at three and a half months for local elote or grown the full four to be consumed as grain. Nahuitzi is not suitable for sale as fresh corn to Mexico City because it has wide kernels. Another variety used in San José for household consumption is the wide and sweet *macuiltzi*. It can be eaten as elote at four and a half months or dried for grain. The decision to harvest the crop as elote or grain thus largely depends on the market price for elote and whether there are interested buyers or intermediaries.

The overall decline in agriculture coupled by the switch to elote production was also related to local and regional problems such as soil fatigue, crop pests, population pressures, and a decline in irrigation water. There were also external problems to contend with like the rising input costs of insecticides, fertilizers, yoke or tractor rentals, and cuts in rural subsidies. The majority of farmers interviewed described an increased difficulty in affording agricultural inputs faced with continuing economic crisis and the decline in irrigation water. While state reforms have introduced new agricultural subsidies aimed to cushion the abrupt transition to free trade, Sanjosepeños argue that little help can be expected from the government. For instance, Procampo grants, a transitional rural subsidy designed to buffer the impact of liberalized trade, tends to be insufficient in making up for the overall effect of inflation and the cuts to price supports and other rural subsidies (see also Myhre, 1998; Nadal, 2000). The switch to elote cultivation was also due in part to the construction of an improved road in the mid-1970s that connected San José to San Sebastián Zinacatepec, a larger *municipio* of elote producers and buyers. Sanjosepeño farmers sell to intermediaries – both transporters and wholesalers – who come from nearby towns to take the fresh corn to regional markets and to Mexico City, in particular to the Central de Abasto in Iztapalapa (Olivares Muñoz, 1995).

While the preference for elote cultivation and US-bound migration clearly developed as common household strategies in the 1980s, the decline in agriculture is more difficult to accurately gauge. There are entirely non-agricultural households in San José that are dependent on the purchase of grain for making tortillas. Conversely, there are also former Sanjosepeños who commute from the regional city of Tehuacán to San José, now just an hour and a half away by bus, to grow elote there. As in other areas of Mexico, some urban

residents regularly return to their home towns to cultivate corn on weekends. But a nascent pattern of land use tells an unmistakable story. As more remittances make their way to San José, the town's inhabited area is expanding and the agricultural area is shrinking. Elote makes up a larger share of the overall agricultural production in recent years, but the parcels of land on the edges of town, which served as cornfields just 7 years ago and were passed within families to their younger members, are now occupied by migrants' cinderblock houses.

Flexible labor

Crisis and neoliberal reform have contributed to an increase in out-migration throughout rural Mexico (Delgado Wise, 2004). Paradoxically, however, transnational migration constitutes part of a local strategy to remain on the land. Formerly a town of few US-bound migrants, San José is now a community reliant on remittances. Almost two-thirds of my 60 interviewees (2001–2002) either had household members in the United States at the time of the interview or had themselves spent time working in the United States within the last five years. Half of this number had left for the first time after the economic crisis of 1994 and the majority of the remaining interviewees had left previous to this, during the 1980s or early 1990s.

Most households combine both subsistence and commercial agriculture with income from several different sources such as construction; agricultural day labor; transnational (and less frequently national) migration; running a bakery, small store, or corn mill out of one's house; piecework embroidery; maquiladora work; or selling goods at the *tianguis* or local market. All but the first two of these are primarily women's work in San José. Although residents have labored in regional agriculture and industry throughout the twentieth century, in recent years, female residents comprise a nascent labor force for valley maquiladoras. Additionally, labor migration today is largely undocumented and transnational. The term transnational is used here to highlight the fact that this migration "is not simply a unidirectional and one-time change in residence from one country to another" (Pries, 1999: 3), but that, at least at this early stage of the process, work activities as well as personal and financial commitments move in both directions across the US-Mexico border (Basch et al., 1995; Smith, 1998; Goldring, 1999).

In San José, households are transnational, maintained not just beyond the borders of the town but now also beyond those of the nation-state. Many of the younger migrants (in their teens and twenties) send what they earn beyond their US living expenses to their parents, just as maquiladora workers who live with their parents hand over their earnings to the household head while keeping some spending money for clothes and small items. This changes when a migrant ages and decides to build and establish his or her own house in town, or when a young woman marries or becomes a mother, at which time a much smaller amount, if any, is given to their parents. Most migrants tend to come home infrequently – once every two or three years for a four-month period or so. Some work for a few years in the United States and then return home for an equal amount of time hoping to repeat the cycle. And there is, of course, a smaller number who never return.

Although undocumented migration is both a dangerous and difficult economic necessity for Sanjosepeños, for many it is experienced as a source of pride, as a means to start their own household or to contribute to that of their parents. Young migrants remit savings to San José in order to subsidize the corn agriculture of their parents, cover the cost of household maintenance, or build a house of their own. At the same time, the wage labor experience in valley factories and in the United States engenders, or in some cases strengthens, their aversion to agriculture. When back in San José, young migrants (in their twenties or younger) tend to work in the valley industries while older migrants work the fields.

Remittances sent to Mexico from the United States approached $16 billion in 2004 (Durand, 2005). In contrast to earlier literature that took a critical approach to the effects of rural migration in Mexico as a kind of "addiction" to the US labor market, more recent research has painted a more positive picture of the impact of migradollars on rural and even national economies, while overlooking the social impact of such migration (eg. Durand et al., 1996). Leigh Binford (2003) has argued that this more recent work on migration conflates consumption with investment and makes three related questionable assumptions: that remittance "investment" generates long term local employment; that there is no saturation point for local investments; and that all economic strata are participating in or benefiting equally from migration. In San José, some households are fortunate enough to use wages and remittances for the purchase of items beyond mere social reproduction and consumption, that is, to invest in machinery or a truck. Although the purchase of a truck may create work for several people in town if, say, a construction business is opened, how many such businesses can open in a town of 7,000 before a market saturation point is reached?

Some of the households interviewed have more resources than others: they reported having either access to irrigation water; five hectares of land or more; and/or some piece of income-generating equipment like a tractor, truck, or electric corn grinder (*molino*). Remittances enabled some households to move up the social and economic ladders. On the other hand, less well-off

migrants reported not making enough money in the United States to save any money; or spending their money on television sets, wedding parties, or constructing their house instead of "investing" in goods related to employment or agricultural production. Most of the households I interviewed with or without "resources," as defined here, had migrant members, but, for the most part, I found that migration in and of itself did not guarantee movement up the social or economic ladder. There is no question, however, that over the past decade or two remittances have become a fundamental part of household reproduction.

To summarize then, residents have adapted to economic crises and in some cases improved their standard of living through out-migration and corn production. But this increased reliance on migrant remittances does not, for the most part, contribute to the generation of local employment alternatives to migration, nor to the long-term reproduction of corn agriculture. Regardless of how successful or unsuccessful they interpreted their experience in the United States to be, many migrant interviewees have returned to the United States for work. The next section explores how migration affects local agricultural practice.

Migrants and the future of local corn

When corn producers in San José were asked whether their children knew how to grow corn and select seed, the majority responded in the affirmative. When migrants in their twenties or younger were interviewed, however, they admitted to having limited knowledge about the details of corn production and the specific qualities to look for when selecting seed. One migrant explained that there is a difference between migrants around his age (36) who send money home to work the land and work the milpa themselves when in town, and a younger generation of migrants who neither know how to work the land nor want to return to it. As a successful migrant who built a house and bought four hectares, access to irrigation water, and a tractor with his income, this interviewee articulated the benefits of migration in helping his family and the town. But he also expressed doubts about the town's future: "What's going to happen to this town if no one wants to work the land?" His perception of a generational difference among migrants was confirmed by my interviews.

Migrants in their teens and twenties have less experience and less interest in the fields than migrants in their thirties or older. As boys they may have helped their fathers' farms, but by the age of 15 or so they are working full-time in valley factories or starting the journey north. Previous generations of migrants – the *bracero* migrants of the 1950s and 1960s or those migrants who began to work abroad in the late 1980s and early 1990s – also left as young adults but tended to be older by a few years with more agricultural experience under their belt. Moreover, prior to the mid-1990s, migrant labor in the United States **was itself often agricultural**, unlike the work in fisheries and restaurants of today's young migrants. Most are non-agricultural workers despite the fact that, since 2004, 150 Sanjosepeños have been contracted to work in Californian tomato production. Today's migrants are returning home less frequently than those who migrated in earlier years because of the expense and heightened border security.

In the southern valley, like in other regions of Mexico, residents have turned to corn cultivation because it is a flexible crop, a crop that can either be sold or consumed at home. Residents prefer tortillas made from regional, white criollo corn over pre-made tortillas or those made from industrial, hybrid corn. But with the overall decline in agriculture and the waning interest in agriculture among young residents, the question is where will such criollo corn come from?

Both men and women select seed for cultivation and women are sometimes responsible for the off-field decisions about corn cultivation in the absence of their male relatives, like hiring laborers. The labor in the cornfield, however, is still considered "men's work." Yet many young interviewees prefer to migrate north and are now accustomed to an hourly wage or at least to thinking in its terms. They describe agriculture work as arduous and unreliable. As a result, some agricultural work in San José is undergoing monetization. When sons and husbands are abroad, many households pay day laborers in cash for elote production and sometimes even subsistence corn production.

During the twentieth century, subsistence corn was largely cultivated by the unpaid male labor of the household or through sharecropping arrangements, but in recent years those households without enough available labor rely on paid day laborers for this task. Additionally, returned migrants hired to work the cornfield expect to be paid regular wages, rather than through sharecropping arrangements. In this way, remittances and wage labor experience in the United States are contributing to the monetization of corn production, a process that primarily impacts older migrants and residents who are responsible for the household's unpaid corn cultivation.

In one interview, two migrant brothers (ages 17 and 23) who were back in San José after working most of the year in the US fish packing industry and service sector, reported wiring money to their parents to save and to use on food, clothes, and agriculture. The eldest had built his own one-level cinderblock house replete with furniture and a television. For most of the year, he lives on the US boat where he works. When the brothers are in San José for a few months of the year, they eat meals at their

parent's house. Like many others, the eldest is in the process of establishing his own household, which may take many years or may never be completed in San José. The younger brother was back in San José indefinitely after a few years up north working at Burger King. They had both left school around the age of 14 to work full-time. As kids they helped with goat herding, worked in maquiladoras, and helped their father in the fields. Neither is able to describe the details of corn cultivation, such as the timing of irrigations in the crop cycle, landraces best suited for different soils, and so on. Like other migrants their age, they are fluent in Nahuatl but hard pressed to come up with the basic terms that cultivators use to differentiate between types of maize. They explain agriculture has no future since "you can't make any money in the milpa!"

This preference for non-agricultural work could, of course, turn out to be a generational phase in the household life-cycle since rural households and subsistence corn production provide a safety net for those who are unemployed, ill, injured, or elderly. Although young men (and women) may learn the details of maize agriculture as they age, they tend to prefer non-agricultural, regional employment when back in San José, or to return to the United States for work because they say this offers a steadier income and a faster return than waiting to sell a harvested crop.

The strategy to contribute to their parents' household or establish their own in town takes young Sanjosepeños away from corn production and related agricultural knowledge. Although transnational labor migration constitutes part of a local strategy to maintain the corn-producing household in San José, current trends – such as the difficult economic and environmental conditions faced by corn farmers, the decline in overall agricultural production, and young migrants' disinterest in agriculture – spell the long-term erosion of corn agriculture and a related displacement of in situ landrace diversity and abundance.

Conclusion

The development of new corn varieties throughout the world relies on genetic information from landraces found in Mexico and elsewhere. Industrialized agriculture is thus dependent upon seed stored ex situ in germplasm banks and in situ, maintained and developed in peasants' cornfields. Without landraces, such agriculture would be unable to adapt to new conditions or pests (Fowler and Mooney, 1990). This essay has argued that the neoliberal corn regime has exacerbated the long-standing problems faced by maize producers and in situ diversity in several ways. Despite restrictions on cultivating or testing GM corn in Mexico and recent steps to strengthen GM regulation, the rise in corn imports has introduced transgenic corn into the Tehuacán Valley, among other regions. Additionally, although the rural strategy to adapt to crisis and reform by increasing maize production seems to suggest that the future will bring an abundance of local maize, in places like the southern Tehuacán valley overall agricultural production is on the decline due to problems like water crisis, pests, population pressures, agricultural labor shortages, and increased input costs. While it remains to be seen whether migrants will take up maize production later in life, I have argued that the conditions for them to do so are increasingly difficult. This essay has thus argued that the fate of Mexican corn biodiversity not only depends upon clear and enforceable biosafety regulations but also upon policies that support and enhance sustainable agriculture and small-scale Mexican maize cultivators.

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