GLOBAL DEVELOPMENT AND ENVIRONMENT INSTITUTE

WORKING PAPER NO. 07-01

Policy Space for Mexican Maize: Protecting Agro-biodiversity by Promoting Rural Livelihoods

Timothy A. Wise

February 2007

Tufts University
Medford MA 02155, USA
http://ase.tufts.edu/gdae

Policy Space for Mexican Maize: Protecting Agro-biodiversity by Promoting Rural Livelihoods

Timothy A. Wise[1]

Abstract

Since the introduction of the North American Free Trade Agreement (NAFTA) in 1994, traditional maize farmers in Mexico have faced difficult economic conditions. In barely more than a decade, as many as one million farmers may have abandoned their land under economic pressure from rising imports, low prices for maize and other traditional crops, weak local and regional demand, and large reductions in public sector support for agriculture. The losses are environmental as well as economic. With the loss of traditional maize, there has been a documented loss of the agricultural biodiversity of which these farmers and their ancestors have been stewards for centuries. With maize trade scheduled to be fully liberalized under NAFTA in 2008, many farm groups are calling for a renegotiation of the treaty's agricultural provisions to prevent further damage. This policy analysis examines the room for alternative policies in Mexico under existing economic and environmental agreements, including NAFTA. It concludes that the Mexican government retains access to many useful policy instruments that could promote rural livelihoods while arresting the losses of important maize diversity. What is lacking is the political will to make use of them.

Introduction

Mexico is the world's center of origin for maize, which remains the country's most important agricultural crop, most critical source of nutrition, most significant source of livelihoods, and the center of Mexican culture. Maize is also one of the world's most important food crops. In Mexico, small-scale producers continue to act as stewards of the country's agro-biodiversity, cultivating more than forty distinct maize landraces adapted to diverse agro-ecological conditions and human needs. Mexico's maize diversity, maintained not only in the world's largest maize gene bank but *in situ* in farmers' fields, is an important source of germplasm in the development of hybrid maize varieties for use in industrial agriculture (Boyce 1999).

[1] An early version of this paper was presented at the XXVIII Colloquium on Regional Anthropology and History, "Desde los Colores del Maíz: Una Agenda para el Campo Mexicano," held in October 2006 at El Colegio de Michoacán, Zamora, Mexico. It will appear in Spanish in a forthcoming collection from the colloquium. The author benefited from the rich exchange at that three-day forum and from comments there by researchers too numerous to name. In addition he would like to thank Hugo Alonso Garcia, Alejandro Nadal, Doreen Stabinsky, Howard Mann, Steve Suppan, and Kevin P. Gallagher for their helpful comments. Elanor Starmer and Muriel Calo provided invaluable research assistance.

My own research and that of many others has documented the negative impact that neoliberal economic policies in general, and the North American Free Trade Agreement (NAFTA) in particular, have had on Mexico's small-scale maize producers. The Mexican government unilaterally waived most of the import restrictions built into NAFTA's 15-year transition to full liberalization in maize trade and failed to avail itself of other opportunities to protect or promote small-scale maize farming. As a result, corn imports from the United States increased three-fold after NAFTA, prices dropped by nearly half, and 2.5-3 million poor farmers in Mexico have found themselves under increasing economic pressure (Nadal and Wise 2004). While the United States increased its support for agriculture – roughly doubling its commodity support budget – Mexico's farm programs declined dramatically. The two countries' support for maize farmers in particular followed a similar trend, with U.S. support rising 48% in real terms to $8.3 billion in 2004, while Mexico's inflation-adjusted subsidies declined 39% to $842 million (OECD 2005). Since 1997, the United States has exported its corn to Mexico and the rest of the world at prices estimated to be nearly 20% below average farmer costs of production, one definition of "dumping" (Murphy, Lilliston et al. 2005).

The socio-economic impact on rural Mexico has been dramatic. While the countryside has suffered an economic shock treatment, it has not produced the economic adjustments most policy-makers predicted. An estimated 1.5 million Mexican farmers have left farming since NAFTA took effect in 1994, but the rural sector in general, and the maize sector in particular, remain large and economically important. Rural poverty remains intractable, and rural migration rates have soared (Taylor and Dyer 2003).

If NAFTA's impacts on farmers' livelihoods raise concerns about poverty and migration out of rural areas and out of maize farming, these in turn pose broader questions of global importance for genetic diversity in maize in the crop's birthplace. These concerns grew all the more serious in 2001 with the discovery in the southern state of Oaxaca of native maize fields contaminated with transgenic maize, almost certainly from grain imported for food from the United States (NACEC 2004).

In the liberalized North American market, low-cost monoculture corn floods the Mexican market while genetic diversity, a global public good, has little or no economic value. As a result, farmers' stewardship of maize diversity goes largely unrewarded, except in regional markets where local landraces earn a premium. These dynamics create a classic public policy challenge. Trade liberalization is extending the reach of private property and market relations into areas previously protected from such pressures. Meanwhile, environmental factors remain largely externalized in such market relations. This leaves environmental goods, particularly those that reside in the global commons, vulnerable to degradation. If *in situ* maize genetic diversity is indeed of value, and if Mexico's small-scale farmers are critical to its preservation, then new policies must protect maize farmers from economic pressures that are leading them to abandon the land. New policies must promote ways to sustain the production of biodiverse maize.

In this paper, I will examine the policy space that Mexico could have at its disposal to pursue alternative policies to protect traditional maize and the farmers who

are the very human link in the plant's ongoing evolution. While the present Mexican administration seems loathe to avail itself of such policy options, they are worth examining. Recent price increases for tortillas, Mexico's most important staple food, have highlighted the food-security risks associated with dependence on foreign supplies of maize. While the NAFTA model has certainly promoted the agriculture and trade policies Mexico has followed, it would be a mistake to think that the agreement has closed off all avenues for Mexican government action.

After presenting an analytical framework for understanding the limitation of markets in dealing with a global environmental good such as plant genetic diversity, I will offer some preliminary evidence from a forthcoming study by colleagues at El Colegio de Mexico of maize farmers in the state of Veracruz, which shows how alarming these trends are. I will then identify some of the policy space that exists within Mexico's existing international obligations, reviewing briefly the differential support systems in the U.S. and Mexico toward maize. I will look more closely at the policy space afforded by Mexico's environmental agreements. I will conclude with a rationale for using this policy space to mobilize Mexican and international support for an alternative set of policies toward Mexico's maize sector.

Framework: Agro-biodiversity, market failure, and state intervention

In recent years, and particularly since the approval of the Convention on Biodiversity (CBD) in 1992, increasing attention has been paid to understanding on-farm diversity, the causes of its erosion, and the policies and practices that can prevent the loss of important stocks of traditional crop varieties. Though the convention focused overwhelmingly on the threats to wild biodiversity, the CBD mandates *in situ* conservation of agro-biodiversity as well. It also recognizes the importance of indigenous and local communities and their rights to benefits-sharing.

The U.N. Food and Agriculture Organization (FAO) has begun to document global agro-biodiversity and the extent of genetic erosion (FAO 1997; FAO 1999). Meanwhile, early calls to action on agro-biodiversity conservation (e.g., Wilkes, Yeatman et al. 1981) are being taken up by a growing number of researchers concerned with the economic causes of diversity loss (see, for example, Fowler and Mooney 1990; Mooney 1996; Tripp and van der Heide 1996; Thrupp 1998; ETC, GRAIN et al. 2001; Mooney 2001).

In many ways, the international seed-collection systems have served crop breeders well. The system defined the world's pool of seeds as a public good. The thousands of so-called accessions in gene banks, which were developed and maintained largely with public funds, were accessible at no charge to researchers and crop breeders. New hybrids developed by private companies from this rich gene pool, of course, were not public goods but were sold to farmers for a profit. These profits in part funded ongoing private research into new varieties, but they did not return value in any significant way to the gene banks' maintenance or the international system of collection and storage. More important, they did not compensate the millions of small-scale

farmers who have, for generations, overseen the adaptation of maize to diverse environments, dietary demands, and cultural preferences. One study estimated that .001 percent of the value derived from bioprospected native plants has been returned to the communities from which the plants came (Pimbert 1999).

Of the main cereal crops, maize has retained the greatest diversity because it is open-pollinated (as opposed to self-pollinated), and the improvements in temperate strains do not translate easily into tropical areas. Still, it tends to have the greatest pressure on diversity because it is the crop in which there have been the greatest productivity gains from hybrids. This has made the maize seed industry more heavily commercial. By comparison, wheat and rice improvements do not so readily pay for the R&D costs associated with their development. Maize's remaining diversity owes to the high costs of improved seeds and their limited applicability to the poor growing environments of traditional farmers (Smale, Bellon et al. 2001).

Global economic integration increases pressure on agro-biodiversity. Market integration promotes specialization and an exclusive focus on high-yield varieties, as national markets become dominated by low-priced imports from the agricultural surpluses of the largest producers. This leads to the loss of local varieties as well as minor crops. Globalization also replaces local cultural traditions with "modern" preferences; wheat bread supplants the market for corn tortillas in Mexico, while imported corn flour further displaces flour made from traditional corn varieties within the national tortilla market. Livelihood pressures lead to the need for off-farm employment to supplement incomes. This results in declining attention to traditional farming, and often to wholesale migration and the abandonment of farming altogether (Almekinders 2001).

Environmental economists have explained this dynamic well (see Swanson, Pearce et al. 1994). Genetic erosion is built into the current system of economic incentives. Modern agriculture depends on traditional agriculture for genes but returns nothing to it, resulting in the erosion of the source on which it depends for raw material. As a public good, many of the values of crop genetic diversity – systemic stability, reduced yield variability – are "non-appropriable values." This creates a bias toward conversion to high-yielding varieties, since incentive structures reward only these "downstream" values, such as exploration (plant breeding), not the "upstream" values contributed by traditional farmers (Correa 1999). This leaves it to governments to determine and supply the appropriate levels of diversity-related "crop insurance," but they will undersupply it because the values involved – reduced variability and vulnerability in world food yields and prices – are global in nature.

Few studies have specifically linked the erosion of diversity to the process of global economic integration. One researcher carried out field studies of traditional jute production in Bangladesh, which is being displaced by imported synthetic fibers, and traditional corn production in Mexico, which is threatened by hybrid corn imports from the United States following trade liberalization. He argues that we are seeing the "globalization of market failure," as economic integration links imperfect markets in

environmentally destructive ways. In both cases, the market prices for modern, Northern products fail to incorporate significant negative environmental externalities. Meanwhile, traditional producers go uncompensated for the positive environmental externalities associated with traditional production. The study shows that nearly the entire price advantage enjoyed by synthetics over jute – about 35 per cent – would be eliminated if environmental externalities were factored into prices (Boyce 1999).

Environmental economists and policymakers sometimes seek to address such market failures through market-based policies to internalize externalities. This involves efforts to quantify the value contributed to modern agriculture by the genetic stocks maintained by traditional farmers. There is general agreement that these values are very difficult to quantify, and even more difficult to internalize (Evenson, Gollin et al. 1998). One study estimated that genetic improvements to U.S. crops from existing diversity increased the value of harvests by an average of $1 billion per year from 1930-1980 (Cromwell, Cooper et al. 2001). Still, valuation fails to provide meaningful guidance for preservation efforts. In part, this is due to the limited development of any functional systems of payment for environmental services (PES) for such diversity. Valuation can serve as a guide to price-setting under such schemes, as it has in the case of the emerging regime for climate change mitigation, which includes payments for forest conservation and development as a form of carbon sequestration. No such widespread regime exists, or is likely to develop, in the case of agro-biodiversity.

In practice, few policies have been developed or implemented to achieve significant *in situ* conservation, but recent attention to the importance of on-farm diversity has generated a growing body of literature on such efforts. Based on extensive field work, much more is known today about the biological nature of on-farm diversity, the location of key centers of diversity for important food crops, the causes of genetic erosion, and the farm-management practices that can promote *in situ* conservation (Tripp and van der Heide 1996; Brush 2000; Friis-Hansen and Sthapit 2000; Smale, Bellon et al. 2001).

One area that has received attention in recent literature on biodiversity is the effort to create niche markets for products made from native crop varieties. Such market-based schemes – which include the promotion of "diversity fairs" in traditional rural areas – could serve to preserve a limited number of varieties in a limited number of communities. They also serve as useful pilot projects to test the potential size of such markets. But the scope of agro-biodiversity erosion suggests a policy response that goes well beyond even the most optimistic estimates of the potential for niche market development. One analyst notes, "At present, the space in this market for small-scale producers and for product diversity is limited. Globalization, industrialization, and technology development have resulted in a market that is increasingly dominated by the demand for uniformity, bulk and competitive prices from agro-industry and urban markets" (Almekinders 2001, 25).

Altieri, Anderson et al (1987) have argued for a more expansive understanding of crop diversity, taking an approach that emphasizes the preservation not only of distinct

crop varieties but of the ecosystems as well as the human cultures that developed and maintain them. They argue that because agro-ecosystems are directly dependent on human management and have evolved under the direct influence of farming practices, they cannot be isolated from the cultures of local people. They stress the importance of including the entire ecosystem, not just the productive crop unit, in conservation efforts, as peasants rely on neighboring land for a wide variety of uses. Crop breeders often view these lands as marginally productive, even though they provide essential ecosystem services to peasants.

This more holistic approach leads to more ambitious policy prescriptions, linking *in situ* conservation efforts to broad-based rural development programs. "We contend, nevertheless, that maintenance of traditional agro-ecosystems and closely associated natural ecosystems is the only sensible strategy to preserve *in situ* repositories of crop germplasm. Conservation of crop genetic resources can still be integrated with agricultural development, through rural development projects that preserve the vegetation diversity of traditional agro-ecosystems and that are anchored in the peasants' rationale to use local resources and their intimate knowledge of the environment" (Altieri, Anderson et al. 1987, 55).

Despite the general acknowledgement of the importance of a supportive macroeconomic policy environment for such conservation, and the recent attention to the microeconomic aspects of *in situ* conservation, few researchers have focused on the macroeconomic causes of genetic erosion and its relationship to global economic integration. Fewer still have examined institutional and policy reforms necessary to preserve on-farm diversity (Thrupp 1998).

What is clear from the Mexican case is that there is great danger in leaving the fate of valuable genetic wealth in maize to market forces. As a public good, maize biodiversity is virtually guaranteed to be undervalued and underprotected in the marketplace. The need for a government response to the problem of genetic erosion is great, particularly in the current economic environment; both continued crisis and sustained recovery pose threats to maize diversity in Mexico. If the economic crisis continues, with sluggish overall economic growth and stagnation in the rural economy, economic pressures will eventually lead to the depopulation of the countryside and the extinction of native species. Paradoxically, recovery may pose an even greater threat. If opportunities for improved livelihoods in urban areas present themselves to traditional farmers beset by the current state of disinvestment, lack of protection, price shock, and failure to compensate valuable environmental services, they may flee the countryside at even more alarming rates.

Evidence from Veracruz

New research from Veracruz underscores the severity of the current situation. Colleagues at El Colegio de Mexico's Program on Science, Technology, and Development (PROCIENTEC) are now completing a case study for World Wildlife Fund on trade, poverty and the environment, examining the implications of changing economic

structures under liberalization for natural resource management. They are studying the communities of Soteapan near the Biosphere Reserve Sierra de Santa Marta, which include a diverse range of producers, from small-scale commercial producers in the lowlands to subsistence producers in the highlands bordering the biosphere reserve. They compare data from earlier surveys with their own surveys done last year. Together the data presents a revealing picture of the emergency situation facing small farmers in Mexico and the severe and potentially irreversible environmental impacts of that crisis. (The following summary is from the forthcoming report by Nadal and Garcia Rano 2007.)

Consistent with previous studies, they find that under pressure from imported maize after NAFTA, prices fell dramatically in local and regional markets, dropping 50% in real terms between 1994 and 2000. Equally significant, however, prices for other important crops in the area also fell, some for reasons unrelated to NAFTA. Coffee prices declined 66% while bean prices fell 44%. This left producers with few options to address their income crisis.

The other dramatic impact on local producers came from the restructuring of local and regional markets with the expansion of Maseca, the multinational Mexican firm that controls a large share of the domestic market for maize flour. Through its national network of suppliers and its access to inexpensive imports, Maseca can provide year-round supplies of flour, *masa*, and tortillas in the area, something local *nixtamaleros* cannot match. Researchers found that Maseca insisted on year-round contracts with its buyers, which made it much more difficult for seasonal millers to gain market access. As a monopsony buyer in local markets, Maseca helped drive prices down to their lowest level while at the same time reducing the marketing options for local producers.

The figures are dramatic. The market for maize in the region surrounding Soteapan increased 59% from 1990-2004, but Soteapan producers' share of that market dropped by over 40%, from 7.3% to 4.3%. This had a particularly harsh impact on commercial producers in the lowlands who sent a majority of their maize to market. That market continues to shrink as local millers go out of business, unable to compete with Maseca.

The income impacts were dramatic as well. Survey results suggest that between 1993 and 2005, commercial producers saw their incomes, adjusted for inflation, decline by more than 40%. Subsistence producers saw their real incomes fall by half. By other accounts, real incomes in the region fell over 70% from 1993-2005. In 2000, 90% of the Soteapan working population was earning less than two minimum wages, a common Mexican standard for extreme poverty.

This story is by now well-known in Mexico. Less well-understood are the impacts of such income and livelihood losses on the environment. Our colleagues at El Colegio de Mexico found a wide range of negative environmental effects, many related to the loss of the traditional *milpa* system of maize intercropped with beans, squash, and other crops. That system has for generations provided Mexicans with a balanced diet

while keeping the agricultural ecosystem in balance as well. If the observations from Soteapan are accurate, the *milpa* will be a thing of the past unless present trends are reversed, and with the *milpa* will go some of Mexico's rich store of agricultural biodiversity.

One source of pressure on the traditional *milpa* comes from diversification, as producers seek crops that can bring more income from their lands. Coffee was an early attempt at diversification in highland communities, but the persistent price crisis in coffee has made it only marginally valuable. Farmers also experimented with more fruit trees (especially papaya), and more recently with palms as a long-term investment in a future palm oil market. They also increased lands devoted to pasture for livestock.

Since 1993, Soteapan producers have reduced the share of their land devoted to maize cultivation from 50% to 32%. The story is far more dire than these troubling figures would indicate. Commercial lowland producers have responded to the crisis by expanding the intensive cultivation of hybrid maize varieties, abandoning the *milpa* altogether. Highland producers have also begun to substitute monoculture hybrid maize for their traditional plots. The reason, in large part, is a shortage of labor, particularly at key harvest times.

It is now well documented that rural migration has increased dramatically with the crisis in the countryside. This is evident in Soteapan. In 1993, few households reported any significant migration, either seasonal within Mexico or permanent to the United States. By 2005, over 20% of households reported at least one family member migrating temporarily, many to the tomato harvest in Sonora. Among some of the middle-income producers, a similar share report permanent migration to the United States or other parts of Mexico.

Because the temporary migration comes at the time of the most intensive need for local labor on the *milpa*, this labor-intensive cultivation process is undermined. Some producers leave and the supply of labor for hire is reduced, driving up wages and making it more difficult to supplement family labor with contracted workers. In addition, the traditional systems of shared community labor are falling into disuse.

Thus many of the diversification strategies observed in Soteapan are adaptive strategies to reduce the labor investment in the family plot. Livestock is less labor intensive than the *milpa*, and so is palm and fruit cultivation. Unfortunately, so too is more intensive cultivation of monoculture maize from hybrids using rising levels of agro-chemicals, a practice observed now not just among commercial producers but also low-income farmers in the highlands.

The impact on agro-biodiversity is quite evident. Survey data from the region show that whereas the typical producer in 1960 used as many as 12 difference native landraces of maize in the *milpa*, now even traditional producers are growing only three landraces, with another two *mestizo* varieties (hybrids crossed with local varieties), and eight different hybrid varieties. The biodiversity decline is even more dramatic for the

milpa as a whole. In 1960, researchers found as many as 32 different plants in a three-hectare plot; now the most researchers could find was eight.

El Colegio de Mexico researchers summarize the transformation: "Today, with economic pressure from all sides, producers are shifting towards a distorted version of the traditional *milpa*. The reason for this is that yields appear to increase, although not enough to reduce the plight of producers' households. In this transformation, monoculture cultivation becomes the main feature of the production system, agro-chemical inputs develop into a necessity, and the old method based on agro-diversity starts to break apart." (p. 21)

The other noteworthy environmental impact in Soteapan of the transformation of the local agricultural economy under liberalization is the rise in unsustainable resource extraction from the biosphere reserve. The most marginalized producers live on the borders of the reserve, and many rely on the reserve for fuel wood. More damaging still, one of the main forms of wage labor for these low-income producers is operating a chain saw for the industry supplying wood to construction projects in the region and to Pemex, which requires vast quantities of wood for scaffolding and other construction needs at its installation nearby. Some 60% of those surveyed said at least one family member hired out for this type of work, and they are increasingly sent into the forested reserve, in violation of the law, to find wood.

Another rising form of illegal and unsustainable resource extraction is hunting of endangered animals including giant toucan, ocelot, emerald iguanas, yellow parrots and macaws, and turtles. Some fetch very high prices on the black market.

PROCIENTEC's new study adds urgency to the demands to reformulate Mexico's policies toward its traditional maize producers. There is ample space to consider alternative policies.

Policy Space – Subsidies in Mexican-U.S. Maize Trade

What policy space exists within Mexico's existing international obligations to construct an alternative set of policies that could support traditional, biodiverse maize production? NAFTA, with its impending final phase-out in 2008 of allowed protections for maize, beans, and a few other products, remains the most formidable obstacle to formulating new policies. The Mexican farmers movement's call for a renegotiation of NAFTA's agriculture provisions, particularly for white maize and beans, is well justified. To protect and promote traditional maize farming, the Mexican government needs the power to impose import restrictions on cheap corn flooding Mexican markets from the United States. These are, of course, precisely the measures that NAFTA proscribes.

Mexican researchers have studied in some detail the precedents for such a renegotiation, which would not necessarily entail reopening the treaty as a whole. Side agreements not to enforce certain provisions of the treaty on the negotiated schedule have been uncommon, but they have taken place, notably regarding the scheduled 2003

liberalization of the market for chicken parts (Zahniser and Link 2002). These are the equivalent of so-called Voluntary Export Restraints, limits negotiated outside of existing bilateral, regional, or multilateral obligations.

Mexican policy analysts have also studied the policy space that exists within NAFTA for continued support for Mexican maize and bean farmers, noting that, as with the Mexican government's unwillingness to enforce the treaty's tariff-rate quota for maize, the government has not availed itself of the powers it has to support traditional farmers (WTO 2002; Zahniser 2005). These include the right to impose emergency safeguard measures to address import surges that cause "serious injury" to domestic producers.

In this paper, I will not repeat those analyses but rather focus on policy space that may exist within Mexico's international environmental obligations particularly as they relate to protecting genetic diversity in maize. First, though, I will briefly review evidence for Mexico's right to impose countervailing duties on U.S. maize imports due to its NAFTA partner's disproportionately large subsidies to its corn farmers.

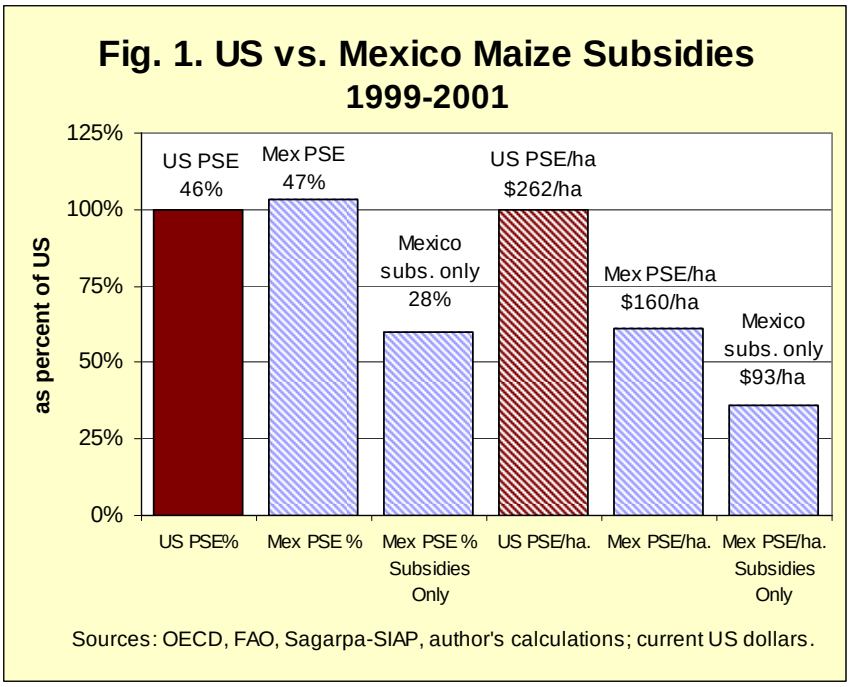
NAFTA explicitly allows the parties to the agreement to apply their anti-dumping and countervailing duties laws to goods imported from NAFTA partners, provided they are consistent with obligations under the GATT. In agriculture, dumping has generally been defined as exporting at prices below domestic prices or at prices lower than the export prices charged to other trading partners. In the case of U.S. corn, neither of these conditions prevail; the United States is, as one agricultural economist has said, an "equal opportunity dumper," as willing to underprice its commodities at home as it is abroad. While there is little question U.S. corn comes into Mexico at prices consistently below production costs – another definition of dumping more commonly applied in the manufacturing sector than in agriculture – Mexico could have a difficult time winning an anti-dumping case against the United States on corn.

Not so in the case of countervailing duties (CVD), tariffs that can be imposed to recoup the potential losses to domestic producers from subsidized imports. NAFTA allows CVDs in cases of proven economic injury to domestic producers from the subsidies applied by an exporting country to its goods. A subsidy valued at more than 5% of the value of the traded good is considered actionable. The General Agreement on Tariffs and Trade (GATT) prohibited such actions in agriculture among member governments under the so-called Peace Clause, which explicitly exempted agricultural goods from the GATT's CVD provisions. The Peace Clause has now expired, however, and the stalled negotiations on a new World Trade Organization agreement leave agricultural exporters that heavily subsidize their farmers vulnerable to action. Canada recently began a dispute process against the United States for its heavy subsidization of corn.

To make its case for CVDs, Mexico would need first to cut through some of the fog of misleading official data on agricultural subsidies. I will make a brief attempt to shine a light through that fog. Agricultural support is tabulated by the OECD based on

detailed submissions of agricultural subsidy and support programs by member states, Mexico among them. The resulting Producer Support Estimate (PSE) is calculated as a value in local currency, but it is most commonly presented as the share of farm value accounted for by subsidies and price supports, overall and for any given supported crop.

Those figures, at first glance, would suggest that Mexico has little chance of mounting a successful demand for the right to impose CVDs on U.S. corn. As the first two bars in Figure 1 show, for the three-year period 1999-2001 Mexico's PSE of 47% actually exceeded the U.S. PSE of 46%.



Does Mexico really subsidize its maize farmers at a higher level than the United States does? No, and it is important to understand why these numbers are misleading. I will only briefly summarize the main reasons for the discrepancies between the PSE percentages and reality. (For a more detailed analysis, see Wise 2004.)

1. **The PSE includes non-subsidy support.** This is called Market Price Support (MPS) and includes the support to producers from tariff protections, price supports, and other forms of non-subsidy government programs. In the years covered in Figure 1, 41% of Mexico's PSE was accounted for by MPS. Take that out, as in the third bar in the graph, and Mexico's true subsidy percentage drops to 28% of the value of maize production.

2. **Non-subsidy support is estimated.** There is good reason to exclude MPS in the case of Mexico. As maize farmers in Mexico will certainly attest, these were years in which previous tariff protection and price support programs were not operating. So where did the MPS figure come from? It is

imputed from the difference between the import price and domestic prices. Since, according to neoclassical economic theory, prices should align in free markets, any difference can be assumed to be the impact of government intervention policy. That is what the OECD does in estimating Mexico's MPS. U.S. export prices are lower than Mexico's domestic maize prices, so the difference is the estimated value of government support *whether any support programs exist or not.*

3. Non-subsidy support is overstated. In the case of Mexico, the U.S. export price is some 20% below the actual costs of production, a price differential that is itself the product of U.S. government policy. This increases the price gap, with the paradoxical effect of raising Mexico's estimated support levels, even if Mexican policies have not changed at all. Higher U.S. support results in higher estimates of Mexican support. For Mexico and the United States, it makes much more sense just to compare true government subsidies.[2]

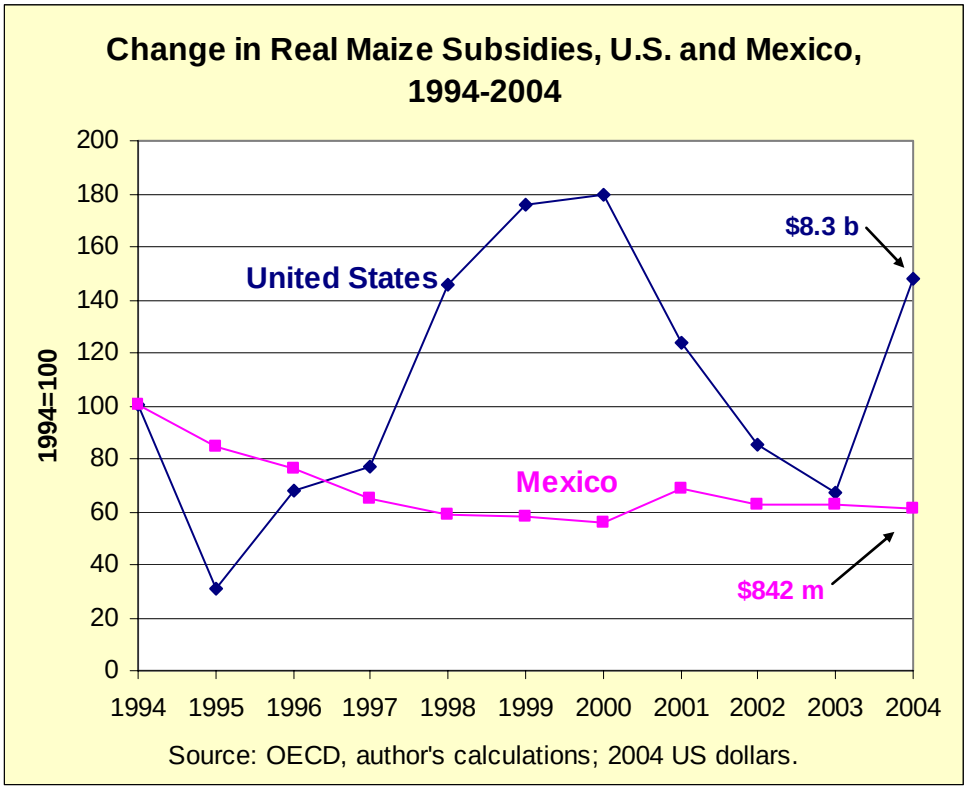
4. Subsidy support is overstated. Mexico's subsidy support is overstated because of the large productivity differences between the U.S. and Mexico, which shows average maize yields one-third of U.S. levels. Because the percentage measure is based on production, the U.S. levels are understated relative to Mexico's. Reporting subsidies on a per-hectare basis factors out this difference. The last three bars of Figure 1 present this data. The U.S. maize subsidy is $262/ha, while Mexico's full PSE/ha is $160/ha, and its true subsidies (excluding MPS) are just $93/ha, barely one-third the U.S. level, which are entirely in the form of subsidies.

Viewed in this light, Mexico has every reason to consider its maize subsidies lower than those of its Northern neighbor and has a sound basis for a claim for countervailing duties. In more recent years the U.S. subsidies to its corn farmers have gone down somewhat due to higher market prices, to 24% of production value between 2002-2004, while Mexico's actual subsidy levels have risen. But from 2002-2004 Mexican maize subsidies per hectare, at $128/ha, were still well below the U.S. per-hectare subsidies of $170.

In fact, the two countries have been moving in opposite directions since NAFTA was passed. Figure 2 shows the changes since 1994 in maize subsidies, indexed and adjusted for inflation. Where Mexico has reduced the value of its payments by about 40%, the U.S. maize payments have been as much as 80% above their 1994 levels.

[2] To some extent, the OECD has acknowledged this problem. In a technical paper on the adequacy of the PSE and the use of distorted reference prices, the OECD notes that for many countries their market price support policies are "no more than a defense against the world market price depression that results from other countries' policies" OECD (2003c). Is the Concept of the Producer Support Estimate in Need of Revision? Paris, OECD**:** 18.

Figure 2



In addition to the option of defending Mexico's maize farmers through the imposition of countervailing duties, based on U.S. subsidy levels, the country also retains the option to increase its own support levels. While fiscal constraints and the lack of political will remain the principal obstacles to raising domestic support levels, it is worth noting that Mexico has a great deal of policy space under its GATT commitments, because most Mexican agricultural subsidies are notified to the WTO as non-trade-distorting programs decoupled from production.

Mexico's total agricultural subsidies (not counting market price support) were 34 billion pesos in 2004, but its notified trade-distorting support was only about 2.7 billion pesos. Mexico's Aggregate Measure of Support (AMS) limit for 2004 was 25.2 billion 1991 pesos, or in 2004 currency 141.2 billion pesos. In other words, Mexico is a remarkable 138.5 billion pesos beneath its AMS cap – *some $12 billion US dollars* – policy space that could be used for even the most trade-distorting forms of domestic support.

NAFTA and the WTO leave Mexico a good deal of policy space to defend Mexico's traditional maize farmers. With the WTO's Peace Clause expired, Mexico could avail itself of NAFTA's provisions for countervailing duties, and an honest accounting of relative subsidy levels between the two countries would justify such a claim. In fact, since the duty imposed is based not on the documented material harm but on the level of the subsidy, it could be argued that the higher the U.S. corn subsidies the more policy space Mexico retains. In addition to countervailing duties, Mexico could

impose even the most trade-distorting forms of domestic support and still not approach the limits imposed under the WTO.

Finding Policy Space in the Environment

In addition to the policy space for Mexico to increase its own agricultural subsidies or take retaliatory action against U.S. subsidies, environmental concerns may provide the most useful vehicle for taking decisive action to protect Mexico's maize farmers and the biodiversity they cultivate. Some of those opportunities may reside, unexplored, in the WTO system itself. Article XX of the GATT 1994 may allow for some protection of biological diversity as an environmental good. In addition, some argue that under Article XI of the GATT Mexico could declare itself a GMO-free zone for marketing its exports, do so for domestic marketing as well, and then ban all imports of GM corn seeds as protection against contamination.[3] Such claims have not been tested but could be explored.

The environmental agreement of greatest relevance, though, is the Cartagena Protocol on Biosafety, which Mexico has signed but its two NAFTA partners have not. While it is questionable whether Mexico is technically in violation of its obligations under the treaty, it is undeniable that the government could interpret its obligations in such a way that it could dramatically reshape U.S.-Mexico maize trade by insisting on a precautionary approach to the importation of genetically modified maize.

The Cartagena Protocol

The Cartagena Protocol was agreed to in 2000 with the goal of ensuring each country's right to protect its biosafety by regulating the transboundary flows of potentially hazardous genetically engineered organisms, or, in the parlance of the Protocol, "living modified organisms" (LMOs). The clear intent of the Protocol was to require full disclosure of any LMO contents of traded goods so that the importing country could decide the level of precaution it wanted to observe and ensure safe handling of any LMO it decided to accept. Mexico has signed and ratified the Protocol, Canada has signed but not ratified it, and the United States has done neither.

The precautionary principle is strongly embedded in the Protocol, itself a product of the Convention on Biological Diversity, granting each signatory the right to take precautionary action. Prior to the first import of any LMO, the importing country can choose to carry out a risk assessment. The Protocol does not give specific guidelines on particular risk management strategies, but does allow parties to "establish and maintain appropriate mechanisms, measures and strategies to regulate, manage and control risks…. Measures… shall be imposed to the extent necessary to prevent adverse effects of the LMO on… biological diversity, taking also into account risks to human health" (Secretariat of the Convention on Biological Diversity 2000). The IUCN notes that the

[3] Personal communication, Howard Mann, International Institute for Sustainable Development, January 28, 2007.

use of the word "prevent" differs from, and appears to be stronger than, the wording used earlier in the Protocol that urges Parties to take a precautionary approach. In fact, the articles laying out the terms for taking decisions on imports (Articles 10 and 11) clearly invoke the main elements of the precautionary principle, stating that: "Lack of scientific certainty due to insufficient relevant scientific information and knowledge regarding the extent of the potential adverse effects of a living modified organism… shall not prevent that Party from taking a decision … with regard to the import of that living modified organism … in order to *avoid* or minimize such potential adverse effects" (emphasis added).

The risk assessment must be based on available scientific evidence, to allow the importing country to identify and evaluate possible threats to biodiversity (Secretariat of the Convention on Biological Diversity 2000). According to the IUCN, "evidence that might not be regarded as scientific – for example, indigenous and traditional knowledge and information, as well as anecdotal information – might also be considered where relevant, provided consideration is carried out in a scientifically sound and transparent manner" (IUCN 2003).

Indeed, Article 26 allows Parties, in reaching a decision on whether or not to import an LMO, to "take into account, consistent with their international obligations, socioeconomic considerations arising from the impact of living modified organisms on the conservation and sustainable use of biological diversity, especially with regard to the value of biological diversity to indigenous and local communities" (Secretariat of the Convention on Biological Diversity 2000).

Parties are also asked to "endeavor to ensure that any LMO… has undergone an appropriate period of observation that is commensurate with its life-cycle or generation time before it is put to its intended use." The language does not specify if the observation must take place in the importing country, or can take place elsewhere. The IUCN elaborates that "if an initial risk assessment suggests that there are significant differences between the place where the period of observation has occurred and the receiving environment, then a further period of observation… may be necessary" (IUCN 2003). Accordingly, then, Mexico could choose to delay importation of particular LMOs if it felt that the tests conducted in the U.S. or elsewhere did not accurately reflect the environment into which they would be introduced in Mexico, which is most likely the case, and could require that in-country tests be carried out before trade could take place.

Key to the functioning of the Protocol is the labeling requirement, which has undergone several changes since the Protocol was first agreed to in 2000. Original language required that Parties exporting LMOs for use as food, feed, or for processing label the shipments as "may contain LMOs," and that the labels include the instruction that the contents were not intended for introduction into the environment (Article 18). The labeling requirements would apply to any shipments of LMOs entering the territory of a Party to the agreement if they chose to make such requirements part of national law, regardless if the country of origin was a non-Party. If Mexico had adopted such labeling requirements as allowed under the Protocol, the U.S. and Canada would have been

obliged to comply in their trade with Mexico even though neither had signed the Protocol.

The specific details of the labels were to be worked out in official meetings within two years after the Protocol took effect (September 2003) (Secretariat of the Convention on Biological Diversity 2000). However, no specifics had been agreed to by 2005. In March 2006, the COP3 finally came to consensus on labeling requirements, a process in which the Mexican government played a disruptive role. The final requirements are as follows:

- Products that have been clearly identified and separated as transgenics will have to carry the label "contains LMOs" and will need to carry specific information on the LMOs contained in the shipment.
- The wording "may contain LMOs" is allowed in cases in which the presence of transgenics has not been documented and identified from origin.
- A Brazilian proposal recommended a four-year transitional period to allow countries to gradually adopt the mandatory labeling. Negotiators expanded that period to six years.
- In four years, the fifth "meeting of the parties" (MOP5) will evaluate how well the labeling clause has been implemented, to help orient the final decision to be reached at MOP6 in 2012.

Mexico blocked MOP3 negotiations until the Parties agreed to a clause stating that rules on labeling will not apply to transboundary transport between Parties to the Protocol and Non-Parties, a restatement of what in fact is international law, but legitimating in legal terms what many observers considered a tripartite agreement between the three countries that contravened the spirit, if not the letter, of the Protocol (International Grain Trade Coalition 2006; Kalaitzandonakes 2006; Osava 2006). Therefore, trade between the United States, Canada, and Mexico does not have to abide by the labeling requirements of the Protocol, even though Mexico has a legal right to require the same information on LMO shipments from these non-Parties as it requires from Parties to the Protocol, much as the European Union has been doing. This trilateral agreement governing trade in LMOs between the three NAFTA countries, described below, is in effect at least until December 1, 2006, but will likely be extended under the Calderon administration.

The text of the Protocol allows Parties and Non-Parties to enter into agreements and arrangements on trade in LMOs, provided they are *consistent with the objective of the Protocol* (Article 24). In 2003, in part to pre-empt MOP3 determinations of the labeling requirements, the governments of Canada, Mexico and the U.S. entered into a Trilateral Arrangement to define the labeling requirements called for in Article 18. The arrangement stated that although the U.S. and Canada are not Parties to the CPB, they would abide by Article 24 of the Protocol. But the agreement called for a very weak labeling scheme. The exporter must only document that a shipment "may contain" LMOs for all shipments with more than 5% LMO content. For shipments requiring the "may contain" warning, the exporter is not obligated to identify the specific LMOs in the

shipment, undercutting one of the key provisions regarding safe handling. The agreement was to be in effect for two years and was extended through December 1, 2006 (International Grain Trade Coalition 2005). Since Mexico was able to get agreement on language exempting non-Parties from the labeling requirements, it is not yet clear whether the three countries are comfortable enough with the new Protocol language to allow the trilateral agreement to lapse.

If Mexico and its North American trading partners have skillfully maneuvered around the Protocol's labeling requirements, where is the space for alternative maize policies in the Protocol? While Mexico may not be in violation of the agreement now, any government committed to developing policies more supportive of traditional maize producers would find a great deal of room to move.

Parties to the Protocol cannot impose commitments on non-Parties, but Article 24(1) obliges the signatory Party to ensure consistency with the objective of the Protocol in all trade with non-Parties, including the precautionary approach outlined in Principle 15 of the Rio Declaration regarding the safe transfer, handling, and use of LMOs. This includes the obligation to ensure that activities involving LMOs are undertaken in a manner that prevents or reduces the risks to biological diversity, taking also into account risks to human health (Article 2(2)), and the obligation to establish and maintain appropriate mechanisms, measures and strategies to regulate, manage and control risks associated with the use, handling and transboundary movement of LMOs (Article 16(1)). The Protocol calls for equivalent protection measures to those agreed among the Parties to the agreement, which includes a means of providing the importing country with an opportunity and a basis for deciding whether or not to consent to the importation of LMOs (IUCN 2003). This would imply full disclosure in labeling to identify the specific LMOs being shipped into Mexico.

As of now, NAFTA would take precedence over Mexico's obligations under the Cartagena Protocol in any case. NAFTA's Articles 103-105 provide for the list of environmental and conservation agreements that take precedence over NAFTA, a list that includes at this point only: The Convention on Endangered Species, the Montreal Protocol on ozone, the Basel Convention on hazardous wastes, and the agreement between the United States and Mexico on the Border Environment. Neither the Convention on Biological Diversity nor the Cartagena Protocol is given precedence explicitly, though ongoing multilateral negotiations in the WTO over the relationship between trade and environmental agreements could have an impact on how NAFTA is interpreted in this regard.

In any case, Mexico has ample opportunities under the Protocol to create the space for new maize policies. Among the measures Mexico could take unilaterally:

- Ask to have the Cartagena Protocol added to the list of agreements that take precedence over NAFTA;
- Tighten the labeling requirements for imported LMOs, citing the Protocol's mandate for security measures equivalent to those observed among the

agreement's signatories. This could include stricter trigger points, below the current 5% threshold, and the detailing of specific LMOs included in a shipment.
- Hold up shipments based on the Protocol's call to ensure testing of LMOs in the environments in which they could be introduced. Mexico's mega-diverse, open-pollinated maize agriculture has little in common with the hybrid monocultures in which transgenic corn varieties have been tested.
- Cite the Protocol's mandate for Parties to "prevent adverse effects of the LMO on… biological diversity," its recognition of the precautionary principle, and its broad recognition of indigenous knowledge and rights to review all policies related to the importation of transgenic maize, which includes virtually all maize imported from the United States.

Three important findings strengthen Mexico's claim to such policy space. First, as a member of the OECD, Mexico is party to several non-binding agreements to "harmonize" standards for biotechnology, particularly in relation to maize because of the country's importance as its center of origin (OECD 2000).

Second, Mexico's own Biosafety Law on Genetically Modified Organisms, while weak, contains a mandate to create a Special Regime to Protect Maize before any transgenic maize is released for planting in Mexico. The Mexican government has done little to comply with this mandate and has continued to explore relaxing the moratorium on the experimental and commercial planting of transgenic maize. A group of farmers, scientists, and non-governmental organizations, however, has published a "manifesto" calling for the full implementation of the mandate.

Third, Mexico can cite the findings of NAFTA's own Commission for Environmental Cooperation (CEC), which carried out the most extensive scientific review to date on the danger of transgenic contamination of traditional maize fields. The CEC research documented evidence of extensive contamination across many states, confirmed the likely source as imported GMO corn distributed as food through a Mexican government agency, and suggested that the preponderance of evidence and the remaining uncertainty called for a precautionary approach to the importation of transgenic corn. The final recommendations, which were strongly opposed by the U.S. government, included the call to allow into Mexico only corn that had been milled so that it could not be planted inadvertently by farmers (NACEC 2004).

The Mexican government has casually ignored all these obligations and recommendations, but together they constitute a compelling case for invoking the policy space afforded by the Cartagena Protocol to slow and regulate maize imports, which would principally affect those from the United States. Two other international agreements are worth noting in this regard as well, though they are not limited to the question of biotechnology crops.

The Convention on Biological Diversity – A meeting of the parties to the CBD took place in Brazil in March 2006. The conference articulated new language that could

be relevant to the maize question. The benefit-sharing provisions call for an international regime on access and benefit-sharing to facilitate access to genetic resources, ensure fair distribution of benefits from their use, protect the rights of indigenous and local communities to their traditional knowledge, and develop national and local models for protecting traditional knowledge. Perhaps most important, the recent meeting called for establishing a mechanism (e.g. certificate of origin) to provide certainty about the origin of genetic resources. Such measures could provide additional weight to any effort by Mexico to protect the diversity of its maize resources.

The International Treaty on Plant Genetic Resources for Agriculture – Also known as "The Law of the Seed," this agreement was developed under the auspices of the UN Food and Agriculture Organization. It excludes 35 food crops and 29 forage plants from Intellectual Property Rights protection, instead guaranteeing free exchange and access to these plants as a public good. The agreement also contains strong Farmers Rights provisions. Parties are broadly obligated "to ensure the conformity of their laws, regulations and procedures with their obligations as provided in the Treaty."

The treaty includes a remarkable array of goals for the maintenance of these key food crops, including:

- Promote or support farmers' and local communities' efforts to manage and conserve on-farm their plant genetic resources;
- Promote *in situ* conservation of wild crop relatives and wild plants for food production by supporting the efforts of indigenous and local communities;
- Parties shall, as appropriate, take steps to minimize or, if possible, eliminate threats to plant genetic resources for food and agriculture;
- Develop and maintain appropriate policy and legal measures that promote the sustainable use of plant genetic resources for food and agriculture, including fair agricultural policies that promote the development and maintenance of diverse farming systems that enhance biological diversity, and expanded use of local and locally adapted crops.

Remarkably, Mexico has neither signed nor ratified the International Treaty on Plant Genetic Resources for Food and Agriculture. The United States has signed but not ratified it, while Canada has both signed and ratified it. As one of the world's most agriculturally diverse countries, and the center of origin for important food crops, Mexico should be party to this important treaty. If Mexico signed and ratified the treaty, the government could theoretically join Canada in petitioning to have the Treaty added to the list of environmental and conservation agreements that take precedence over NAFTA. Such a move would open up significant space for supportive maize policies.

Addressing the State of Emergency for Mexican Maize

The Mexican government has a great deal of policy space to pursue more supportive policies toward the country's traditional maize farmers. A government dedicated to its rural sector and the ecological wealth on which it is based could increase its own farm subsidies dramatically, impose countervailing duties for the heavy

subsidization of U.S. corn, and invoke a wide range of environmental findings and agreements. What is lacking is the political will to take such actions, just as there is little political will to renegotiate the relevant agricultural provisions of NAFTA.

Policies to protect Mexico's agro-biodiversity in maize must promote rural livelihoods and development while recognizing the market failures endemic to the sector. Such policies will need to reassert a strong role for the government in a variety of areas. Many of these policies represent a significant departure from the neoliberal model that has guided Mexican rural policy for the last 15-20 years.

Mexico needs to address two distinct problems: chronic rural poverty, which the neoliberal model has failed to address due to inadequate job creation; and the current and threatened loss of maize genetic diversity. The two are inextricably connected. Rural livelihoods will not be strengthened through the industrialization of agriculture, given the limitations in the development of the export agricultural sector. Rather than seeking to replace peasant agriculture with modern agricultural methods or with expanded service or industrial sectors, policies should build on the value that exists in traditional agriculture. One key aspect of that value is maize genetic diversity. Mexico has the policy space to chart a new path if it can find the political will.

Timothy A. Wise is Deputy Director of the Global Development and Environment Institute at Tufts University; inquiries can be directed to tim.wise@tufts.edu.

REFERENCES

Almekinders, C. (2001). Management of Crop Genetic Diversity at Community Level. Eschborn, Deutsche Gesellschaft fur Technische Zusammenarbeit (GTZ) Gmbh.

Altieri, M. A., M. K. Anderson, et al. (1987). "Peasant Agriculture and the Conservation of Crop and Wild Plant Resources." Conservation Biology **1**(1): 49-58.

Boyce, J. K. (1999). The Globalization of Market Failure? International Trade and Sustainable Agriculture. Amherst, MA, Political Economy Research Institute (PERI).

Brush, S. B., Ed. (2000). Genes in the Field: On-Farm Conservation of Crop Genetic Diversity. New York, Lewis Publishers.

Correa, C. (1999). Access to Plant Genetic Resources and Intellectual Property Rights. Buenos Aires, FAO.

Cromwell, E., D. Cooper, et al. (2001). Agriculture, Biodiversity and Livelihoods: Issues and Entry Points For Development Agencies. London, Overseas Development Institute, Seeds & Crop Diversity Programme.

ETC, GRAIN, et al. (2001). Sustaining Agricultural Biodiversity and the integrity and free flow of Genetic Resources for Food for Agriculture, Forum for Food Sovereignty.

Evenson, R. E., D. Gollin, et al., Eds. (1998). Agricultural Values of Plant Genetic Resources. New York, CABI Publishing.

FAO (1997). The State of the World's Plant Genetic Resources for Food and Agriculture. Rome, FAO.

FAO (1999). Agricultural Biological Diversity: Assessment of Ongoing Activities and Instruments. Montreal, FAO and CBD.

Fowler, C. and P. Mooney (1990). Shattering: Food, Politics, and the Loss of Genetic Diversity. Tucson, AZ, The University of Arizona Press.

Friis-Hansen, E. and B. Sthapit (2000). Participatory Approaches to the Conservation and Use of Plant Genetic Resources. Rome, International Plant Genetic Resources Institute.

International Grain Trade Coalition (2005). Notice to Trade #5.

International Grain Trade Coalition (2006). Notice to Trade #7.

IUCN (2003). An Explanatory Guide to the Cartagena Protocol on Biosafety, IUCN.

Kalaitzandonakes, N. (2006). "Cartagena Protocol: A New Trade Barrier?" Regulation(Summer 2006): 18-25.

Mooney, P. (1996). "The Parts of Life: Agricultural Biodiversity, Indigenous Knowledge, and the Role of the Third System." Development Dialogue(special issue).

Mooney, P. (2001). New Enclosures: Alternative Mechanisms to Enhance Corporate Monopoly and Bioserfdom in the 21st Century. Winnipeg, ETC Group.

Murphy, S., B. Lilliston, et al. (2005). WTO Agreement on Agriculture: A Decade of Dumping Minneapolis, Institute for Agriculture and Trade Policy.

NACEC (2004). Article 13 Report: Maize and Biodiversity: The Effects of Transgenic Maize in Mexico. Montreal, NACEC.

Nadal, A. and H. Garcia Rano (2007). Trade, Poverty and the Environment: A Case Study in the Biosphere Reserve Sierra de Santa Marta. Washington, DC, World Wildlife Fund**:** 45.

Nadal, A. and T. A. Wise (2004). The Environmental Costs of Agricultural Trade Liberalization: Mexico-U.S. Maize Trade Under NAFTA. Medford, Mass., Working Group Discussion Paper DP04, Working Group on Development and Environment in the Americas.

OECD (2000). Report of the Working Group on Harmonization of Regulatory Oversight in Biotechnology. Paris, OECD.

OECD (2003c). Is the Concept of the Producer Support Estimate in Need of Revision? Paris, OECD**:** 18.

OECD (2005). Agricultural Policies in OECD Countries: Monitoring and Evaluation.

Osava, M. (2006). Biosafety Protocol Alive, but Restricted. IPS.

Pimbert, M. (1999). Agricultural Biodiversity Background Paper. Maastricht, The Netherlands, FAO/Netherlands Conference on the Multifunctional Character of Agriculture and Land.

Secretariat of the Convention on Biological Diversity (2000). Cartagena Protocol on Biosafety, United Nations Environment Programme.

Smale, M., M. Bellon, et al. (2001). Economic Concepts for Designing Policies to Conserve Crop Genetic Resources on Farms. Rome, IPGRI.

Swanson, T. M., D. W. Pearce, et al. (1994). The Appropriation of the Benefits of Plant Genetic Resources for Agriculture: An Economic Analysis of the Alternative Mechanisms for Biodiversity Conservation. Commission on Plant Genetic Resources, First Extraordinary Session, Rome, FAO.

Taylor, E. and G. Dyer (2003). NAFTA, Trade, and Migration. Washington, D.C.

Thrupp, L. A. (1998). Cultivating Diversity : Agro-biodiversity and Food Security. Washington D.C.. World Resources Institute.

Tripp, R. and W. van der Heide (1996). "The Erosion of Crop Genetic Diversity: Challenges, Strategies and Uncertainties." Overseas Development Institute, Natural Resource Perspectives **7**(March 1996).

Wilkes, G., C. W. Yeatman, et al., Eds. (1981). Plant Genetic Resources:A conservation imperative. American Association for the Advancement of Science selected symposium. Boulder, Colorado, Westview Press.

Wise, T. A. (2004). The Paradox of Agricultural Subsidies: Measurement Issues, Agricultural Dumping, and Policy Reform. Medford, Mass., Global Development and Environment Institute**:** 32.

WTO (2002). Trade Policy Review Mexico: Report by the Secretariat, World Trade Organization.

Zahniser, S., Ed Young, and John Wainio (2005). Recent Agricultural Policy Reforms in North America. USDA/ERS. **WRS-05-03**.

Zahniser, S. and J. Link (2002). Effects of North American Free Trade agreement on Agriculture and the Rural Economy. Washington, US Department of Agriculture.

The Global Development And Environment Institute (GDAE) is a research institute at Tufts University dedicated to promoting a better understanding of how societies can pursue their economic goals in an environmentally and socially sustainable manner. GDAE pursues its mission through original research, policy work, publication projects, curriculum development, conferences, and other activities. The "GDAE Working Papers" series presents substantive work-in-progress by GDAE-affiliated researchers. We welcome your comments, either by e-mail directly to the author or to G-DAE, Tufts University, 44 Teele Ave., Medford, MA 02155 USA; tel: 617-627-3530; fax: 617-627-2409; e-mail: gdae@tufts.edu; website: http://ase.tufts.edu/gdae.

Papers in this Series:

00-01 Still Dead After All These Years: Interpreting the Failure of General Equilibrium Theory (Frank Ackerman, November 1999)
00-02 Economics in Context: The Need for a New Textbook (Neva R. Goodwin, Oleg I. Ananyin, Frank Ackerman and Thomas E. Weisskopf, February 1997)
00-03 Trade Liberalization and Pollution Intensive Industries in Developing Countries: A Partial Equilibrium Approach (Kevin Gallagher and Frank Ackerman, January 2000)
00-04 Basic Principles of Sustainable Development (Jonathan M. Harris, June 2000)
00-05 Getting the Prices Wrong: The Limits of Market-Based Environmental Policy (Frank Ackerman and Kevin Gallagher, September 2000)
00-06 Telling Other Stories: Heterodox Critiques of Neoclassical Micro Principles Texts (Steve Cohn, August 2000)
00-07 Trade Liberalization and Industrial Pollution in Mexico: Lessons for the FTAA (Kevin Gallagher, October 2000) *(Paper withdrawn- see www.ase.tufts.edu/gdae/ for details)*
00-08 Waste in the Inner City: Asset or Assault? (Frank Ackerman and Sumreen Mirza, June 2000)
01-01 Civil Economy and Civilized Economics: Essentials for Sustainable Development (Neva Goodwin, January 2001)
01-02 Mixed Signals: Market Incentives, Recycling and the Price Spike of 1995. (Frank Ackerman and Kevin Gallagher, January 2001)
01-03 Community Control in a Global Economy: Lessons from Mexico's Economic Integration Process (Tim Wise and Eliza Waters, February 2001)
01-04 Agriculture in a Global Perspective (Jonathan M. Harris, March 2001)
01-05 Better Principles: New Approaches to Teaching Introductory Economics (Neva R. Goodwin and Jonathan M. Harris, March 2001)
01-06 The $6.1 Million Question (Frank Ackerman and Lisa Heinzerling, April 2002)
01-07 Dirt is in the Eye of the Beholder: The World Bank Air Pollution Intensities for Mexico (Francisco Aguayo, Kevin P. Gallagher, and Ana Citlalic González, July 2001)
01-08 Is NACEC a Model Trade and Environment Institution? Lessons from Mexican Industry (Kevin P. Gallagher, October 2001)
01-09 Macroeconomic Policy and Sustainability (Jonathan M. Harris, July 2001)

02-01 Economic Analysis in Environmental Reviews of Trade Agreements: Assessing the North American Experience. (Kevin Gallagher, Frank Ackerman, Luke Ney, April 2002)
03-01 Read My Lips: More New Tax Cuts—The Distributional Impacts of Repealing Dividend Taxation (Brian Roach, February 2003)
03-02 Macroeconomics for the 21st Century (Neva R. Goodwin, February 2003)
03-03 Reconciling Growth and the Environment (Jonathan M. Harris and Neva R. Goodwin, March 2003)
03-04 Current Economic Conditions in Myanmar and Options for Sustainable Growth (David Dapice, May 2003)
03-05 Economic Reform, Energy, and Development: The Case of Mexican Manufacturing (Francisco Aguayo and Kevin P. Gallagher, July 2003)
03-06 Free Trade, Corn, and the Environment: Environmental Impacts of US-Mexico Corn Trade Under NAFTA
03-07 Five Kinds of Capital: Useful Concepts for Sustainable Development (Neva R. Goodwin, September 2003)
03-08 International Trade and Air Pollution: The Economic Costs of Air Emissions from Waterborne Commerce Vessels in the United States (Kevin P. Gallagher and Robin Taylor, September 2003)
03-09 Costs of Preventable Childhood Illness: The Price We Pay for Pollution (Rachel Massey and Frank Ackerman, September 2003)
03-10 Progressive and Regressive Taxation in the United States: Who's Really Paying (and Not Paying) their Fair Share? (Brian Roach, October 2003)
03-11 Clocks, Creation, and Clarity: Insights on Ethics and Economics from a Feminist Perspective (Julie A. Nelson, October 2003)
04-01 Beyond Small-Is-Beautiful: A Buddhist and Feminist Analysis of Ethics and Business (Julie A. Nelson, January 2004)
04-02 The Paradox of Agricultural Subsidies: Measurement Issues, Agricultural Dumping, and Policy Reform (Timothy A. Wise, February 2004)
04-03 Is Economics a Natural Science? (Julie Nelson, March 2004)
05-01 The Shrinking Gains from Trade: A Critical Assessment of Doha Round Projections (Frank Ackerman, October 2005)
05-02 Understanding the Farm Problem: Six Common Errors in Presenting Farm Statistics (Timothy A. Wise, March 2005)
05-03 Securing Social Security: Sensitivity to Economic Assumptions and Analysis of Policy Options (Brian Roach and Frank Ackerman, May 2005)
05-04 Rationality and Humanity: A View from Feminist Economics (Julie A. Nelson, May 2005)
05-05 Teaching Ecological and Feminist Economics in the Principles Course (Julie A. Nelson and Neva Goodwin, June 2005)
05-06 Policy Space for Development in the WTO and Beyond: The Case of Intellectual Property Rights (Ken Shadlen, November 2005)
05-07 Identifying the Real Winners from U.S. Agricultural Policies (Timothy A. Wise, December 2005)
06-01 The Missing Links between Foreign Investment and Development: Lessons from Costa Rica and Mexico (Eva A. Paus and Kevin P. Gallagher, February 2006)
06-02 The Unbearable Lightness of Regulatory Costs (Frank Ackerman, February 2006)

06-03 Feeding the Factory Farm: Implicit Subsidies to the Broiler Chicken Industry (Elanor Starmer, Aimee Witteman and Timothy A. Wise, June 2006)

06-04 Ethics and International Debt: A View from Feminist Economics (Julie A. Nelson, August 2006)

06-05 Can Climate Change Save Lives? (Frank Ackerman and Elizabeth Stanton, September 2006)

06-06 European Chemical Policy and the United States: The Impacts of REACH (Frank Ackerman, Elizabeth Stanton and Rachel Massey, September 2006)

06-07 The Economics of Inaction on Climate Change: A Sensitivity Analysis (Frank Ackerman and Ian J. Finlayson, October 2006)

07-01 Policy Space for Mexican Maize: Protecting Agro-biodiversity by Promoting Rural Livelihoods (Timothy A. Wise, February 2007)