Mexico: Neoliberal Reform, Climate Change, and Rural Vulnerability

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The University of Texas at Austin; November, 2009

Background

With an area covering nearly two million square kilometers and an estimated population of 109 million people, Mexico is the 14th largest and the 11th most populous nation in the world. Between the years of 1964 and 1994, the population of Mexico doubled. (Eakin, 2000) The fact that 30% of the population currently works in agriculture, that the nation suffers from an ever-increasing food deficit, and that climatic models predict that soil will be even less apt for cultivation in the future, has made food policy one of Mexico's greatest ongoing challenges through the last century. (O'Brien and Leichenko, 2000)

Food production in Mexico has been consistently threatened by low rainfall and frequent droughts. (Appendini and Liverman, 1994) Of Mexico's 195 million hectares, 85% is considered semi-arid, arid, or very arid, and a climate that has characteristically low, seasonal, and highly variable rainfall. (O'Brien and Leichenko, 2000) Compounding the unfavorable climatic variability is relative infertility of the soil, limited water resources, and a complex topography. (Eakin, 2000) A mere 16% of Mexican soil is considered suitable for agricultural production. (O'Brien and Leichenko, 2000)

This paper will look at the challenges facing farmers of rainfed maize crops in Mexico in responding to the increased temperatures and lower rainfall predicted by climate models. In recent years, climatic variation, liberal agricultural policies, decreased price guarantees, and credit availability have undermined efforts to mitigate the impact of climate change on vulnerable growing areas inhabited, principally, by peasant maize farmers.

Maize and the Mexican Food System

Due to the agricultural vulnerability of Mexico's growing regions and a rapidly increasing population, food policy took a priority position in 20th century Mexican policy debates. The population outgrew Mexico's production capacity in the 1970s, with imported maize, the country's most important staple crop, accounting for 20 to 25% of the overall supply. (Appendini and Liverman, 1994)

Mexico's basic staples - maize and beans - are typically grown on the 80% of cultivated land that is rainfed. As a result of the Green Revolution and government investment of the 1960s, most irrigated land was planted with cash crops that were more profitable on the international market. And while the Green Revolution was considered highly successful in its improvements of commercial, irrigated maize, most subsistence farmers could not afford the inputs required to see any boost in crop yield. (Appendini and Liverman, 1994)

At the end of the 1960s, maize was comparatively unprofitable relative to other crops. Its cultivation became concentrated in the poorest growing areas, widening the gap between so-called 'modern agriculture' and 'peasant agriculture', maize being labeled as a 'peasant crop' by the end of the 1970s. Throughout the period that spanned the Green Revolution, which focused on non-subsistence crops, maize output grew by a mere 0.4

percent and the area under cultivation decreased by 1.5 million hectares. Government support for rural agriculture had greatly eroded by the end of the 1980s. Coupled with degraded environmental conditions and price drops, rural maize farmers throughout Mexico struggled to maintain maize production as a viable means of subsistence. (Appendini and Liverman, 1994)

Climate Variability and Agriculture in Mexico

As more than one third of Mexico's population currently works in agriculture, a sector of great importance to the nation's economy, increased climatic variability or a decrease in the already sparse rainfall could have devastating effects in rural regions. (Liverman and O'Brien, 1991)

As mentioned above, Mexico's soil is generally unfavorable for crop production. In addition, rainfall in Mexico is greatly disproportionate, with a southeastern region representing seven percent of the total landmass receiving 40% of the total rainfall. Only 12% of the nation's water falls on the central plateau, where 60% of the national population and 51% of the cropland is located. Decreased precipitation as part of a warmer future climate will mean greater competition for water from hydroelectric production, industry, and specifically agriculture, which currently accounts for 80% of the total water supply. (Liverman and O'Brien, 1991)

Though only one fifth of Mexico's cropland is irrigated, it accounts for half the value of the country's agricultural production. (Liverman and O'Brien, 1991) While most irrigated crops in Mexico are grown for export, rainfed crops provide much of the domestic food supply. Drought, which affects non-irrigated regions at an exponentially greater rater, is the most devastating of all climatic hazards, drought accounts for ninety percent of agricultural losses in Mexico. (Eakin, 2000)

Five General Circulation Models (GCMs) have been run for Mexico, each exemplifying the variability typical to climate modeling. Though regional differences vary greatly in some areas of Mexico, the general conclusion shared by all models is that Mexico will be both drier and hotter, with greater rates of evaporation and decreased moisture availability. Though it is unclear how soil moisture would respond in a scenario with both higher temperatures and precipitation, which some models predict, any reduction in soil moisture would devastate the majority of Mexican cropland that depends upon low and variable rainfall. (Liverman and O'Brien, 1991)\

As climatic hazards continue to threaten agricultural productivity, scientific researchers and farmers have come under increased pressure to develop techniques to mitigate climatic risk.

The responses of farmers to increased climatic risk and variability in the context of climate change will vary depending upon the institutional context within which he or she is making decisions. Exploring the case of peasant farmers, we come to understand the structural limitations that hinder their ability to adapt to extreme climate events, overall temperature increase, and decreased rainfall availability. (Eakin, 2000)

Agricultural Policy and Climate Change

Mexican food policy has, since the creation of the community-owned *ejido* system and agrarian land reforms of the 1930s, played a pivotal role in determining the development of rural Mexico and the ability of farmers to adapt to climatic vulnerability.

One of the most notable responses to low and variable rainfall has been massive federal investment in irrigation infrastructure. Yet, much of the infrastructure investment goes unseen by subsistence farmers in areas dependent upon rainfed moisture. Wheat, sugar, diary, fruits and vegetables have replaced subsistence corn cultivation in recent years. The change of soil use to new crop varieties has exacerbated already stressed water resources. (Appendini and Liverman, 1994)

While the 1930s land reform gave peasant farmers access to land that would provide for subsistence food production, the majority of distributed land was of poor quality. Irrigated land has tended to stay in the private sector, and many *ejido* farmers have suffered not only losses in the crop that provides them with an income, but also a loss of a direct source of nourishment. The *ejidatorios* remain marginalized and increasingly vulnerable due to lack of access to irrigation, credit, improved seeds, or other resources. (Liverman, 1993)

Agrarian reform and agricultural technology allowed Mexican food production to keep up with growing populations in the first part of the twentieth century. The weaknesses in the system became more evident, however, as the process evolved. As evidenced in the current gap between ‘modern’ and ‘peasant’ agriculture, the economic and nutritional benefits of agricultural development policies during the land reform were not equally distributed. (Liverman and O’Brien, 1991)

Mexico’s agricultural ministry continues to give preference to commercial agriculture, with much of the technology investment and distribution aimed at boosting Mexico’s competitiveness in the free-market. The signing of the North American Free Trade Agreement (NAFTA) in 1994 signified a withdrawl of subsidies in all productive sectors. Government support declined from 27.5% of the cost of production in 1985 to 6.5% in 1990. (Eakin, 2000)

Interest rate subsidies have also been reduced, with the effect of increasing the cost of production and limiting the availability of credit for farmers that had previously been supported by the public bank BANRURAL. In the early 1990s, BANRURAL shifted its client base to focus on middle-income farmers working in commercial agriculture. (de Janvry, A., 1995) Similarly, crop insurance that was previously required of all farmers as part of loan programs, is now only available through private firms at non-subsidized rates. (Eakin, 2000) Currently, the government works with PROCAMPO, a system of direct subsidies to farmers. In 1997, the PROCAMPO program payment totaled 556 pesos/hectare of cultivated maize, an amount that would not cover the costs of recommended fertilizers alone. (Cruz, 1993)

It is therefore the peasant farmers, working in ecologically and economically marginalized conditions, that have been the most affected by these policy changes and least supported when attempting to adapt to increased climatic risk. The ability of these farmers to incorporate new drought-resistant seed varieties, experiment with new crops, invest in chemical inputs, and take advantage of forecasting information is greatly limited by their inability to access credit, insurance, technical support, and favorable market conditions. Even traditional techniques used by farmers to mitigate climatic hazards, such as terracing, solar blocking, and low tillage as means of retaining limited nutrients and precipitation are constrained by unavailable financial resources. (Eakin, 2000)

In the last decade, significant research has gone into better understand the El Niño/Southern Oscillantion (ENSO) phenomenon, accompanied by discussion of how such forecasts might help to mitigate climatic risk in agriculture. There is a high likelihood that this technology will be useful only to those farmers who are already well position in the commercial markets and enjoy the financial security that would allow them to benefit from these forecasts. The possible use of climate forecasting appears to be yet another example of a tool that will be preferentially introduced to commercial farmers while remaining relatively inaccessible to subsistence farmers. (Eakin, 2000)

Summary

Despite the numerous political and environmental challenges posed to Mexico's small-scale maize farmers, it is likely that peasant farmers who remain on marginal land will continue to grow maize for self-consumption so long as it remains more viable and aforable than buying grain from the international market. (Appendini and Liverman, 1994)

Small farmers have been increasingly removed from the banking system that previously guaranteed the viability of growing maize for subsistence. (Appendini and Liverman, 1994) When Mexico liberalized its trade economy, subsistence agriculture sufferance a number of consequences that have continued to marginalize small-scale producers, creating an ever-growing disparity between commercial agricultural production and domestic food production. (Bonnis and Legg, 1997)

Though the specific impacts that climate change poses to Mexican agriculture is uncertain, the general conclusion, based on the results of several GCMs, is that Mexico will be hotter and drier as greenhouse gases in the atmosphere contribute to overall warming. The regions of Mexico most prone to drought damage, decreased precipitation, and increased evaporation rates, are largely the remains of the community *ejidos*, subsistence farmers that rely upon maize as a primary source of income and nourishment. (Liverman and O'Brien, 1991)

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