

Adaptação à Variabilidade Climática dos Agroecossistemas Tradicionais em Oaxaca, México

Adaptation of Traditional Agroecosystems to Climate Variability in Oaxaca, Mexico

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Resumo

Mudanças climáticas antropogênicas são projetadas de ter um grande impacto em Oaxaca, México. A mudança da quantidade e da temporada de chuva vai impactar agroecossistemas que dependem de precipitação, especialmente em regiões marginais. Entrevistamos vinte famílias agrícolas das comunidades de Zaragoza, Huautla, e Coxcaltepec na Mixteca Alta de Oaxaca, México sobre a percepção delas da variabilidade climática histórica e atual. Agricultores tradicionais selecionam práticas agrícolas baseado em predição do clima e conhecimento profundo dos agroecossistemas. A compreensão de como agricultores de regiões marginais percebem e se adaptam através do tempo à variabilidade climática ofereça uma visão da capacidade das agroecossistemas tradicionais de se adaptar às mudanças climáticas no futuro.

Palavras-chave: Mudanças climáticas, precipitação, resiliência, milho.

Abstract

Anthropogenic climate change is projected to have large impacts on precipitation in Oaxaca, Mexico. We interviewed twenty farming families in the communities of Zaragoza, Huautla, and Coxcaltepec in the Mixteca Alta of Oaxaca, Mexico about their perceptions and adaptations to historic and current climate variability. Traditional farmers select agricultural practices based on climate predictions and deep understandings of their agroecosystem. Understanding how farmers from marginal regions perceive and adapt to climate variability will provide insights into the capacity of traditional agroecosystems to adapt to future climate changes.

Keywords: Climate change, precipitation, resilience, maize.

Introduction

Climate change is projected to have large impacts on precipitation over southern Mexico in the twenty-first century. Changes in the amount and timing of precipitation may affect the viability of rain-fed agroecosystems, particularly in marginal regions (Eakin 2000; Magrin et al., 2007). By studying traditional agricultural practices and historic climate variability in the Mixteca Alta, we begin to understand the potential for traditional rain-fed agroecosystems to respond to the threat of future climate change.

Several studies have found that farmers' traditional knowledge and practices help them adapt to climate variability (Yohe et al., 2007). In the Mixteca Alta, several traditional agricultural practices allow farmers to cope with climate variability on inter-annual timescales. Rain-fed maize production is most common agroecosystem in the Mixteca Alta. Corn is often planted as a "milpa," a polyculture of corn, beans, and squash. We believe that this agricultural practice may conserve soil moisture and that crop diversity in the milpa system may provide some level of productivity under marginal conditions.

The "Maíz cajete" is another traditional farming practice in the Mixteca Alta (Rivas et al., 2004).

Farmers sow maíz cajete in small depressions called "jollas" with subsurface water flow during the dry period of the year. Farmers plant native long-season corn varieties that are capable of growing on residual soil moisture. Under the environmental conditions of the Mixteca Alta, maíz cajete produces equivalent or greater yields to rain-fed cropping corn production.

These traditional practices may confer resilience to environmental stress, particularly drought. We investigated whether Oaxaca farmers use these and other traditional methods to adapt to historical changes and whether farmers' memory of climate variability influences their agricultural practices.

Methods

We interviewed twenty subsistence farming families from three communities - Zaragoza, Huautla, and Coxcaltepec - in the Municipality of Tilantongo, Oaxaca, Mexico (N 17.47853°, W 097.21609°). This region, located in the Mixteca Alta at an approximate elevation of 2,000 meters, is characterized by diverse topography and soils as well as large variability in precipitation. Most farmers in these communities practice small-scale agriculture, employing one or more traditional farming practices. We attempted to gather sufficient representation of traditional farming practices in the region by interviewing farmers from three distinct communities in the Mixteca Alta.

Our investigation combines agronomic observations and individual interviews. We observed farmers' agricultural practices during key periods of the cropping cycle. We systematically documented the farmers' traditional farming practices that are thought to be adapted to low rainfall conditions in terms of biomass production, yield, pests, and efficiency of soil moisture use and conservation.

We investigated how farmers perceive and adapt to climate variability using observations, and individual and group interviews (RONCOLI, 2006; WEST et al., 2003). The interviews addressed how farmers relate to their local climatic conditions. We asked farmers to describe their perception of the normal regional climate, what indicators (if any) they use to infer upcoming climate variability, and to what extent the climate influences their agricultural practices year-to-year. We also compared the farmers' historical memories of climate to regional weather station data dating back 30 years.

We were especially interested in farmers' historical memories of droughts, and how these memories may influence their current practices. How do farmers respond to dry years? Are they able to pro-actively respond to early indications of low rainfall? Do their memories of droughts inform their current farming practices? How much do they account for the possibility of an especially dry year in choosing the mixture of crop varieties to plant?

Results and Discussion

Our monitoring of farmers' fields indicate that milpa production practices -- growing corn in a polyculture with beans and squash -- are more efficient in terms of soil moisture use compared to fields planted with corn alone. This suggests that under water stress, milpas will be more resilient than corn monocultures. The maíz cajete production practice was even more efficient than milpas in water use efficiency. This is due to the use of maize varieties that adapted to low soil moisture conditions. The long growing season of maíz cajete acts as a buffer to intra-annual variability in precipitation. Both traditional farming practices produced more biomass than comparable monoculture agroecosystems. Efficiency of resource use and productivity under stressful environmental conditions are essential characteristics of cropping practices for resource-poor farmers in marginal environments.

Farmers were able to identify the benefits of traditional farming practices under water stress. They described the annual rainfall patterns in the region as bimodal and unpredictable. Farmers chose when to plant based on tradition, in accordance with the moon cycles or after the first rainfall events in May. For maíz cajete, farmers chose to plant in February and March. Farmers' historical memory of climate could be traced on average to seven years in the past. Farmers did not specifically recall dry cycles or periods, but indicated that dry years were common and recurrent. In terms of predicting climate, farmers did not identify reliable methods of climate prediction and did not incorporate information from Mexican weather service agencies into their decision making. Farmers considered climate to be an important factor in their decision making. Instead of fundamentally changing their production systems in response to climate from year to year, farmers rely upon common fundamental criteria to design their agroecosystems. Crop diversification and rotation, planting geographically distant fields, native varieties, and low external input use are the most important criteria identified by farmers to accommodate uncertainty in their environment.

Traditional farmers' memories of climatic events shape their management of the agroecosystem over time. Our research provides insight into how the climate and traditional knowledge inform agricultural practices in the Mixteca Alta. Traditional farmers choose farming practices that will protect them from extreme drought events. They do not rely on information from weather stations to make decisions.

Conclusion

Traditional agroecosystems are the product of long-term adaptation processes to climatic conditions. Our research indicates that traditional practices do provide farmers with some resilience to variable climatic conditions. Certain aspects of traditional agroecosystems in the Mixteca Alta may allow resource-poor farmers to prepare for climatic changes in the future. Future studies are needed to understand what climate variables are most important in predict rainfall in the Mixteca Alta to help farmers further adapt. In-depth studies of traditional farming practices should be studied to understand the principles and mechanisms that make agroecosystems more resilient to climate change.

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