Vulnerability and Adaptation of Tropical Agriculture to Climatic Variability

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MAJOR EFFECTS OF "EL NIÑO" AS OF NOVEMBER 1997

- China: Drought affecting staple food in north, floods threatening grain harvest in south.
- Pacific: Drought has led to poor harvests and water shortages in Iowa and玉米 Yield in Oregon.
- United States: Parts of northwest US have had rainfall 200% above normal for this time of year, reduced snowfall in Rocky Mountains.
- Nicaragua: Drought has decreased food production, drought damage affecting about 250,000 people.
- Central America: Drought has led to 95-98% drop in maize, coffee, and sugarcane production.
- Southern Africa: Damage to corn crops predicted.
- South/South East Asia: Abnormally low rainfall during monsoon season, tea harvests in India and Sri Lanka threatened. Tea yields down 10%.
- Australia: Drought in the grasslands threatens wheat production. Crops dying in parts of NSW.
Overview

• What makes tropical agriculture particularly vulnerable to climatic variability?
  – Biophysical factors
  – Political-economic factors

• How do structural conditions in tropical agriculture limit adaptation options?
  – examples from Mexico and Southern Africa

• Questions for discussion
Biophysical vulnerability

- older, low fertility soils
- constant high temperatures
- seasonal rainfall
- high rainfall intensity
- spatial and temporal rainfall variability
- multiple driving forces: ENSO, NAO, monsoons, ITCZ etc.
Climatic Variability in Tlaxcala, Mexico

Fig. 4: Interannual Rainfall Variability in Apizaco, Tlaxcala 1961-1995

Political and Economic Vulnerability

- national economic dependence on agriculture
- household livelihood security

Agricultural Dependence in Southern Africa and Mexico

<table>
<thead>
<tr>
<th></th>
<th>Ag. value added as % of GDP</th>
<th>% of labor force in ag.</th>
<th>pop. earning &lt; $1 day</th>
<th>cropland as % of land area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malawi</td>
<td>36</td>
<td>87</td>
<td>N/A</td>
<td>18</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>16</td>
<td>68</td>
<td>41</td>
<td>8</td>
</tr>
<tr>
<td>Zambia</td>
<td>28</td>
<td>75</td>
<td>85</td>
<td>7</td>
</tr>
<tr>
<td>Mexico</td>
<td>5</td>
<td>28</td>
<td>15</td>
<td>14</td>
</tr>
</tbody>
</table>

“Bimodal” Agriculture in Mexico and Zimbabwe

- inequitable land and resource distribution distorts vulnerability
- implications of economic and agricultural policy not uniform

<table>
<thead>
<tr>
<th></th>
<th>Ejidos or Communal</th>
<th>Large Scale Private</th>
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<tbody>
<tr>
<td>% of land area</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>50</td>
<td>37</td>
</tr>
<tr>
<td>Mexico</td>
<td>16</td>
<td>50</td>
</tr>
<tr>
<td>% of total farmers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>75</td>
<td>.002</td>
</tr>
<tr>
<td>Mexico</td>
<td>58</td>
<td>8.8</td>
</tr>
<tr>
<td>avg. arable land</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>3-5 ha.</td>
<td>2223 ha.</td>
</tr>
<tr>
<td>Mexico</td>
<td>2 ha.</td>
<td>40 ha.</td>
</tr>
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</table>

and de Janvry, et. al. (1995) *Reformas del Sector Agricola y el Campesinado en Mexico.*
Mexican Reservoir capacity

San Gabriel  
La Boquilla  
L.F. Leon  
F.C. Madero

Capacity  1990-93  1993  May-95

Million cubic meters
Economic Globalization and Neo-liberal Reform as Context of Adaptation

• over a decade of structural adjustment
• global trend in economic liberalization, free-market agreements
• privatization of services
• increased agricultural competition

But

• new flows of technology and information
• possibilities in regional climate forecasting and global climatic knowledge
Agricultural Policy in Mexico

- price liberalization for products and inputs
- reduction in Government subsidies
- “commercially viable” production focus for credit and extension
- land tenure change
# Farm-level adaptation to drought and frost

<table>
<thead>
<tr>
<th>Selected Adaptation Strategies</th>
<th>Some socioeconomic constraints</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early and deep planting</td>
<td>availability of draught power, credit, labor</td>
</tr>
<tr>
<td>Crop and seed selection</td>
<td>seed availability, seed promotion policies, privatization, credit</td>
</tr>
<tr>
<td>Crop diversification</td>
<td>price liberalization, food insecurity, technical assistance, marketability</td>
</tr>
<tr>
<td>Land management (water and soil conservation)</td>
<td>land tenure, input credit, technical assistance, land quality</td>
</tr>
</tbody>
</table>
Climatic vs. Political-Economic Risks

• Price, market and financial uncertainties outweigh climatic risk in short-term

• Farmers have strategies and experience with climatic risk but strategies are limited by resources, technology and policy/economic uncertainties
  – competing labor demands
  – lack of financing for inputs and equipment
  – market inaccessibility or uncertainty
Questions for Discussion

• What is the relationship between agricultural and economic policy and vulnerability and adaptation?

• How can economic and climate-risk mitigation policy interact to enhance flexibility and adaptation to both economic and environmental change?

• What is the value of diversity -- both biological and social -- in mitigating vulnerability?

• How can existing knowledge of farmers in tropical countries serve as the foundation for improving the adaptive capacity of tropical agriculture?

• Can new climate products enhance adaptation in tropical context?