Policies or projects? Land use incentives and soil conservation in a Philippine watershed

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Farmers and markets in uplands

• Previous assumption: ‘semi-subsistence’ production
  – Upland farmers beyond reach of markets & policies
• Implication: *direct intervention needed* for dev’t or conservation
  – Projects, command/control approaches to w/shed mgt
• But non-market strategies now lag behind reality of commercialized ag.
Location of study site
Yellow corn prices, Lantapan farm gate and Agora wholesale market, Cag. de Oro (SANREM data)
Sales as percent of major crops, Lantapan, 1994

Source: SANREM data
## Participation in non-farm labor markets

<table>
<thead>
<tr>
<th>Year</th>
<th>Percent of households</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994</td>
<td>n.a.</td>
</tr>
<tr>
<td>1996</td>
<td>58.1</td>
</tr>
<tr>
<td>1998</td>
<td>79.2</td>
</tr>
<tr>
<td>2000</td>
<td>80.9</td>
</tr>
<tr>
<td>2002</td>
<td>75.5</td>
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</table>
Three implications of commercialization

• Land values and land use decisions depend on commercial considerations rather than household needs (‘separability’)

• Greater reach of market interventions such as price and trade policies

• Market-based policies are cheaper and more efficient than direct interventions
  – They affect all commercial farmers, not just those in one project area
Philippine upland ag. devel. policy

• Direct and sectoral interventions:
  – Early (1950s): support for ‘land to the landless’ programs
  – Later (1970s+): commodity support through R&D, extension, ‘high value crops’ programs
  – Price stabilization efforts (corn, palay) through NFA

• Trade policies
  – Vegetable import restrictions: cabbage, potato bans; binding WTO tariffs @ 100% (David 2003)
  – Rising protection for corn and sugar producers -- in spite of WTO accession.
## Trends in nominal protection rates for corn and sugar (%)

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</thead>
<tbody>
<tr>
<td>Corn</td>
<td>24</td>
<td>26</td>
<td>67</td>
<td>76</td>
<td>87</td>
</tr>
<tr>
<td>Sugar</td>
<td>5</td>
<td>42</td>
<td>154</td>
<td>81</td>
<td>106</td>
</tr>
</tbody>
</table>

Source: David 2003, Table 6.7.
Implications of upland ag. devel. policies

• In Lantapan, highest rates of crop area growth between 1960 and 1990s were in corn and sugarcane
• Vegetable production (esp. cabbage and potato) became important crops after 1960s
  – As source of income, less so as percent of land area
• Thus: agricultural expansion and intensification in upland areas
Lantapan land use 1973
(source: Li Bin 1994)

- Dense Forest: 52%
- Rubber trees or pasture: 8%
- Corn and vegetable: 18%
- Corn and sugarcane (mainly s'cane): 7%
- Corn and sugarcane (mainly corn): 3%
- Lowland paddy field: 0%
- Shrub and tree (besides forest): 2%
- Shrub and tree (other distribution): 7%
- Bare soil: 0%
- River and creek: 3%
Lantapan land use 1994
(Source: Li Bin 1994)

Dense Forest 29%

Shrub and tree (besides forest) 10%

Shrub and tree (other)

River and creek 3%

Lowland paddy field 1%

Rubber trees or pasture 0%

Bare soil 1%

Corn and sugarcane (mainly s'cane) 9%

Corn and sugarcane (mainly corn) 5%

Corn and vegetable 35%
Environment-economy interactions

• Commercial ag. expansion and intensification at expense of watershed functions
  – Expansion involves deforestation, shorter fallows
  – Unaccounted externalities (siltation, water pollution, unstable stream flows)

• Ag. development policies and conservation goals may be mutually contradictory
  – Forest cover and watershed function are threatened by expansion of protected and ‘high value’ crops
A model of upland land use decisions

• Farmers assumed to maximize profits from ag.production, subject to constraints, e.g. availability of family labor

• Total land area of the farm (A) is a choice:
\[ \sum N_i \leq A_{t-1} + \Delta A \]
  – where \( N_i \) is area planted to crop \( i \), \( A_{t-1} \) is lagged area, \( \Delta A \) is year-on-year area change

• Land allocation by crop (\( N_i \)) is also a choice
Model solution

- Optimal land use and farm area choices depend on crop prices, input prices, family labor, household characteristics, and agro-ecological characteristics
  - Location in the watershed (e.g. altitude) is important
- We can distinguish separate ‘decision units’ by location for purposes of linking to environmental analyses
- We parameterize the model using Lantapan farm survey data from 1994 - 2002
Different crops require different input mixes

Estimated cost shares (%) of inputs by crop

<table>
<thead>
<tr>
<th></th>
<th>Land</th>
<th>Labor</th>
<th>Fertilizer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td>41</td>
<td>31</td>
<td>6</td>
</tr>
<tr>
<td>Veg</td>
<td>22</td>
<td>61</td>
<td>19</td>
</tr>
<tr>
<td>Coffee</td>
<td>34</td>
<td>42</td>
<td>8</td>
</tr>
</tbody>
</table>

Source: production function estimates
Policy ‘shocks’ will have differential effects by crop

- Higher corn or coffee prices will promote greater relative increases in total farm land area
- Higher vegetable prices will promote intensification (fert. & chem. intensity)
- Rising fertilizer prices will reduce vegetable area and use of chemicals
- Non-farm employment growth will reduce vegetable production faster than other crops
  - But may also discourage soil cons measures (Rola and Coxhead 2002)
### Price elasticities of land use & area change

<table>
<thead>
<tr>
<th>Variable</th>
<th>Corn area</th>
<th>Vegetable area</th>
<th>Total planted area</th>
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<tbody>
<tr>
<td>Corn revenue</td>
<td>0.26</td>
<td>-1.20</td>
<td>0.10</td>
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<tr>
<td>Veg. revenue</td>
<td>-0.17</td>
<td>0.42</td>
<td>-0.13</td>
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<tr>
<td>Wage</td>
<td>-0.23</td>
<td>-1.73</td>
<td>-0.39</td>
</tr>
<tr>
<td>Fam. labor</td>
<td>-0.07</td>
<td>0.26</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Source: Coxhead and Demeke 2004
Extrapolation: effects of price and wage changes on corn area planted

<table>
<thead>
<tr>
<th></th>
<th>Cut corn tariff to 50%</th>
<th>Wages increase by 25%</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>(=25% price reduction)</td>
<td>(= half of 1990s wage rise)</td>
</tr>
<tr>
<td>Lantapan (study site)</td>
<td>−0.065 ha/farm</td>
<td>−0.056 ha/farm</td>
</tr>
<tr>
<td>Mindanao</td>
<td>−45,000 ha</td>
<td>−40,000 ha</td>
</tr>
<tr>
<td>Philippines</td>
<td>−225,000 ha</td>
<td>−200,000 ha</td>
</tr>
</tbody>
</table>
Further implementation of WTO reforms

- Reducing Philippine ag. protectionism will diminish pressures on all upland watersheds
  - Quantifying environmental effects will require additional data and resources
  - Distributional & poverty outcomes uncertain
- Reducing US/EU domestic farm subsidies will have opposite land use effects!
  - Higher world corn prices --> incentives to expand area
  - Will offset domestic reform effects
Property rights and local policy issues

• Ag. expansion in upper watershed is contingent on land availability
  – Enforcement of buffer zone restrictions limits expansion
  – Institutional mechanisms for this? Decentralization

• Environmental impacts of farming differ by location as well as crop and technology
  – Current ag. land tax laws, using capitalized income approach, can in principle be adjusted for these factors
For more information

• Sanrem-SEA site:  
  www.aae.wisc.edu/sanrem-sea

• Sanrem-SEA publications: see display & request copies

• Request revised & updated Sanrem-SEA CD-ROM (coming soon)
Why do farmers specialize or diversify?

- Diversification is a risk-reducing strategy
- Specialization may reflect constraints, e.g. managerial skills for vegetable production
- Could diversification also reflect benefits of biodiversity?
  - Crop rotations, fallowing maintain biodiversity
  - Could this have measurable productivity effects, through economies of scope?
  - Farm vs. watershed-scale policy issues in biodiversity protection