Trends in Irrigated Agriculture in the Southwest & Southeast United States

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I. Introduction
• Food, land, & water security are interlinked & will become more critical with population growth & climatic change

II. Objective
• Use county level data from the southeastern United States (SE-US) and southwestern United States (SW-US) to assess how the distribution of irrigated land to harvested land is distributed within the two regions

III. Methods
• Calculated ratios of irrigated to harvested acreage at the county level for the primarily irrigated SW & predominantly rainfed SE for 1959 & 2007

IV. Results
Regional Level
Table 1. Irrigated & harvested land, ratios of irrigated to harvested land, & natural logarithms of one plus ratios of irrigated to harvested land in the SW & SE regions during 1959 & 2007

<table>
<thead>
<tr>
<th>Region, Yr</th>
<th>Irrigated Acres</th>
<th>Harvested Acres</th>
<th>Ratio</th>
<th>Ln(1+ratio)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SW, 1959</td>
<td>~5,630,000</td>
<td>~9,000,000</td>
<td>0.62</td>
<td>0.48</td>
</tr>
<tr>
<td>SW, 2007</td>
<td>~5,460,000</td>
<td>~7,940,000</td>
<td>0.68</td>
<td>0.52</td>
</tr>
<tr>
<td>SE, 1959</td>
<td>~590,000</td>
<td>~20,780,000</td>
<td>0.02</td>
<td>0.02</td>
</tr>
<tr>
<td>SE, 2007</td>
<td>~3,090,000</td>
<td>~15,520,000</td>
<td>0.20</td>
<td>0.18</td>
</tr>
</tbody>
</table>

IV. Results, continued

Country Level
• Ratio medians for SW & SE counties in 1959 are significantly different than for 2007 (Mann-Whitney U, p < 0.05) (Figure 1)
• Over ~50 years, the % of counties with a ratio > 1 in the SW increases from 56% to 69% but remains constant at 1% in the SE (Figure 1)

Figure 1. Natural logarithms of one plus ratios of irrigated acres to harvested acres

V. Discussion
Arid-semiarid Southwest
• Fastest growing region in US
  • Agricultural sector must compete with growing water demand from other sectors
  • Competition is likely to increase as a result of local climatic changes
  • Climate model projections for SW suggest transition to more arid climate, increasing likelihood of multyear drought
  • Given water scarcity in the region, the large fraction of ratios of irrigated to harvested acres greater than one is surprising
  • Water is being used to irrigate non-harvested land
  • Water laws in the SW based on prior appropriation doctrine (water rights can be lost if not used), perhaps encouraging wasteful use
  • e.g., ratios >> 1 or log(1 + ratios) > 0.69
  • Results suggest SW counties may have opportunities to increase the productivity of agricultural land through increased efficiency & better management of resources

Humid Southeast
• Historically benefited from abundant renewable fresh water supply, but second only to the SW as fastest growing region in US
• Recent water stress increased competition for water, challenging traditional supply side management
• Fraction of harvested land irrigated increased substantially between 1959 & 2007
• Significant opportunity to increase productivity, provided adequate allocation of water for irrigation & construction of appropriate infrastructure
• Integrated water management could make more water available to the agricultural sector for irrigation purposes – even in times of water stress

Food Security
• County-level analysis of SW- & SE-US ratio of irrigated land to harvested land suggests we can increase agricultural productivity even without an increase in cropland
• Irrigation boosts yields & reduces variability
• Successful yield increases in US could help meet future food security goals

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