

Trends in Irrigated Agriculture in the Southwest & Southeast United States



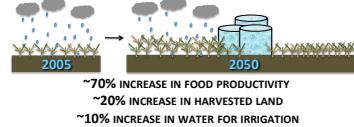
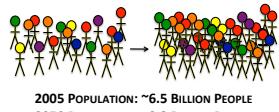
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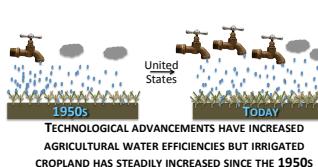
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I. Introduction

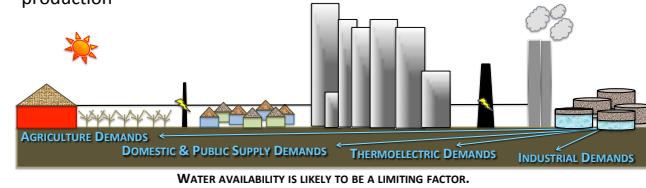
- Food, land, & water security are interlinked & will become more critical with population growth & climatic change



- Developed countries can play a vital role in maintaining & increasing yields



- Productivity of agricultural land must increase to meet growing food demands; irrigation boosts yields & reduces interannual variability of production



- Can effective water management strategies be found through exploring irrigated land changes at subregional scales?

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

| Region, Yr | Irrigated Acres | Harvested Acres | Ratio | Ln(1+ratio) |
|------------|-----------------|-----------------|-------|-------------|
| SW, 1959 | ~5,630,000 | ~9,000,000 | 0.62 | 0.48 |
| SW, 2007 | ~5,460,000 | ~7,940,000 | 0.68 | 0.52 |
| SE, 1959 | ~590,000 | ~20,780,000 | 0.02 | 0.02 |
| SE, 2007 | ~3,090,000 | ~15,520,000 | 0.20 | 0.18 |

IV. Results, continued

County 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)

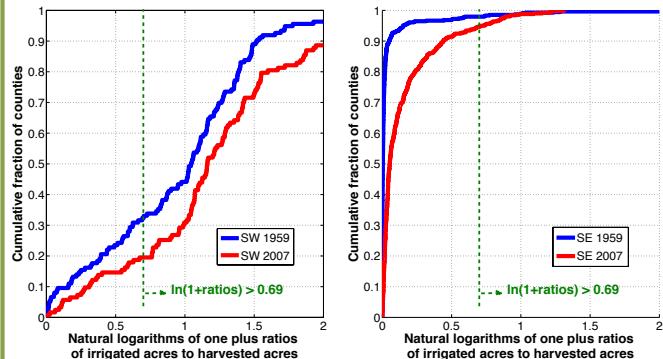


Figure 1. Natural logarithms of one plus ratios of irrigated to harvested land in SW (left) & SE (right) counties during 1959 (blue) & 2007 (red). Note that values above 0.69 on the horizontal axis indicate irrigated to harvested ratios of greater than one.

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 multiyear 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 $\log(1 + \text{ratios}) >> .69$
- 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**

VI. Acknowledgements

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