Mapping Regional Production Capacity and Climate Change Sensitivity

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Abstract
The eastern seaboard region (ESR) imports over 70% of its fresh fruit and vegetables from outside the area. The stability of this distantly produced food supply is vulnerable to uncertainties posed by fuel and transportation costs, product safety, climate change, and other concerns. Food security and access can hypothetically be improved by promoting more reliance on locally and regionally derived production systems. The ESR has a robust natural resource base for this purpose, including ideal climate, rainfall, fertile soils, and land availability. However, the potential production capacity, as limited by biophysical constraints, has not been quantified. To this end, USDA-ARS corn and potato models MAIZSIM and SPUDSIM were integrated with a geospatial interface to study potential yields and resource requirements as influenced by soil properties, field management, land-use configurations, and historical weather patterns at a sub-county spatial resolution. The sensitivity of this baseline production potential over the 13-state region to mid-century climate change (including shifts in CO₂ mean daily air temperature, and rainfall) was also studied. Efficacy of using water management and planting dates as adaptation approaches was assessed. Results can be used by regional planners to study the viability of regionally based food systems as well as anticipate and respond to potential climate change risks.

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Objectives
- Evaluate the potential production capacity of the ESR.
- Quantify effects of climate change on production capacity.
- Investigate potential adaptation approaches.

Geospatial Crop Model Interface
1) Input data layers (weather, soil, management, land use) are georeferenced and organized in ArcGIS for the region of interest.
2) Spatially homogeneous modeling units (MUs) are created.
3) For each unique input combination, 30 independent growing seasons are simulated with SPUDSIM and MAIZSIM.
4) Output is spatially linked and aggregated to the county level. Models validated using published NASS statistics for selected years.

1. Potential Production Capacity
A. Observed Harvested Areas

B. Simulated Yields (potato) – Cropland Area

C. Simulated Yields (corn) – Cropland Area

2. Climate Change – Simulations (A2 scenario)
A. Rainfed Comparisons

B. Irrigated Comparisons

C. Irrigated versus Rainfed Comparisons

3. Adaptation Responses
A. Water management

B. Planting / Harvest Dates

Conclusions
- ESR has a large capacity for increasing regional food production. This is closely tied with yield and irrigation availability.
- ESR will be sensitive to climate change; however, the degree of sensitivity is specific to different crops and latitude.
- Both irrigation and planting/harvest date adjustments may be effective adaptation strategies for future climate change impact.