

Adaptability of Irrigation to a Changing Monsoon in India: How far can we go?

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I. Research Question

How will climate change alter the demand for unsustainably pumped groundwater to meet India's irrigation needs?

- India is the world's largest groundwater user
- Agriculture in India has come to depend on groundwater pumping
- Current levels of groundwater use are unsustainable, and have caused significant declines in groundwater levels
- Irrigation water requirements are closely linked to monsoon rainfall

Modeling Method:

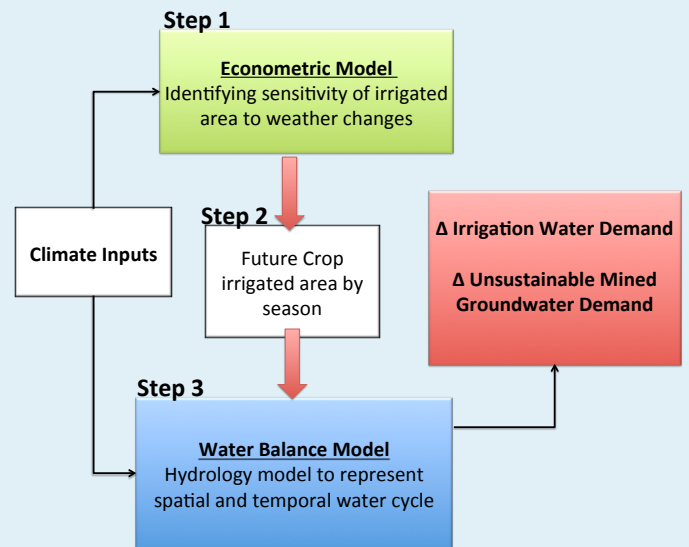
Step 1: Econometric model quantifies how irrigation decisions have changed historically (1970-2005) in response to climate, specifically monsoon rainfall.

Step 2: Build projections of irrigated area based on future climate projections, assuming other variables (e.g., population density, policies) remain constant.

Step 3: Water balance model estimates total irrigation water demand and unsustainable water demand using inputs from Step 2.

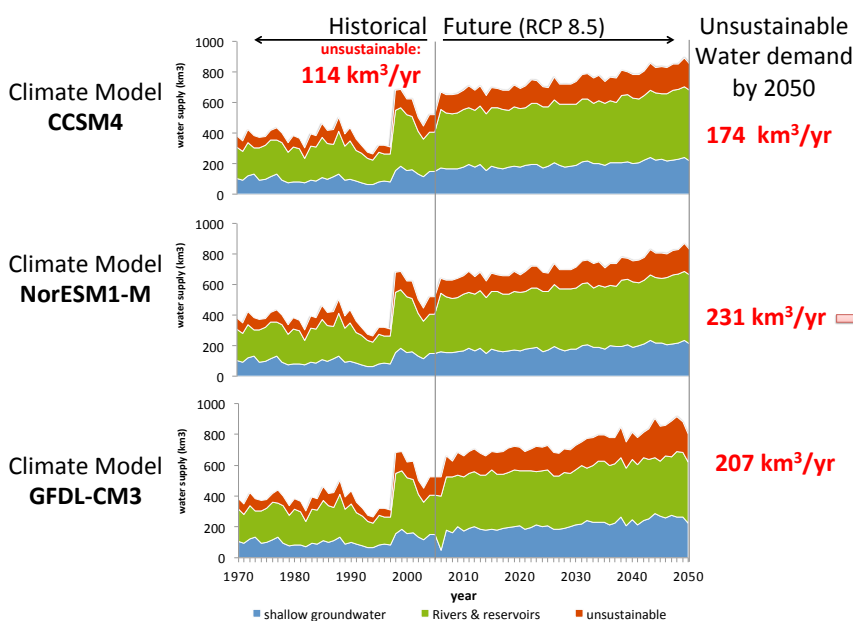
II. Approach

Combined Econometric-Hydrologic Model



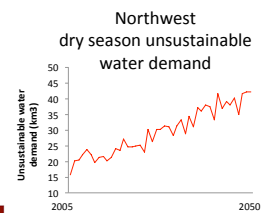
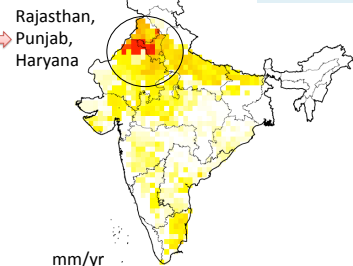
III. Results

Irrigation water demand by source



Demand for unsustainably pumped groundwater may increase 50% to 100% by the year 2050. Range is due to climate model uncertainty.

The northwest accounts for a large portion of the increase in unsustainable water demand



Increase in dry season unsustainable groundwater demand, 2005 to 2050 (model: NorESM1-M)