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2013 International SWAT Conference

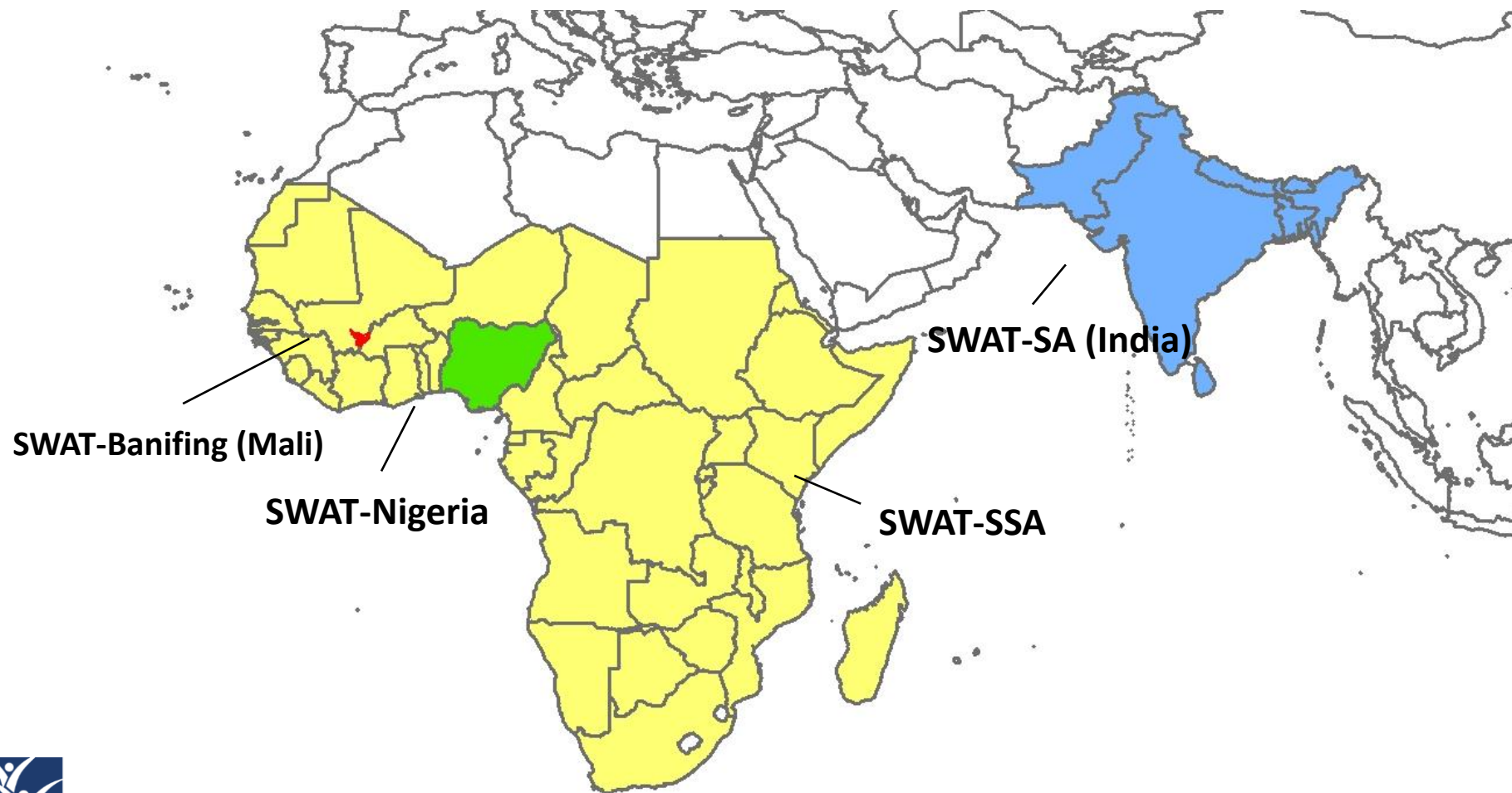
Developing Drought Assessment Tool for India under Intensive Groundwater Irrigation: a SWAT-based Approach

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Paul Sabatier Université, Toulouse, France
17-19 July, 2013

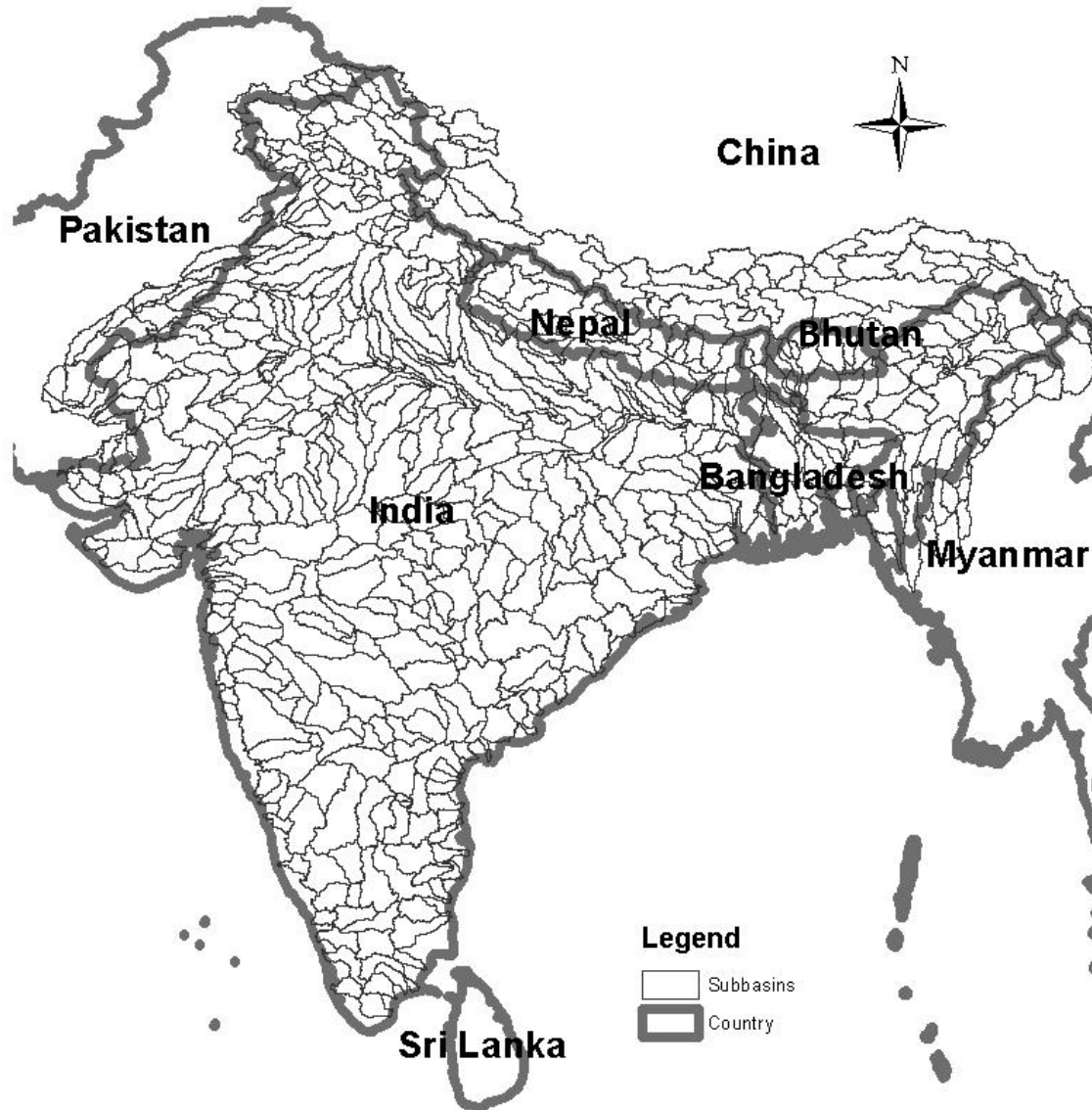
SWAT Modeling Activities at IFPRI



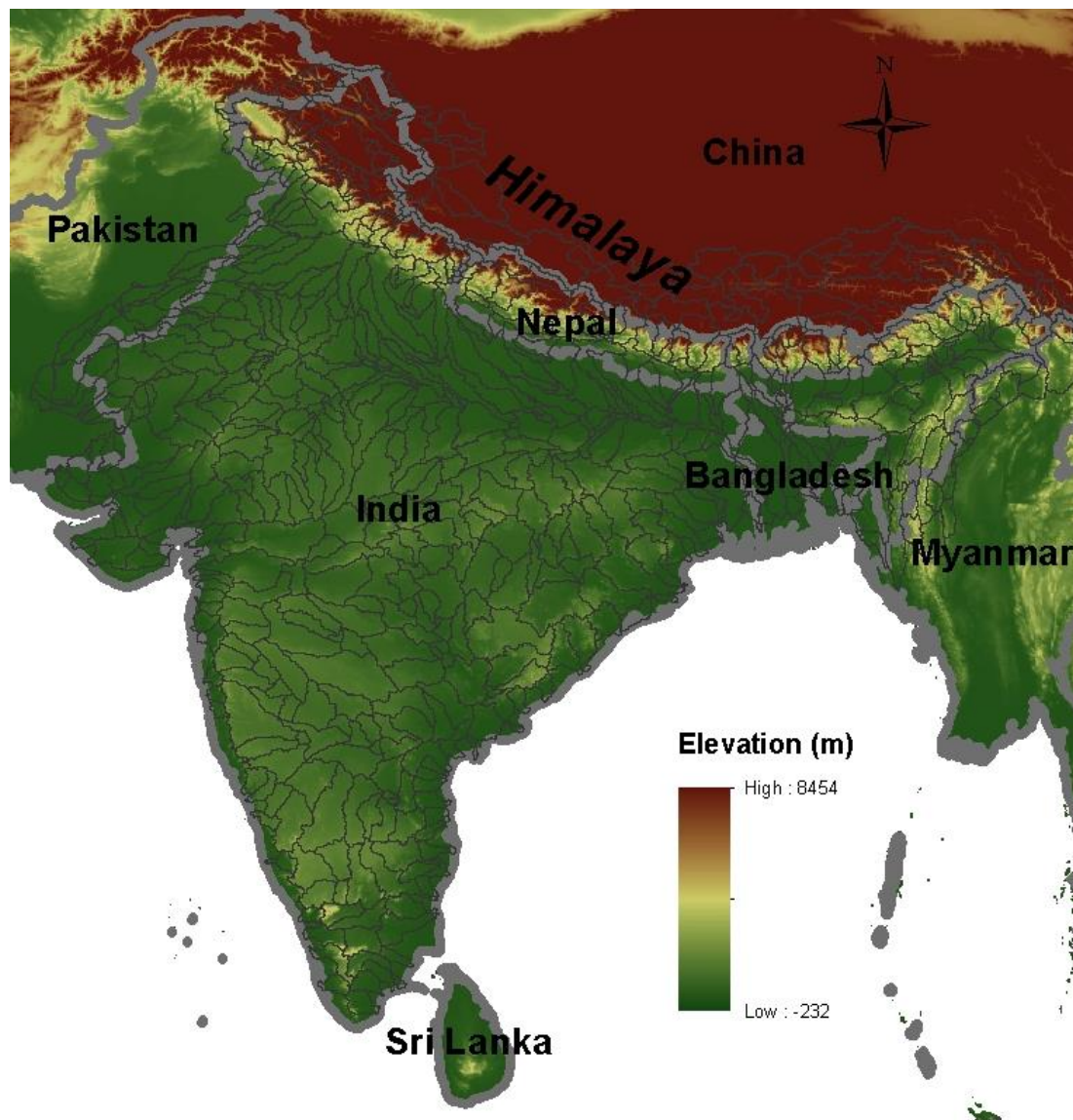
Why SWAT?

- Methods for drought analysis
 - *drought indices (SPI, PDSI and CMI etc.)*
 - *process-based model*
- Advantages of the SWAT model
 - *hydrology*
 - *crop production*
 - *water and land management practices (irrigation)*

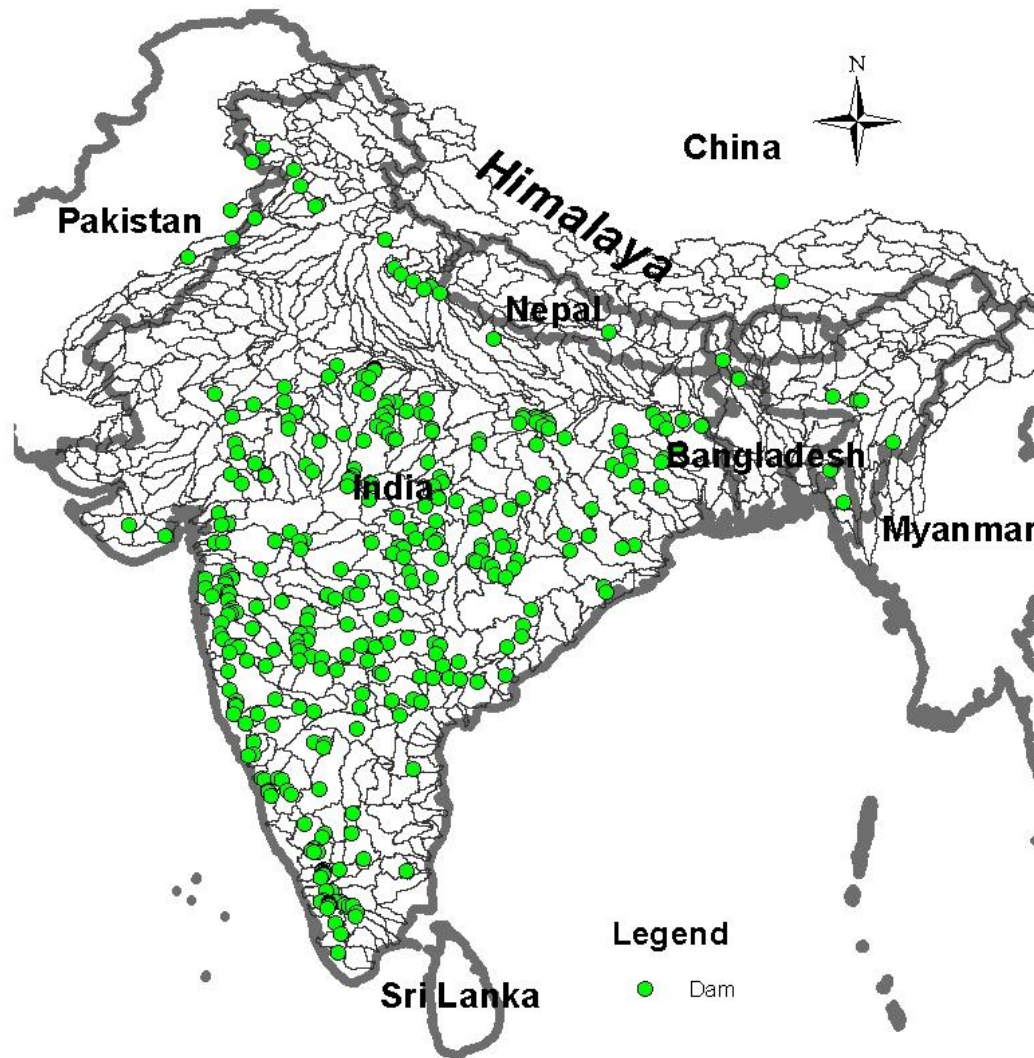
Study Area



Challenges in SWAT-India Model Development



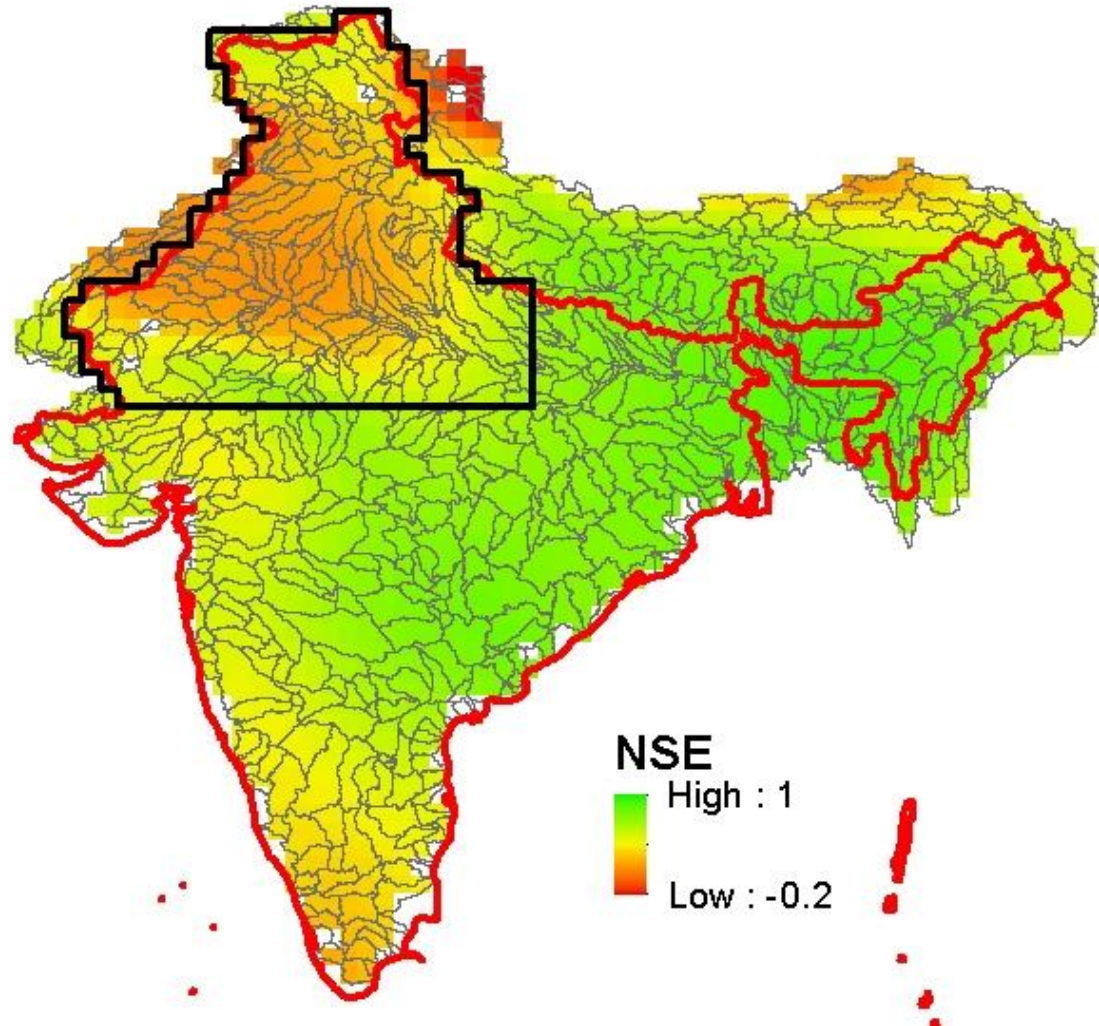
Challenges in SWAT-India Model Development



Model Validation

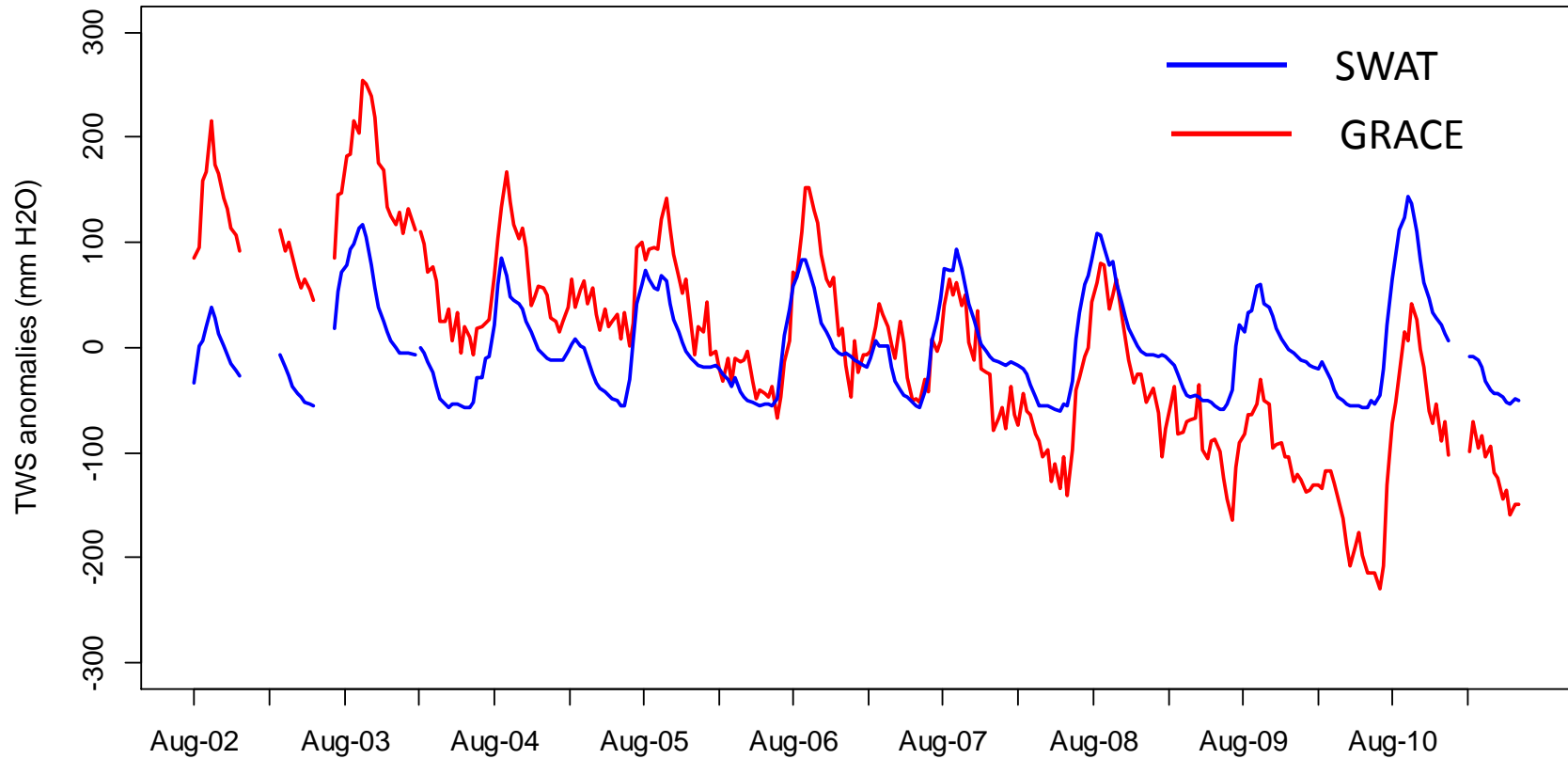
- Total Water Storage (TWS) variation data from Gravity Recovery And Climate Experiment (GRACE)
 - *vertically integrated water mass anomalies (surface water, groundwater and soil moisture etc.)*
- Methodology for comparing GRACE- and SWAT-based TWS variation data
 - *Xie et al. (2012, Hydrol. Earth Syst. Sci., 16, 3083-3099, doi:10.5194/hess-16-3083-2012)*
- GRACE data for this study
 - *10-day TWS variation data from July, 2002 through June, 2011*

Mode Fit to GRACE Data



No simulation for groundwater irrigation activities

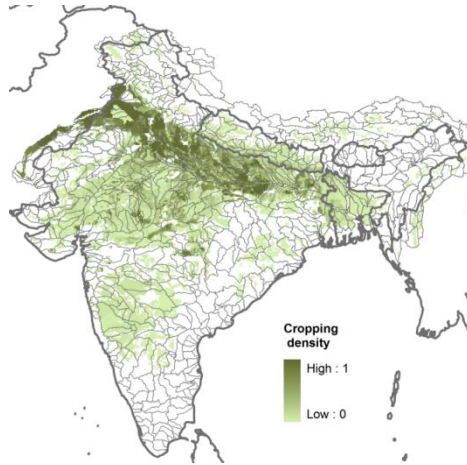
Mode Fit to GRACE Data



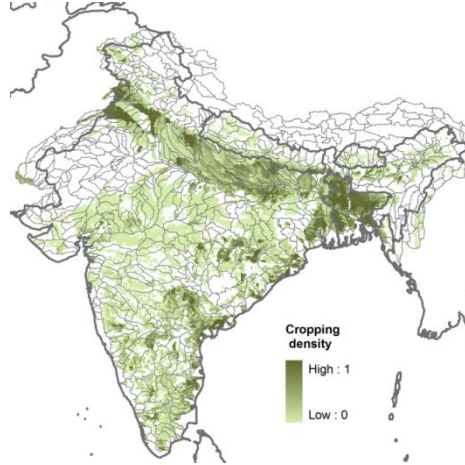
No simulation for groundwater irrigation activities

Irrigated Crops

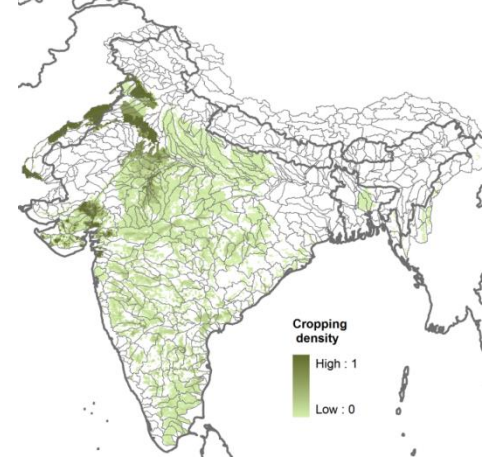
(a) Wheat



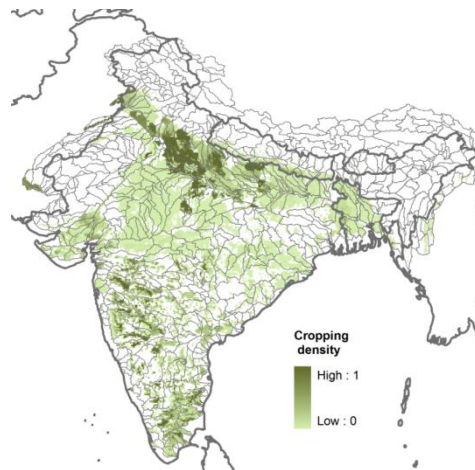
(b) Rice



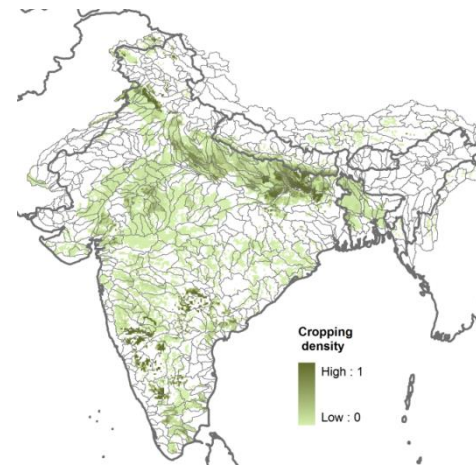
(c) Cotton



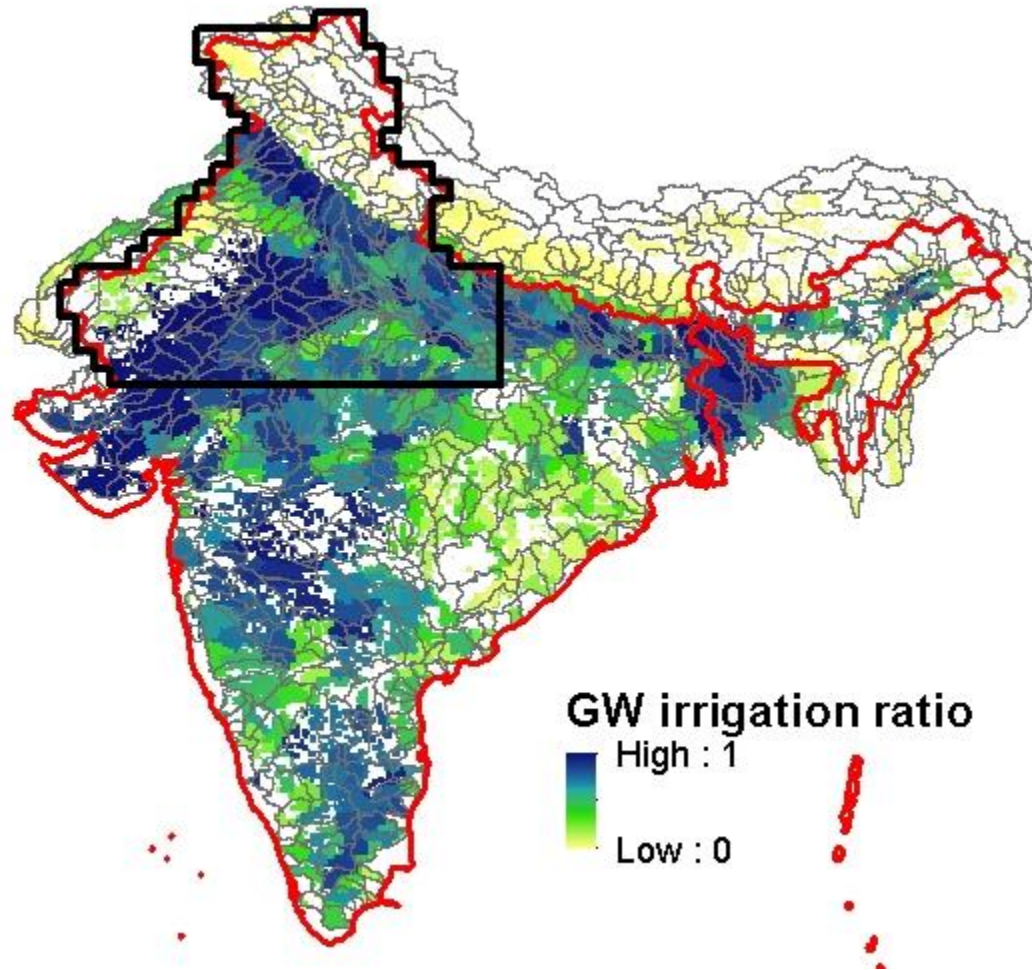
(d) Sugarcane



(e) Maize



Groundwater Irrigation in India

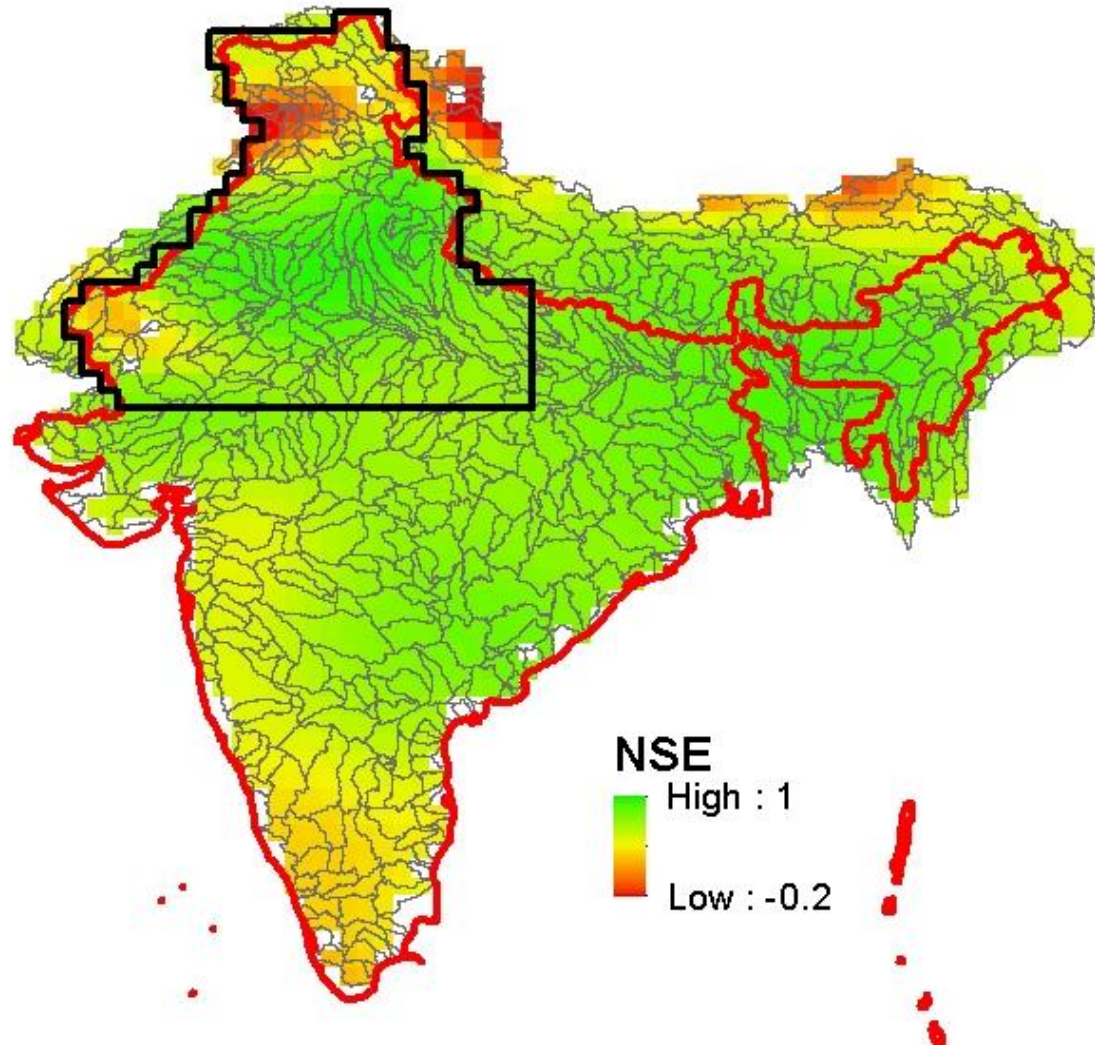


Data source: Global groundwater use inventory (Siebert et al., 2010)

Other Key Steps/Parameters/Assumptions

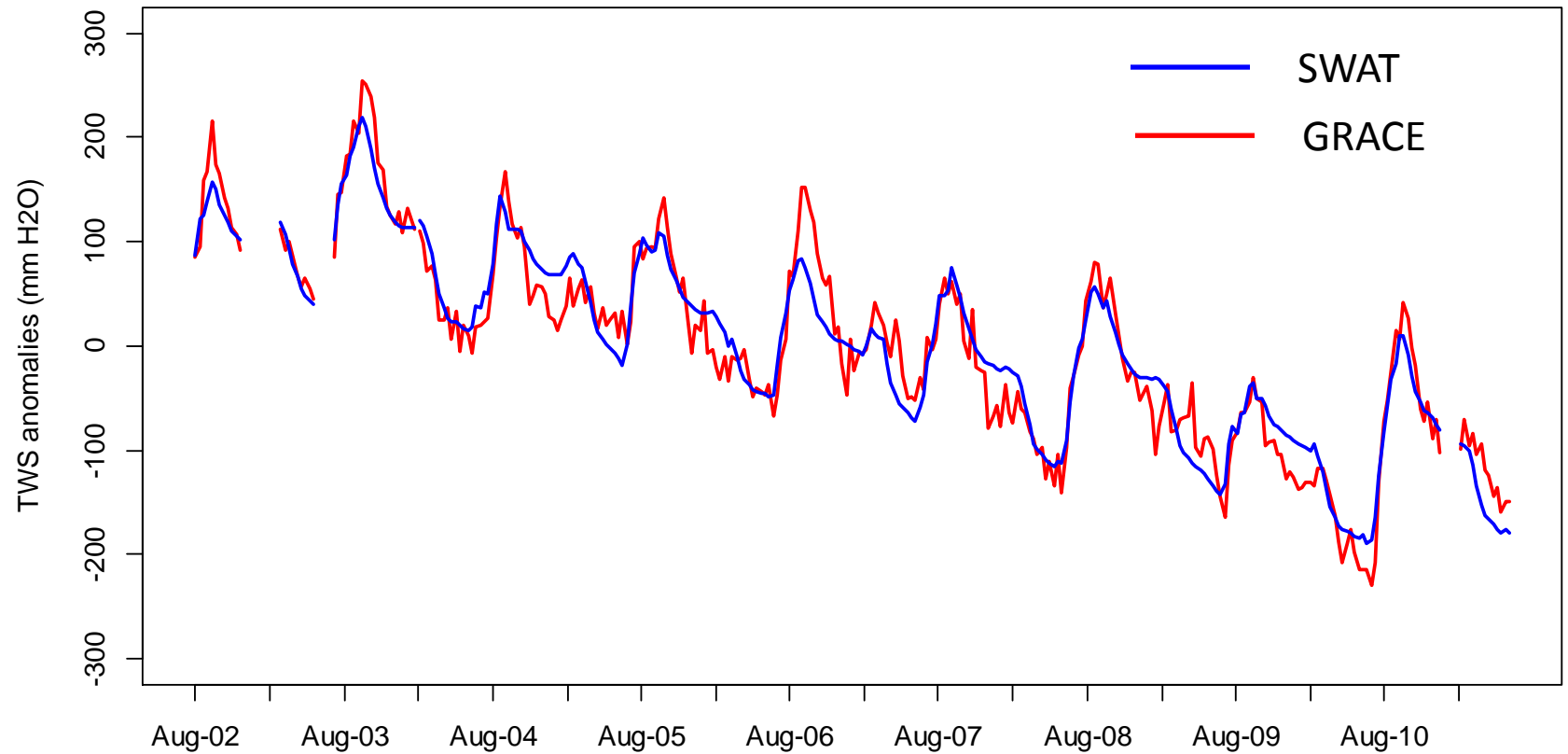
- Modified subroutine (Kang et al., 2006; Xie and Cui, 2011) for water balance simulation of rice paddy (*percolation and seepage loss=3 mm H₂O/day*)
- *Irrigation efficiency=0.7*
- Consolidation of shallow and deep aquifer (*deep aquifer percolation coefficient =0*)
- Unconstrained abstraction from unconsolidated aquifers in northern India

Mode Fit to GRACE Data



With simulation for groundwater irrigation activities

Mode Fit to GRACE Data



With simulation for groundwater irrigation activities

Conclusions and Discussions

- The developed SWAT application is promising to serve as a predictive modeling tool to address groundwater management issues in future drought analysis
- Uncertainties
 - *lack of full accounting of groundwater balance*
 - *parameter sensitivity*

A high-speed photograph of a water splash, creating a circular, swirling pattern of blue water droplets and bubbles. The water is captured in mid-air, with many small droplets scattered around the main circular splash. The background is plain white.

Thank you !