

Water management challenges in the Indo-Gangetic plain



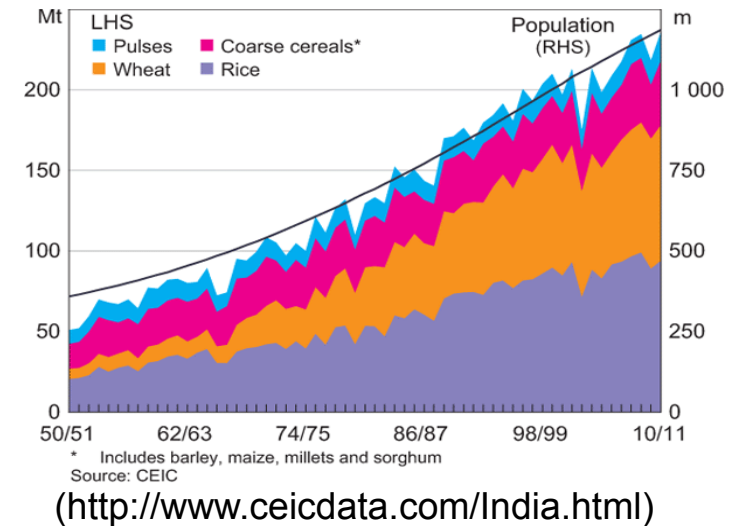
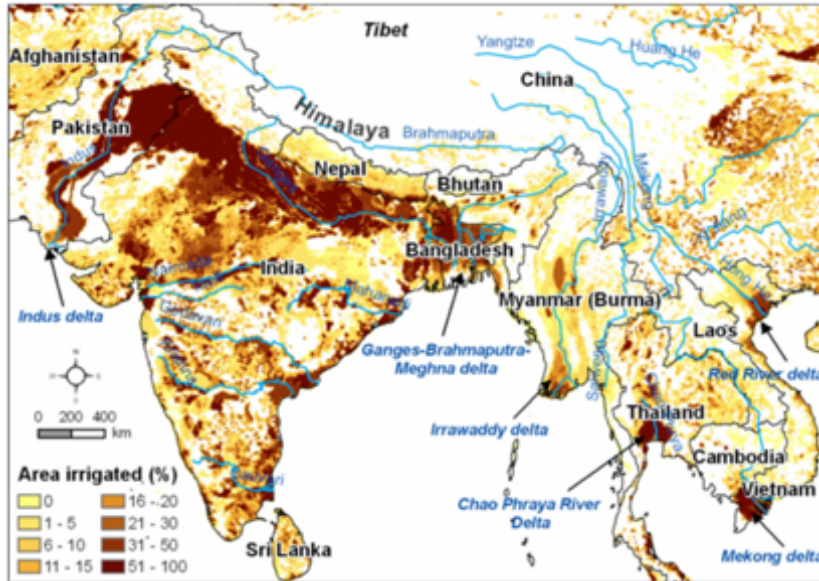
Imperial College
London

Jimmy O’Keeffe
September 2016

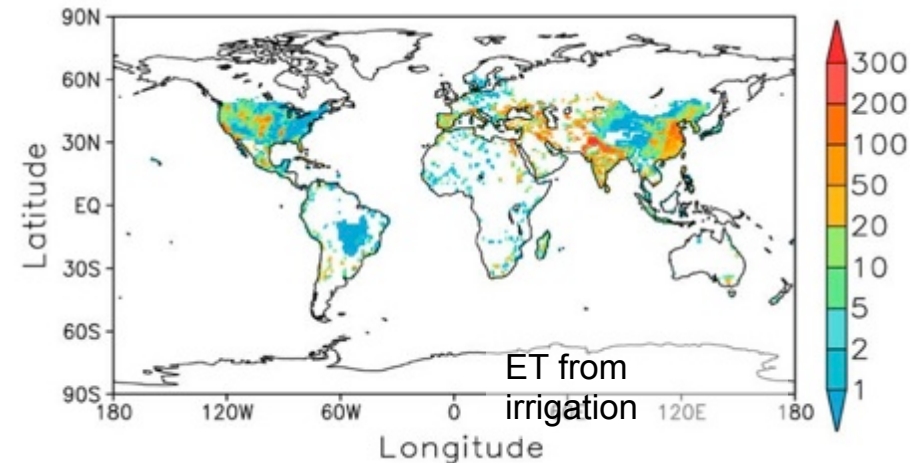
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SCIENCE OF THE
ENVIRONMENT



- **Overview of India's water resource problems**
- **The challenges facing water management**
- **CHANSE project – working towards solutions**

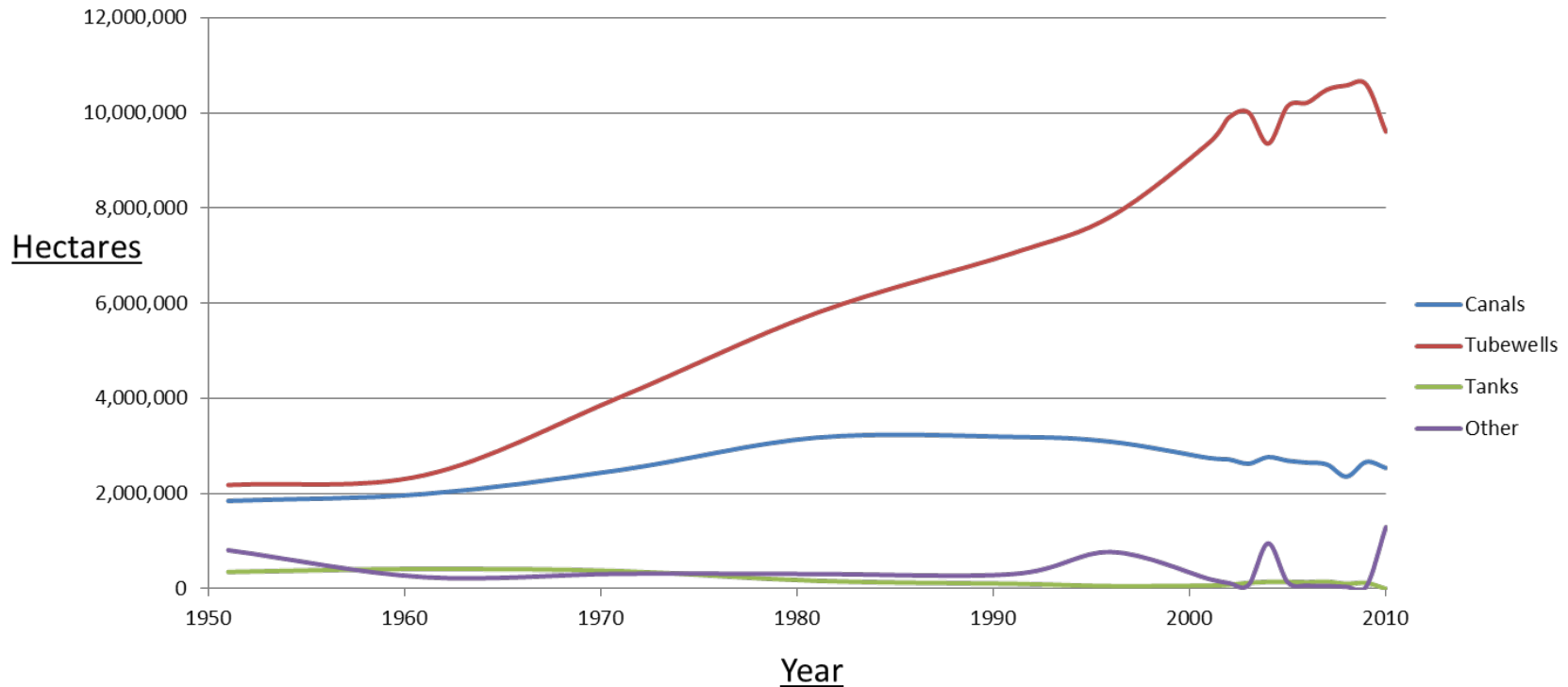


- Green revolution: large scale land use change
- Improvements in technology (irrigation, seed variety, fertiliser)
- Increase in irrigated area and irrigation intensity

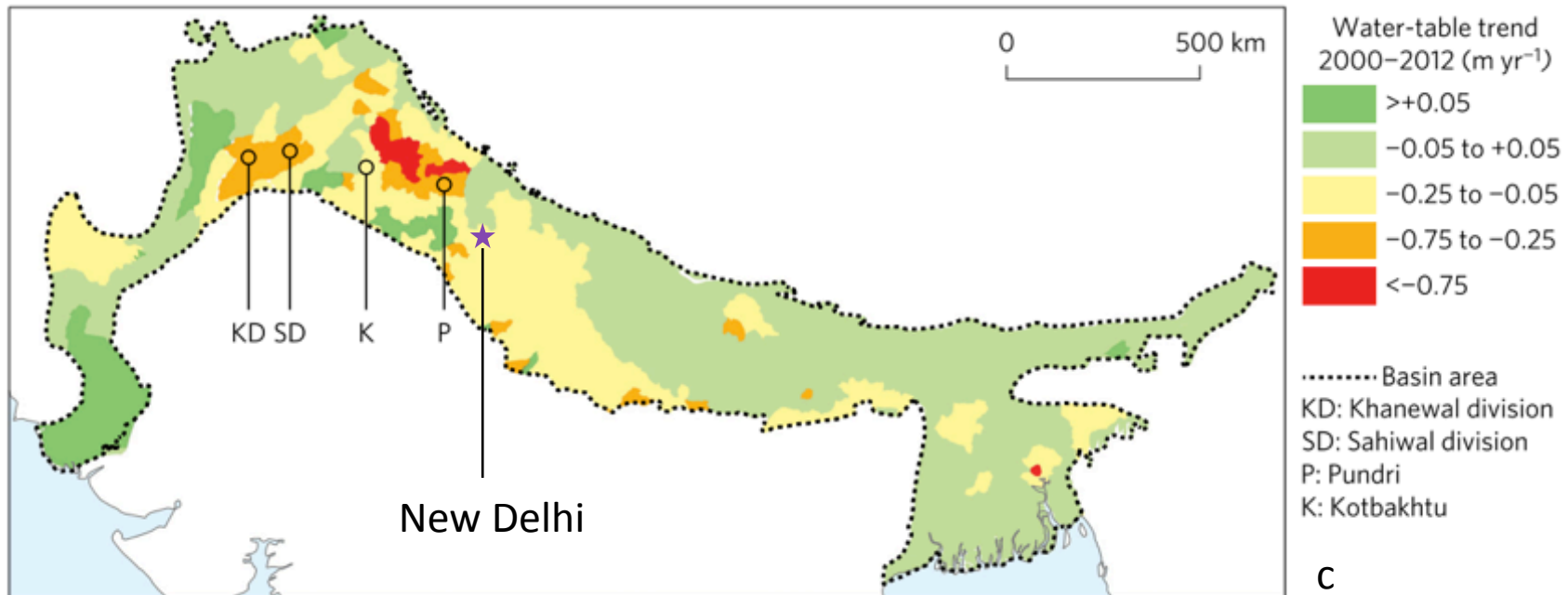
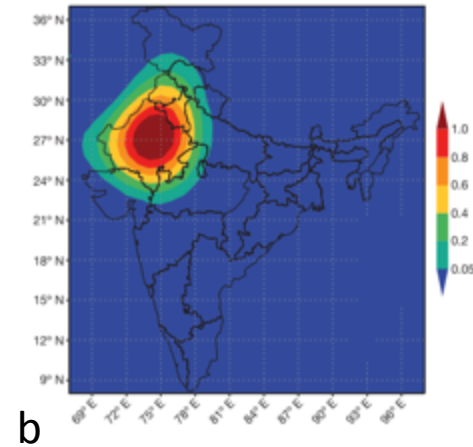
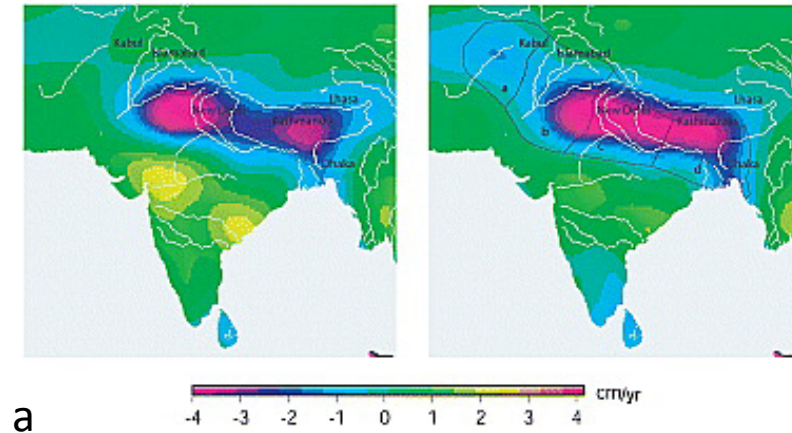


(Boucher et al., Climate Dynamics, 2004)

Changes in area irrigated by irrigation method – Uttar Pradesh 1951-2009



Data taken from: *Uttar Pradesh Development Report (2009) & Statistical Abstract of Uttar Pradesh (2012)*

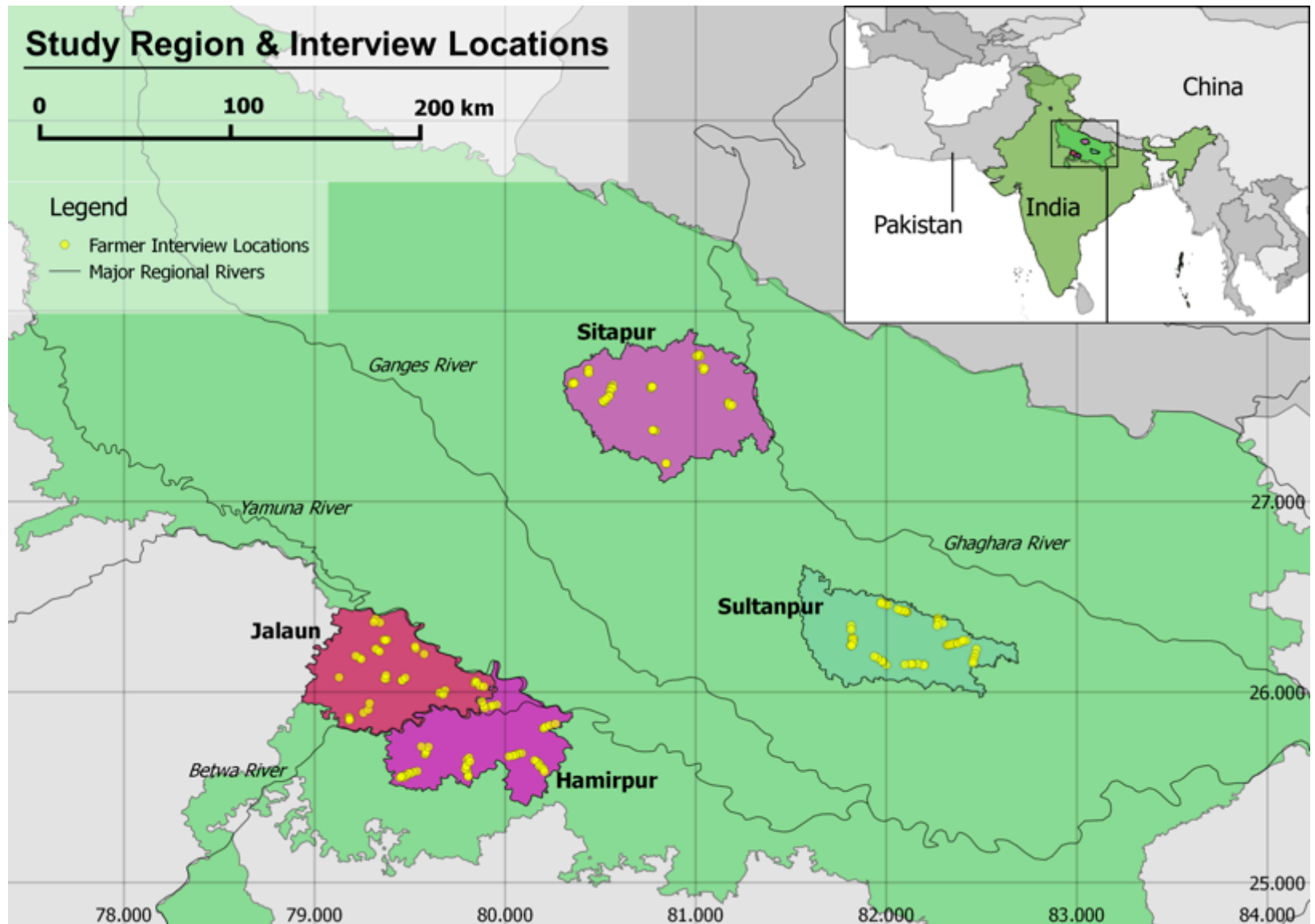


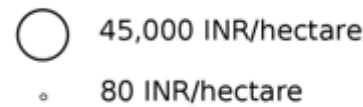
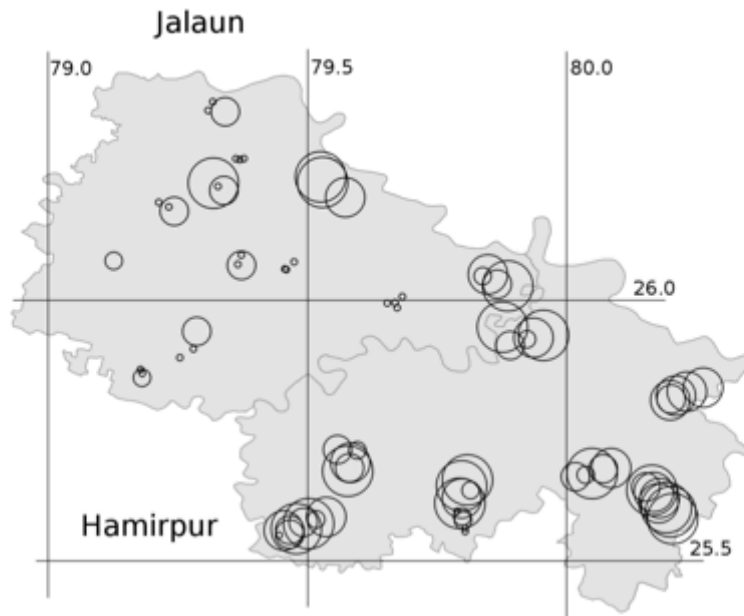
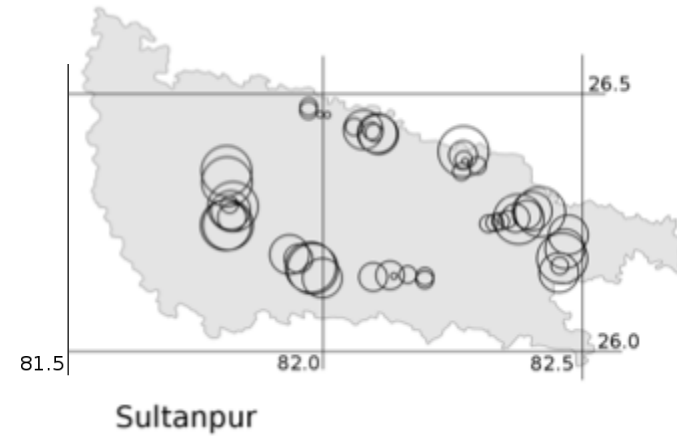
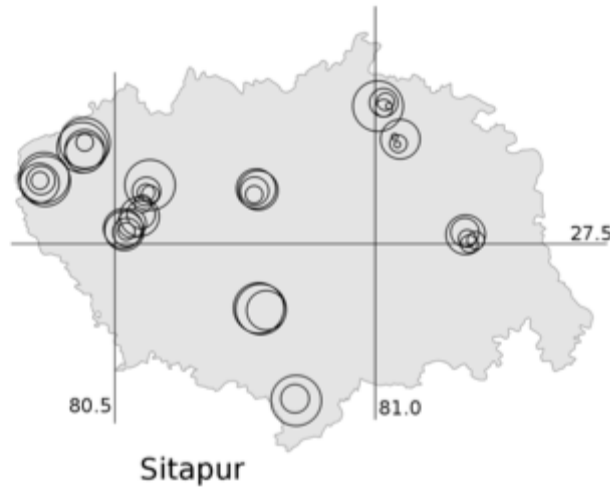
- Semi-structured interviews with approximately 200 farmers in Jalaun, Sitapur, Sultanpur & Hamirpur
- Participants – farmers growing rice and/or wheat
- 50 farmers interviewed in each district in 10-12 randomly selected villages
- Conducted through translators
- All interviews audio recorded & GPS locations taken



(photo by S. Swarnkar)

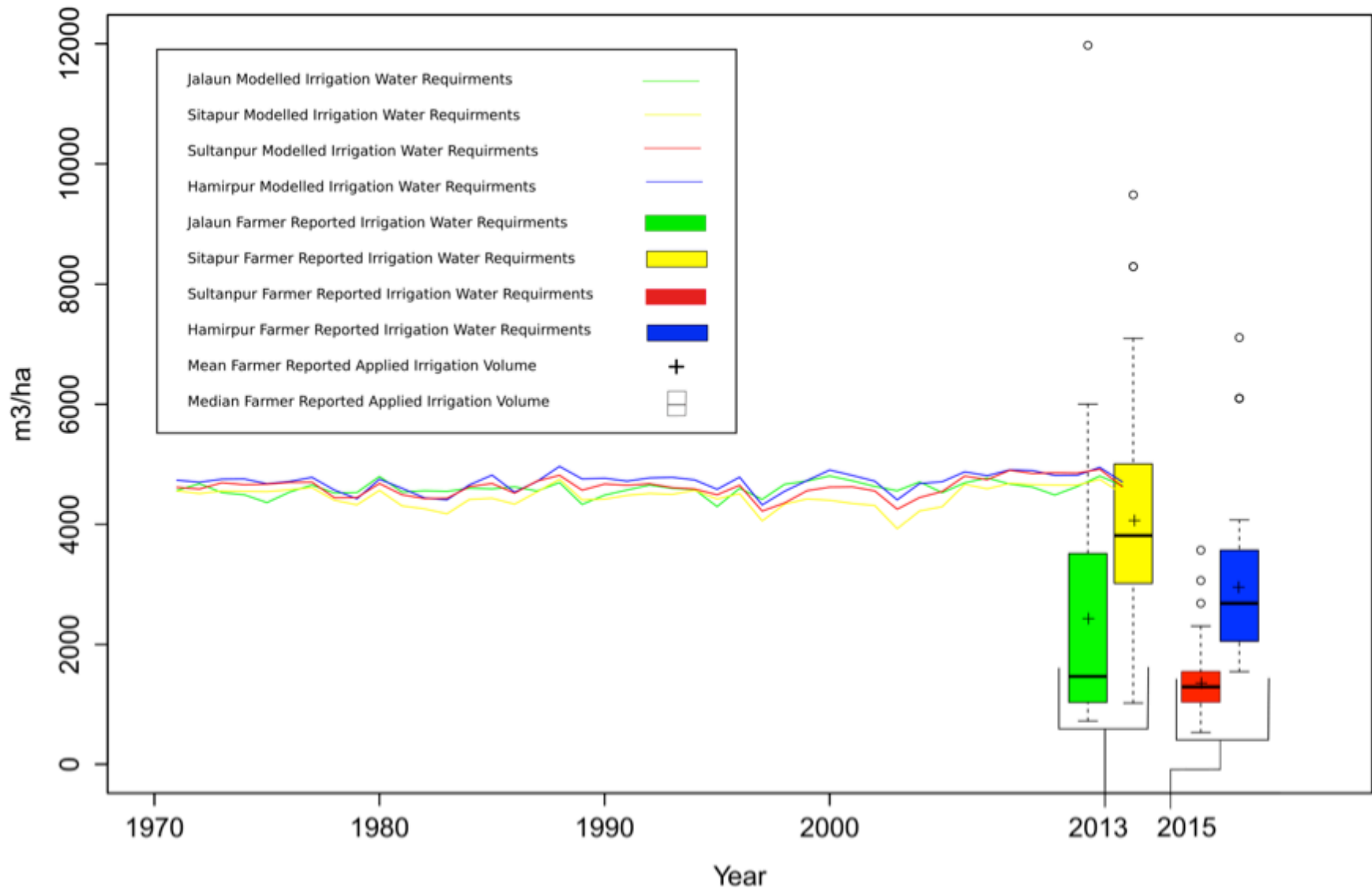






Seasonal irrigation cost - wheat: INR/hectare

Modelled Irrigation Water Requirements – Wheat (m³/ha/year)



- Significant challenges due to scale, bio biophysical complexity and the dynamics of its institutional and socioeconomic characteristics
- Impact on ecosystem services
- Imbalance between water demand and seasonal availability
- Lack of regulations and governance



J.O'Keeffe

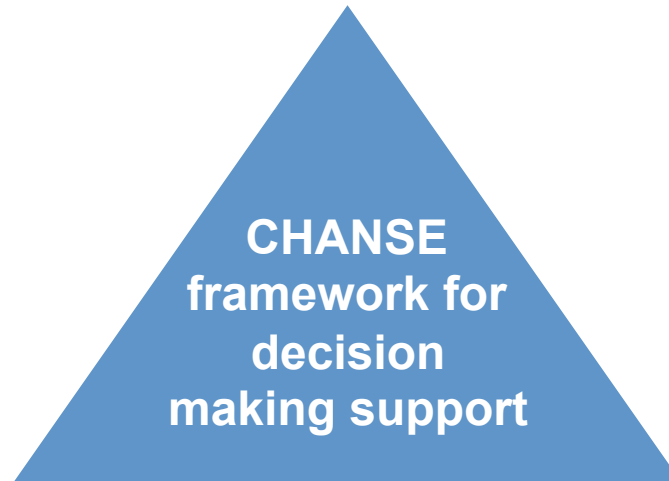


Hindustan times

CHANSE framework for holistic understanding of complex dynamics of the human-natural system

Water end users

(agriculture, urban environments,
river ecology, fisheries and biodiversity)

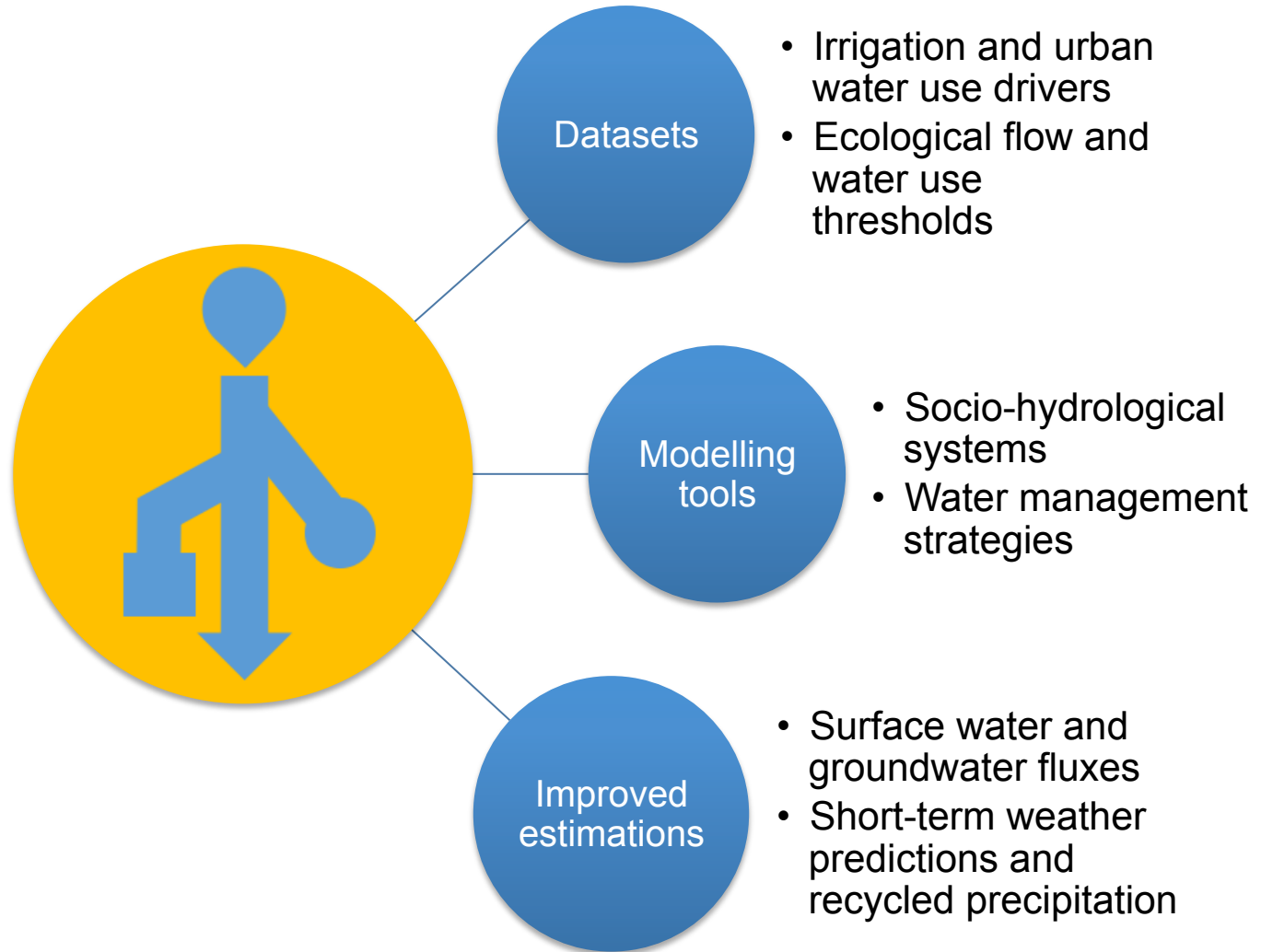


Human-natural system

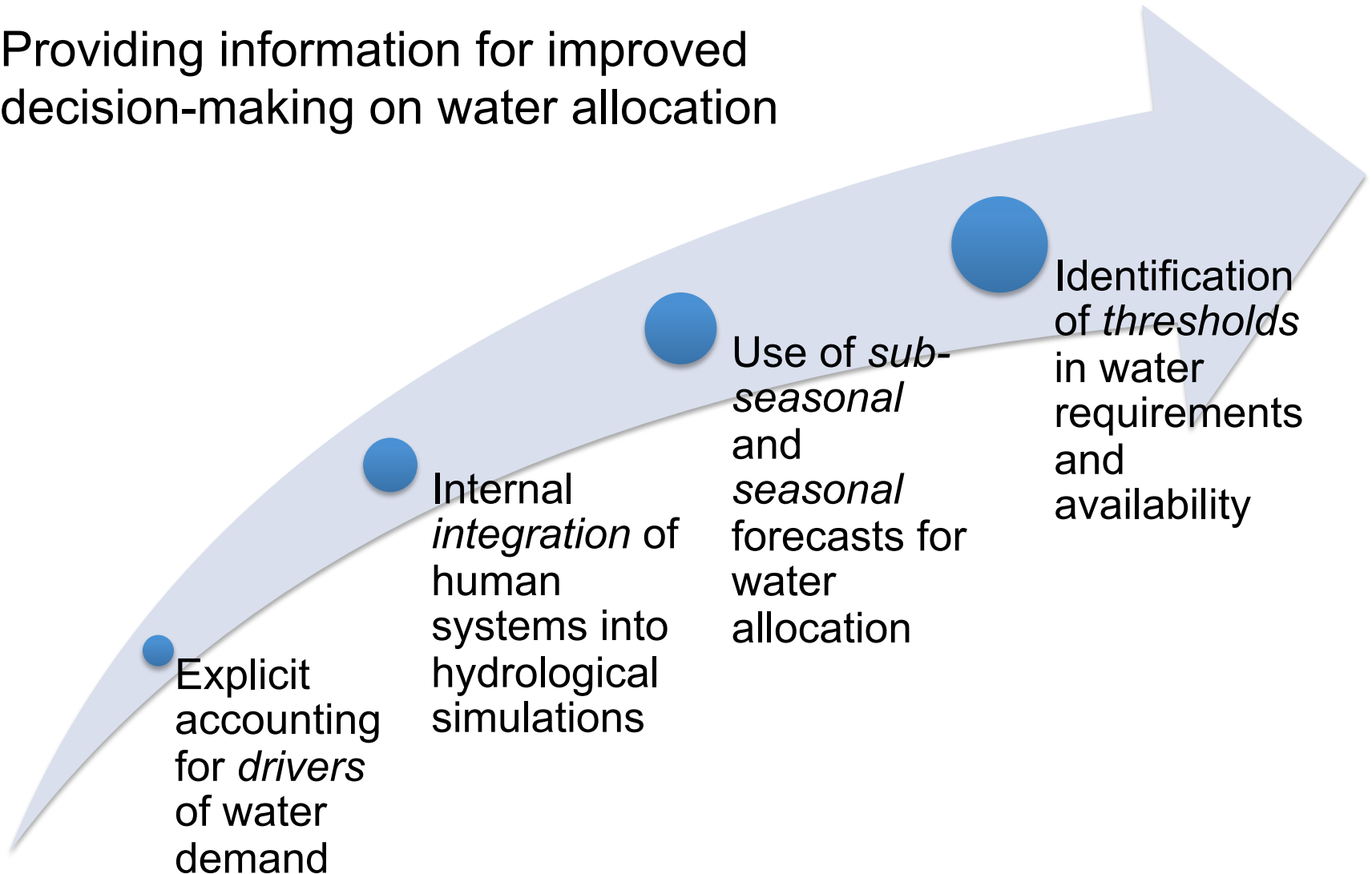
(river stages, sediment
characteristics
and groundwater levels)

Scenario constraints

(climate variability, policy and
techno-economic
factors)



Providing information for improved
decision-making on water allocation



Hydroflux India



Hydrometeorological feedbacks and changes in water storage and fluxes in Northern India

Resolving major fluxes in the Ganges basin



Reconstruction of historical land-use dynamics

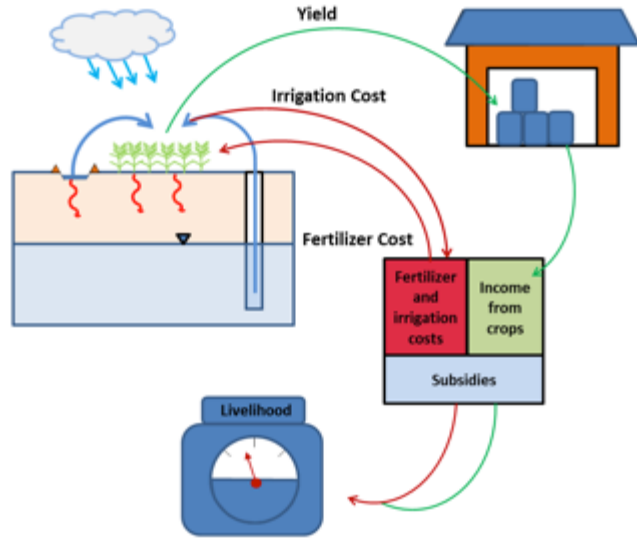
- Historical satellite imagery
- Land-use and socio-economic trends

Integrated hydro-climate modelling

- Coupled groundwater – surface water model
- Feedbacks with a global climate model

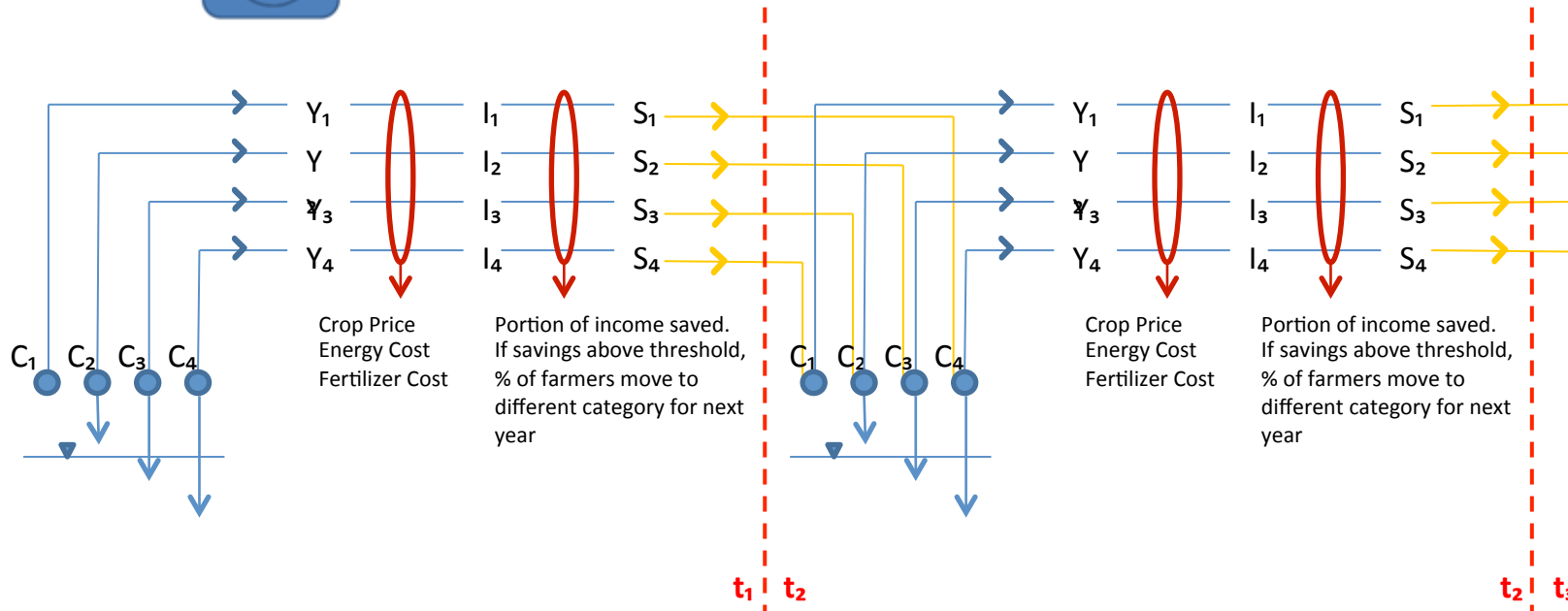
Simulating past and future trends

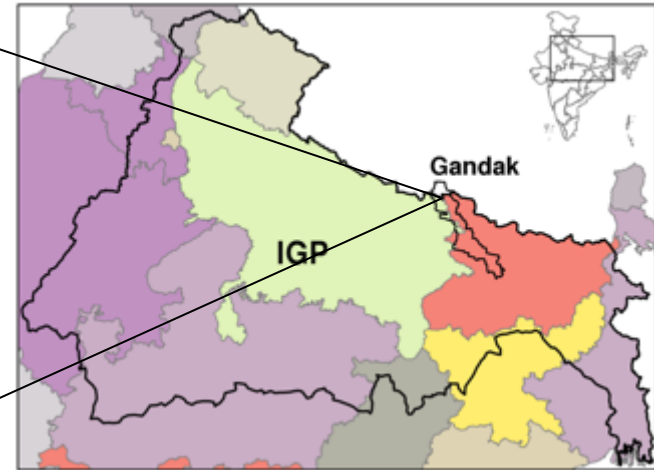
- Groundwater availability
- Changes in extreme events



*Hydro-economic modelling
framework*

*Informed and driven through field
work*





Water use for agriculture
and fisheries



Groundwater-dependant
urban water supply



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