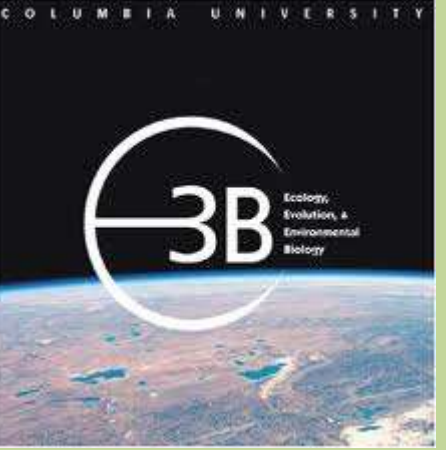


Agricultural susceptibility to climate variability: Insight from two Indian agro-ecoregions

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Background

- A majority of the rural Indian population relies on agriculture for sustenance and livelihoods.
- A future challenge for India's agricultural sector will be to produce 50% more grain over the next decade to feed an increasing population (1).
- Crop productivity in India is highly dependent on monsoon rainfall and varies greatly with inter-annual climate variability (2).
- It is important to identify relative climate dependence of small-scale farmers in different Indian agro-ecoregions in order to assess vulnerability to climate change at a national scale.



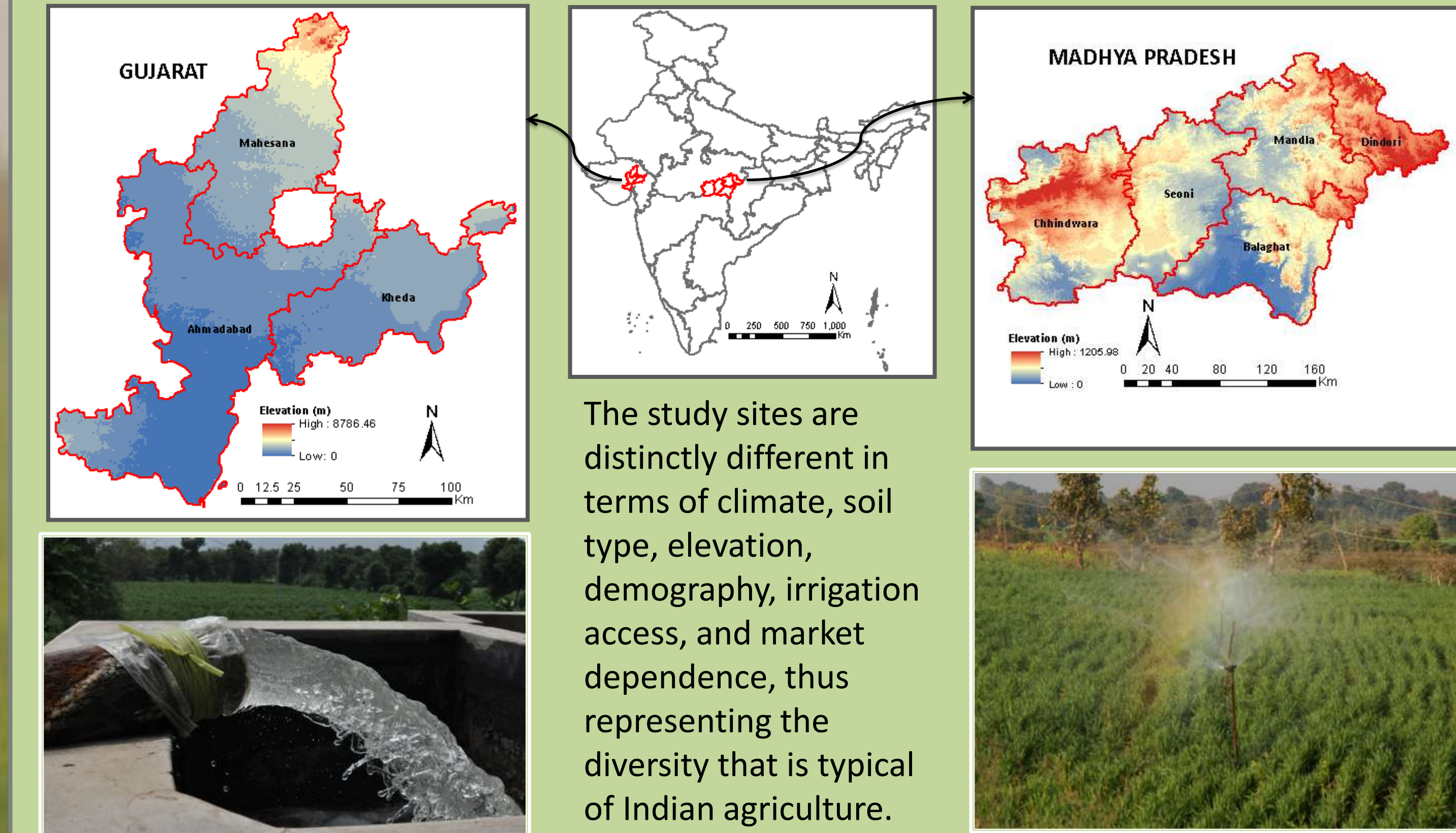
Research Questions

1. Do seasonal crop phenologies in different agro-ecoregions respond differently to inter-annual climate variability?
2. What factors determine such differential agricultural sensitivity to climate variability?

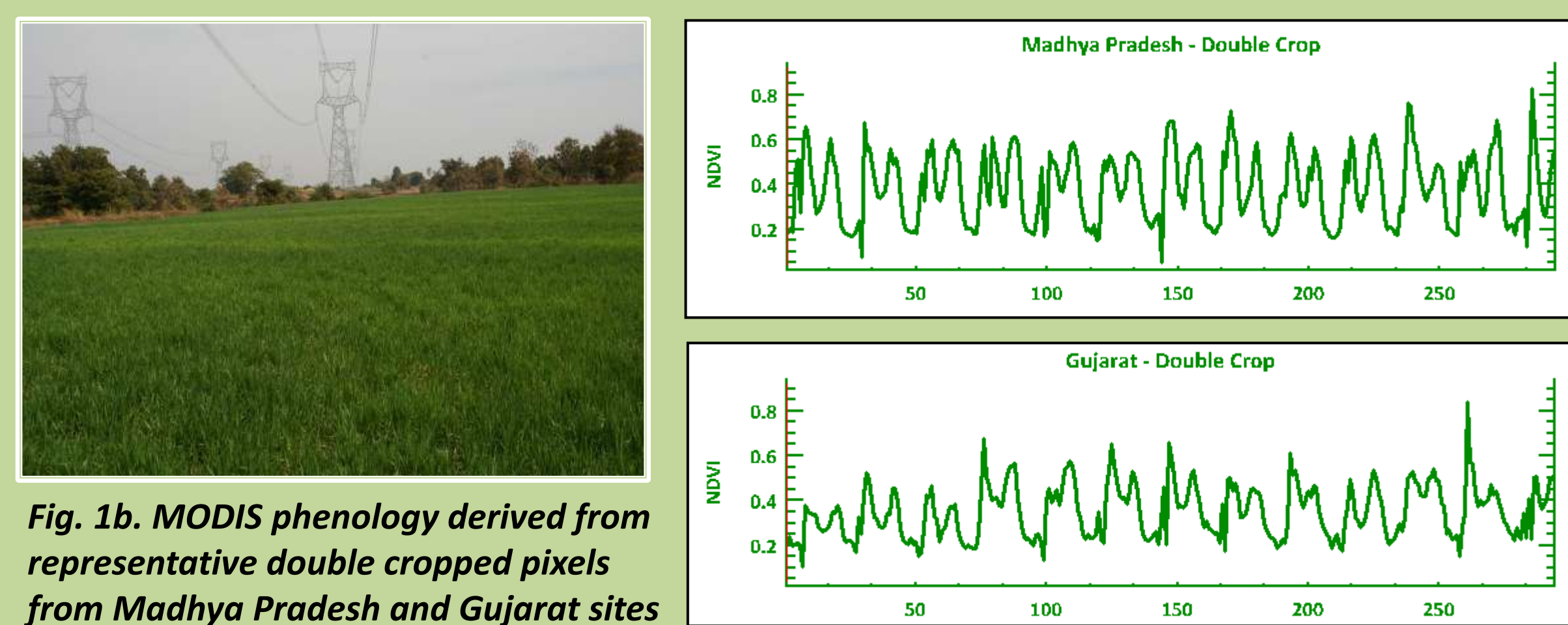
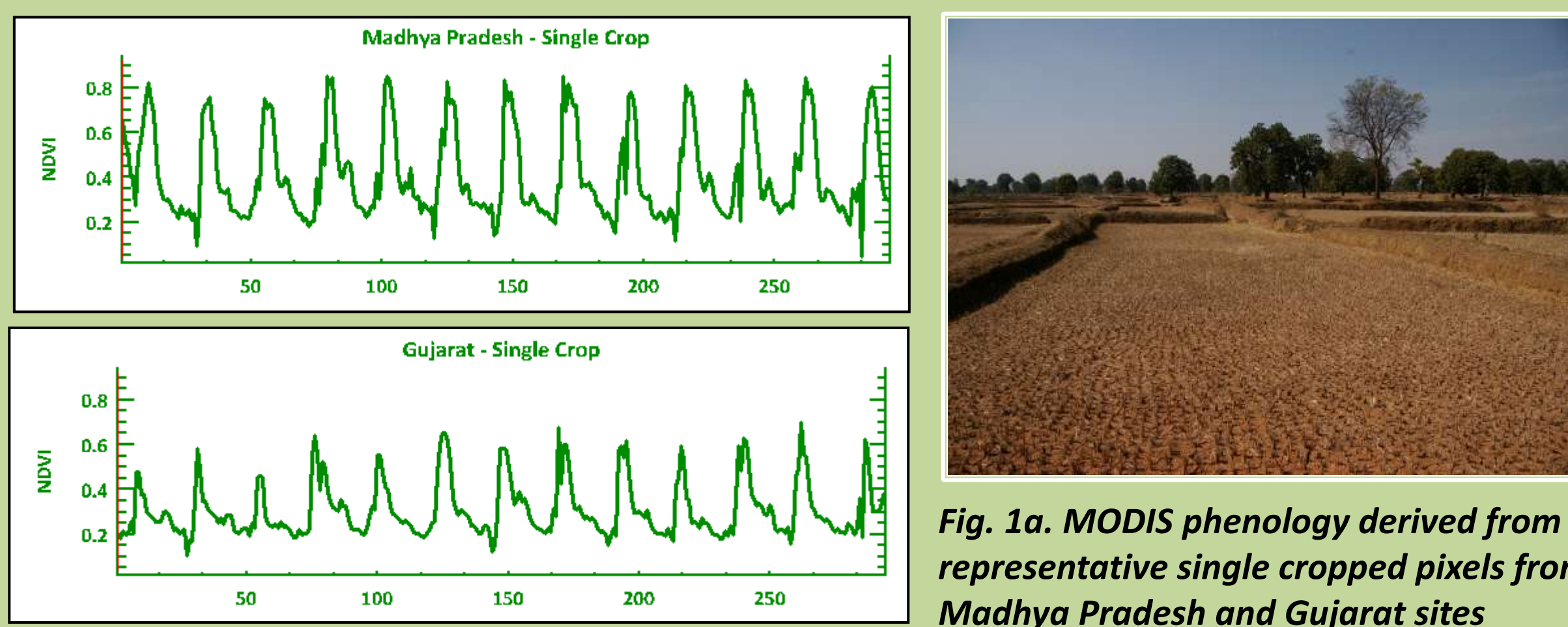
Method

- Step 1:** Identify multiple years (2000, 2004, 2005, 2009) to represent a range of climate variability compared to a 13-year monsoon mean (2000-2012).
- Step 2:** Calculate Δ NDVI (peak-season NDVI – pre-season NDVI) as a proxy for crop productivity for random cropped pixels for the selected years
- Step 3:** Select climate variables derived from MODIS and TRMM
- Step 4:** Examine statistical relationships between Δ NDVI and climate variables

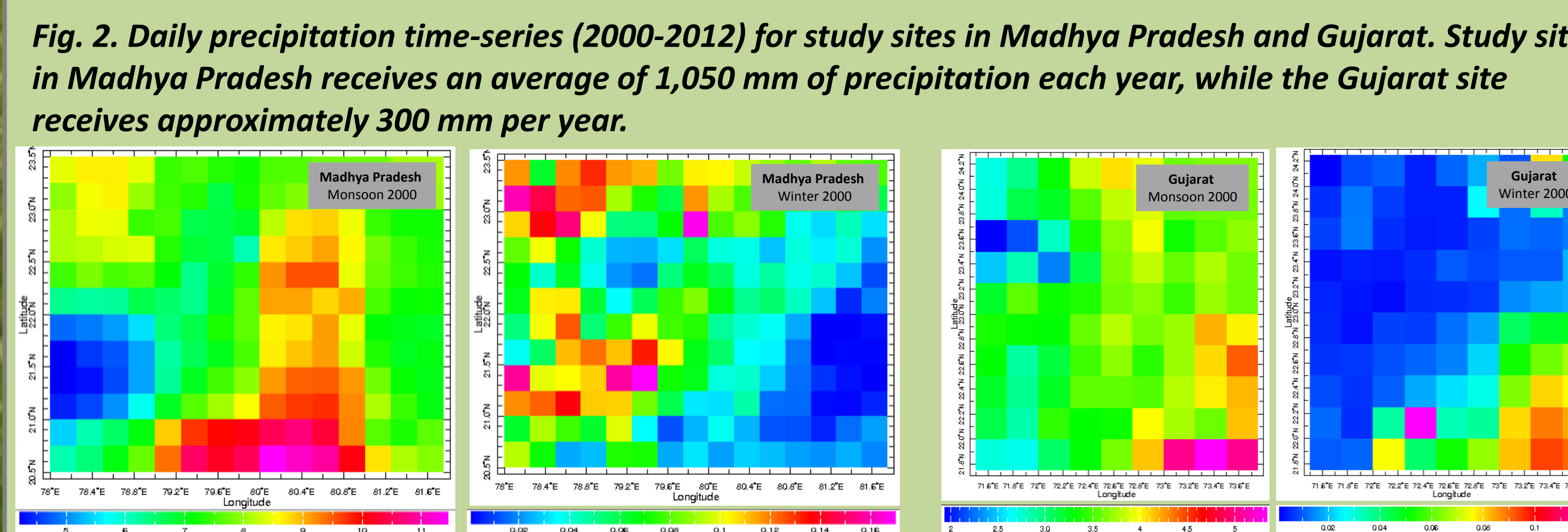
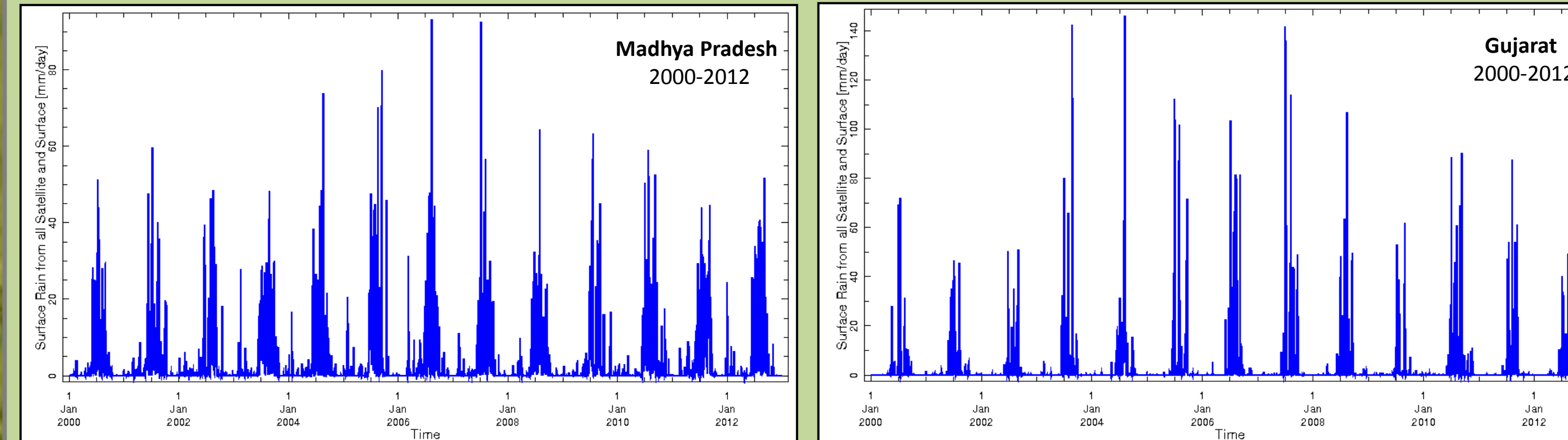
Study Area



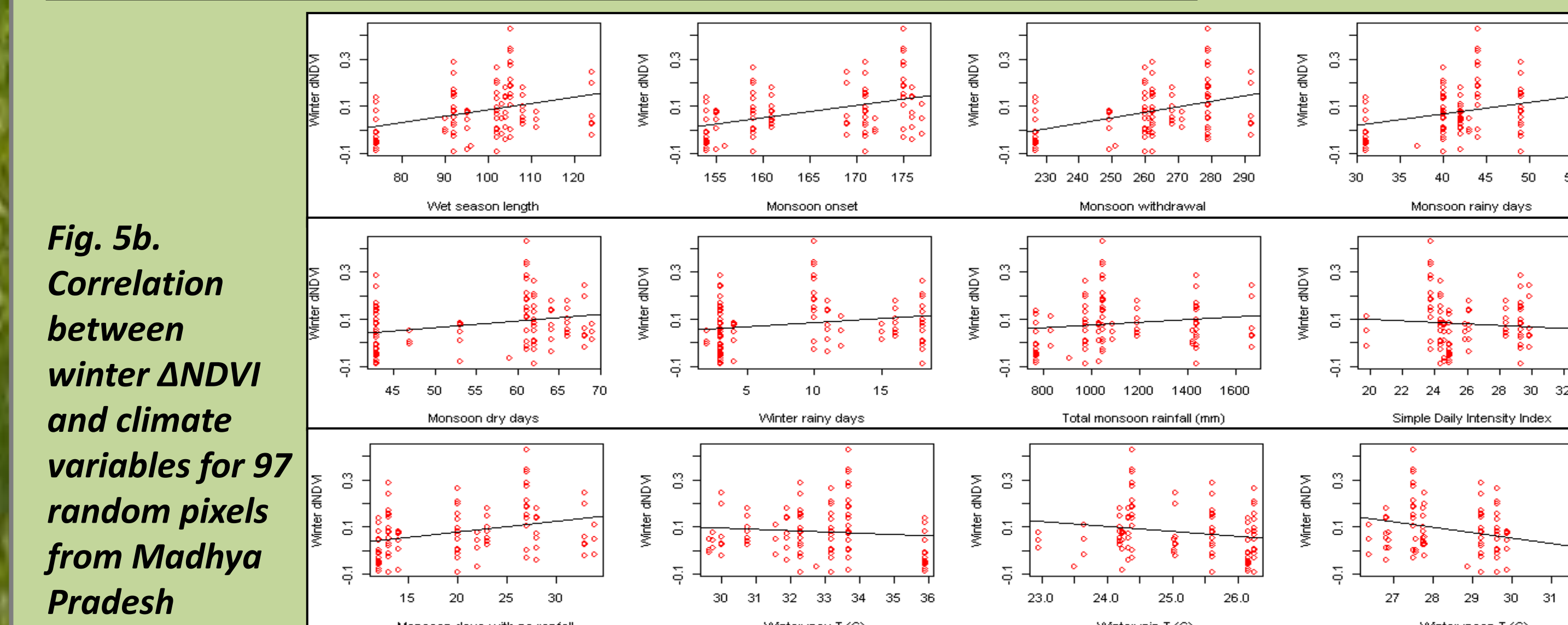
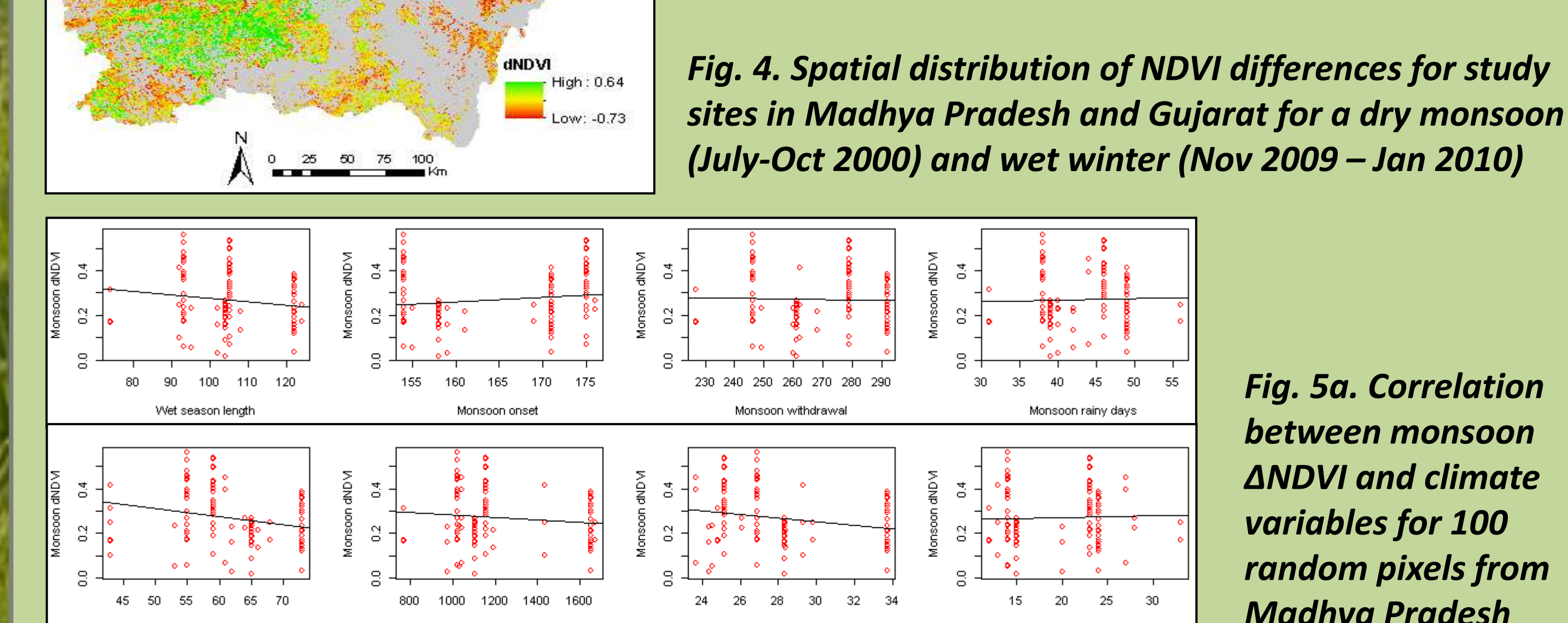
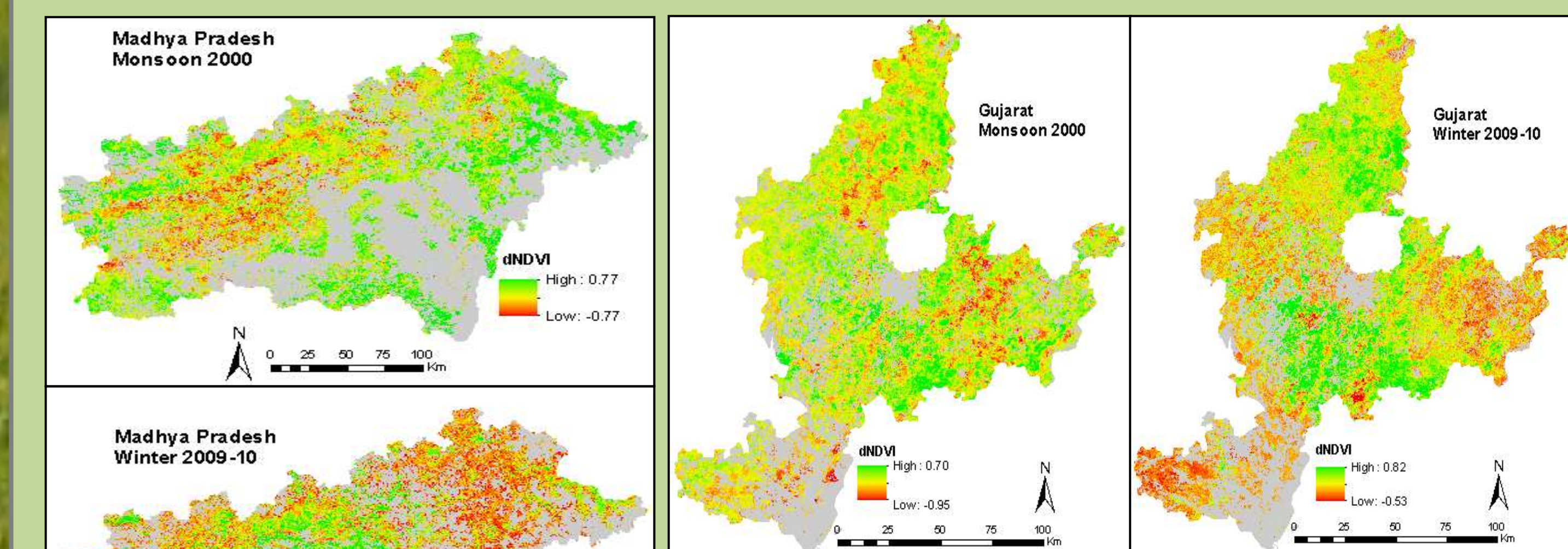
MODIS Phenology



Climate Data



Preliminary Results



Key Findings

- Crop phenology in both study sites show close statistical relationship with climate variables.
- Preliminary results from Madhya Pradesh suggest lower crop productivity in response to adverse climatic trends, such as lower total monsoon rainfall, increased number of monsoon dry days, and increasing winter temperature. Crop productivity in this region is especially sensitive to climate variability during winter cropping season due to predominantly climate-dependent surface irrigation.
- Preliminary results and field data from Gujarat suggest crop productivity, especially in winter, is less sensitive to climate variability due to better access to ground-water irrigation.

Future Work

- Future work would extend this analysis to other agro-ecoregions in India to assess relative climate dependence at a national scale.
- This work would further contribute in developing a national-level climate vulnerability map based on satellite data, and socio-economic data.

Acknowledgements & References

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1. Paroda, R. S., and P. Kumar (2000), Food production and demand in South Asia, *Agricultural Economics Research Review*, 13(1), 1-24.
2. Kumar, K. K. (2009), Climate Sensitivity of Indian Agriculture, Madras School of Economics, Chennai, India.

