



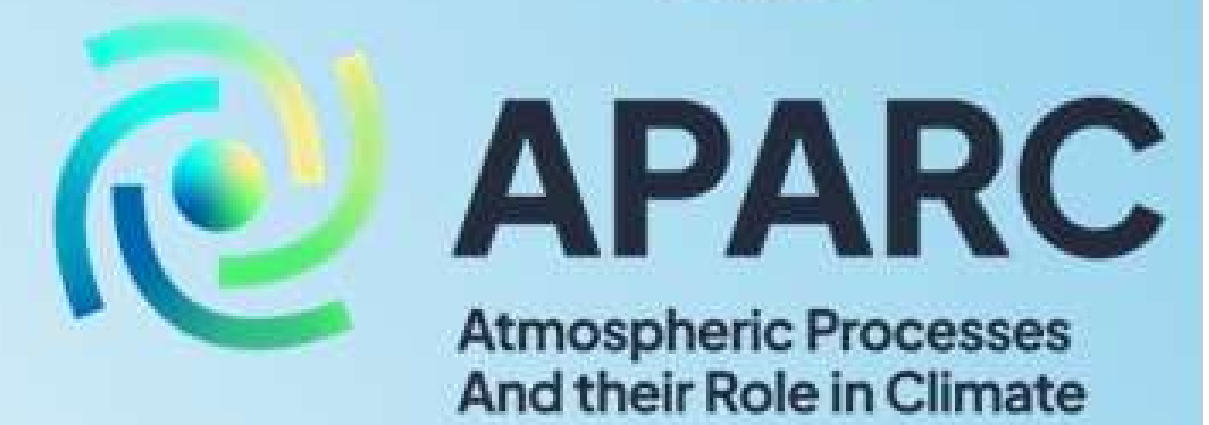
Projected Monsoon Climate Shifts and Land Surface Response in the Brahmani-Baitarni River Basin Under RCP 4.5

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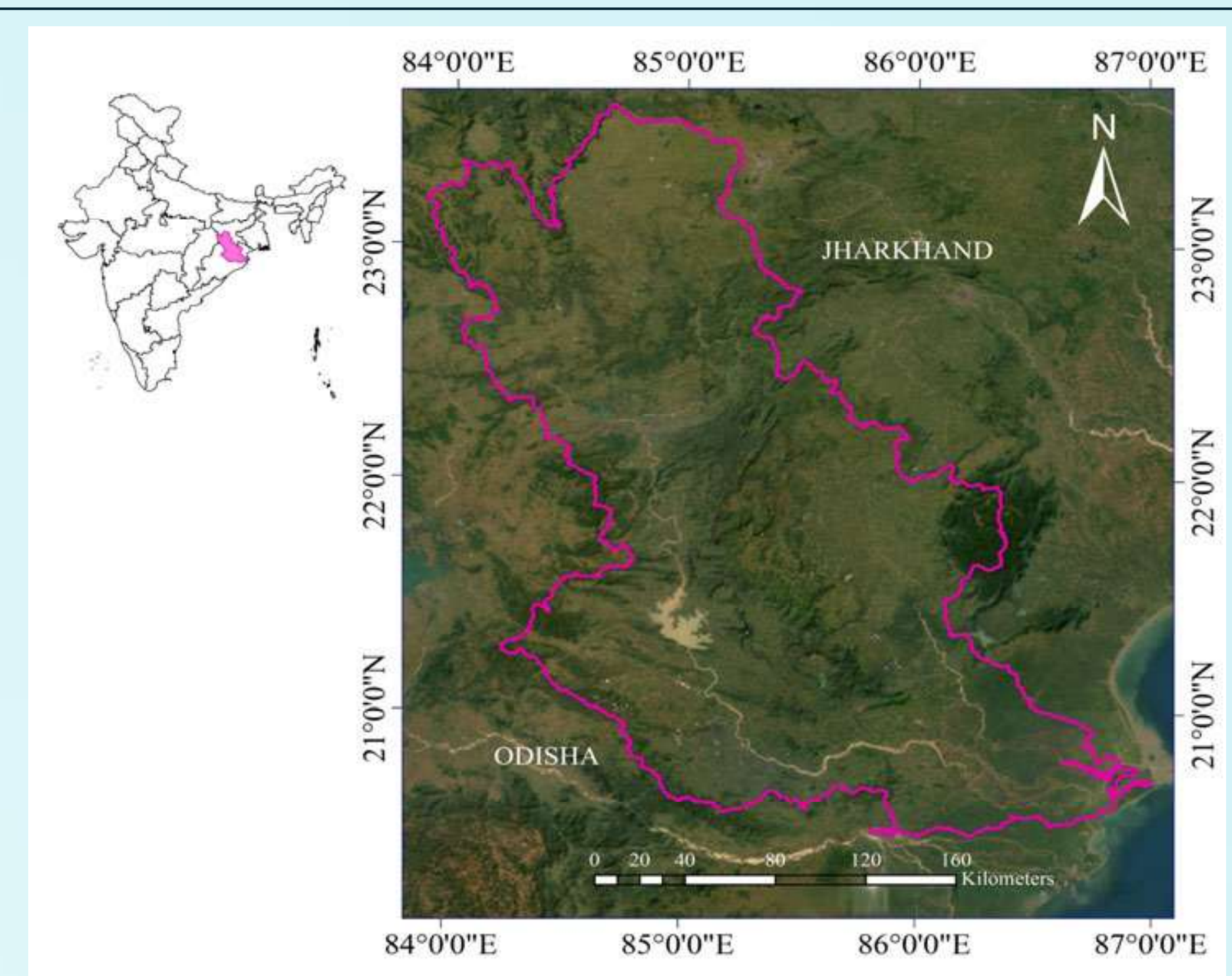
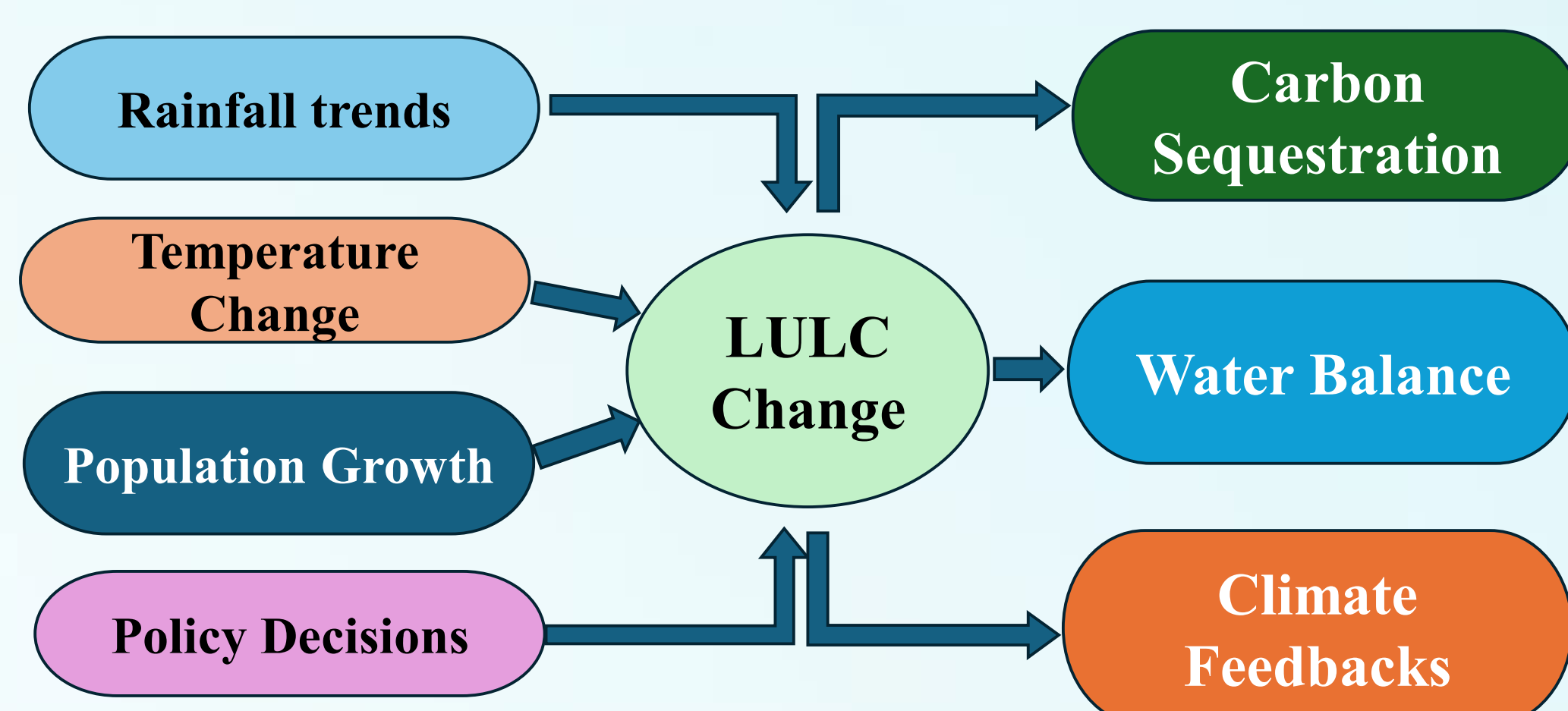
Abstract

Historical observations and CORDEX projections reveal increasing rainfall and warming across the Brahmani–Baitarni Basin, driving significant LULC changes by 2080. A climate-driven CA–ANN Random Forest model (85.61% accuracy) predicts forest and urban expansion alongside cropland decline, highlighting climate impacts on land dynamics and adaptation planning.

Introduction

Why Monsoon-Driven Land Change Matters?

Atmospheric warming across the monsoon belt of tropical South Asia is reshaping the land surface it sits above yet the pathway from **rainfall and temperature trends to land use/land cover (LULC) change** is rarely quantified end-to-end.



The Brahmani–Baitarni River Basin

Methodology

A hybrid modelling framework integrates observed and projected climate data with a cellular automata model to predict LULC. BORUTA for feature selection and Random Forest for transitions.

Data sources

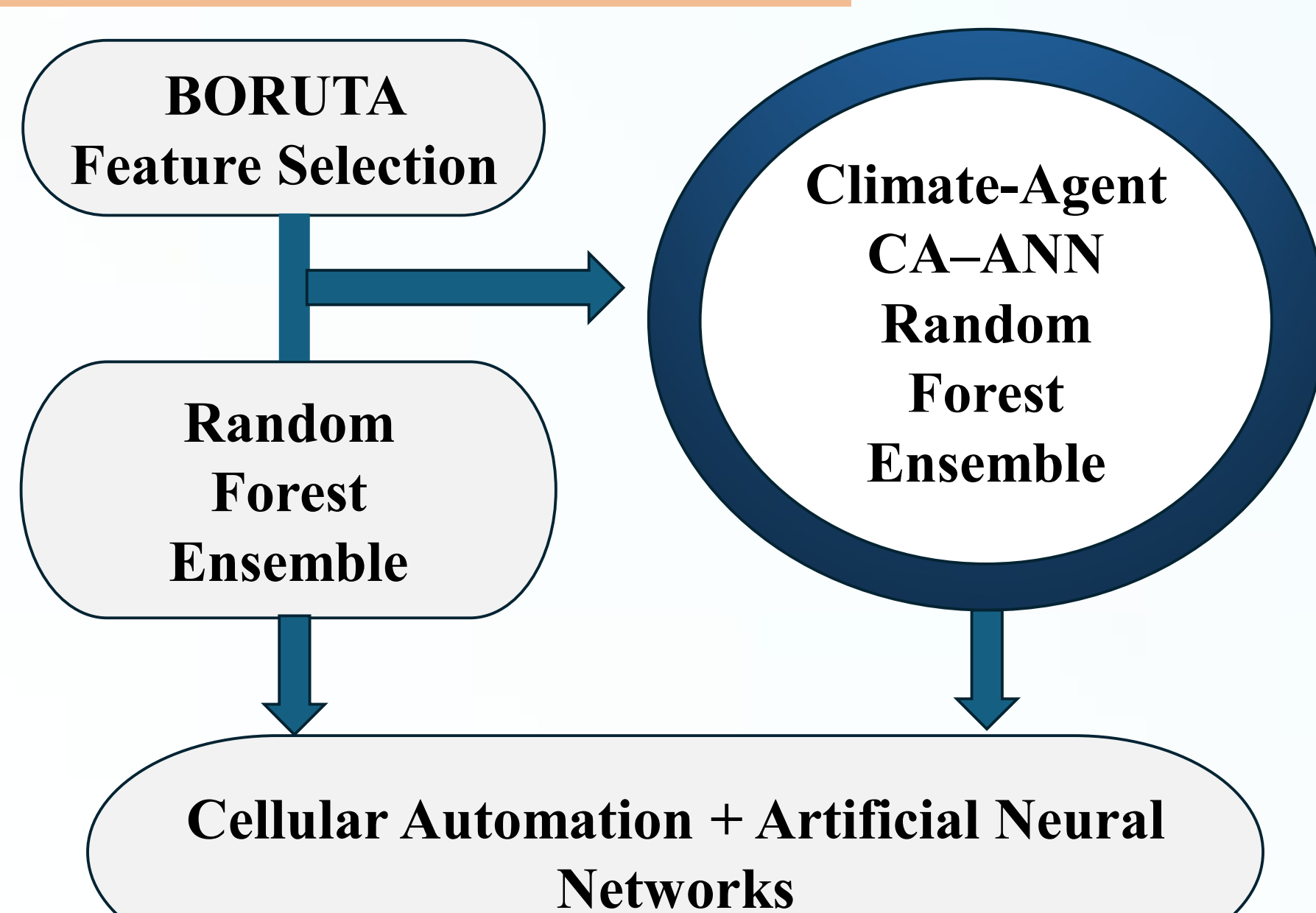
NASA POWER
20 stations

Observed period
2003–2023

ESGF / CORDEX
RCP 4.5

Projection period
2030–2080

Climate-Agent Ensemble



The Brahmani-Baitarni River Basin
LULC projections to 2080

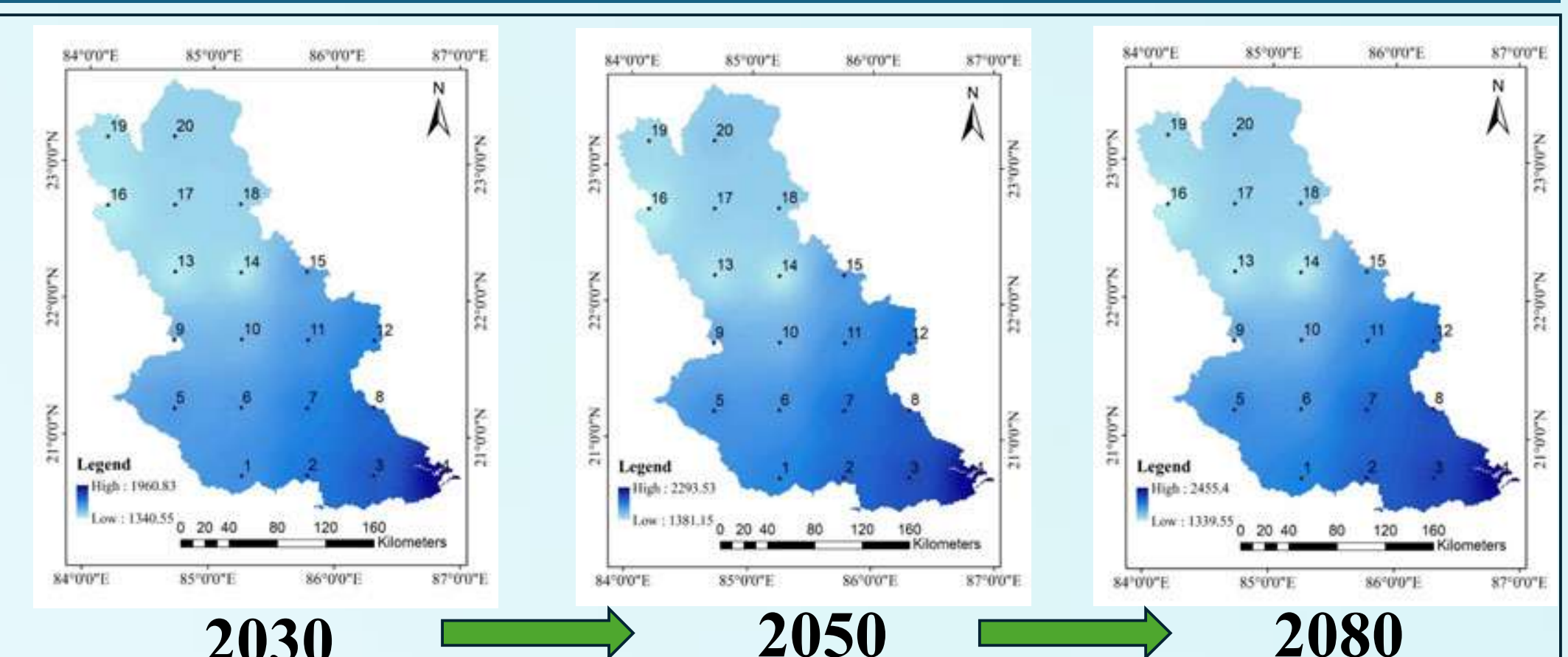
85.61% Overall Accuracy
Cohen's Kappa (κ) = 0.735

Results & Implications

Data & climate trends

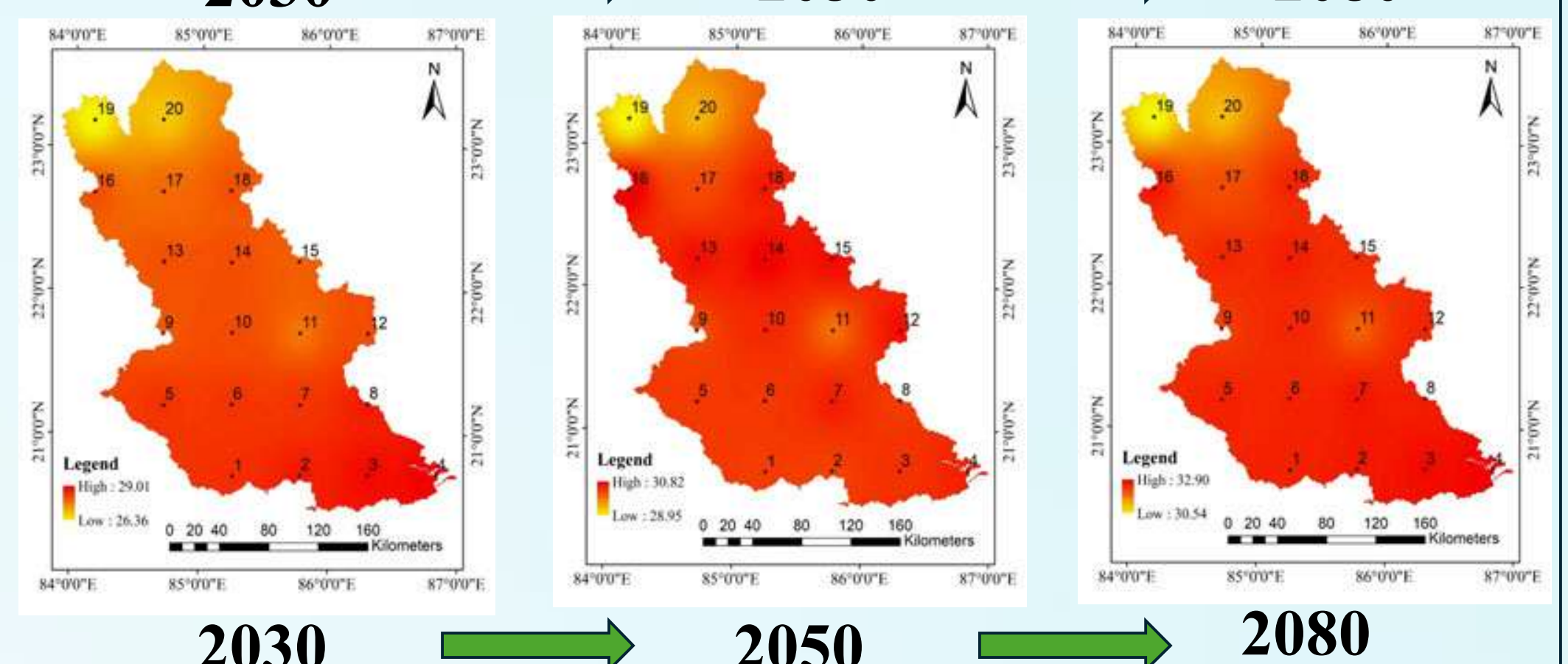
Rainfall Change (%)

➤ Basin-wide, rainfall increased 1.03–18.50% over 2003–2023 to continued intensification of rainfall up 1.66–25.32% by 2080 in the coastal zone.

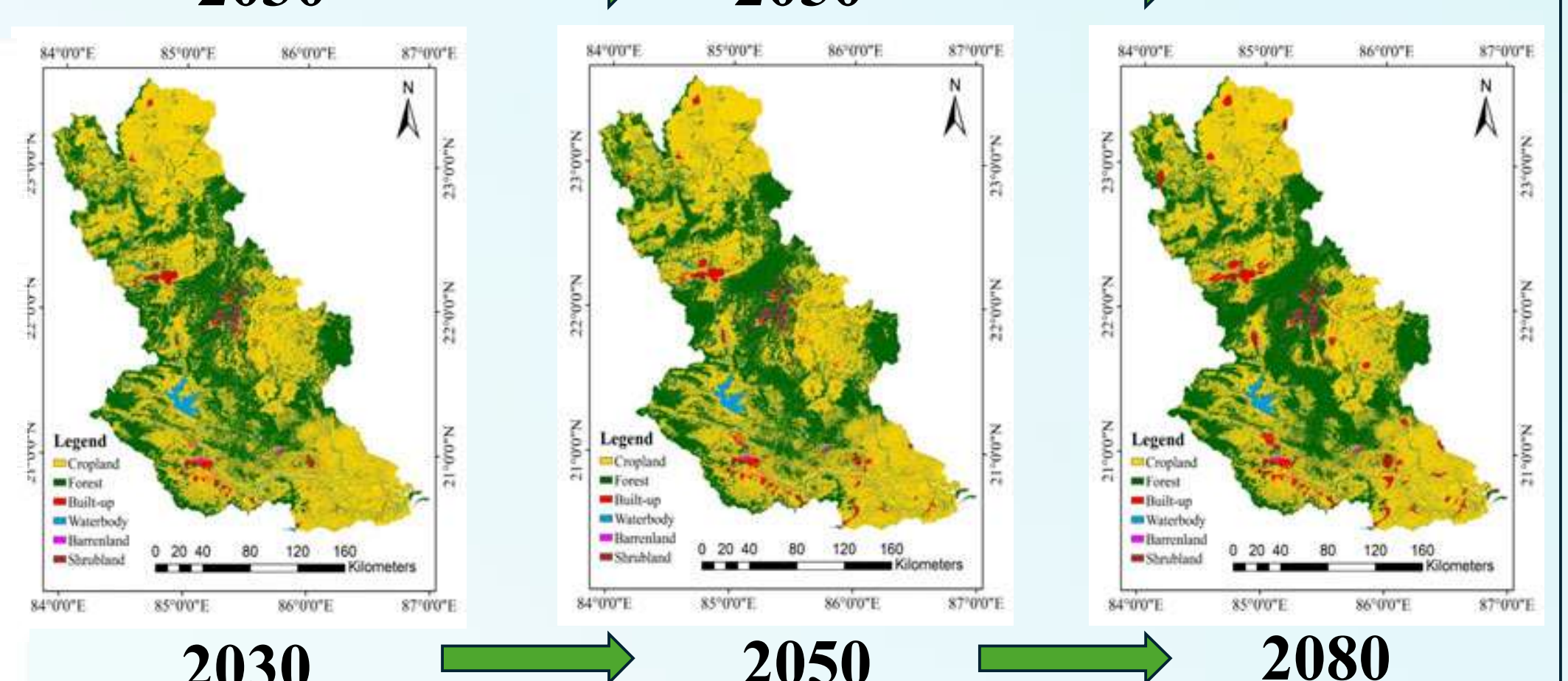
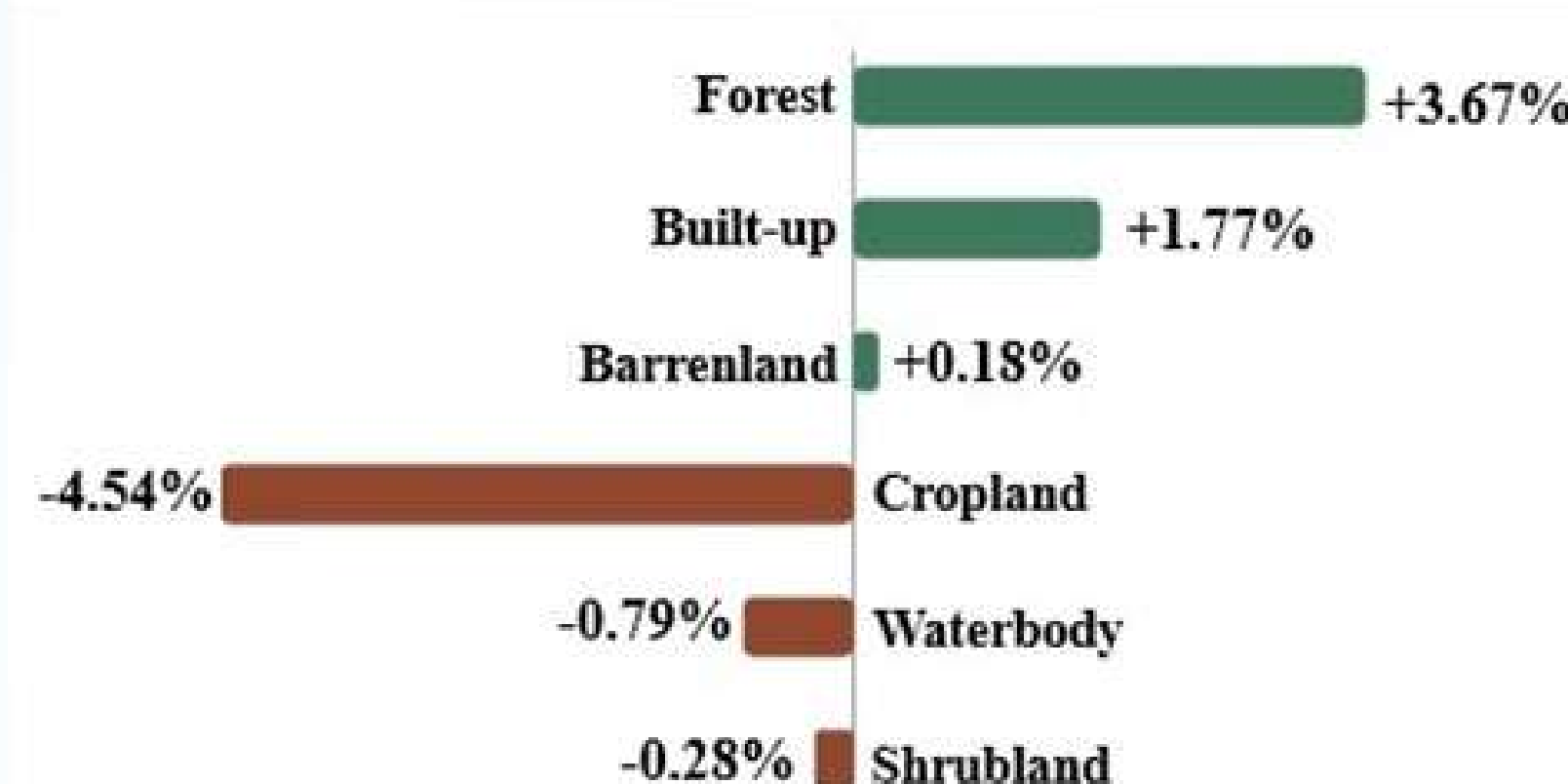


Temperature Change (°C)

➤ Temperature rose 0.5–1.0 °C over 2003–2023. Regional climate projections (CORDEX, RCP 4.5) point to continued intensification upto 1–3 °C by 2080 in the inland zone.



Projected LULC Change by 2080



Key Findings

- Climate-driven expansion of forest (+3.67%) and urban land (+1.77%) comes at the expense of cropland (−4.54%) and water bodies (−0.79%) by 2080
- The BORUTA algorithm proved to be the best screening method ($K = 79.298$, $\kappa = 0.611$) among all algorithms.

References

- Panda, K. C., Singh, R. M., & Singh, S. K. (2024). Advanced CMD predictor screening approach coupled with cellular automata-artificial neural network algorithm for efficient land use-land cover change prediction. *Journal of Cleaner Production*, 449, 141822.
- Sharma, S. K., Sinha, R. K., Eldho, T. I., & Patel, H. M. (2024). Individual and Combined Impacts of Land Use/Cover and Climate Change on Water Balance Components of a Tropical River Basin. *Environmental Modeling & Assessment*, 29(1), 67-90.