



# Evaluating the Impact of Canal Irrigation on Agricultural Command Areas in India

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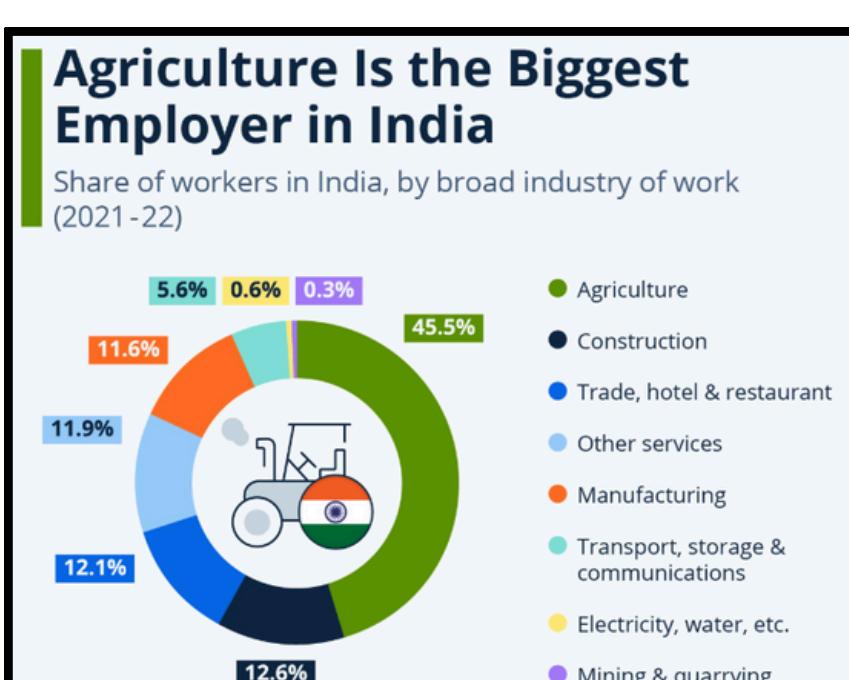
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## 1. Motivation

India, as a rapidly growing economy with a strong agrarian base, still relies heavily on agriculture—not just for food security, but also as a backbone for employment and GDP. Nearly 60% of the population depends on farming, which makes irrigation a central pillar for rural development and national growth.



**ETGovernment**  
Published On Dec 11, 2021 at 07:09 PM IST  
**UP: PM Modi to dedicate to nation Rs 9,802 crore Saryu Canal today**

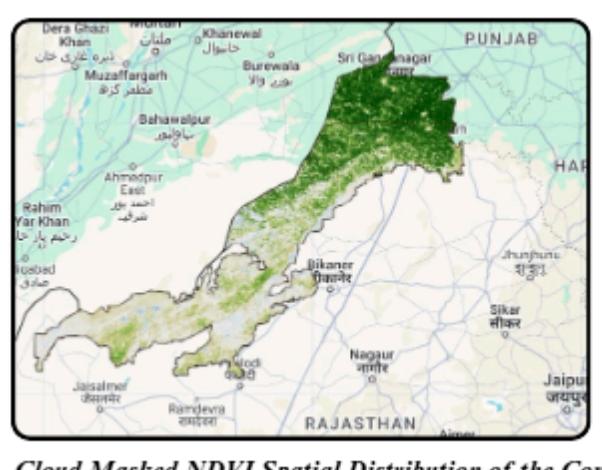
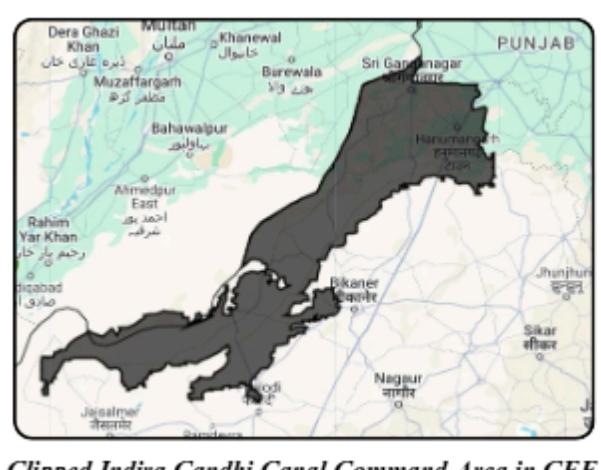
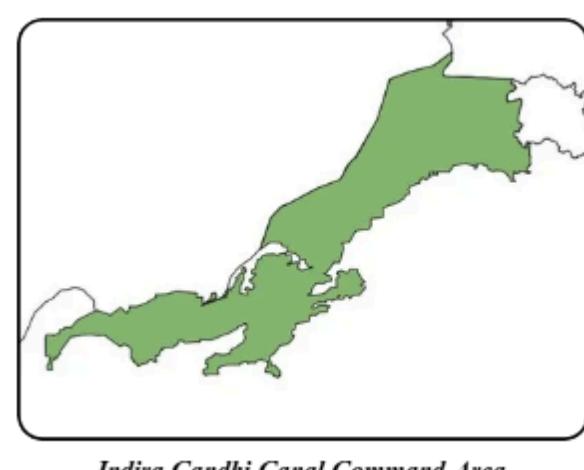
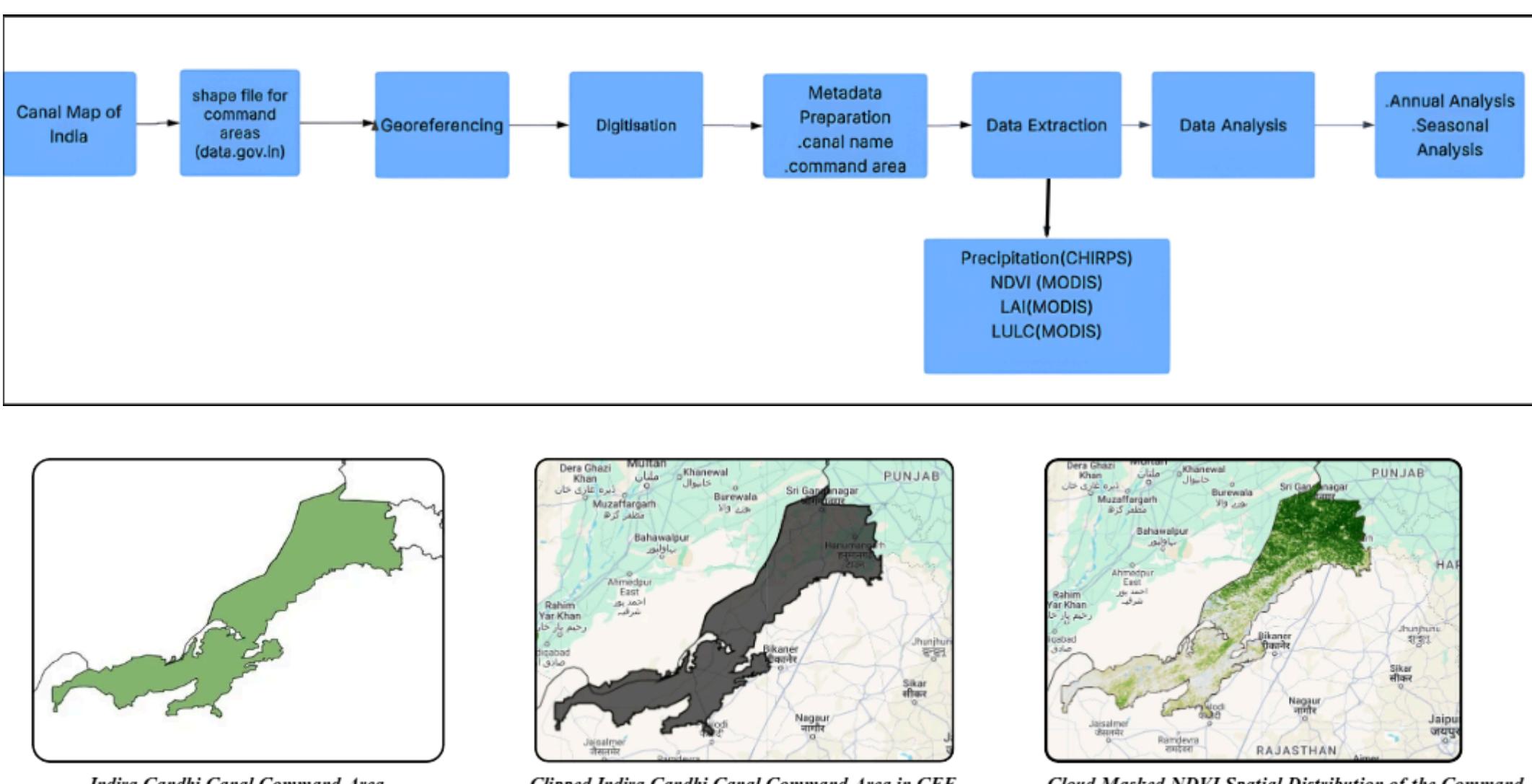
The project, which is the biggest in Uttar Pradesh, will benefit 25-30 lakh farmers in nine eastern UP districts - Bahraich, Gonda, Shravasti, Balrampur, Basti, Siddharthnagar, Sant Kabir Nagar, Gorakhpur and Mahajanpur, Jal Shakti Minister Mahendra Singh said.

**35000 Hectares Of Land Will Get Irrigation Facility In Gujarat Through Narmada Canal; CM Patel Reviews The Project**

July 20, 2024 • Gujarat Headlines • Comment(0)  
Today Gujarat Chief Minister Bhupendra Patel visited Source-1 near Goraj village and Source-3 canal near Hasulpur to review the progress of first phase of ₹ 377.65 crores project under total cost of ₹ 1400 crores project of improvement of irrigation facilities in Fatewadi-Nalkantha area.

These large-scale investments are a perfect example of what we're analyzing in our project - how canal irrigation affects agricultural command areas.

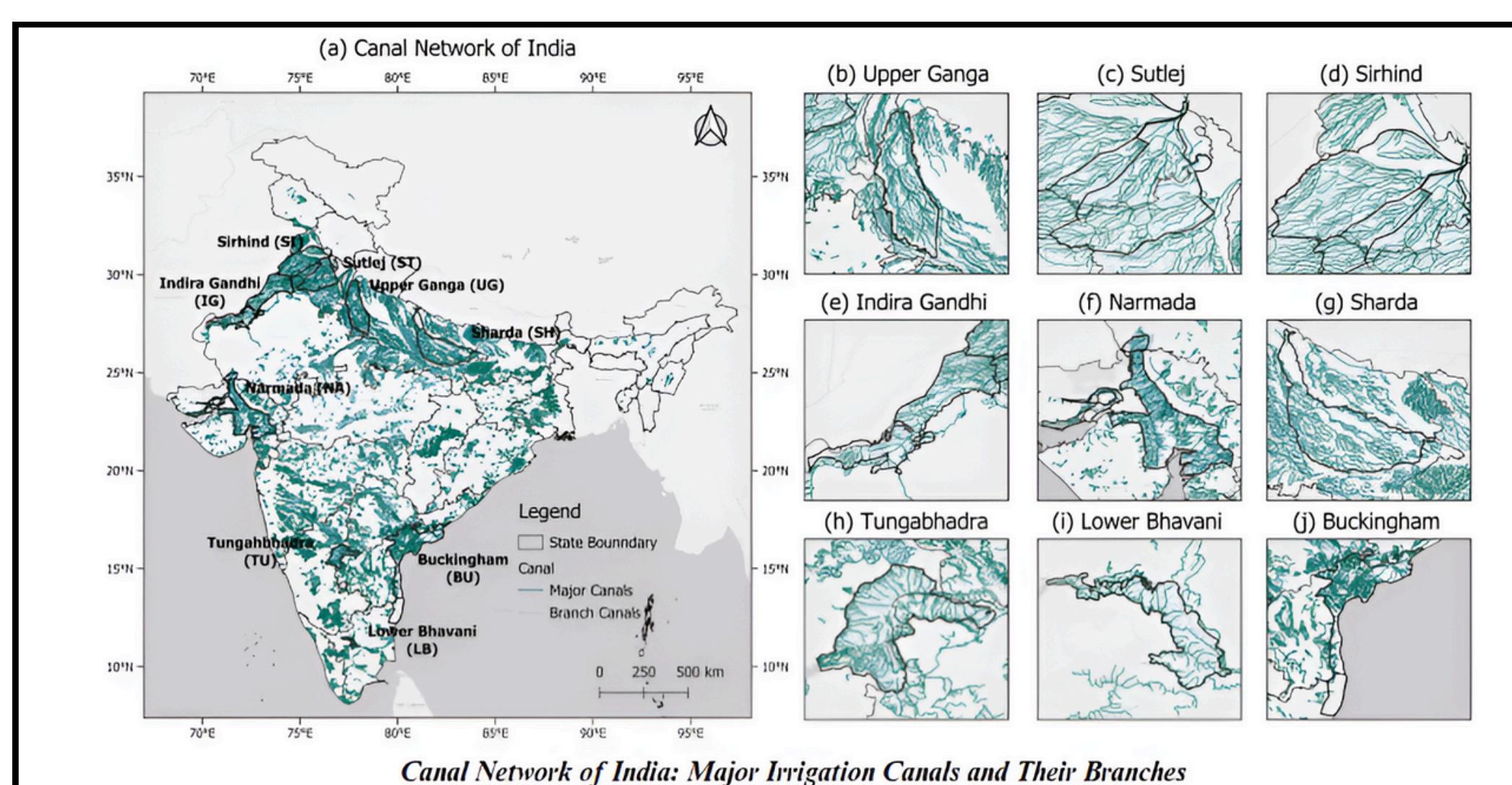
## 2. Methodology



## 3. Canal Network of India

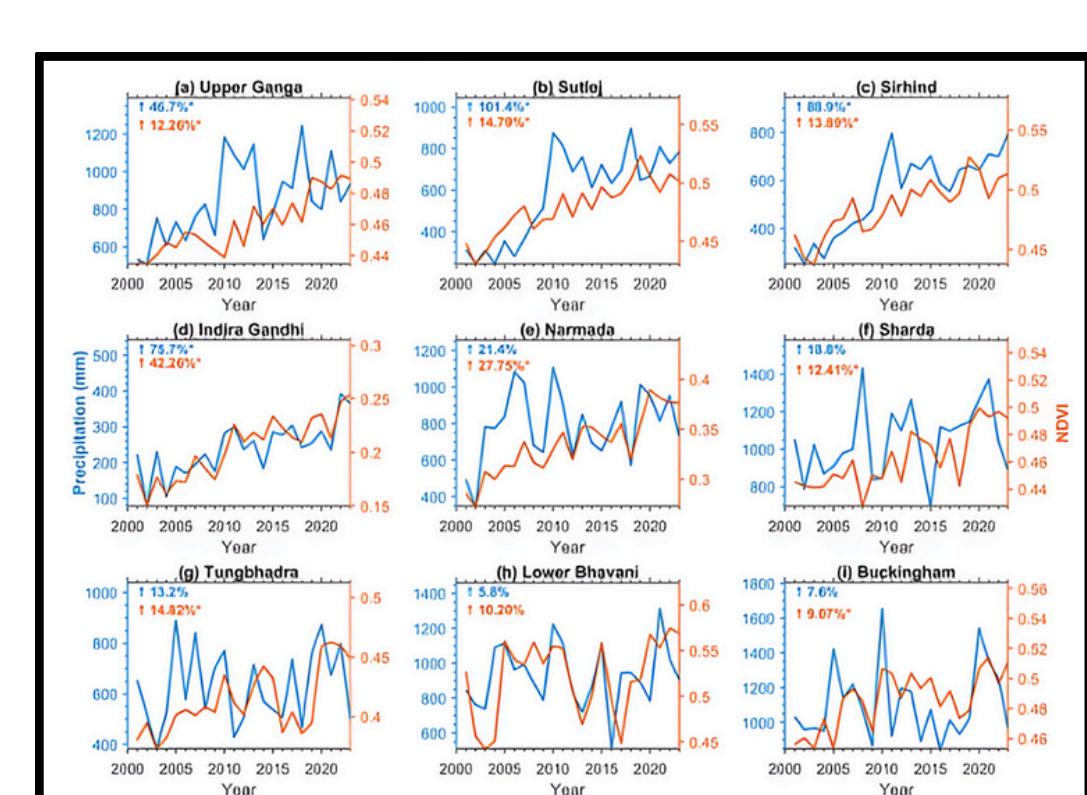
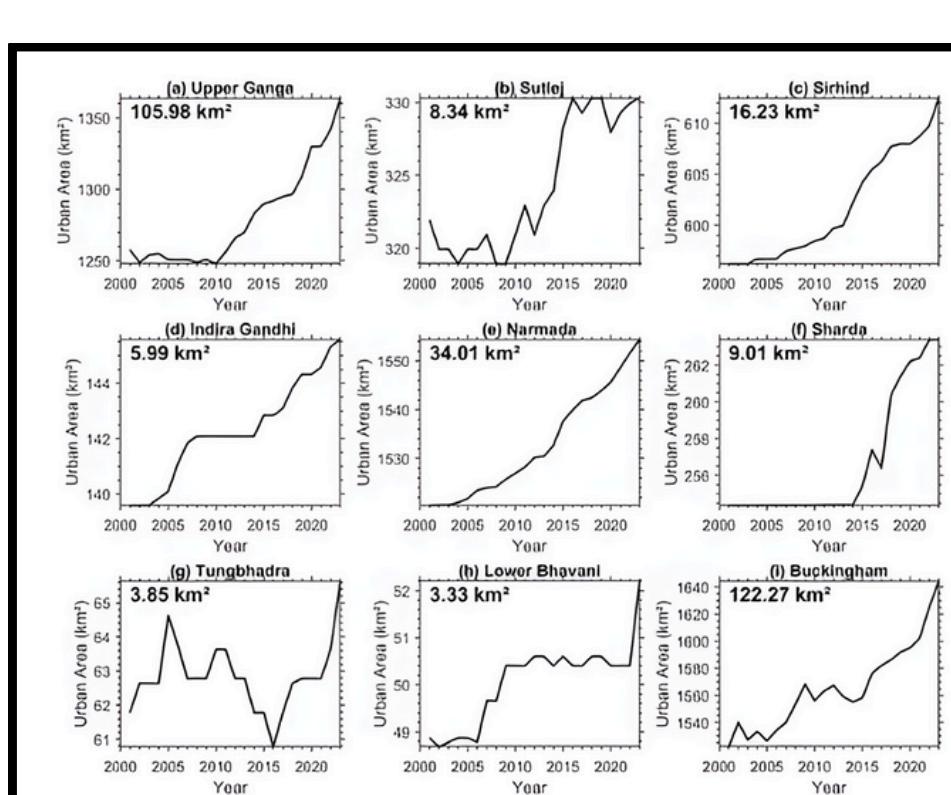
Canal	Length (km)	Capacity (cusecs)	Command Area (million Ha)	States Covered
Narmada Main Canal	532	40,000	2.128	Gujarat, Rajasthan
Indira Gandhi Canal	650	18,500	1.96	Rajasthan, Punjab and Haryana
Buckingham Canal	796	5,600	0.81	Tamil Nadu and Andhra Pradesh
Tungabhadra Canal	226	6,992	0.65	Karnataka and Andhra Pradesh
Upper Ganga Canal	291	13,066	0.88	Uttar Pradesh
Lower Bhavani Canal	201	2,260	0.83	Tamil Nadu
Sutlej Canal	214	10,500	3.5	Punjab, Haryana and Rajasthan
Sirhind Canal	240	12,620	1.42	Punjab
Sharda Canal	14	11,500	1.612	Uttar Pradesh

We selected these 9 canals because they represent a wide geographical coverage across India and include some of the largest and most important canal systems in the country. These canals differ in terms of length, capacity, and command area, allowing us to study various irrigation patterns and impacts.



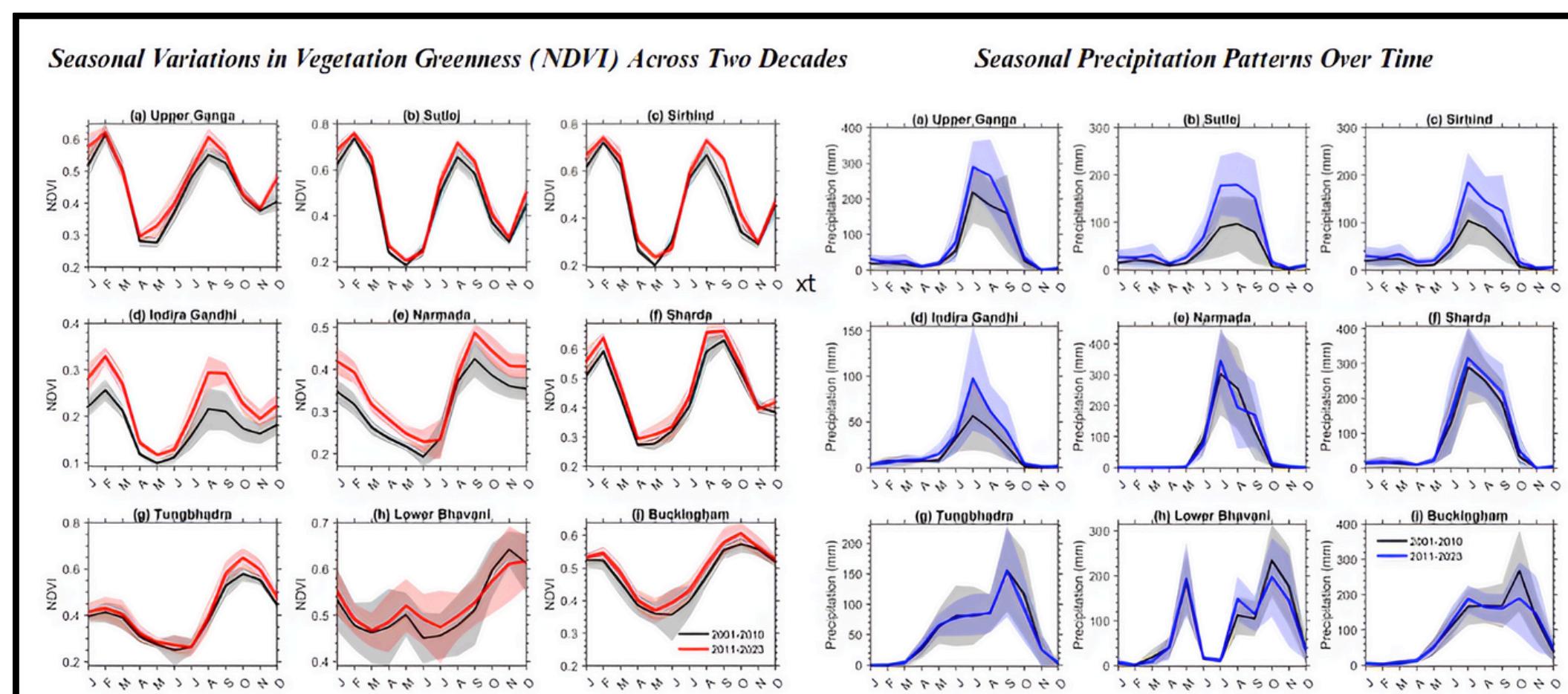
## 4. Climate shifts and Rising Demands

Urban areas have expanded significantly around major canal regions, highlighting the role of canals in supporting both agriculture and urban growth. While canals are vital for irrigation, groundwater also plays a crucial supplementary role, especially in dry or underserved areas.

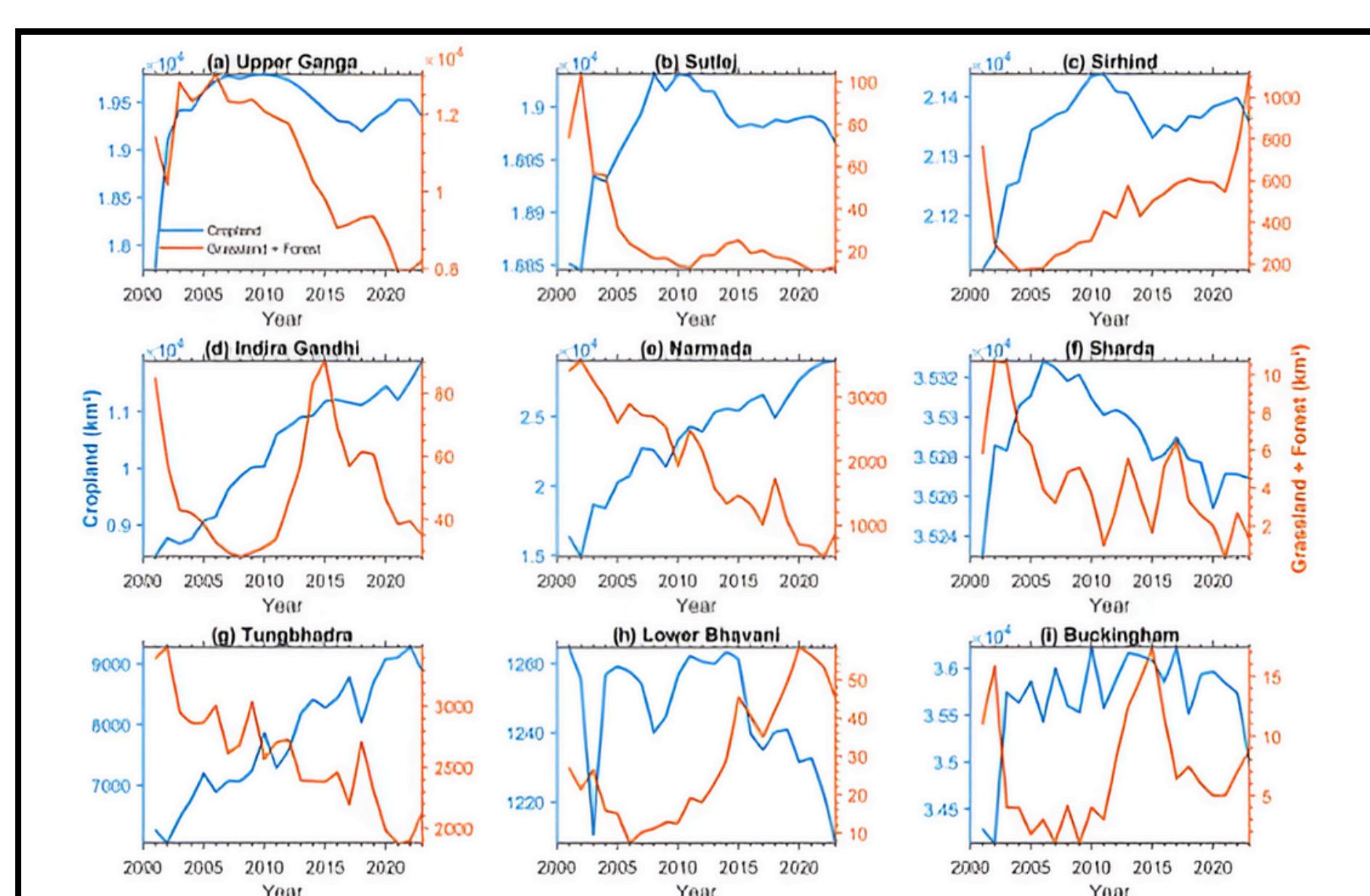


Rainfall and NDVI trends from 2000–2022 show varied climate impacts across canal regions, affecting water availability and crop demand. This highlights the need for adaptive, climate-resilient irrigation strategies.

## 5. Results



Improved NDVI in the past decade across several canal regions indicates healthier vegetation, especially during monsoon seasons. This reflects the positive impact of canal irrigation in buffering rainfall variability and supporting crop growth.



Our results show that increasing vegetation greenness (NDVI) across major canal command areas is primarily driven by cropland expansion and canal irrigation, often accompanied by a reduction in forest cover.

## 6. Conclusion

Our analysis shows that canal irrigation has had a significant positive impact on agricultural command areas across India. The increase in vegetation greenness (NDVI), especially during monsoon seasons, indicates improved crop health and productivity. Despite varying rainfall patterns, canal systems have helped stabilize water supply, support agricultural expansion, and meet rising demands driven by urban growth. However, this expansion is often linked to reduced forest cover, highlighting the need for balanced and sustainable land and water management.