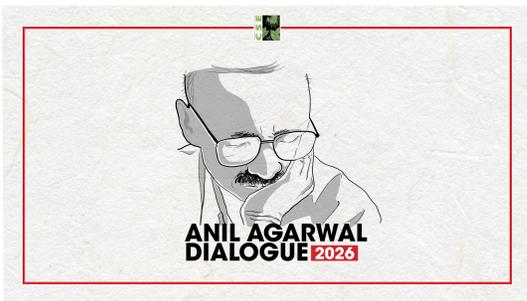


# How do humans and animals navigate a warming planet ?

## India in the Anthropocene and ecological futures

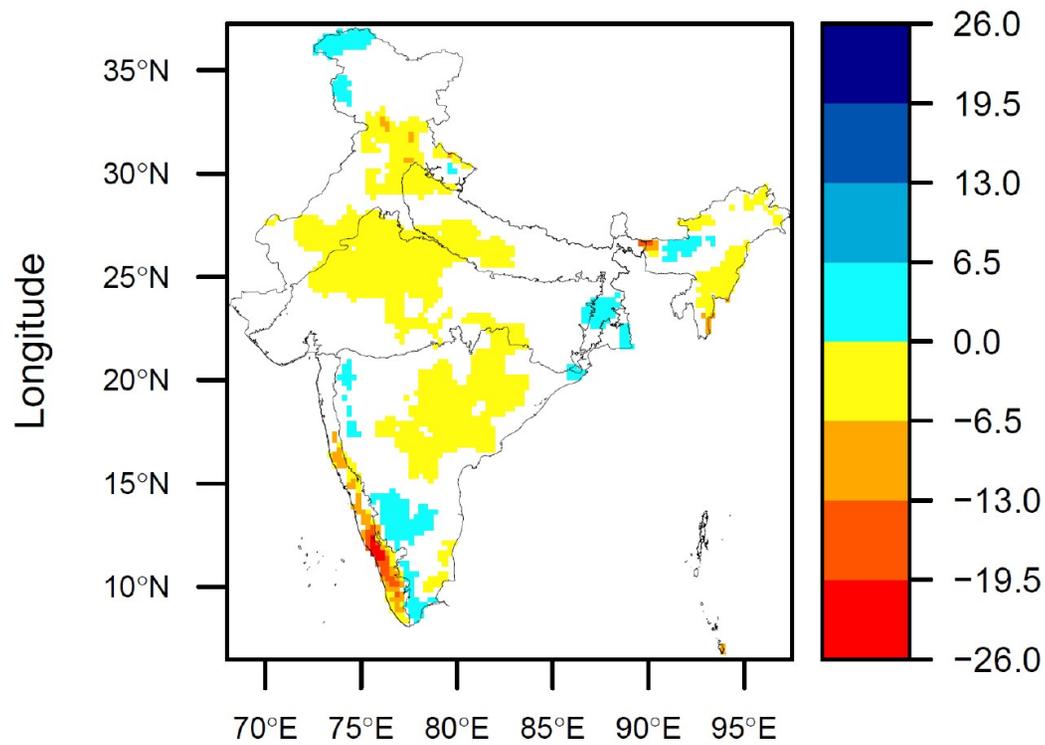
Jagdish Krishnaswamy



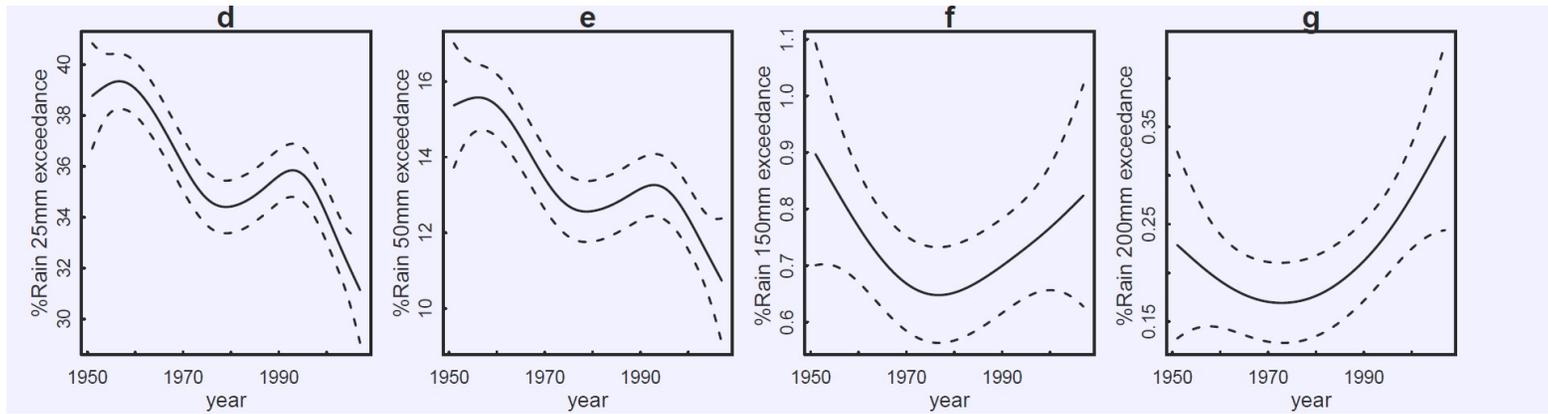
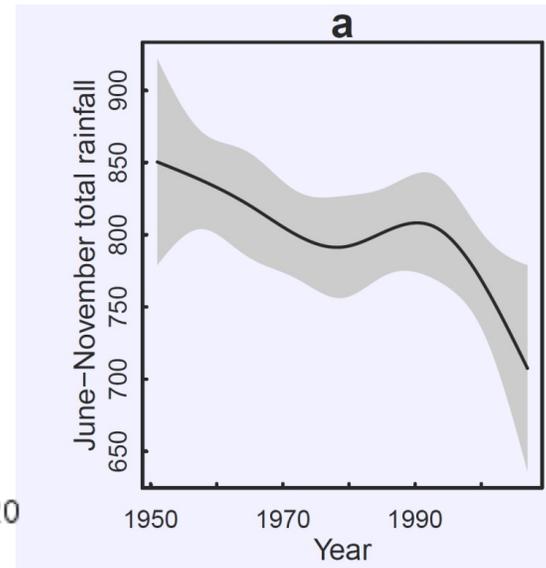
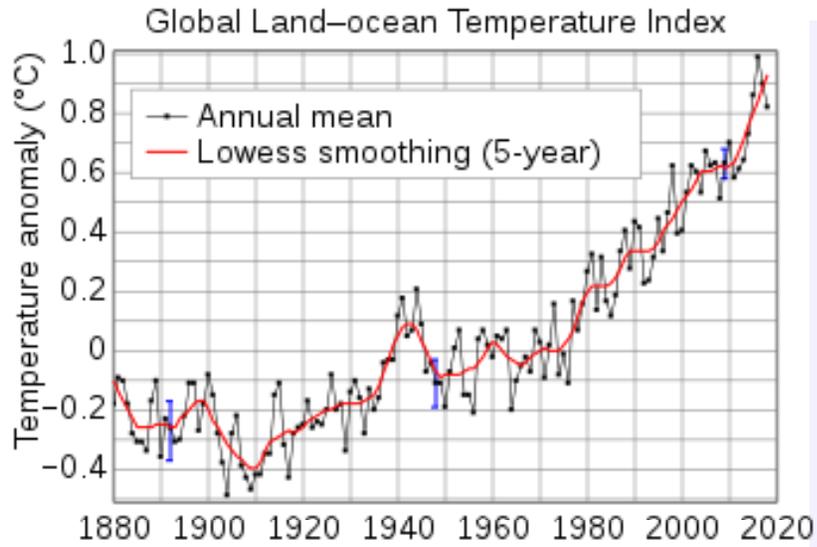
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# Observed decline not captured by most climate models

Decline in Indian Monsoon



Krishnaswamy and Vaidynathan



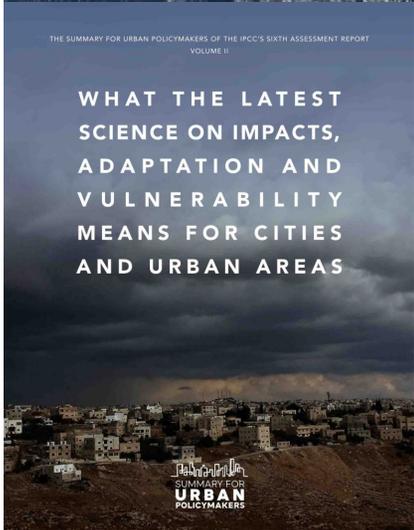
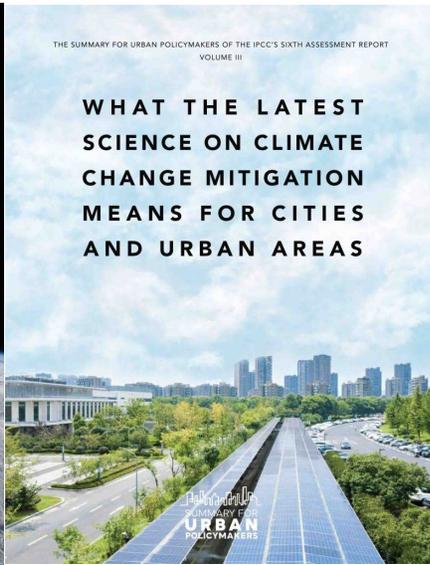
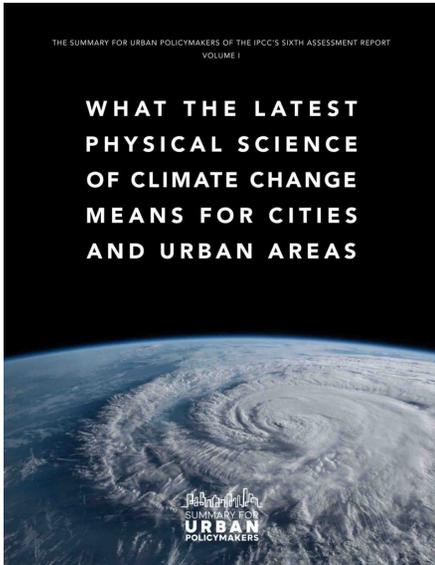


Figure 1: Duration of exposure to very strong heat stress (March 1 - May 19, 2022)

Over **35 crore** people in urban areas were exposed to Very Strong Heat Stress over the last few months

Duration of Exposure to very Strong Heat Stress:

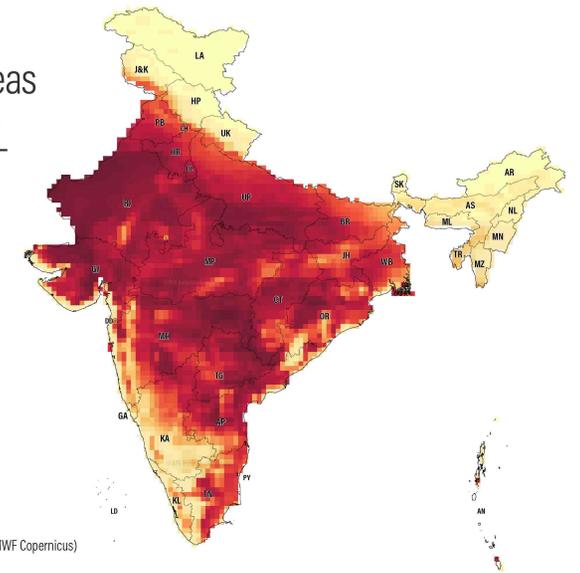


Figure 5: Land surface temperature within builtup areas, Bengaluru (Mean of March, April, May between 2017-2021)

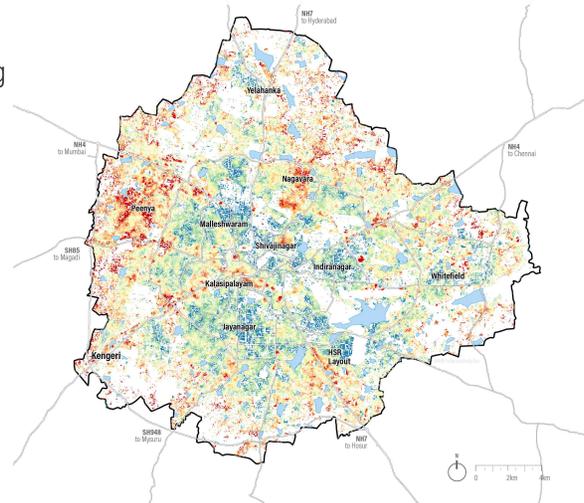
**Heat Clusters** indicate varying surface temperatures across the city based on *urban form, limited green cover, landuse typologies and roofing material*

□ BBMP boundary

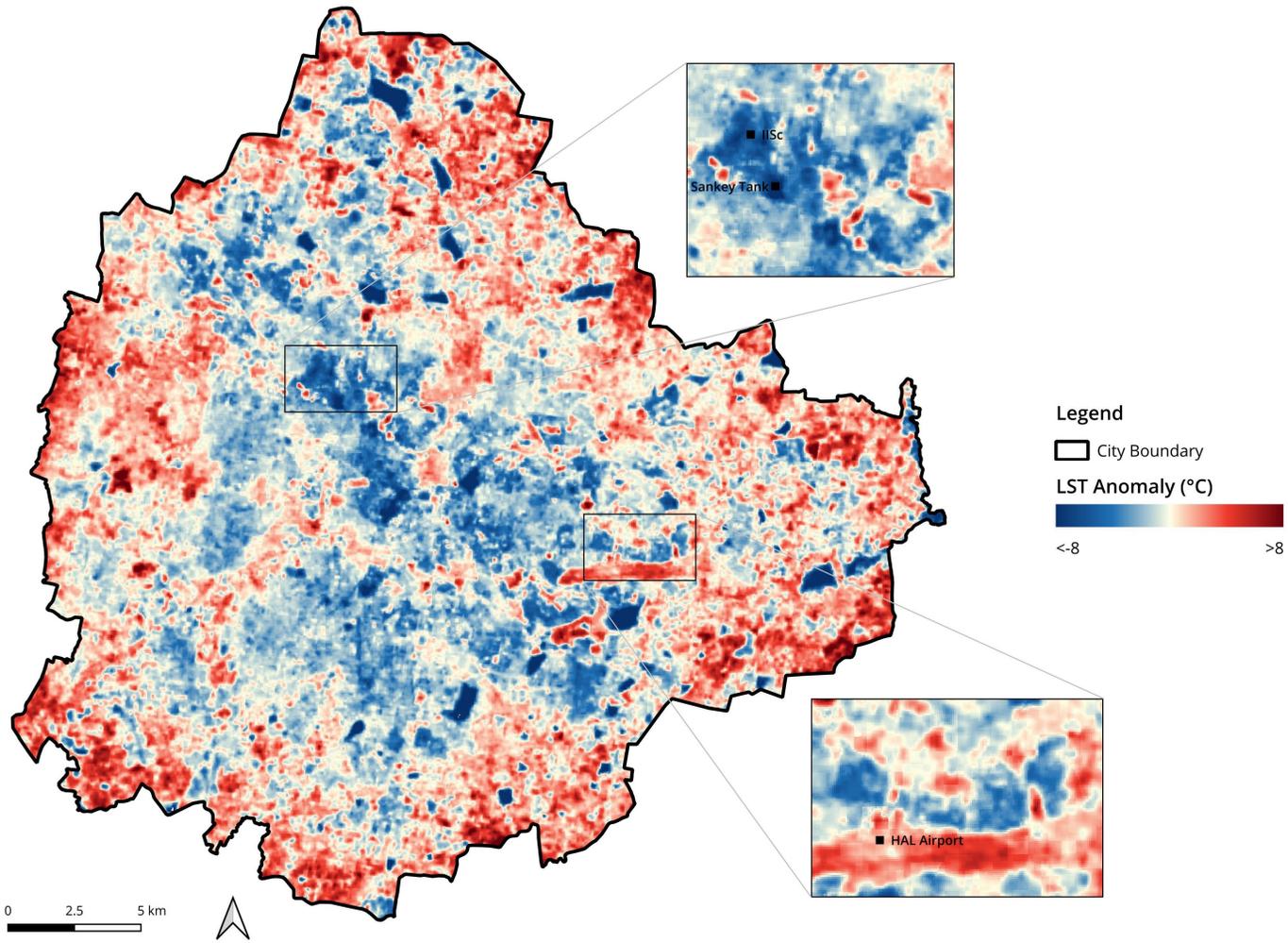
Summer Land Surface Temperature:



Source: WRI India Geo-Analytics; Landsat 8 (USGS/NASA)

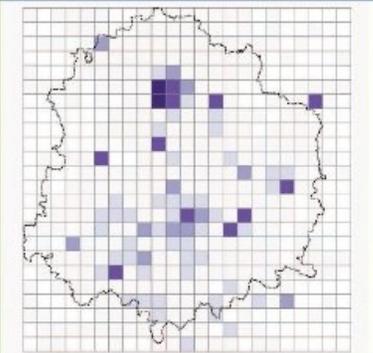


Bangalore: Land Surface Temperature anomaly of 26 March 2024, derived from Landsat 8 image



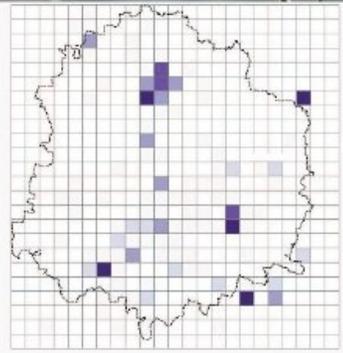
## Effects of heat stress and green cover on urban birds in the megacity of Bengaluru

Ravi Jambhekar, Dilip G. T. Naidu, Jagdish Krishnaswamy



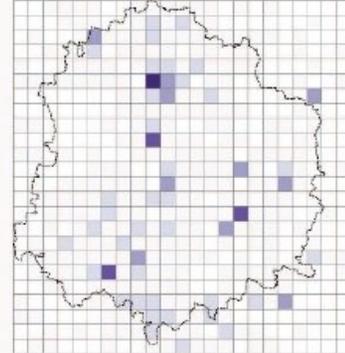
Bird Occupancy Study:  
Number of lists with  
Red-whiskered Bulbul

**Legend**  
□ City Boundary  
Number of Lists  
1-100  
101-200  
201-300  
301-400  
401-500



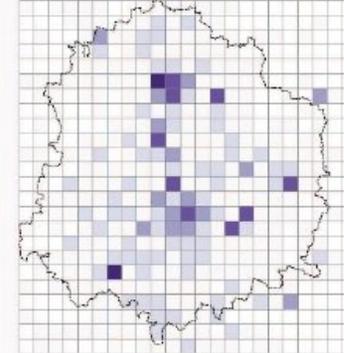
Bird Occupancy Study:  
Number of lists with  
Red-vented

**Legend**  
□ City Boundary  
Number of Lists  
1-5  
6-10  
11-15  
16-20  
21-25



Bird Occupancy Study:  
Number of lists with  
Coppersmith Barbet

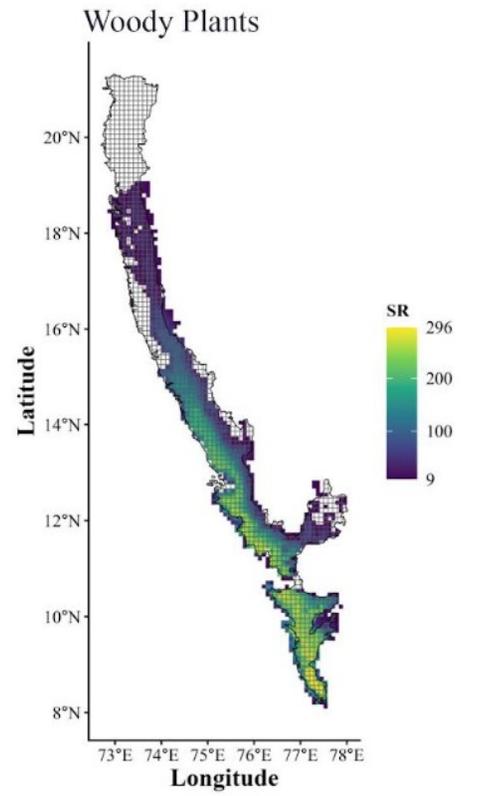
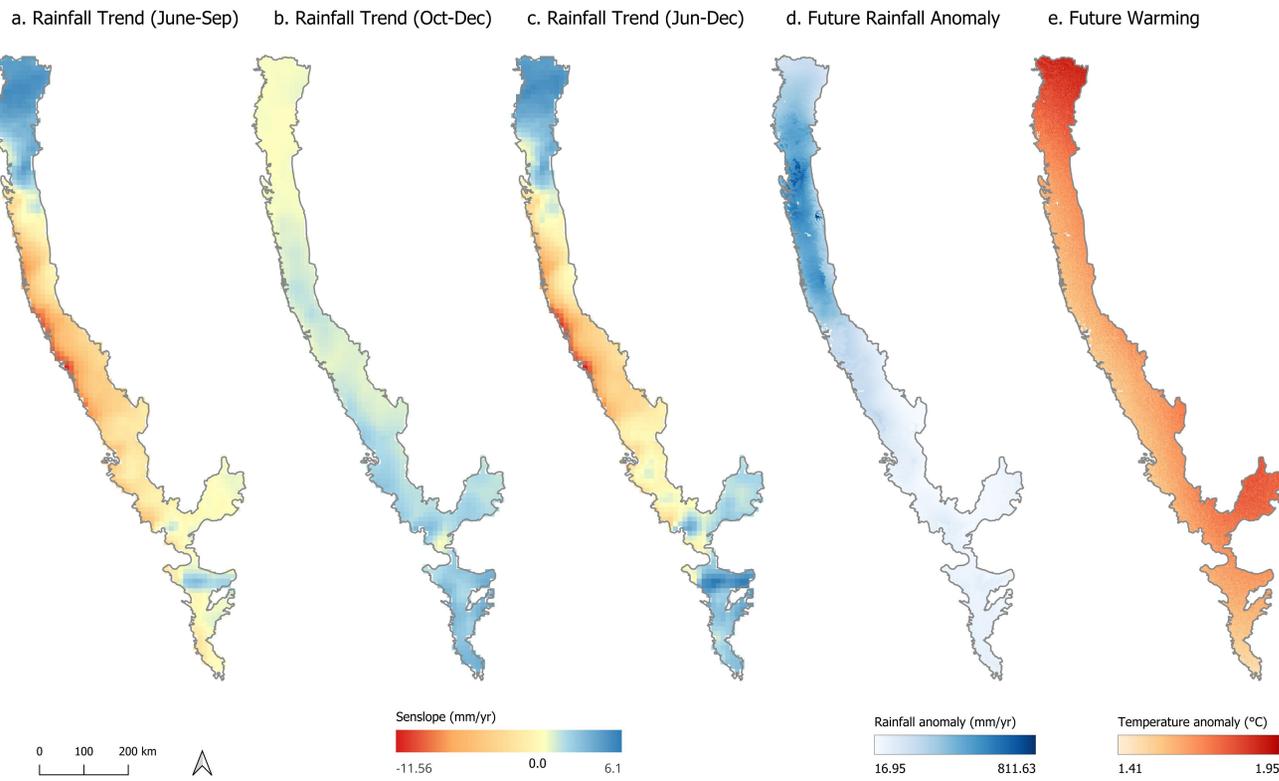
**Legend**  
□ City Boundary  
Number of Lists  
1-25  
26-50  
51-100  
101-150  
151-200  
201-250



Bird Occupancy Study:  
Number of lists with  
White Cheeked Barbet

**Legend**  
□ City Boundary  
Number of Lists  
1-25  
26-50  
51-100  
101-150  
151-200  
201-250

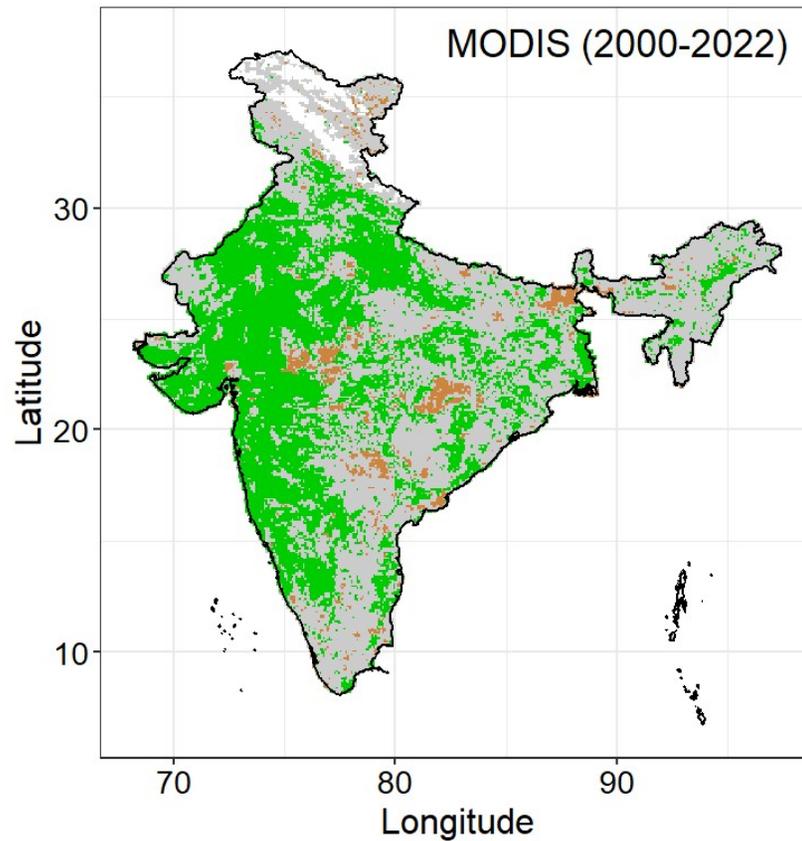
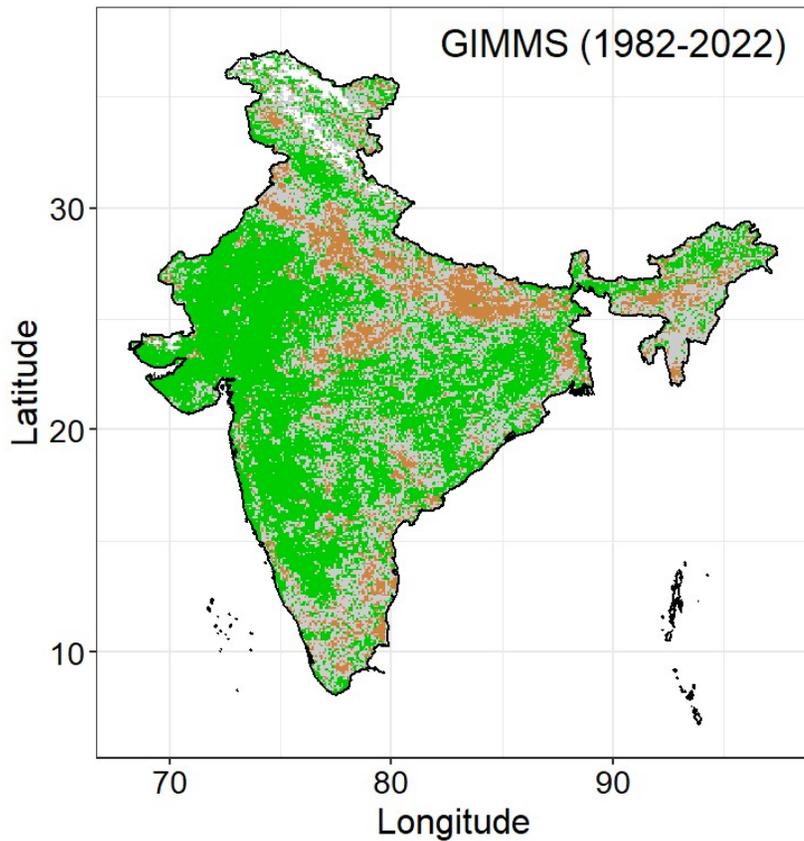
**Fig. 5: Historical and future climate trends**



# Greening and Browning Atlas of India

$\Delta$  EcoDistance

 Browning  Greening  No change



Dilip Naidu and Jagdish Krishnaswamy

## Invasive Alien Species and their impact on hydrology and biogeochemistry

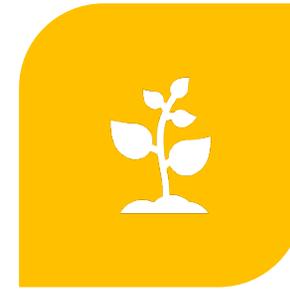




WATTLE HAS INCREASED  
FLOOD RISK IN THE WET  
SEASON



WATTLE HAS REDUCED DRY  
SEASON STREAM FLOW

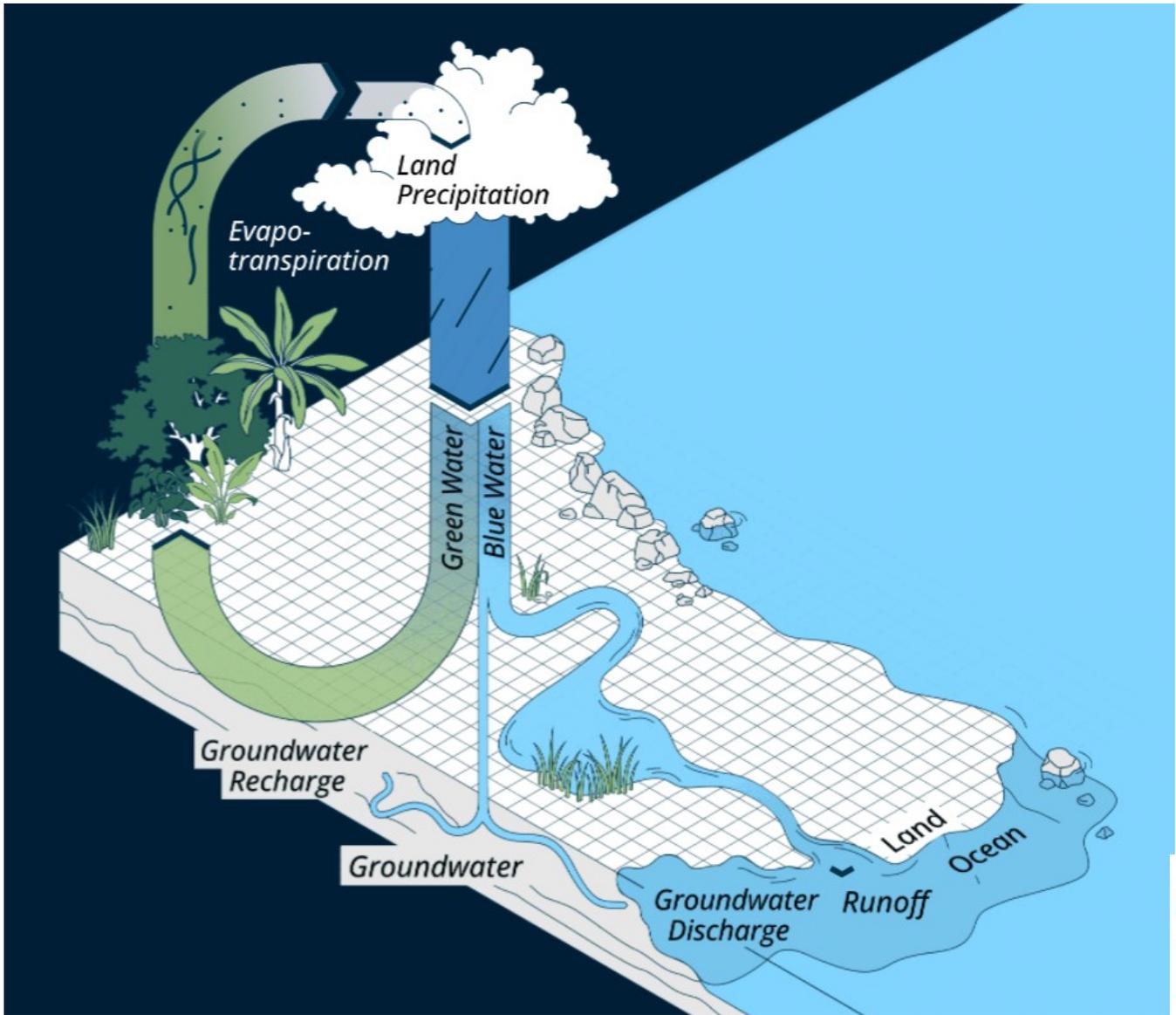


WATTLE HAS CHANGED THE  
NITROGEN CYCLE IN SOILS  
AND IN THE STREAMS

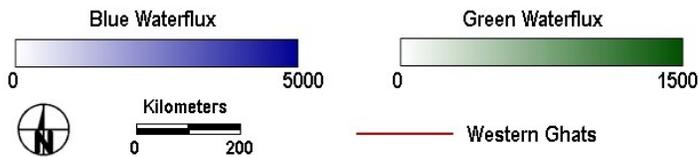
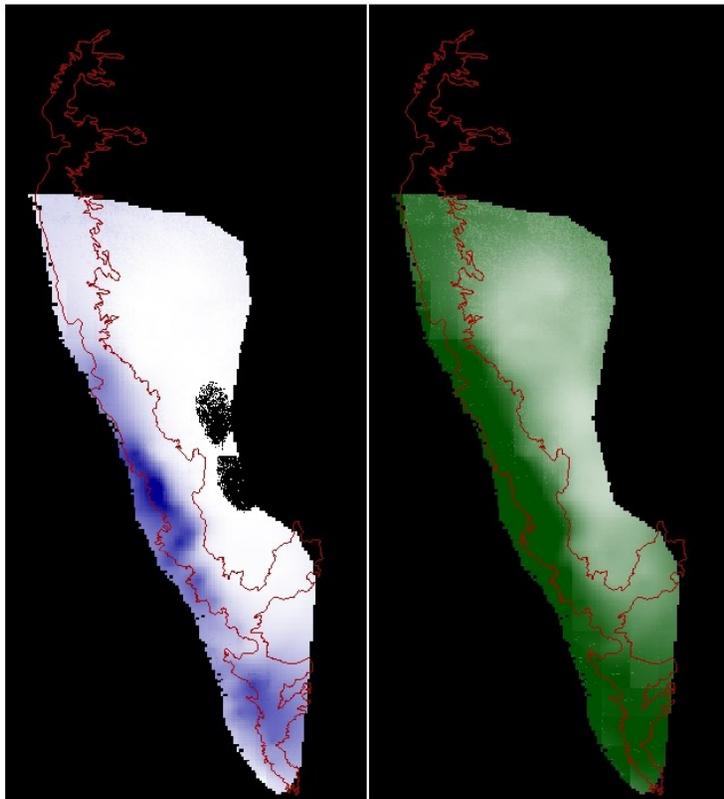








**GLOBAL COMMISSION** on the  
**ECONOMICS OF WATER**



## Western Ghats' biodiversity is a significant source of moisture for monsoon

RAGHU MURTUGUDDE



A view of the Western Ghats at Kakayam area in Kozhikode district. - THE HINDU

PUNE, MAY 4

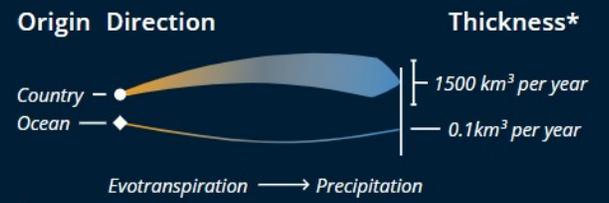
The mountain range that runs along the west coast of peninsular India from Tamil Nadu through Kerala, Karnataka and Goa to Maharashtra is known as the Western Ghats and is well known for its majestic beauty. It is also among the top eight biodiversity hotspots in the world. The Western Ghats host over 400 species and seven distinct vegetation types.

The Western Ghats are often in the news due to constant threat to their biodiversity. Forest cover has declined by up to 50 per cent in parts of Uttara Kannada district of Karnataka and the evergreens in Kerala face a threat of extinction. The overall deforestation is reported to have accelerated over recent decades. In the meantime, water distribution remains a contentious issue among states in the region. What has not been understood clearly is just how critical a source of moisture the greenery of the Western Ghats is for some of the water-stressed states.

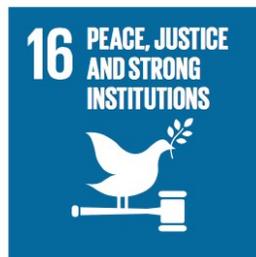
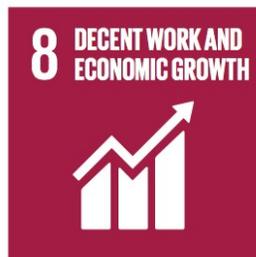
Paul et al 2018. Moisture Supply From the Western Ghats Forests to Water Deficit East Coast of India. *Geophysical Research Letters*, 45(9), pp.4337-4344.



### HOW TO READ THIS GRAPHIC



*\*flows under 0.1 km<sup>3</sup> not shown.  
 Note: The line widths in the legend are not to scale with the graphic, but the ratio of the line widths remains the same.*



# Global Water Crisis

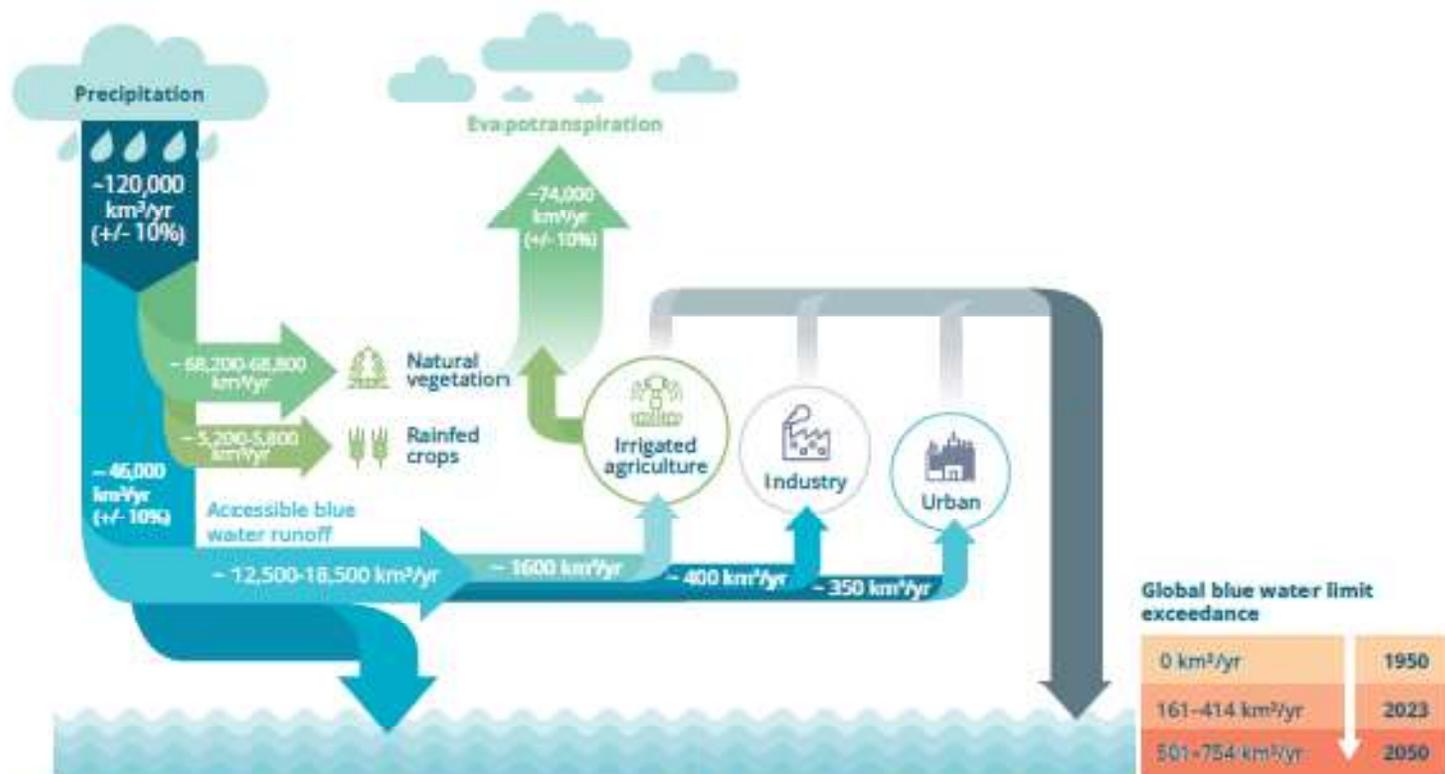
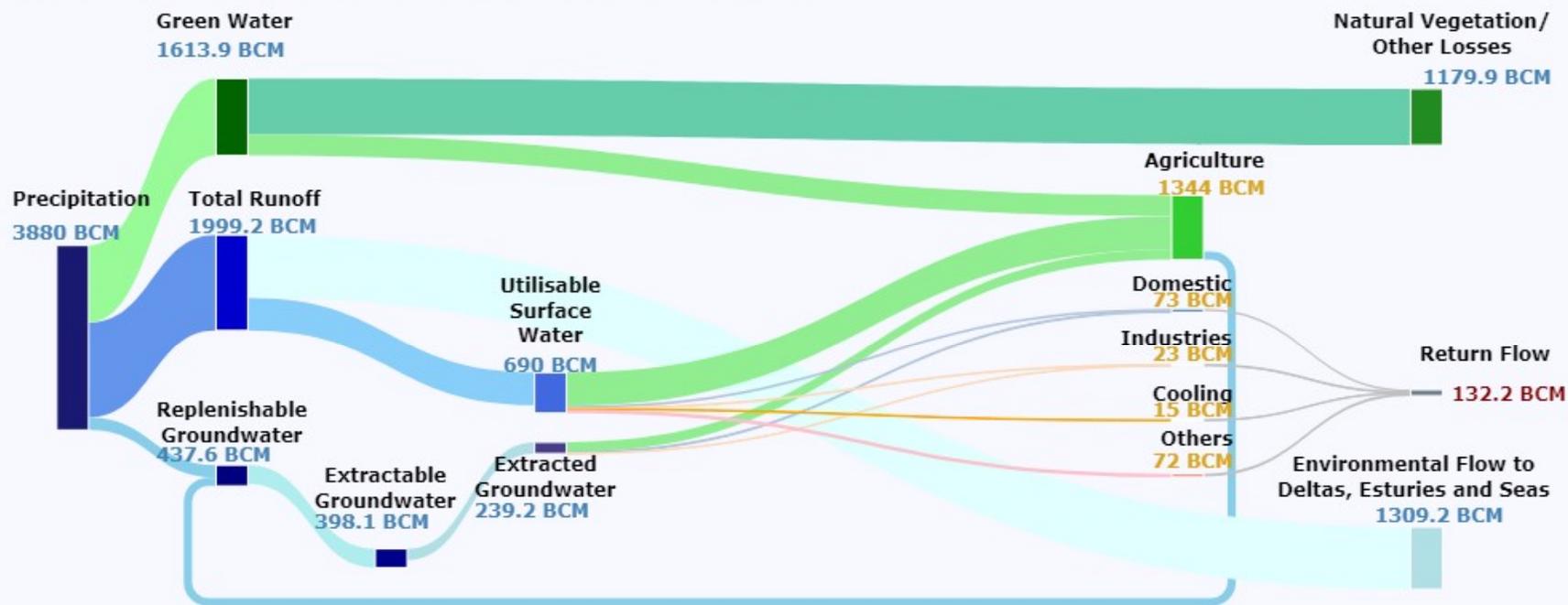
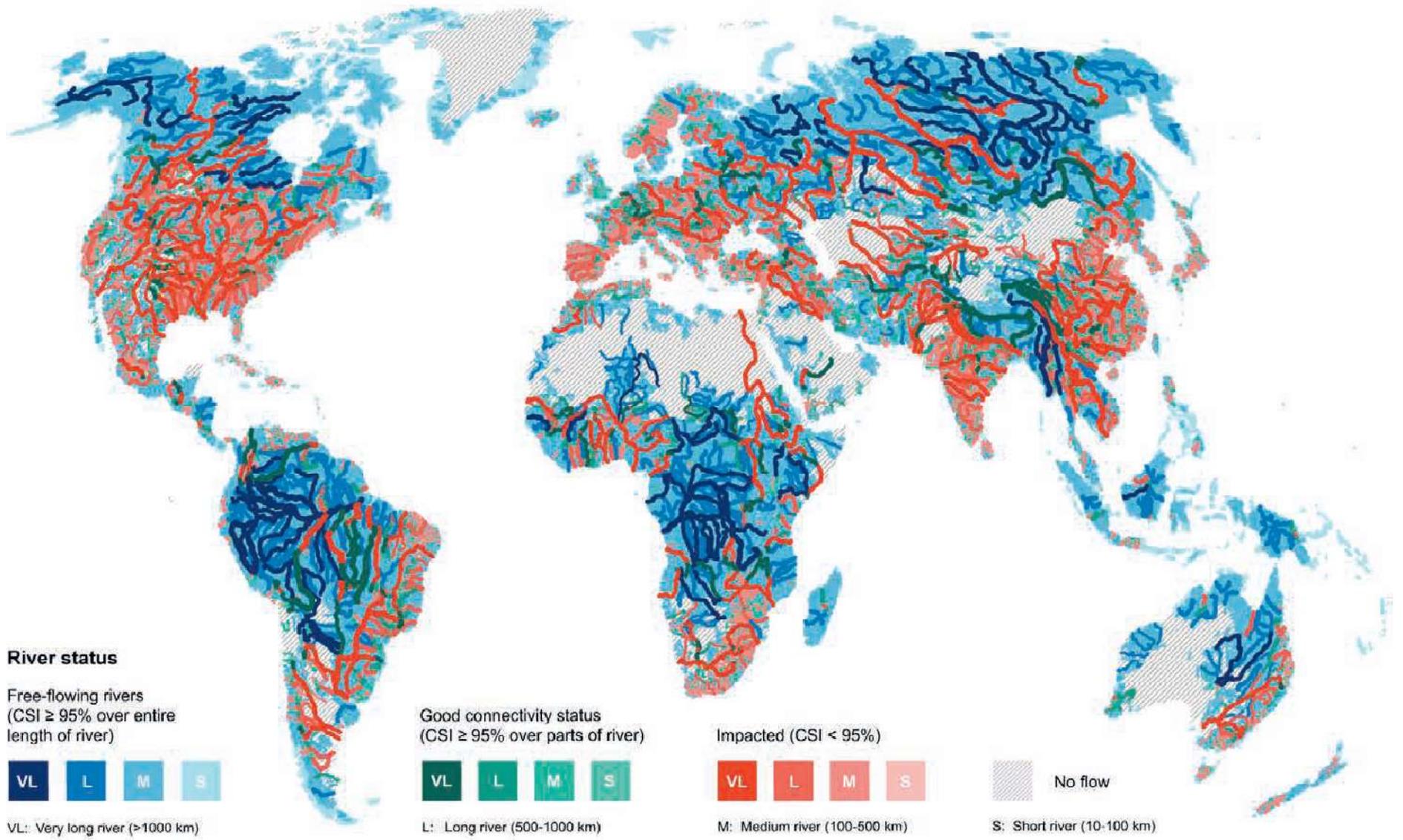


FIGURE 2.2 The water cycle, global water consumption by sector and blue water consumption exceedance  
 SOURCE: Authors. Details of data sources and calculations provided in Grafton, Krishnaswamy and Revi, 2023

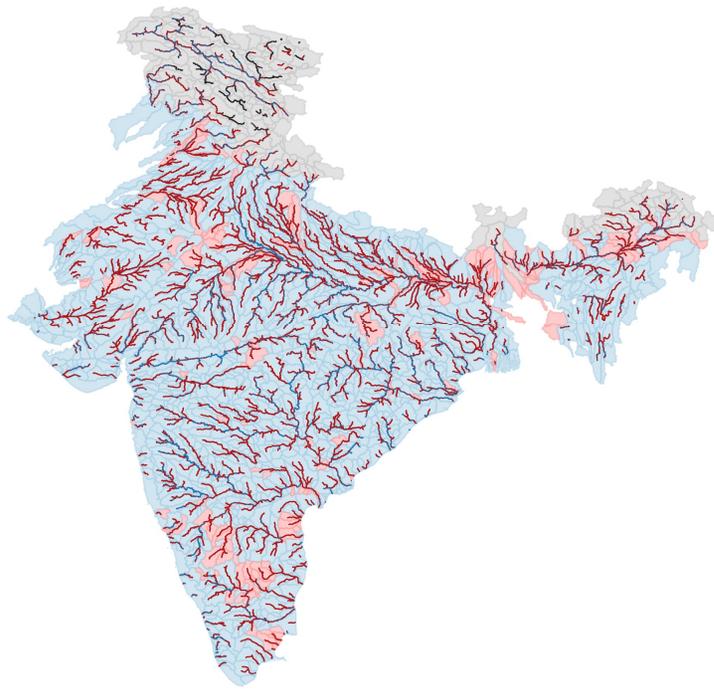
# Annual Water Use in India



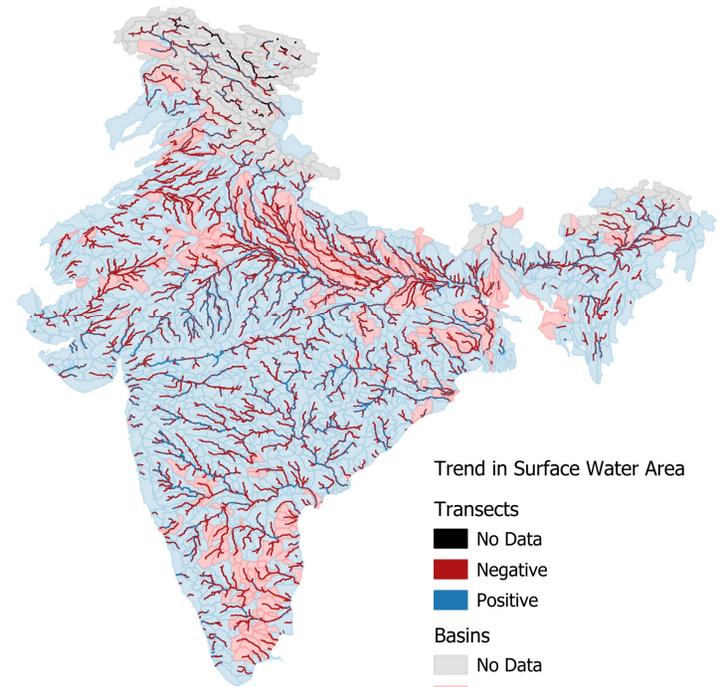


# Wetting and Drying Atlas of India

Dry Season



Wet Season



Trend in Surface Water Area

Transects

■ No Data

■ Negative

■ Positive

Basins

■ No Data

■ Negative

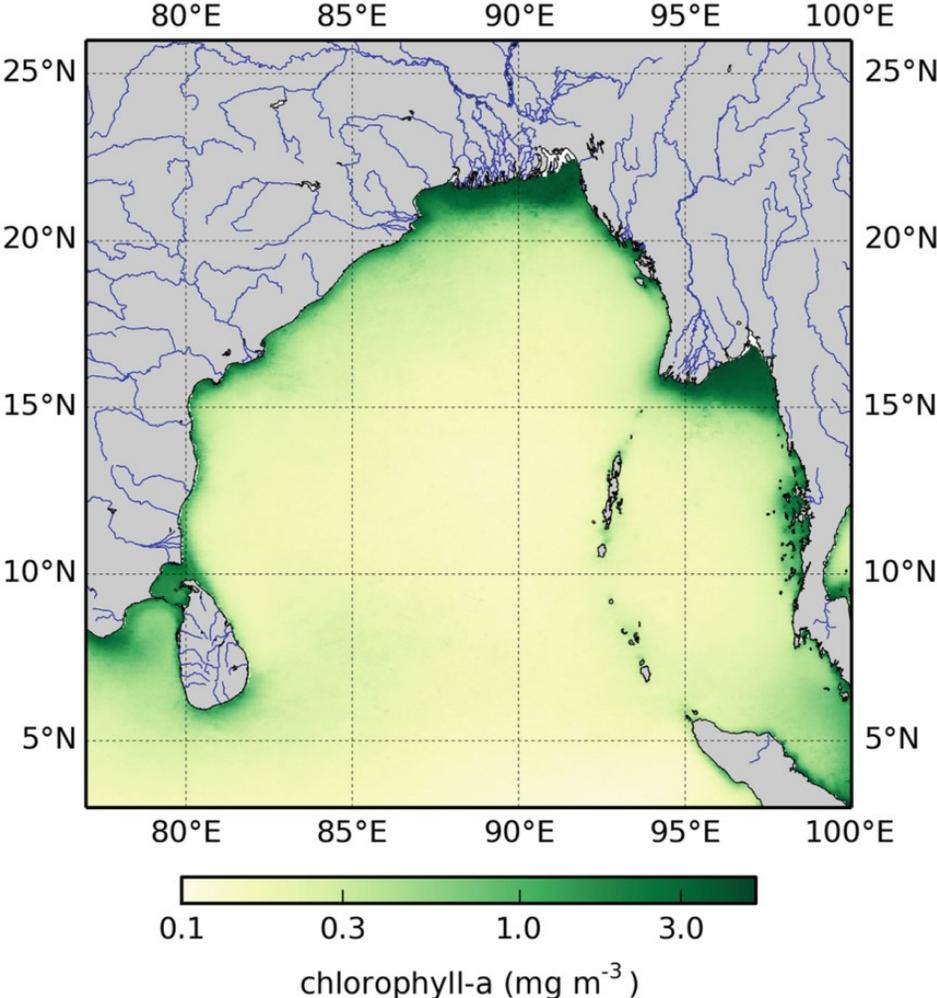
■ Positive

Data Source: <https://sites.google.com/view/surface-water-trends-india/>  
Kougi & Jumani (2023)

Map Prepared by Dawn Sebastian

Rivers reaching the sea with sediment are critical for estuarine and marine ecosystems and reducing vulnerability of coastal and delta communities

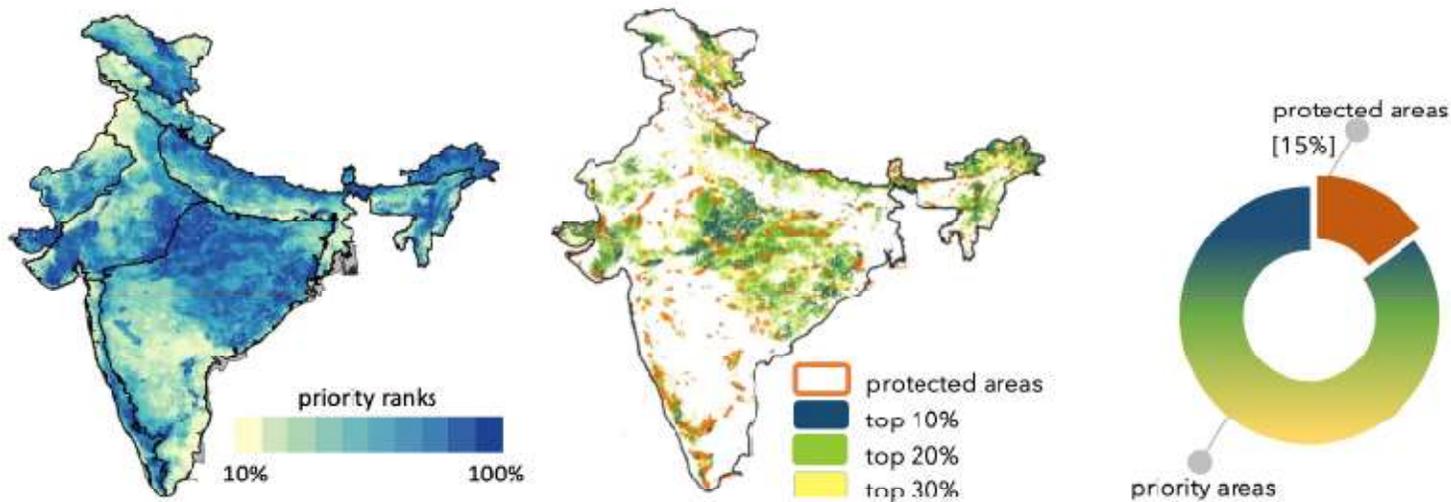
Marine exports in 2019-20: 6.68 Billion USD



Monthly mean 200-2009, Ocean Colour Climate Initiative, version 2, European Space Agency

# priority landscapes

Combining all these aspects, we demarcated **landscapes** that make up the **top 30% priority** areas across India. Unfortunately, only **15%** of these locations are within the **Protected Area network**.



Safeguarding these **30% areas** will help India meet targets like **post-2020 CBD/Global Biodiversity Framework** and **COP15 NDC** to conserve our biodiversity by **2030** while achieving the country's **Sustainable Development Goals**.

nature sustainability

Analysis

<https://doi.org/10.1038/s41893-023-01063-2>

**Prioritizing India's landscapes for biodiversity, ecosystem services and human well-being**

Received: 25 July 2022

Accepted: 12 January 2023

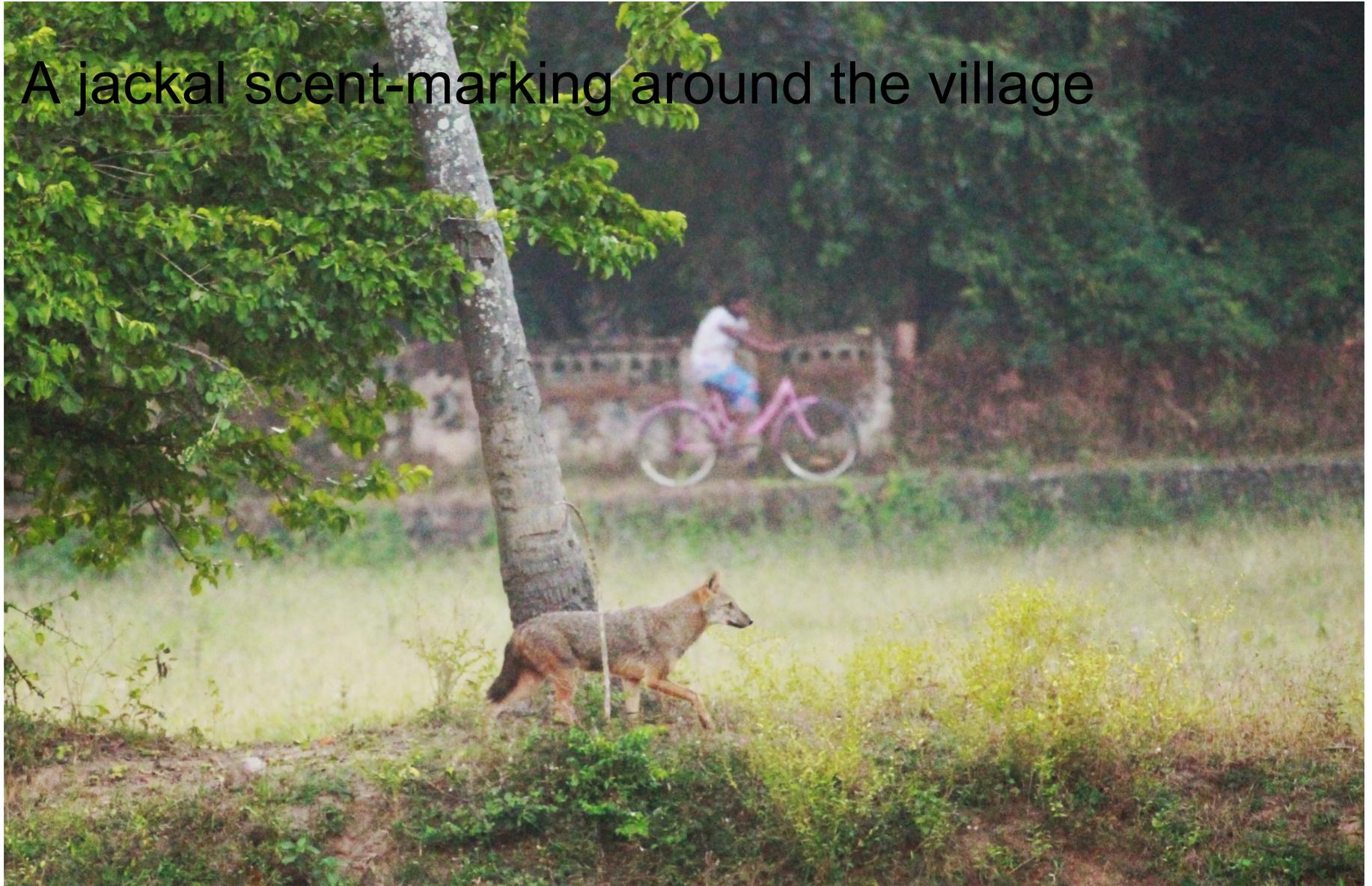
Published online: 06 February 2023

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Amrita Neelakantan<sup>10</sup>, Prachi Thattai<sup>11</sup>, Srimvas Vaidyanathan<sup>12</sup>,  
Himadri Verma<sup>13</sup>, Jagadish K. Intarasamvann<sup>14</sup>, Madhusri Sankaran<sup>15</sup> &  
Uma Ramakrishnan<sup>16</sup>



A jackal scent-marking around the village



## Urbanization and river front development







*Urban*

*Peri-urban*

*Rural*

High bee species richness  
Low bee abundance

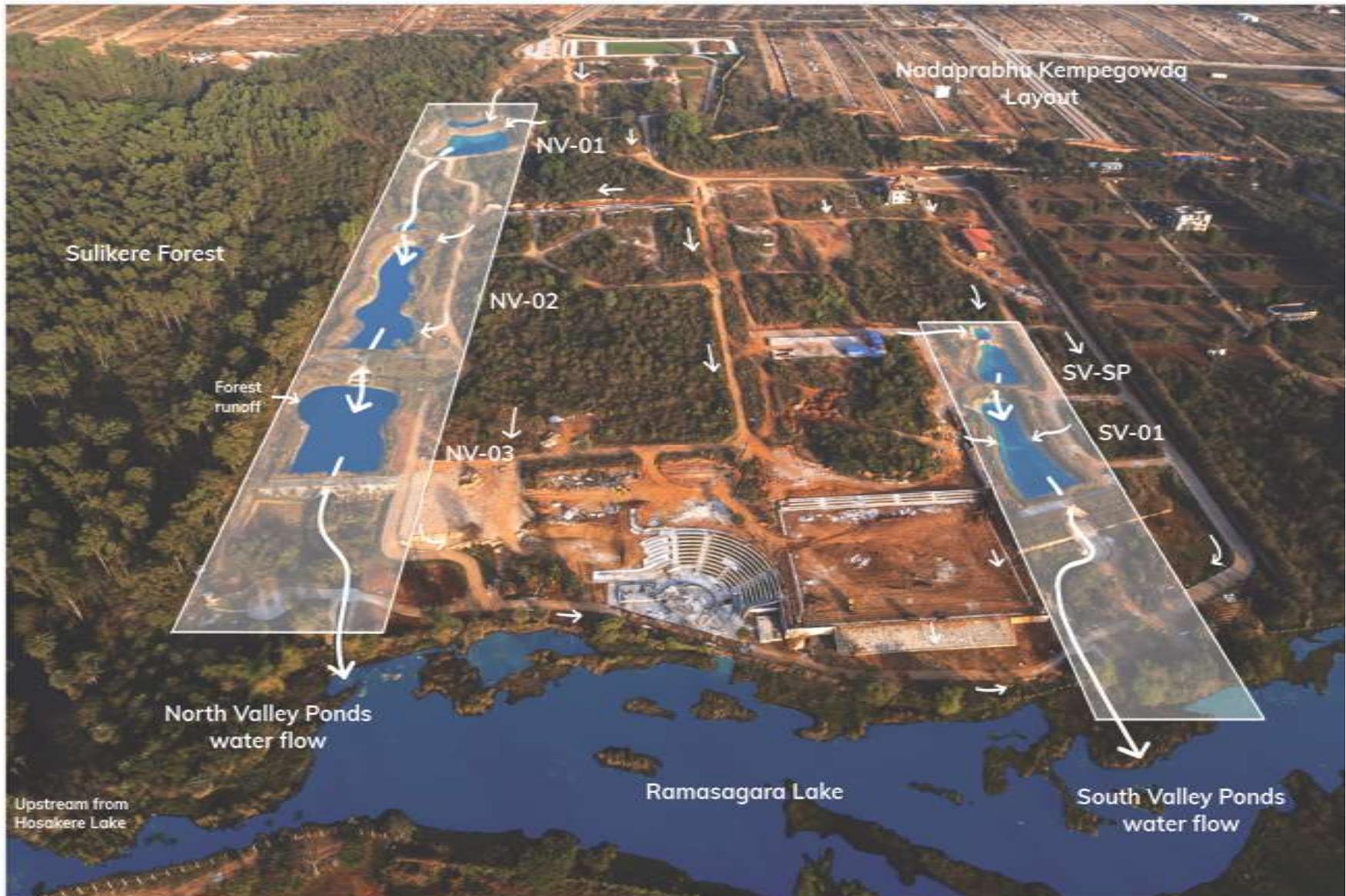


Low bee species richness  
High bee abundance











176/178



100-9596



1/100

F6.3

ISO 5000

MENU



RAW + JPEG





5/13/2023 8:41 PM



# Perils and promises for the future

- Huge escalation of human wildlife conflict
- Pollution of all kinds, micro-plastics
- Managing, regulating and adapting to invasive species
- Climate change interacting with incompatible land-use
- Tolerance and conflict management
- Any possibility of using some forms of wildlife as a managed resource ?
- Emergence of a competing political economy around blue and green “infrastructure” and ecological restoration
- Alternative management of agriculture and water infrastructure : food-water-energy-ecosystems nexus
- Emerging technologies and early-warning systems
- Avoidance of projects on the principle of irreplaceability of ecological assets
- Ecological security as an integral part of national security

