



# Mapping and Assessment of Agricultural Ecosystem Services in a Village Landscape: Evidence from Eastern India

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## Introduction

- Context:** Urbanization, Change in the land use pattern – Agriculture & Wildlife
- Conflict between Conservation & Commercialization
- Political Ecology and Valuation of Agricultural Ecosystem Services
- Ecosystem Services Classification (MA, 2005),
- Developments in Ecosystem Services Assessment (Costanza et. al., 2017)
- Rice Ecosystem Services Assessment (Nayak et. al., 2019)

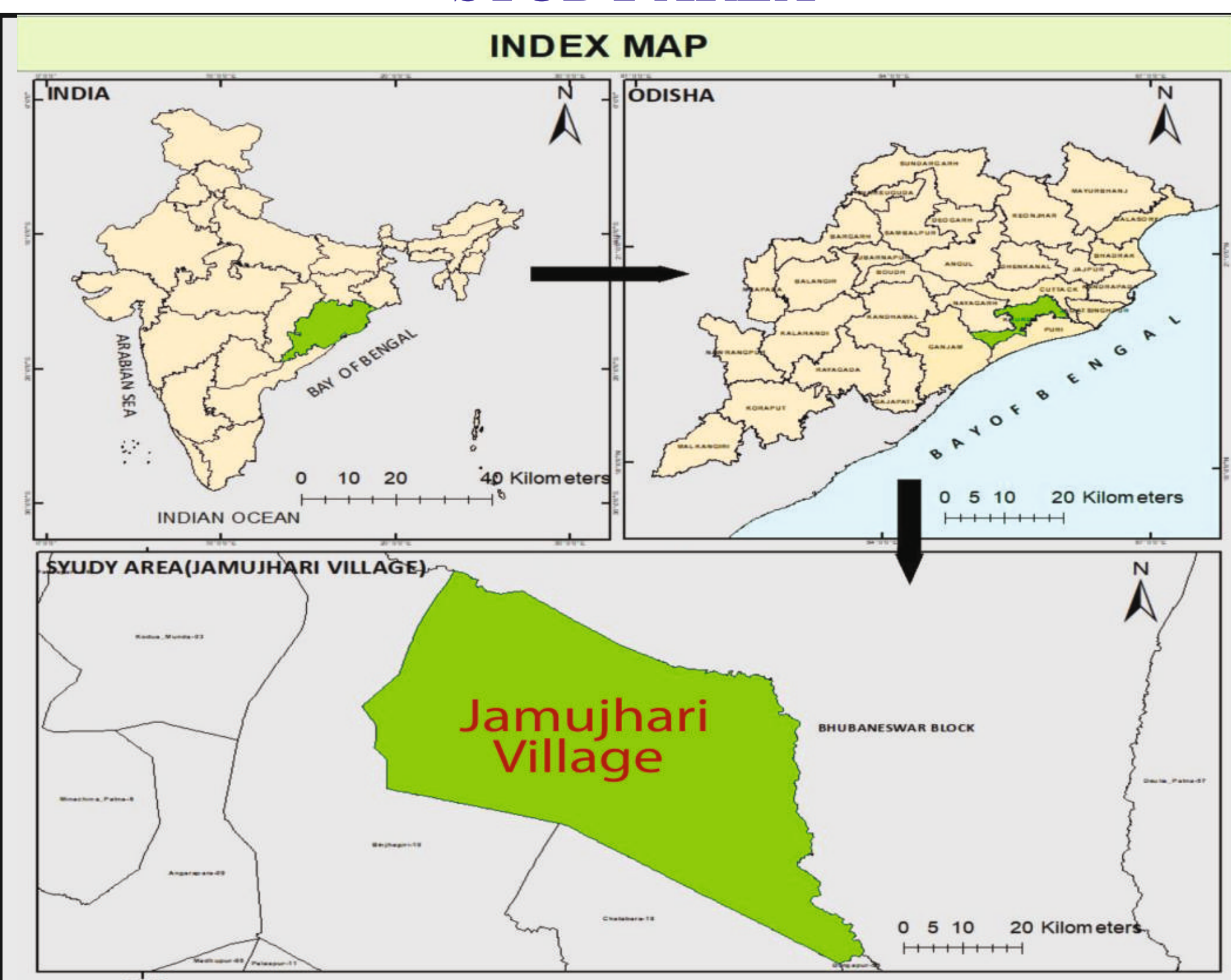
## Research Aims

- Mapping } Ecosystem Services at Village Landscape
- Temporal Change } Village Landscape
- Valuation } Agro-Ecosystem Services

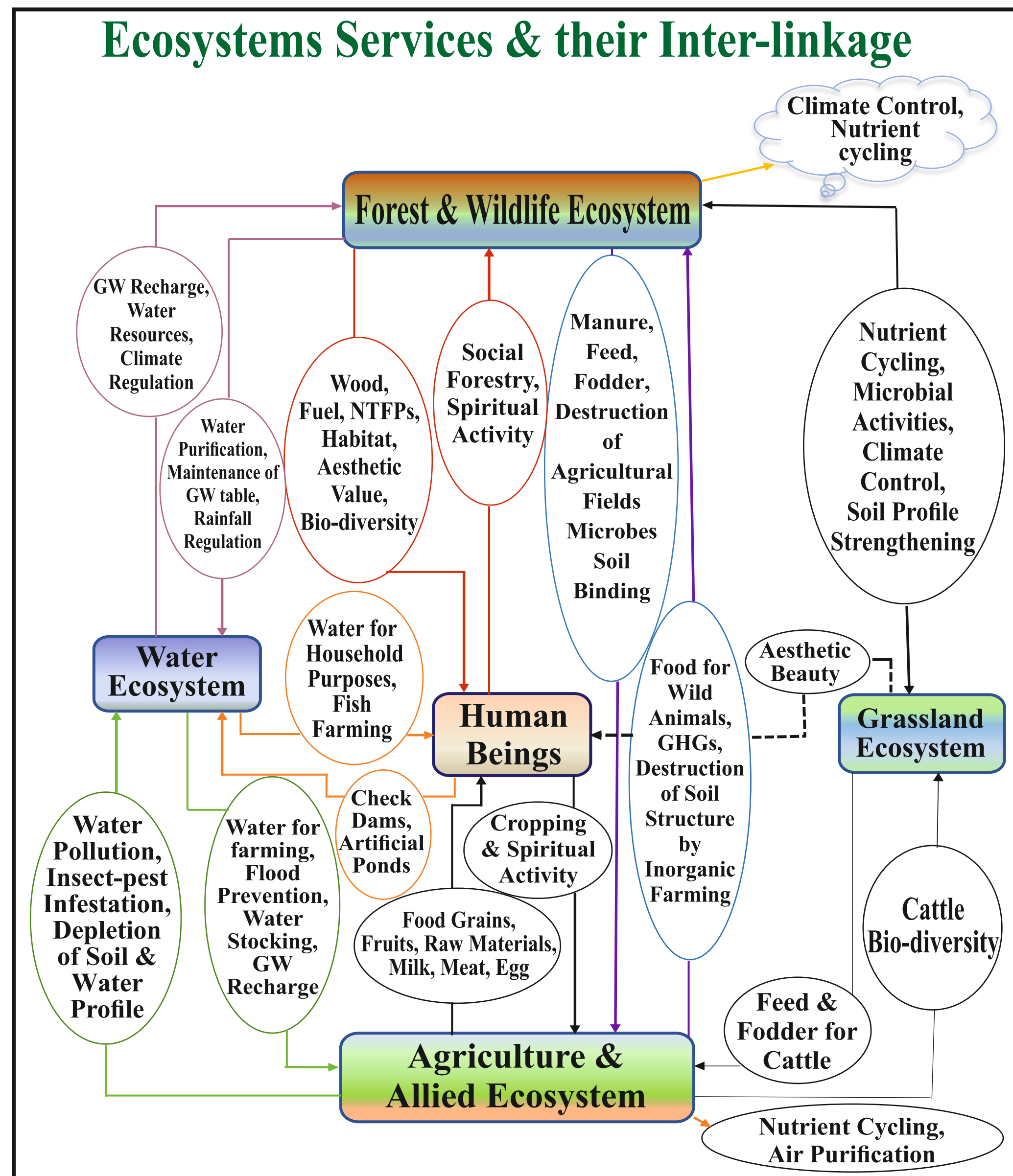
## Methodology:

- Data** } Primary & Secondary
- Sampling** } Purposive
- Mapping of Ecosystem Services** } CICES, TEEB & MA framework
- Tools** } Delphi technique, FGD, Conceptual Framework.
- Valuation of Rice & Fallow Land Ecosystems** } Benefit Transfer Method & Willingness to Pay

## STUDY AREA



## Results & Discussion



### Drivers of Ecosystem Changes



Valuation of Ecosystem Services from Rice		
Ecosystem Services	Conversion factor in USD	Total Value per year (52.4 ha) in the village (\$)
Food	MSP (\$ 24.05)	47258.51
Straw	\$ 0.0155 per kg	4568.76
<b>Market value of ES</b>	-	<b>51827.27</b>
Bio-control of pest	1 Spider = US\$0.038, 1 Miridbug = US\$0.008, 1 Ladybird beetle = US\$0.06, 1 Ground beetle = US\$ 0.0043	83.84
Soil formation	Top-soil value is US\$ 2093 per ha	146.72
Mineralisation of plant nutrients	Equivalent price of N = US\$ 0.082 per kg	4192
Carbon flow	CER (Carbon Emission Reduction) is about US\$ 21.71	- 26.2
Nitrogen fixation	\$ 0.082 per kg	81.74
Soil fertility	Market price of fertilizers	5292.4
Hydrological flow	US\$ 1.5 per 1000 m <sup>3</sup>	576.4
Soil Erosion	Top soil value as US\$ 2093 per ha	- 209.6
<b>Non-market value of ES</b>	-	<b>10137.30</b>
<b>Total Economic value of ES</b>	-	<b>61964.57</b>

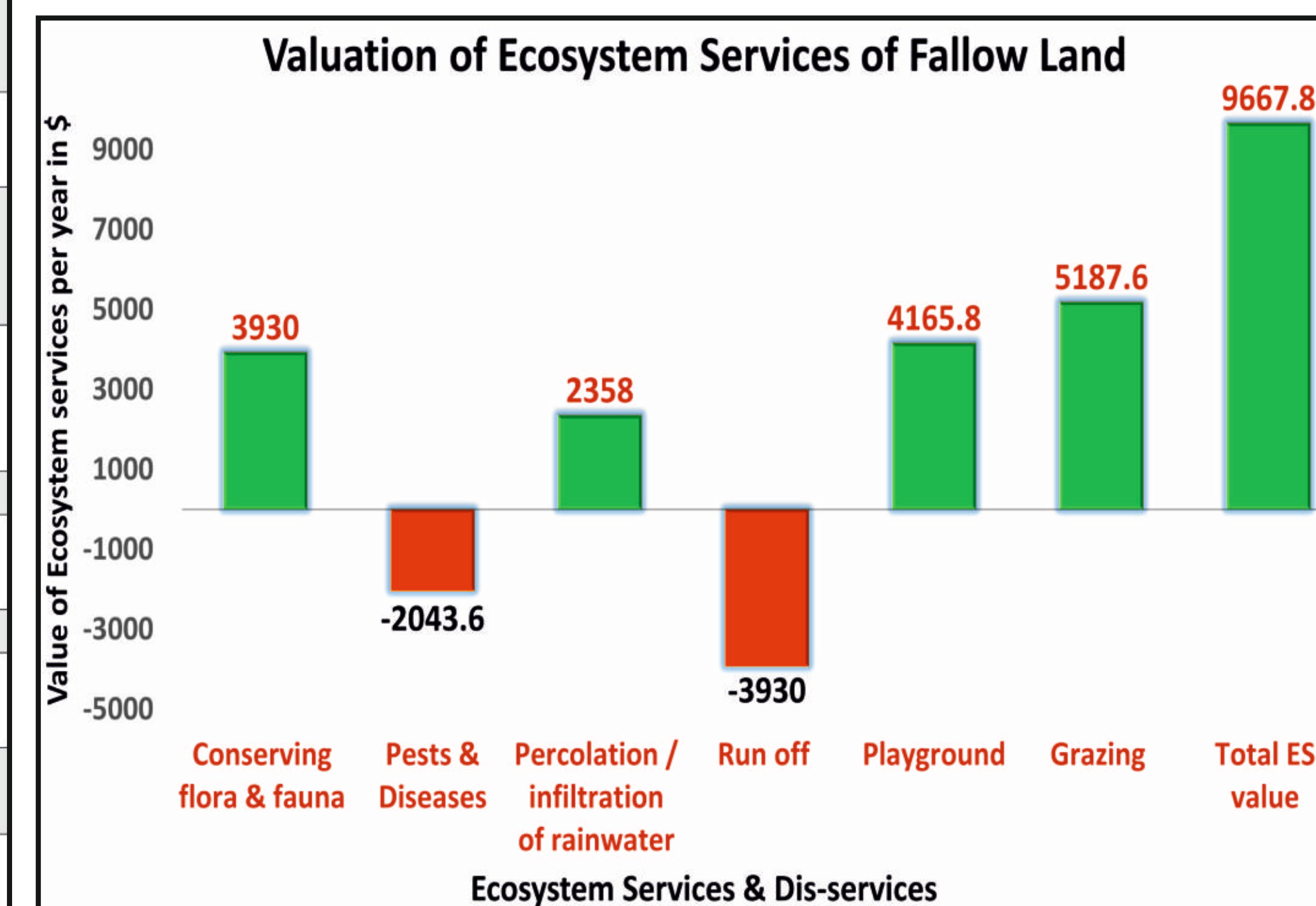
### Major Temporal Changes in the Ecosystem Services and their Use by the Local Residents (1990-2020)

- Forest and Wildlife Ecosystem: Decrease in available ecosystem services, displaced habitat of tribals
- Water Ecosystem: Decrease in natural fish in local water sources
- Grassland Ecosystem: Roughly no change
- Agricultural Ecosystem: Fall in the crop diversity, shift towards monocropping, inorganic farming & fallowing, fall in ecosystem services



### Trade-off caused by the Drivers

- Decrease in ecosystem services but increase in rural economy owing to intensive, mechanised and inorganic farming
- Conflict between ecology & economy- Change of livelihood from agriculture to service sector
- Overall increase in global welfare as a result of development & conservation projects – Declaring the forest as an Elephant Sanctuary (Chandaka)



## Conclusions

- Intensive mono-cropping & continuous fallowing: degrades ecosystem & its services**
- Heavy pressure of urbanization on the ecosystem**
- Reduced dependency on natural ecosystem**
- Significant economic benefit from Rice (\$1182.53 ha<sup>-1</sup>) & Fallow Land (\$123 ha<sup>-1</sup>) ecosystems.**

## Further Research

- Identification of Indicators for non-marketable ecosystem services & Payments for Ecosystem services
- Quantification of the inter-linkages among the various ecosystems in the region
- Welfare implications of ecosystem services changes under local and global context.

## References:

- Costanza et al. 2017. Twenty years of ecosystem services: How far have we come and how far do we still need to go? *Ecosystem Services* 28: 1–16.
- MA, Millennium Ecosystem Assessment. 2005. Ecosystems and human well-being: Synthesis. World Resources Institute, Washington, DC.
- Nayak et al. 2019. Assessment of ecosystem services of rice farms in eastern India. *Ecological Processes* 8:35. <https://doi.org/10.1186/s13717-019-0189-1>.

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