# Decadal Climate Variability and Its Impact on Mangrove Ecosystems of the Southwestern Coast, India

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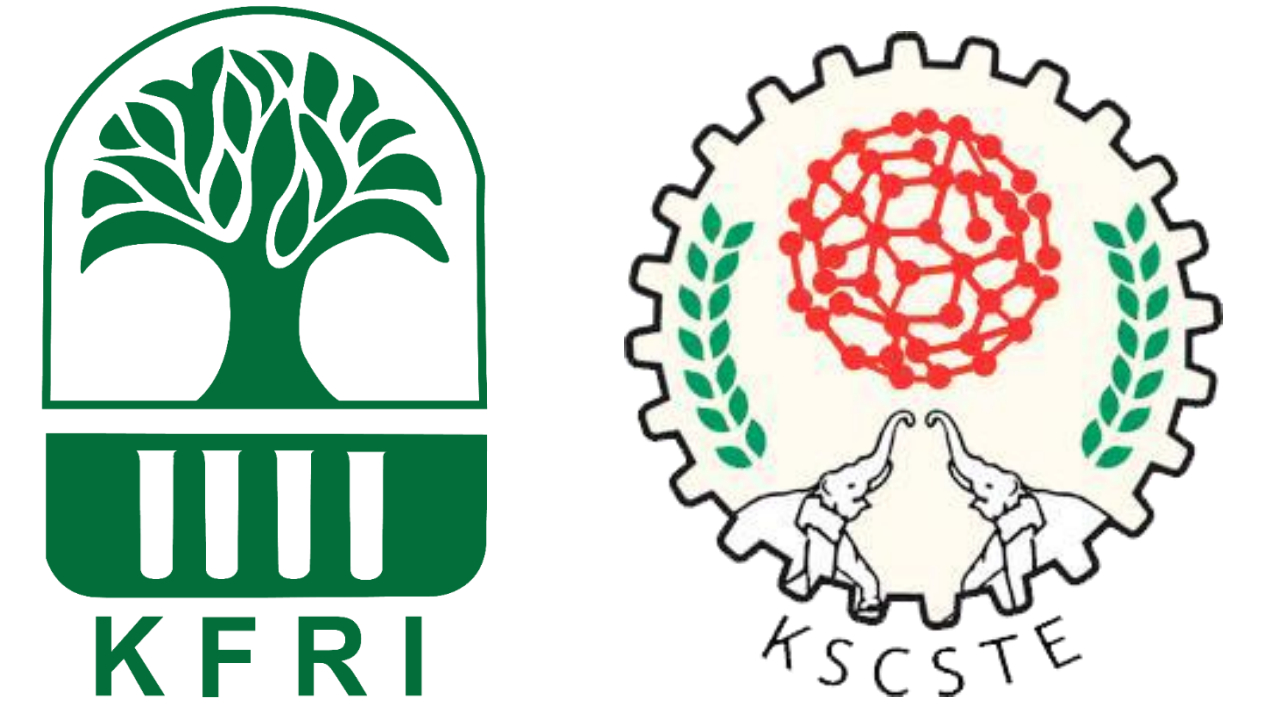
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1. INTRODUCTION

- Mangrove ecosystem: Wetland forest system found in tropical and subtropical coastal regions
- Protects coastal habitats, which are ecologically and socio economically important in the biosphere, that are rich in nutrients, variety of species, aquatic organisms, animals, birds, etc.
- Key factors such as tide height, salinity, precipitation, temperature, etc. influence the mangrove system
- Climate change along with the exponential increase in anthropogenic activities can make substantial impact on mangrove ecosystem
- Impact of climate variation on mangroves can be assessed by extended time series of vegetation indices such as Normalized Difference Vegetation Index (NDVI), Enhanced Vegetation Index (EVI) as proxies of health status

2. OBJECTIVES

- To identify the trend of climatic variables, tide height and vegetation indices
- To identify the correlation between the climatic variables and tide height with Enhanced Vegetation Index

3. DATA & METHODS

- Study Area: Mangrove patches in Kozhikode, Ernakulam and Kollam districts of Kerala, India
- Satellite based data for the study area is extracted using Google Earth Engine
- Seasonal trend analysis of rainfall, temperature, tide height, land surface (LST) and sea surface temperature (SST) - analyzed using Sen's slope and Mann- Kendall Statistics
- Kendall's rank correlation (non-parametric) – indicate the strength of monotonic association between the different climatic variables, tide height, etc. with Enhanced Vegetation Index (EVI)
- Average annual rainfall at Kozhikode, Ernakulam and Kollam are 2934 mm, 3082 mm and 2305 mm, respectively

Sl. No.	Variable	Data Source	Resolution	Date Range
1	Rainfall (mm/day)	IMD	0.25*	2012-2022
2	Max temp (°C)	IMD	0.5*	2012-2022
3	Min temp(°C)	IMD	0.5*	2012-2022
4	Tide height(cm)	INCOIS	-	2017-2022
5	LST(°C)	MODIS	1000 m	2012-2022
6	SST(°C)	NOAA	4000 m	2012-2022
7	ET(mm/8day)	MODIS	500 m	2012-2022
8	EVI	Landsat 8	30 m	2013-2022
9	Salinity Index	Landsat 8	30 m	2013-2022

4. STUDY AREA

Legend: IMD Grid Point; Region for SST; Kerala; Ernakulam; Kollam; Kozhikode; Mangroves
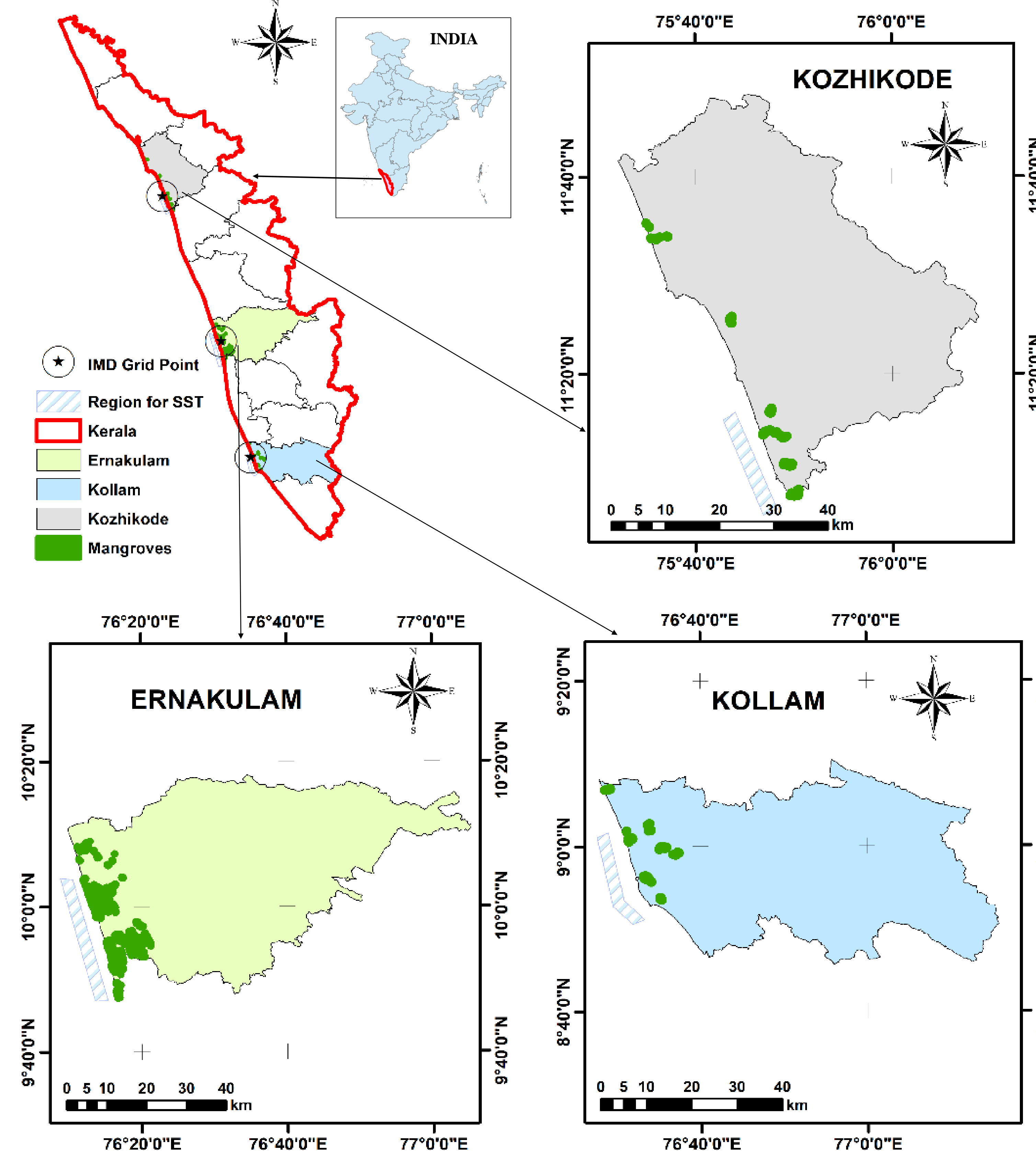
5. SEASONAL VARIABLITY OVER A DECADE

Site	NE MONSOON (OND)					SW MONSOON (JJAS)					SUMMER (MAM)				
	Cum. Rainfall (cm)	Avg. Temp (°C)	Avg. LST (°C)	Avg. Tide height (m)	Avg. SST (°C)	Cum. Rainfall (cm)	Avg. Temp (°C)	Avg. LST (°C)	Avg. Tide height (m)	Avg. SST (°C)	Cum. Rainfall (cm)	Avg. Temp (°C)	Avg. LST (°C)	Avg. Tide height (m)	Avg. SST (°C)
Sen's Slope															
Kozhikode	2.05	0.03	-0.07	0.02	-0.22	0.02	0.03	0.17	0.00	-0.20	5.16	-0.01	0.13	0.01	-0.28
Ernakulam	3.54	-0.01	0.09	0.06	-0.16	-2.38	-0.03	0.14	0.05	-0.07	5.43	-0.02	0.03	0.06	-0.11
Kollam	3.33	-0.01	0.03	0.00	-0.22	-0.10	-0.03	0.10	0.00	-0.13	2.94	-0.02	-0.01	0.00	-0.44
Mann-Kendall Statistic (Z)															
Kozhikode	1.48	1.32	-1.01	2.18	-1.32	0.08	0.86	2.57	2.41	-1.48	1.63	-0.23	1.01	1.79	-1.79
Ernakulam	1.32	-0.54	0.86	2.41	-1.79	-0.39	-1.17	1.48	3.35	-0.70	2.10	-0.54	0.54	3.81	-1.01
Kollam	1.32	-0.23	0.23	2.26	-1.95	-0.08	-1.17	1.95	0.55	-0.54	1.63	-0.39	-0.08	-0.31	-1.63

Positive and negative trend at 10 % significance level
Positive and negative trend at 20 % significance level

- LST and average air temperature doesn't show much variability
- This preliminary study focused only on the past decade, long term analysis is required for making general conclusion

6. RESULTS

Correlation of EVI for the study areas:
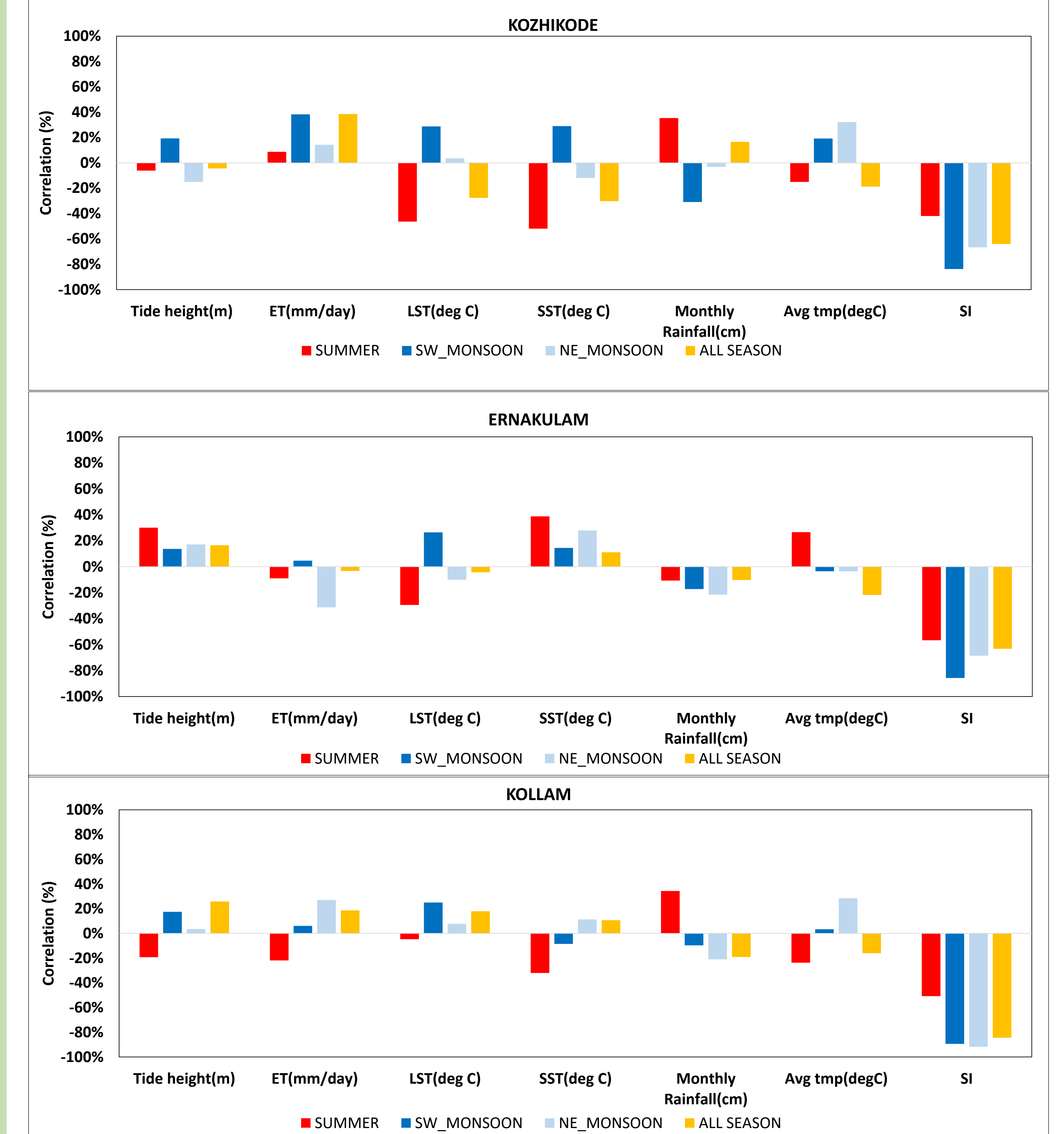
7. CONCLUSIONS

- Correlation of EVI with climate variables, tide height and salinity index shows seasonal variability
- Average tide height shows a positive trend, where as average sea surface temperature shows a negative trend, irrespective of the season in the recent past
- Salinity, monsoon rainfall and summer LST are observed to be negatively correlated with the EVI in all three study areas
- During the southwest monsoon season, the tide height and LST positively correlate with EVI
- This indicates an optimum rainfall, salinity, and LST conditions are favourable for the growth of mangroves, beyond which it negatively impacts vegetation compared to the rise in the tide height
- The accuracy of the study can be improved by utilizing high resolution satellite data or actual field data