

Chlorophyll-a estimation and evaluating the effect of land use change in a Ramsar Site of North East India

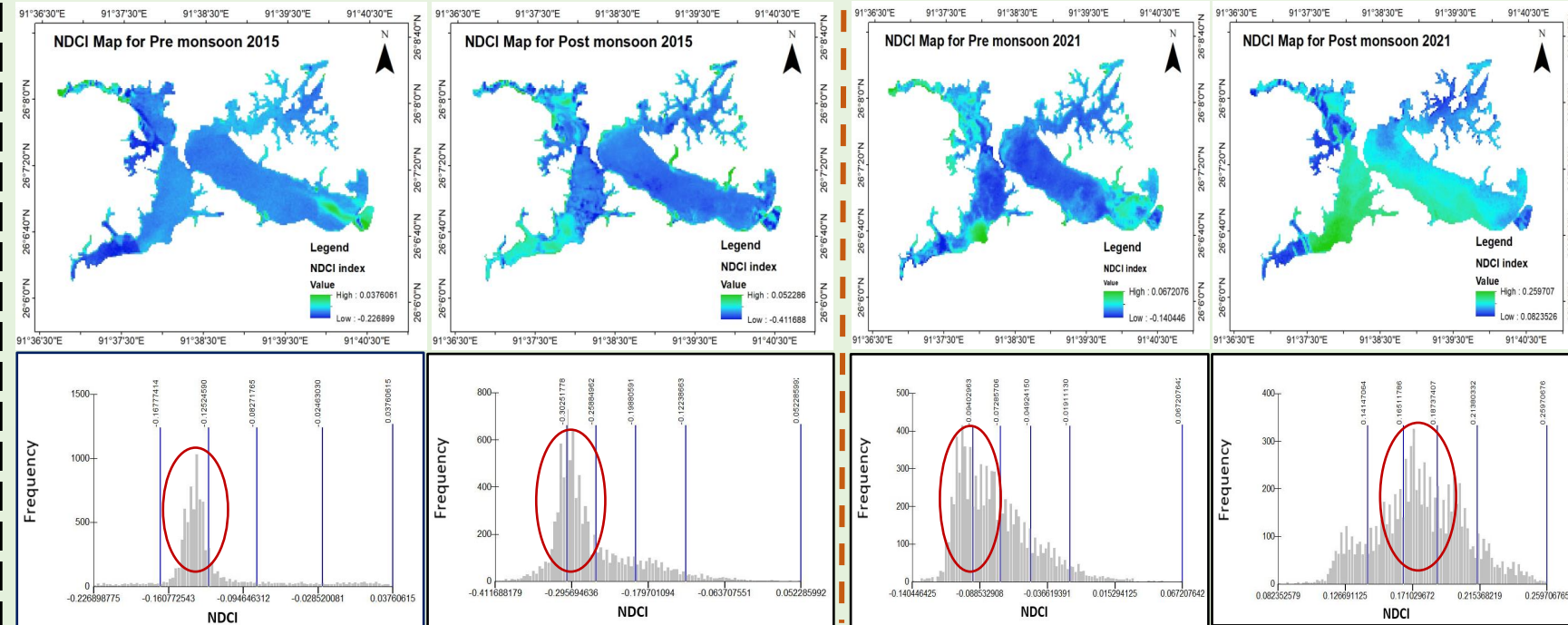
Bhaswatee Baishya¹, Gaurav Talukdar², Arup Kumar Sarma³

Introduction and Methodology

- ✓ Chlorophyll-a concentrations may be used to assess the relative productivity and health of lakes and ecosystems. The amount of chlorophyll concentrations in water bodies is measured to determine phytoplankton activity, which is used as a proxy for primary production and eutrophication.
- ✓ In this study, we have employed the Normalized Difference Chlorophyll Index (NDCI) algorithm to estimate the Chl-a concentrations based on the bands of Landsat-8 satellite imageries in the Deepor beel.
- ✓ For NDCI [1],

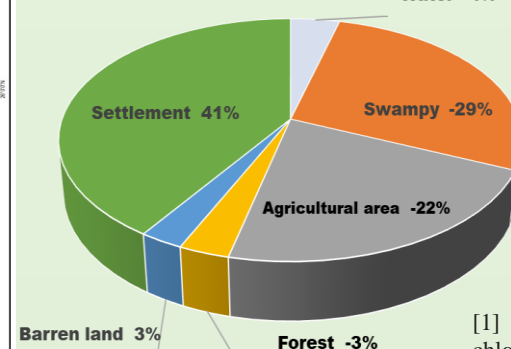
$$NDCI = \frac{R_{rs}(\lambda_{red}) - R_{rs}(\lambda_{green})}{R_{rs}(\lambda_{red}) + R_{rs}(\lambda_{green})}$$

Results



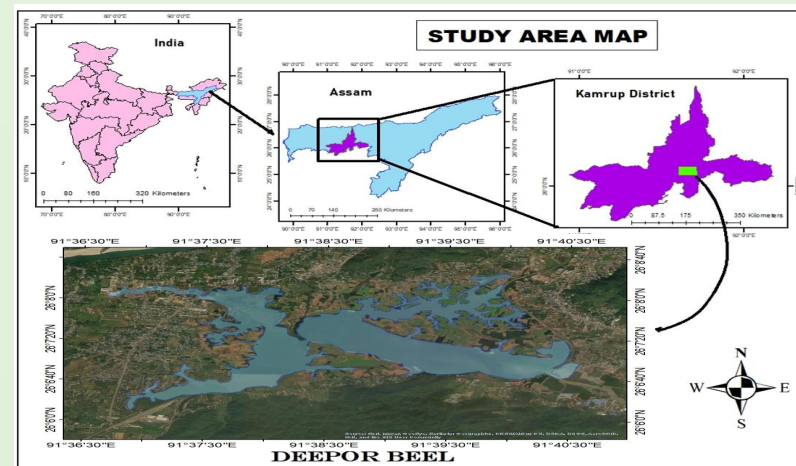
Conclusions

LULC CHANGE for 2015-2021



- ✓ The NDCI value was observed high in post-monsoon period as compared to pre monsoon period over the years.
- ✓ The cause for this degradation can be concluded from the LULC change analyses, as increase of about 40% in settlement areas was observed in the lake basin.
- ✓ Based on the analysis, the study would be of significant importance in evaluating the nutrient loading in lakes, where the fertilizer spill or toxicity levels may be an important aspect under consideration.

[1] Mishra, S., & Mishra, D. R. (2012). Normalized difference chlorophyll index: A novel model for remote estimation of chlorophyll-a concentration in turbid productive waters. *Remote Sensing of Environment*, 117, 394-406.



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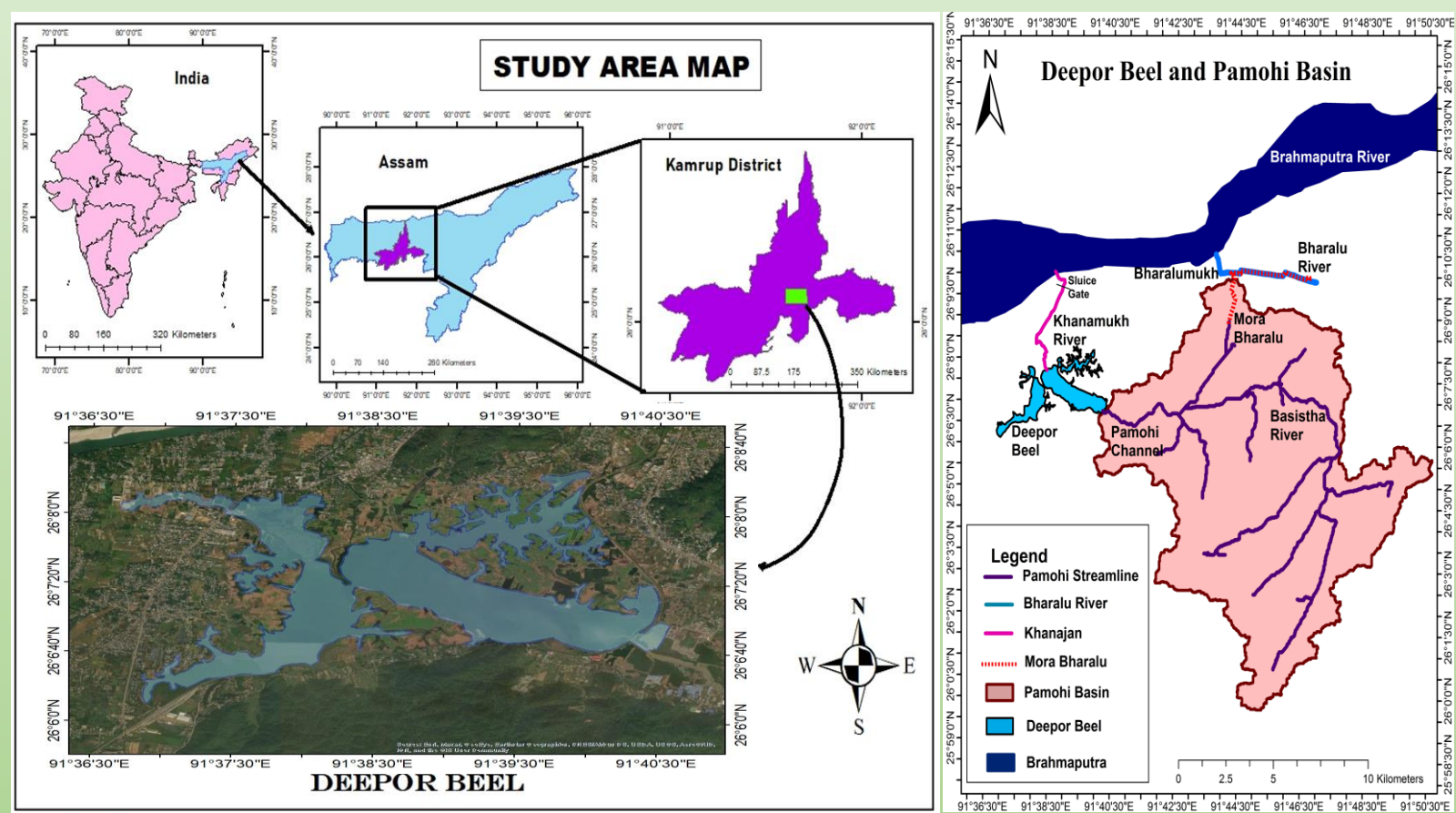
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INTRODUCTION

- ❑ Chlorophyll-a concentrations may be used to assess the relative productivity and health of lakes and ecosystems. The amount of chlorophyll concentrations in water bodies is measured to determine phytoplankton activity, which is used as a proxy for primary production and eutrophication.
- ❑ In addition, satellite imageries provide spatial and temporal changes that would indicate the health of the ecosystems.
- ❑ Chl-a mapping using satellite data provides insight to its spatial and temporal variability in near surface waters.





CASE STUDY AREA

- Deepor Beel (Beel means wetland or large aquatic body in Assamese language), located about 10 km southwest of Guwahati city, lies between latitude 26°03'26" to 26°09'26" N and longitude 90°36'39" to 90°41'25" E.
- In 2002 it was declared as one of the Ramsar Sites of Northeastern part of India.
- For evaluating the land use change, lake basin known as Pamohi was analyzed as the Pamohi Basin collects water from the residential areas along with hilly forest areas of Guwahati city.



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METHODOLOGY

- ❑ In this study, we have employed the Normalized Difference Chlorophyll Index (NDCI) algorithm to estimate the Chl-a concentrations based on the bands of Landsat-8 satellite imageries in the Deepor beel.
- ❑ The advantage of NDCI is that it can be used to detect algal bloom and qualitatively infer Chl-a concentration ranges, when the ground data is not available. Two spectral bands at 530 to 590 nm (Green Band) and 640 to 670 nm (Red Band) were selected to develop the index (Mishra and Mishra, 2012) .
- ❑ Remote Sensing Reflectance (R_{rs}) was calculated from the bands and employed to obtain Chl-a using the NDCI index.

For NDCI,

$$NDCI = \frac{R_{rs}(\lambda_{red}) - R_{rs}(\lambda_{green})}{R_{rs}(\lambda_{red}) + R_{rs}(\lambda_{green})}$$





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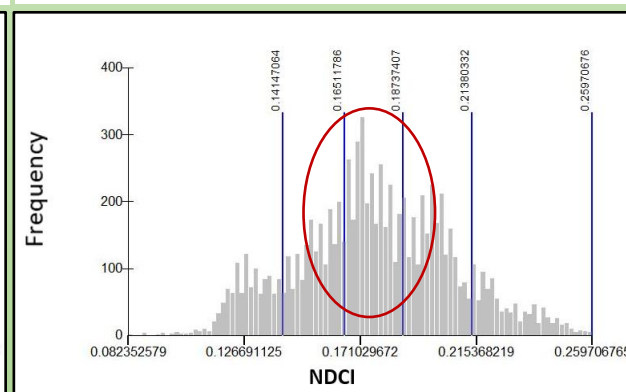
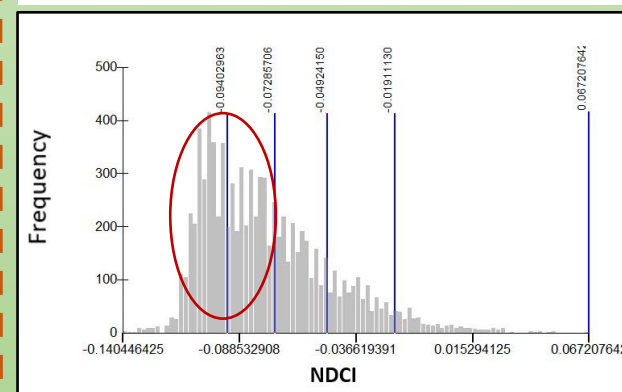
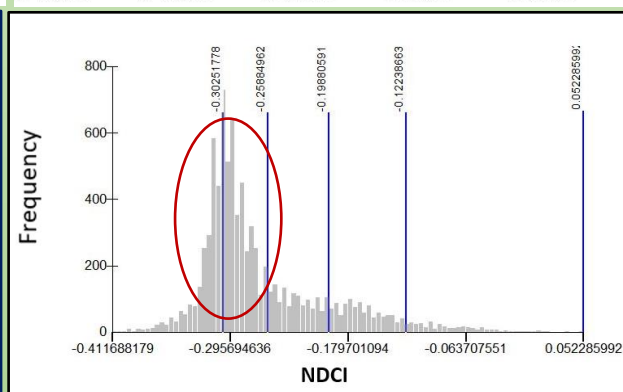
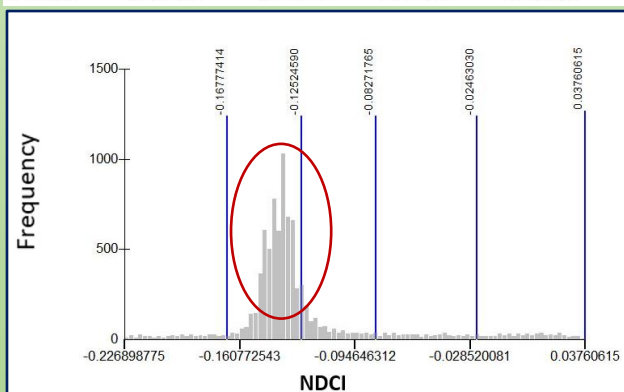
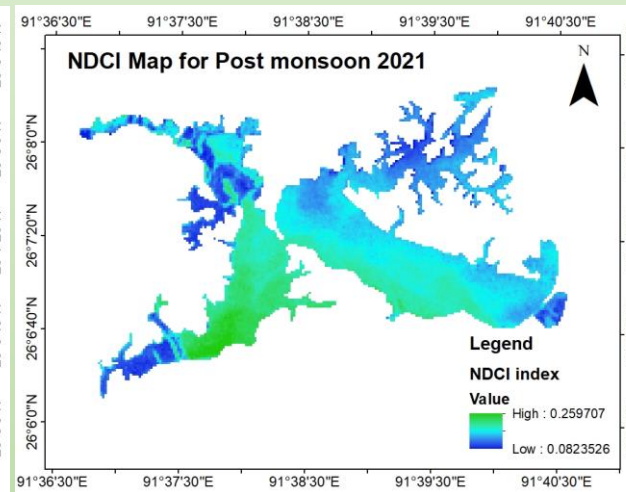
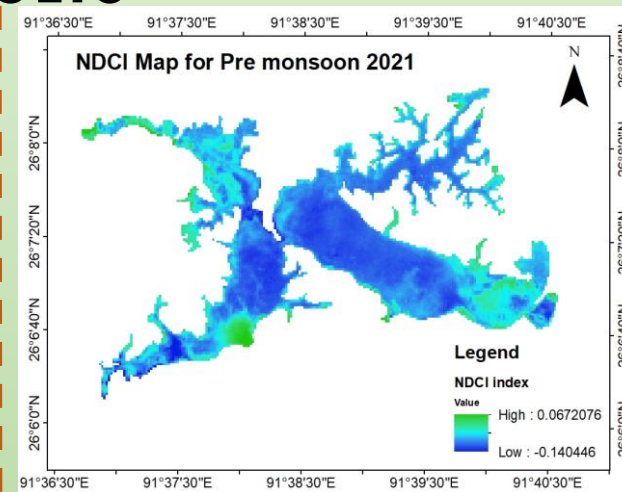
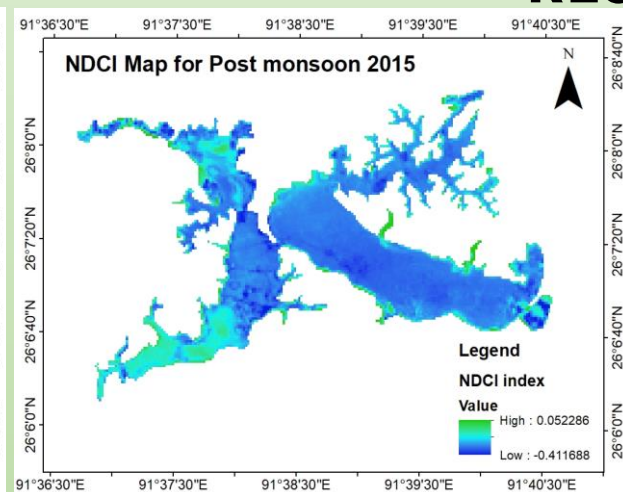
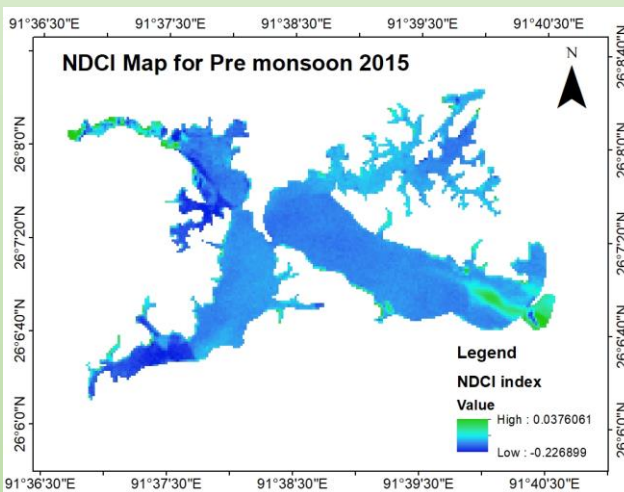
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RESULTS



Chlorophyll-a estimation and evaluating the effect of land use change in a Ramsar Site of North East India

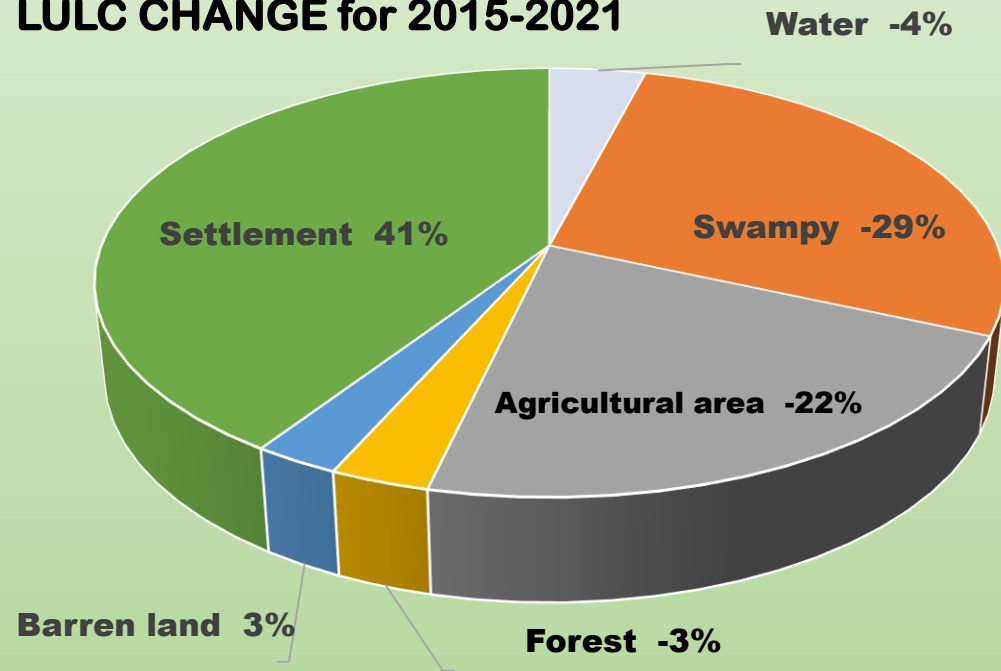
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DISCUSSIONS

LULC CHANGE for 2015-2021



- ❑ We found the values to be significantly high during the Post monsoon period compared to the pre-monsoon period.
- ❑ The NDCI value for 2015 pre monsoon period was found to vary between 0.037 to -0.22 and for post monsoon period, it varied between 0.052 to -4.11. Similarly, for 2021 pre monsoon period varied between 0.067 to -0.14 and for post monsoon period, varied between 0.26 to 0.08.
- ❑ NDCI index value ranges between -1 to +1, value close to -1 indicates clear water, between -0.3 to 0.5 indicates moderate bloom and between 0.5 to 1 indicates high algal bloom. (Mishra and Mishra, 2012)
- ❑ The change in the LULC showed that the settlement area has significantly increased over the years, while the swampy areas and water bodies decreased, which is represented in the pie chart.



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CONCLUSIONS

- ❑ The ecosystem of the Deepor Beel provides people and animals with various valuable services. Due human disturbances, development of industries, dumping in the fringe areas are all contributing to the ecosystem degradation. Therefore, understanding of wetland functions and the threats is essential for the long-term management of the wetland.
- ❑ The NDCI value were used to analyse the seasonal variation of Chlorophyll-a concentration and was observed that concentrations during post-monsoon period was high as compared to pre monsoon period and was intercompared over the years.
- ❑ The cause for this degradation can be concluded from the LULC change analyses, as increase of about 40% in settlement areas was observed in the lake basin.
- ❑ Based on the analysis, the study would be of significant importance in evaluating the nutrient loading in lakes, where the fertilizer spill or toxicity levels may be an important aspect under consideration.



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- [2] Poddar, S., Chacko, N., & Swain, D. (2019). Estimation of Chlorophyll-a in northern coastal Bay of Bengal using Landsat-8 OLI and Sentinel-2 MSI sensors. *Frontiers in Marine Science*, 6, 598.
- [3] Watanabe, F., Alcantara, E., Rodrigues, T., Rotta, L., Bernardo, N., & Imai, N. (2017). Remote sensing of the chlorophyll-a based on OLI/Landsat-8 and MSI/Sentinel-2A (Barra Bonita reservoir, Brazil). *Anais da Academia Brasileira de Ciências*, 90, 1987-2000.



EGU22-11568



THANK YOU!



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