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# Multi-temporal ecosystem changes monitoring in areas with high population growth dynamics

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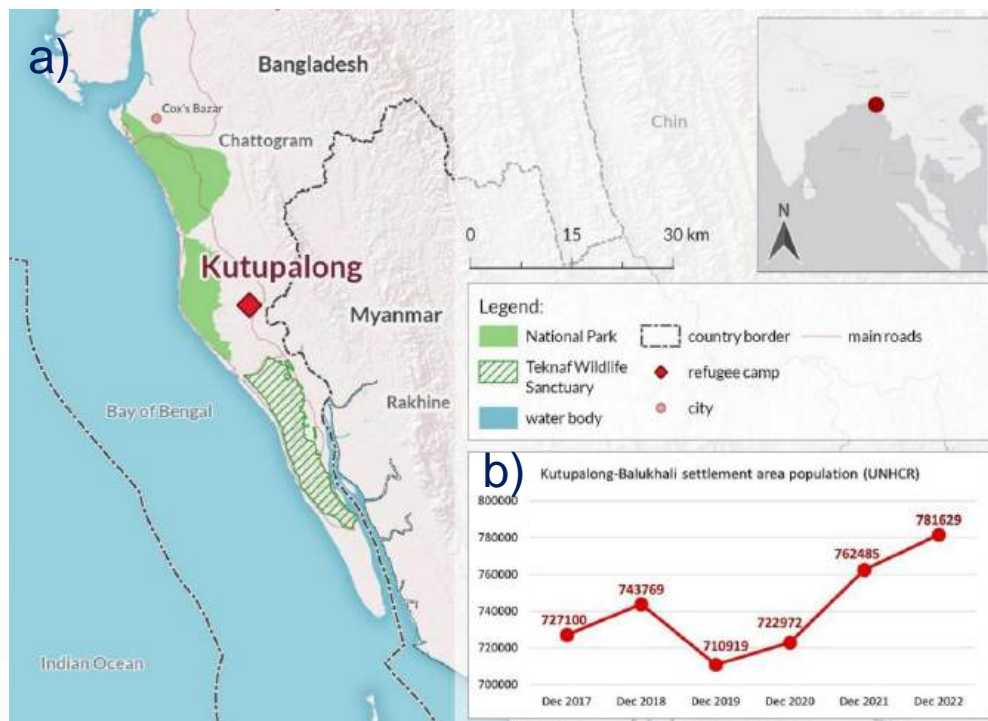
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# Research Context

- **Early detection of changes** occurring in the ecosystem is crucial for accurate monitoring of its condition, effective protection and proper management.
- In protected areas and those with large, rapid population growth, there is an increasing need **to determine the impact of human activities and climate change** on the ecosystem (*Gromny et al., 2024; Sobczak-Szelc et al., 2024*).
- **Ecosystem Functional Type (EFT)** analysis can be used to detect early changes in vegetation processes before they are identified on land cover maps, when degradation is already difficult to reverse (*Domingo-Marimon et al., 2024*).

# Study Area

Ground-truth data acquired during the fieldwork in Oct 2022 (*ARICA Geoplatform & Camp Stories*):



a) Location of Kutupalong-Balukhali Refugee Settlement and the surrounding area; b) distribution of camp population from October 2017 to December 2022.



Refugee camp



Agriculture fields



Teknaf Wildlife Sanctuary

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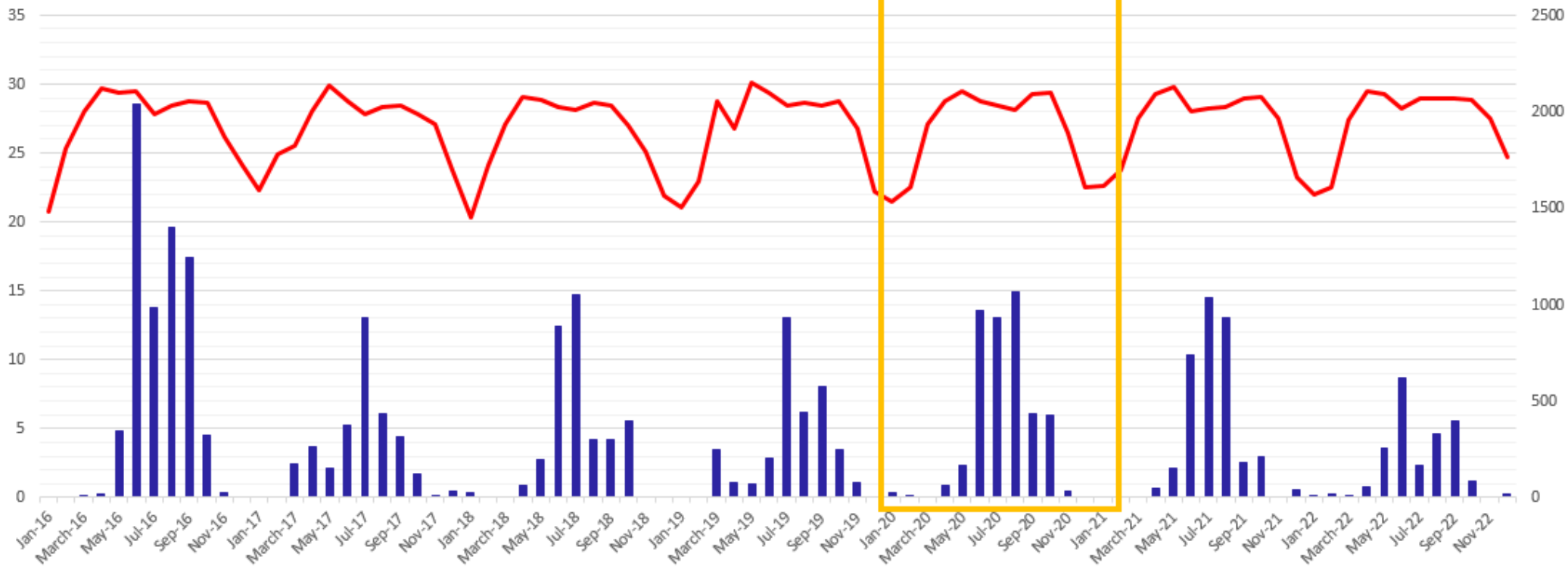
Naf River

© shutterstock

# Study Area

**Station :** COX'S BAZAR (BANGLADESH)

**Location :** 21 26N , 91 56E



Based on data from Meteomanz.com

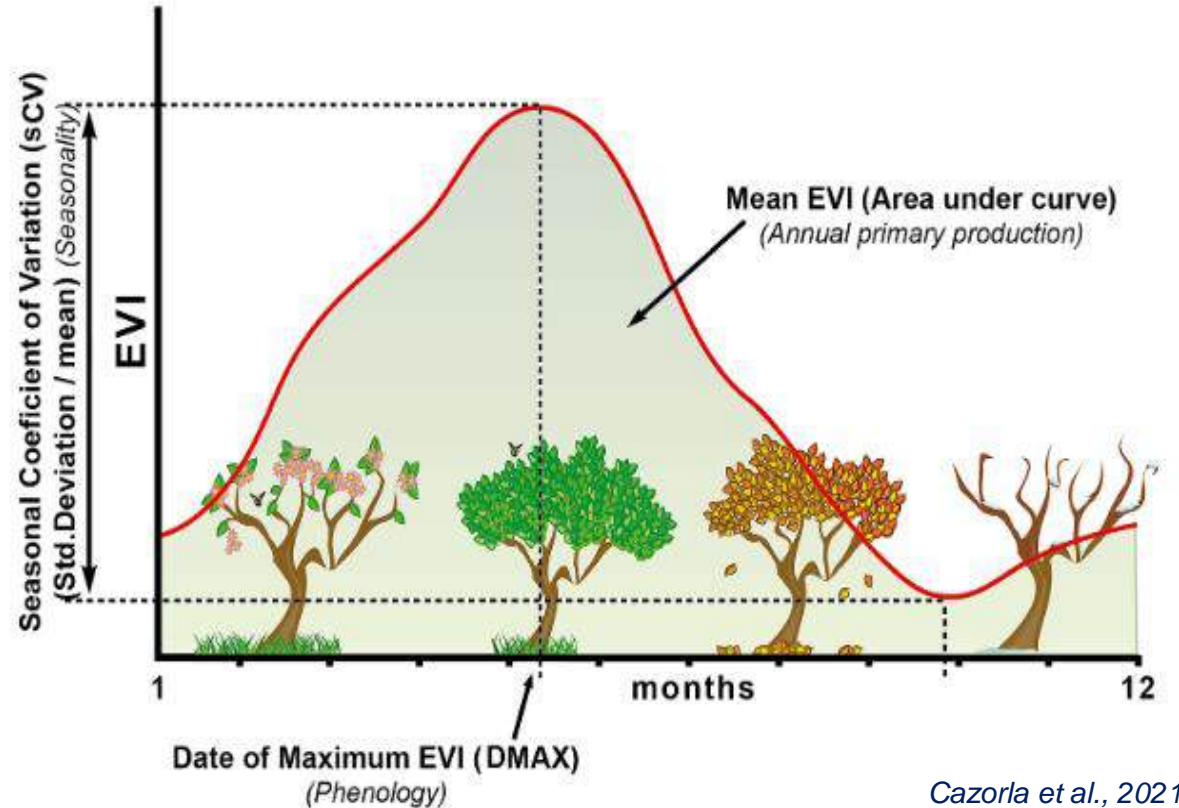
# Ecosystem Functional Types

The annual vegetation index curve determines the 3 main Ecosystem Functional Attributes of EFA :

**Primary Production** (NDVIMEAN):  
The average of the values recorded per season.

**Seasonality** (sCV): Seasonal coefficient of variation, the standard deviation divided by the mean value.

**Phenology** (DMAX): The date of the maximum value recorded in a season.

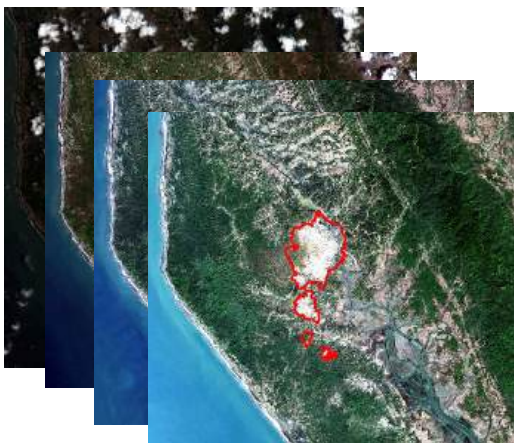


Cazorla et al., 2021



# EFT Calculation

**Input data:**  
Satellite data Sentinel-2 (10m)

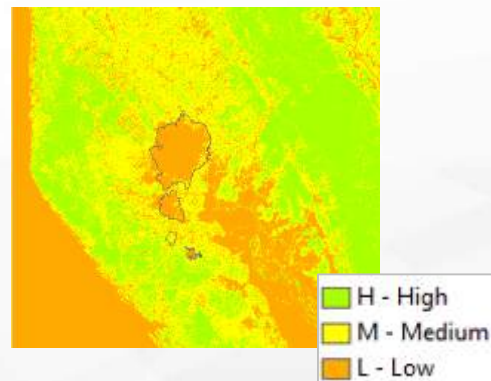
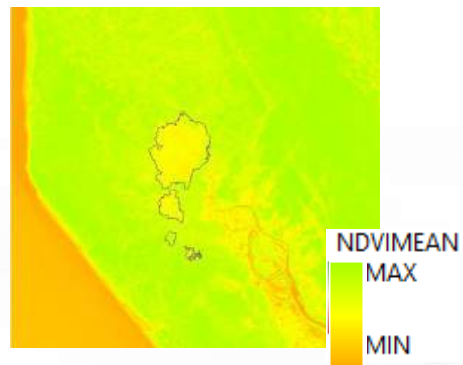


Multi-temporal dataset of one growing season

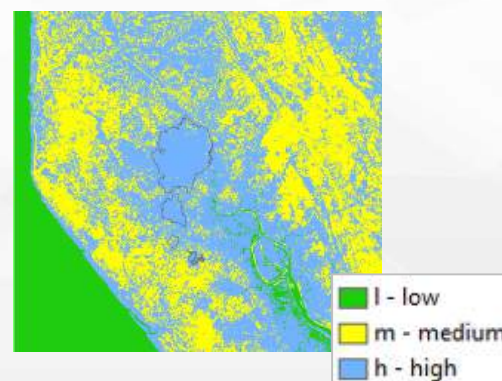
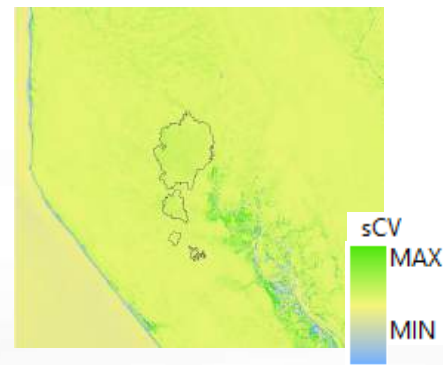
Example: 2018 growing season

Season	Wet	Dry	Total
Jan. 2016 - Dec. 2016	3	4	7
Jan. 2017 - Dec. 2017	2	8	10
Jan. 2018 - Dec. 2018	4	9	13
Jan. 2019 - Dec. 2019	2	11	13
Jan. 2020 - Dec. 2020	2	10	12
Jan. 2021 - Dec. 2021	4	9	13
Jan. 2022 - Dec. 2022	5	10	15

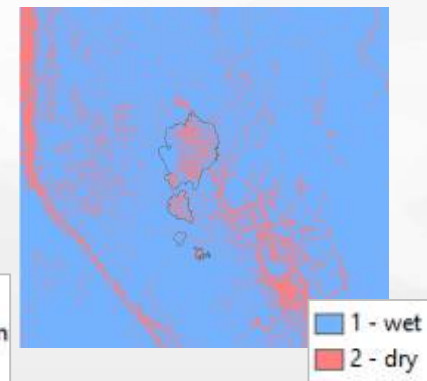
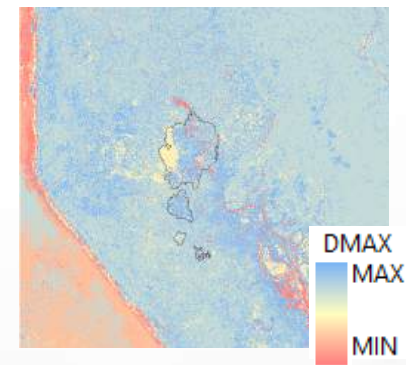
**Primary Productivity**

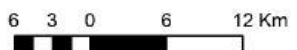
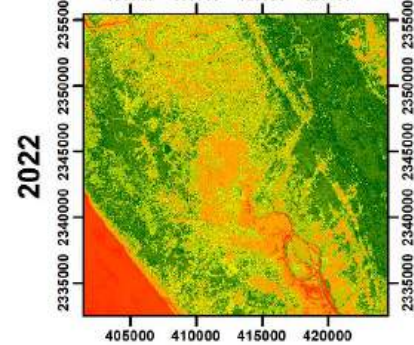
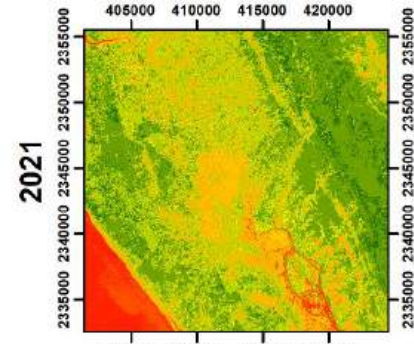
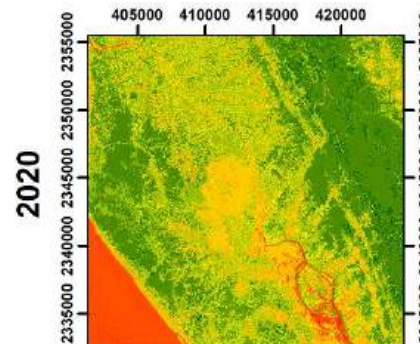
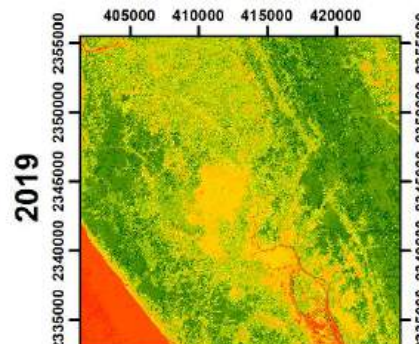
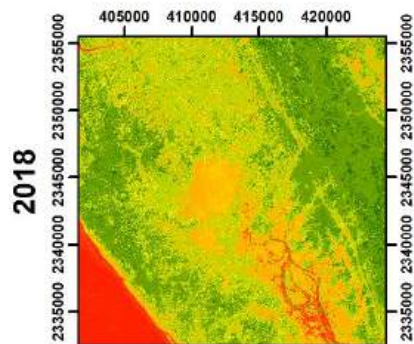
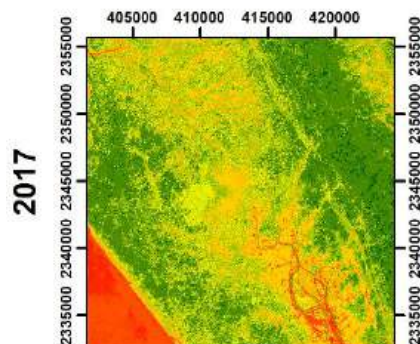
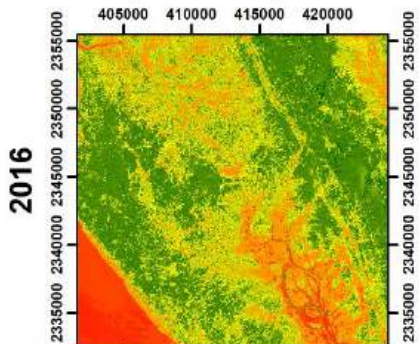


**Seasonality**

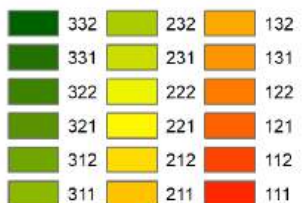


**Phenology**



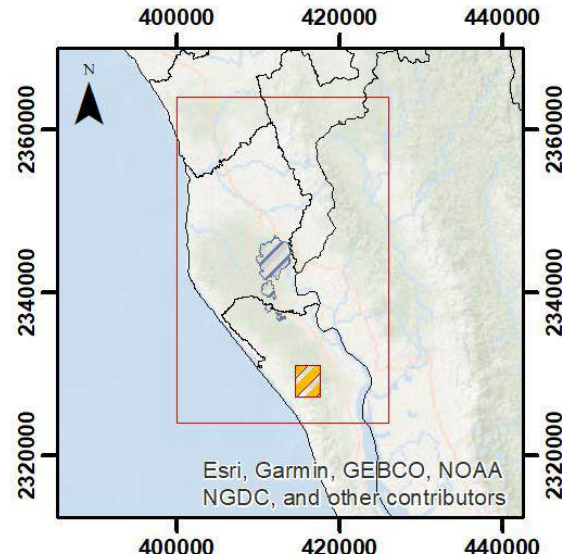


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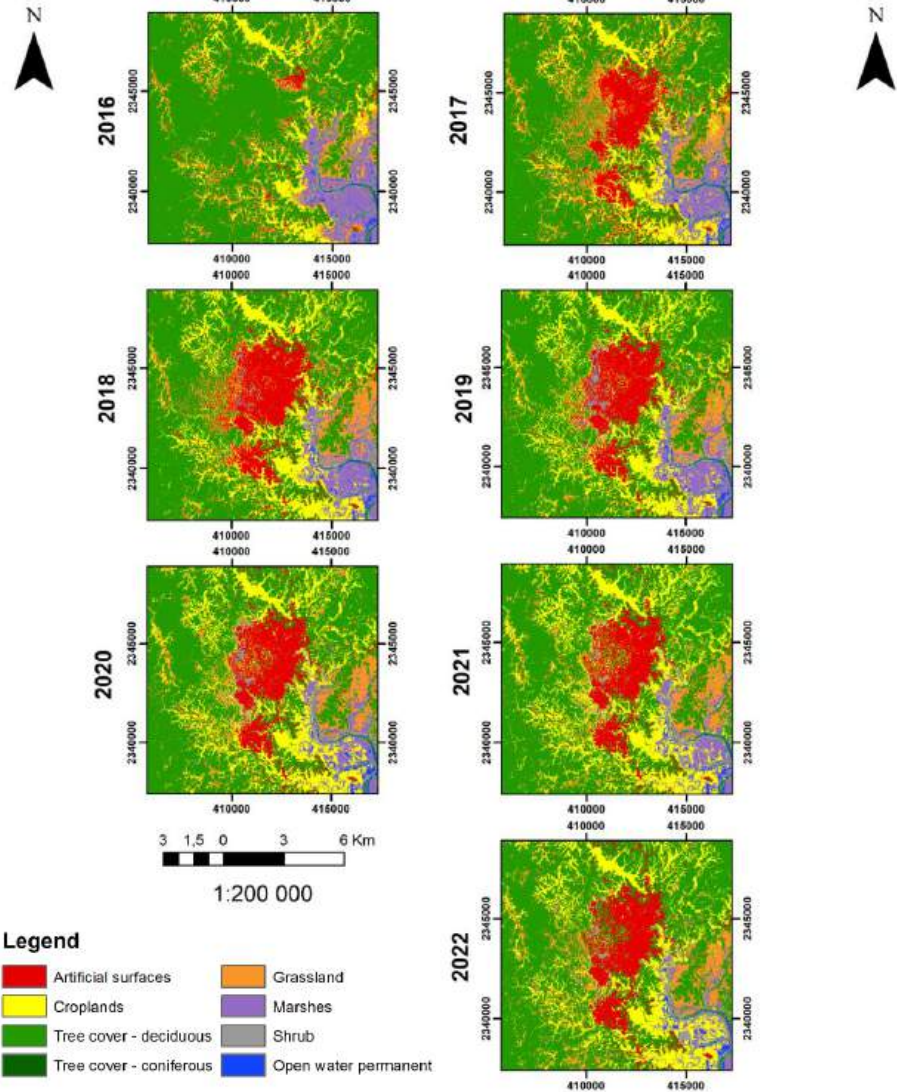


EFT results for 7 growing seasons: 2016 - 2022.

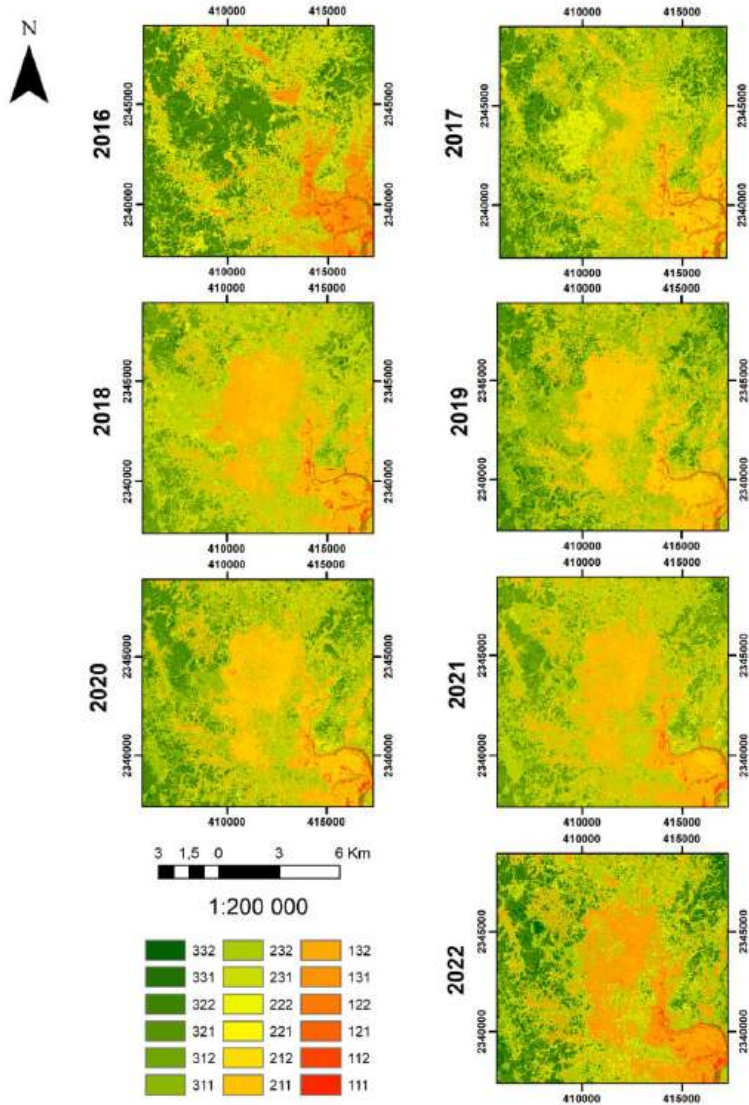
# Results







**LU/LC annual classification products**



**EFTs per growing season**

# EFTs and Land Use/Cover comparison



2016

2017

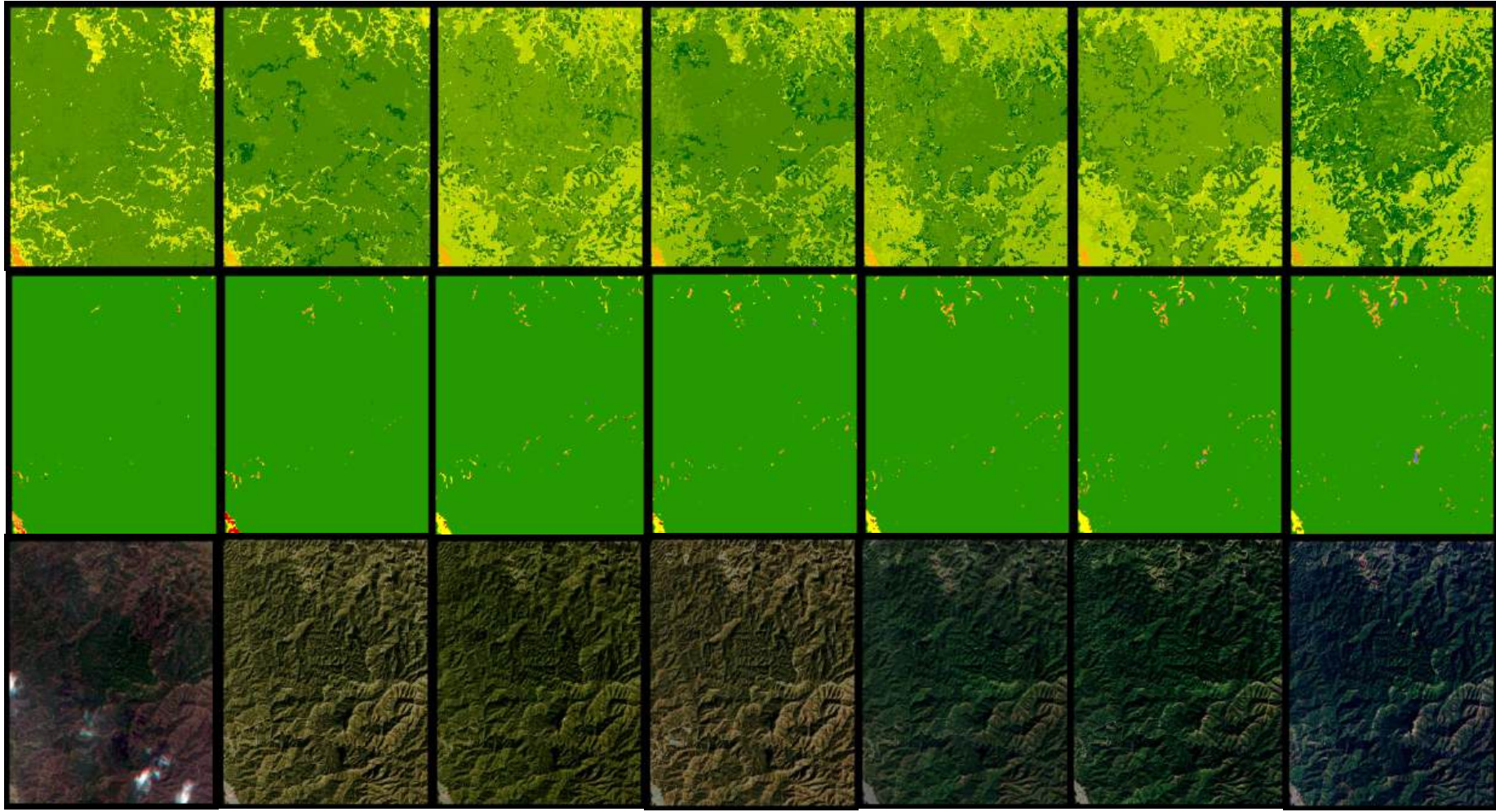
2018

2019

2020

2021

2022



**EFTs**

**Land Use/Cover**

**Optical VHR**

# Summary

- **Analysis of Ecosystem Functional Types (EFT)** in both the Kutupalong-Balukhali settlement area and in Teknaf Wildlife Sanctuary **reveals changes** over 7 growing seasons as opposed to annual land cover and land use maps.
- A limitation of the method based on optical data is cloud cover. An alternative may be the use of **radar data**.
- The presented results can be integrated in **the environmental monitoring system** in order to facilitate the preservation of a healthy environment both in its current state and in the future perspective.

# References

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## THANK YOU

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