Satellite Applications for Enhancing Water, Sanitation and Hygiene towards Sustainable Health in Lake Chad Region

Presented by

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Prince Sultan Bin Abdulaziz International Prize for Water

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INTRODUCTION

- Water is critical to the equitable, stable, and productive functioning of society and ecosystems.
- Water security is based on social and economic considerations as well as the physical availability of freshwater supplies in relation to demand (e.g. sound water planning and management approaches, institutional capacity to provide water services, sustainable economic policies).
- As a result, the United Nations designated guaranteeing water security as one of seventeen sustainable development goals (Goal 6). (SDGs). In the coming decades, many international river basins are likely to experience 'low water security.'

LAKE CHAD BASIN

- The Lake Chad basin, located in northern Central Africa, spans seven countries and covers over 8% of the continent. Algeria, Niger, Nigeria, Sudan, Algeria, Cameroon, the Central African Republic, Chad, Libya, and Libya are all part of it.
- For about four decades today recurring droughts, a general decline in rainfalls, and degradation of the vegetation cover have led to drastic changes in the environmental conditions of the Lake Basin. The drying up of Lake Chad, the encroachment of the desert, and the decline of agriculture, livestock and fisheries, threatens the social and economic well-being of **over 22 million people** living in the Basin.

STUDY AREA

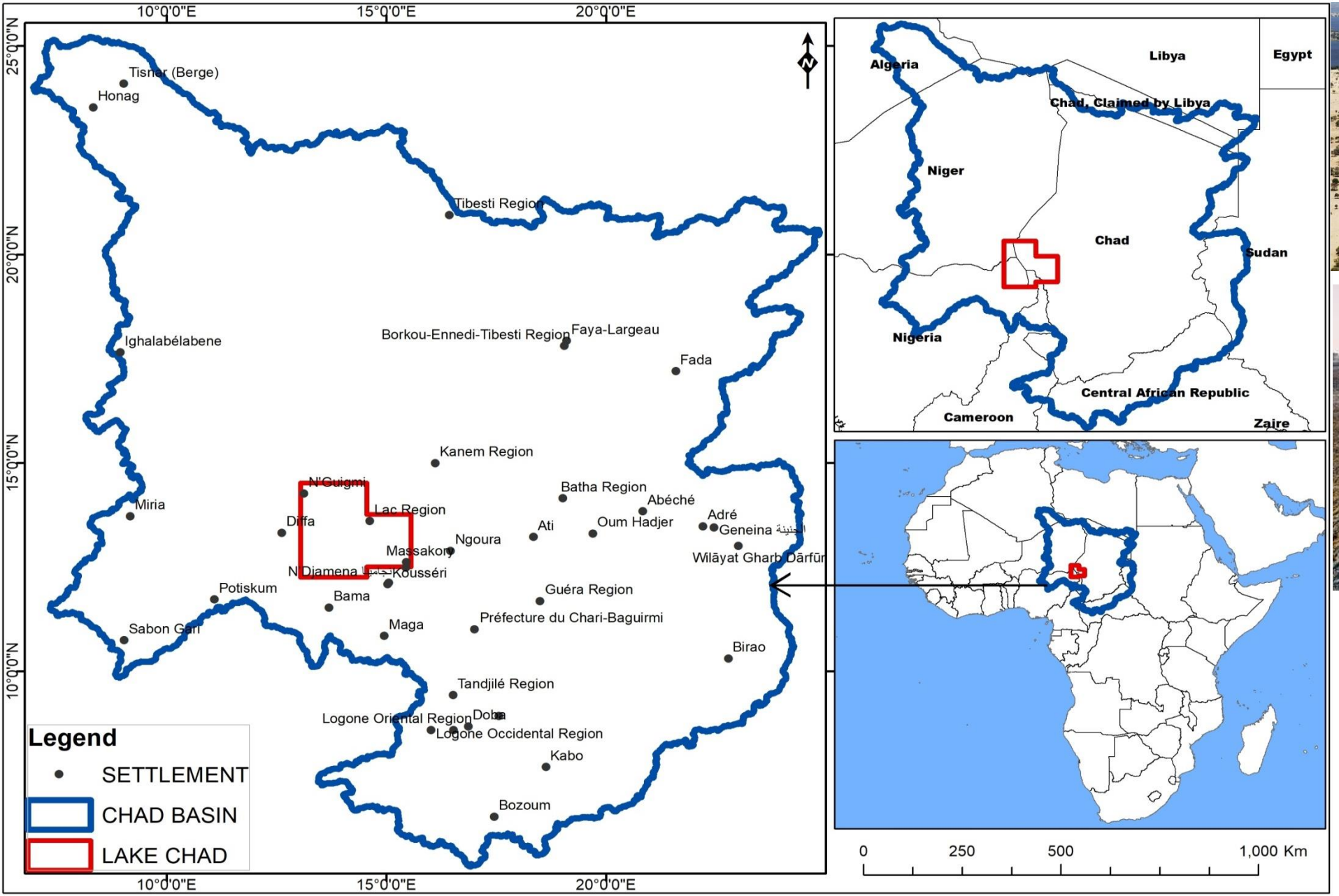


Fig. 1 STUDY AREA MAP SHOWING THE LAKE CHAD AND THE RIVER BASIN

Table 1: Data Sources and Description

N	DATA	Required Date(s)	DATA FORMAT	Scale/Resolution	DATA SOURCES	APPLICATIONS
1	Field Survey data	2018-2022 ?	??	??	??	??
2	Topography & Hydrograph chart	1950-2020	Digital & Manual	1:50,000	internet	The streams, rivers and lake in the Study Area weill be digitized from it.
3	Landsat	1972-2022	Digital	30m	www.glovis.org	LULC, NDVI, NDWI analysis
4	Sentinel -2 Optical	2015-2022	Digital	10, 20m	www.esa.int	LULC analysis & Vegetation mapping
5	SRTM	2014	Digital	30m	USGS Explorer	DEM, Topography & Stream Network
6	CRU, CHIRPS, ERA5	1970-2021	Numerical	≤ 50 km	www.badc.ac.uk	Climatic trends analysis & Anomaly plots
7	Population	2000-2020	Numerical		UN-WPP	Population density & dynamics

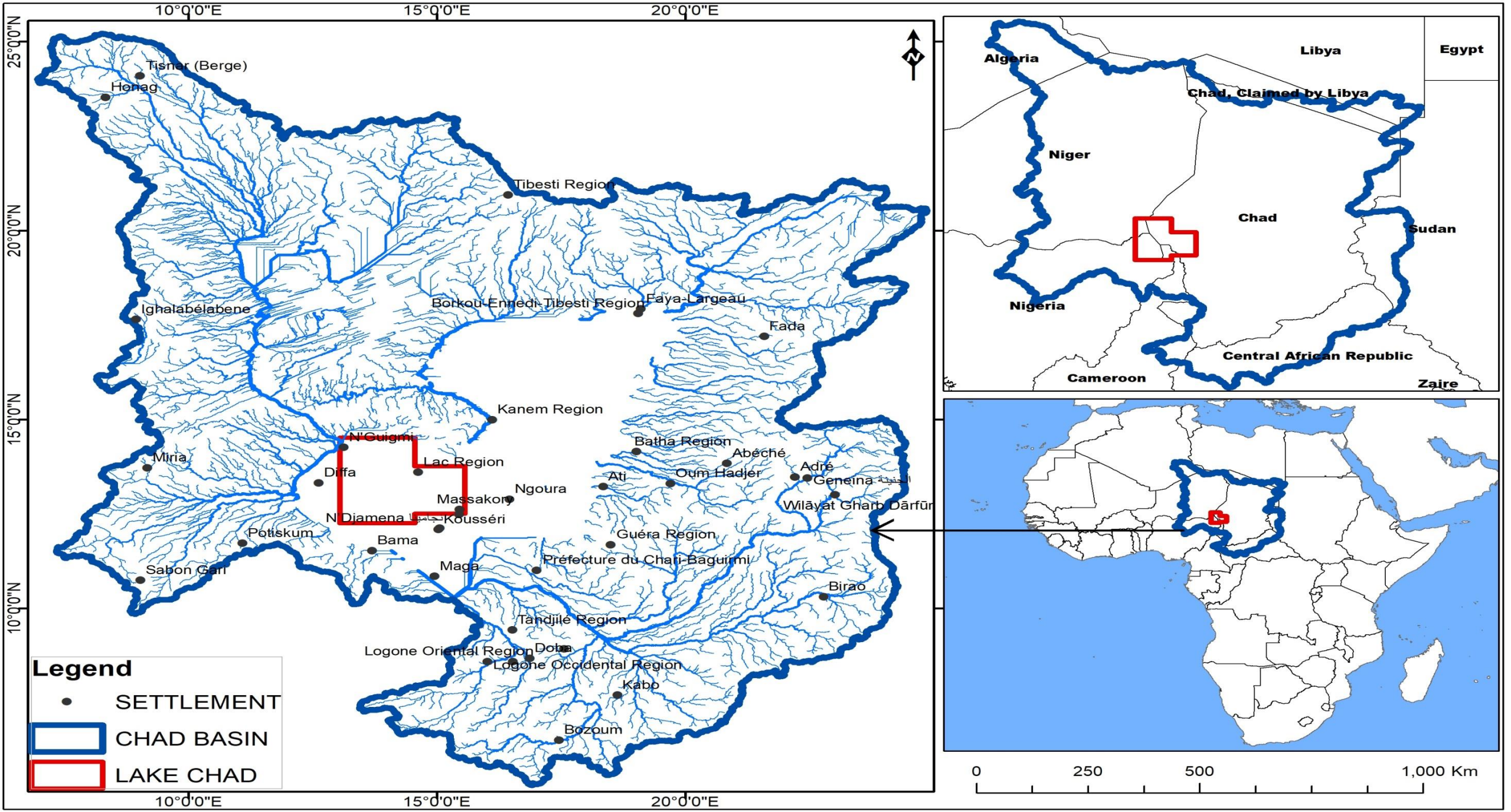
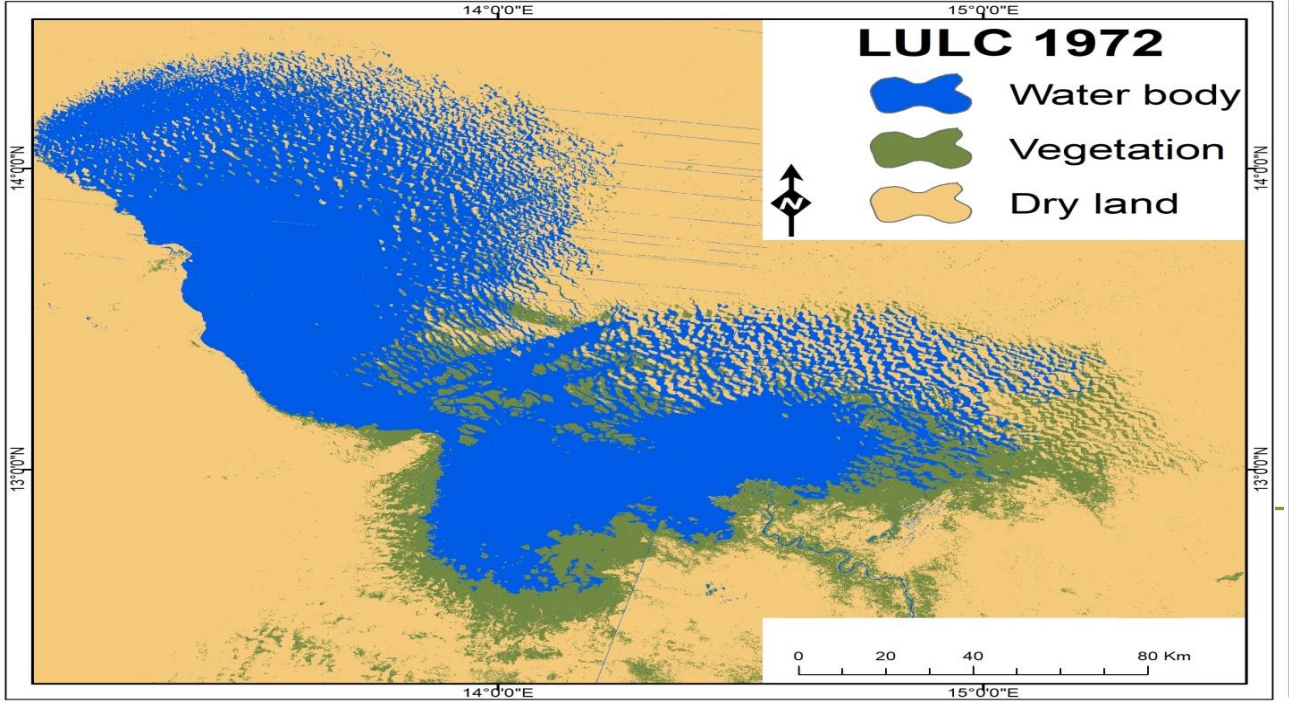
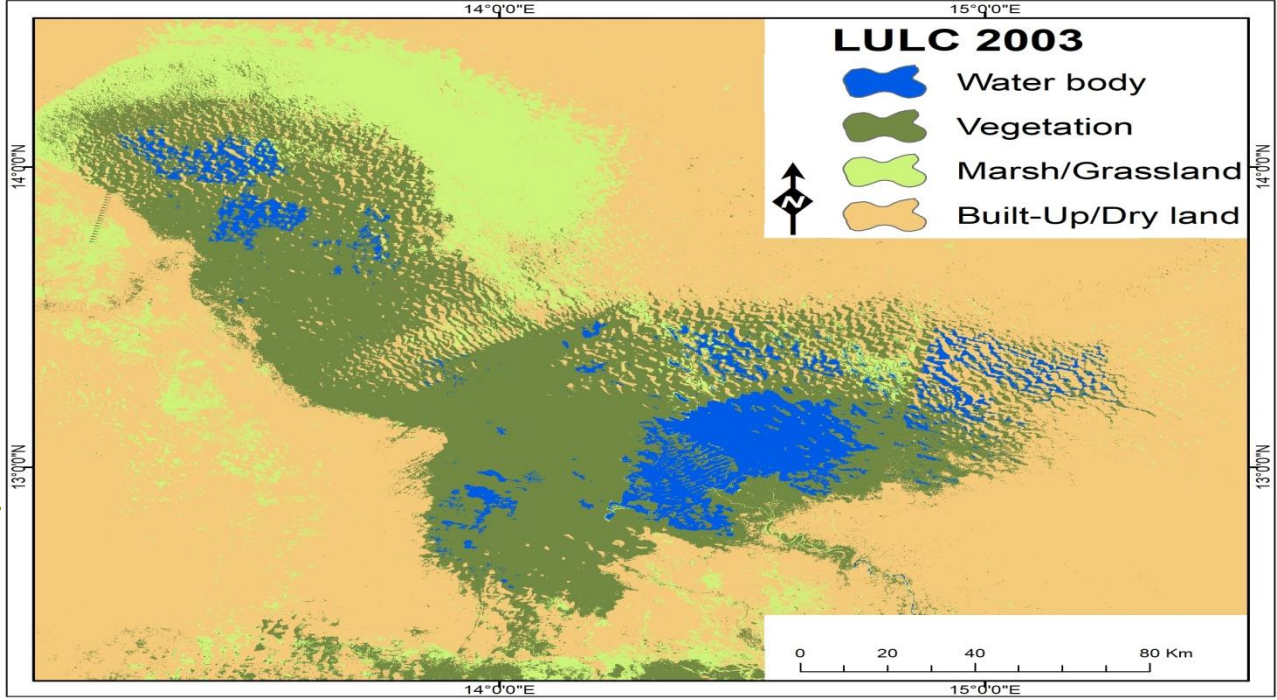
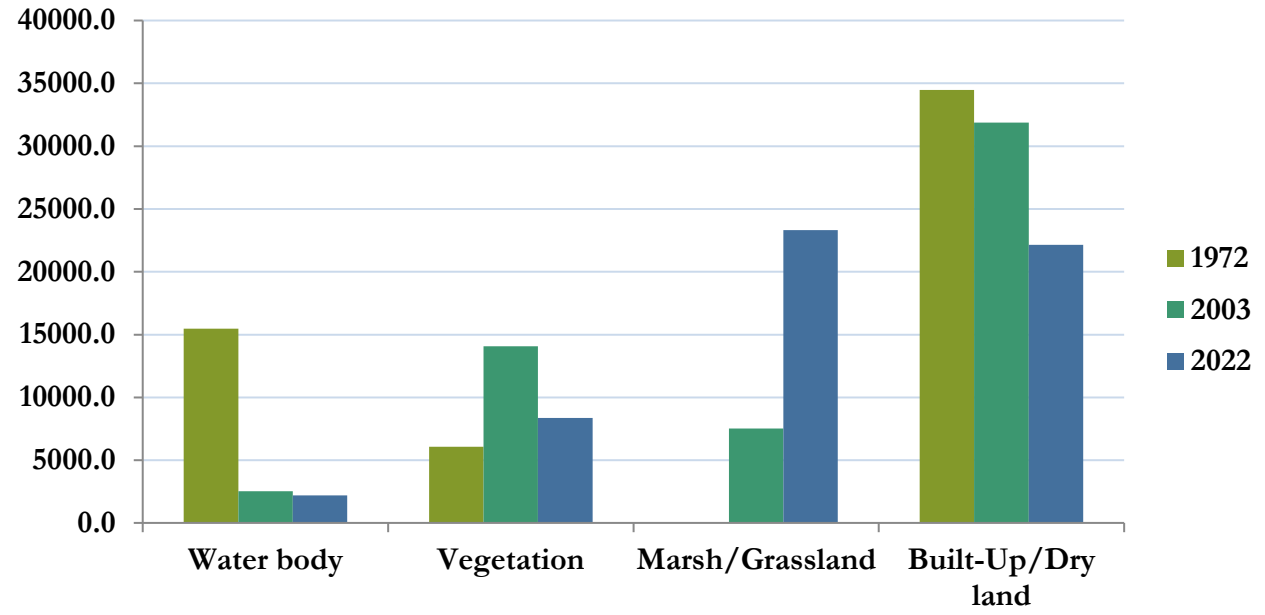
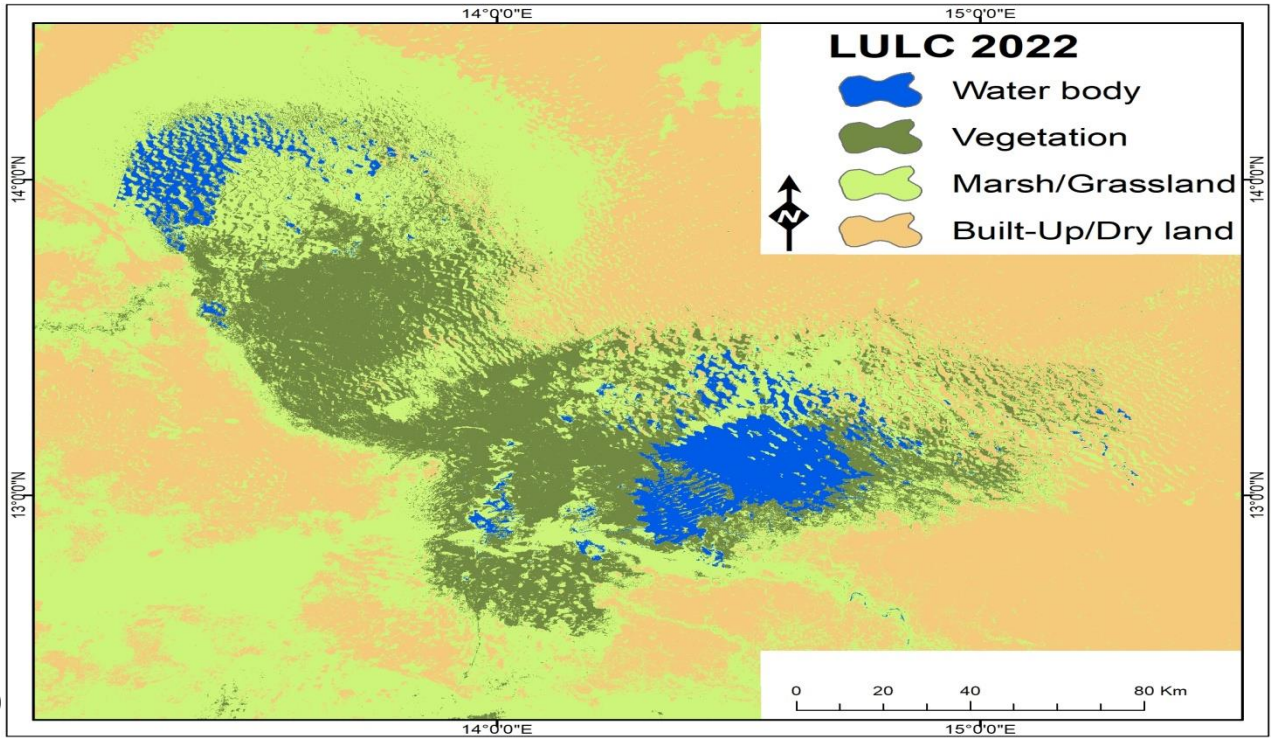


Fig. 2 STREAM FLOW OVER THE LAKE CHAD BASIN

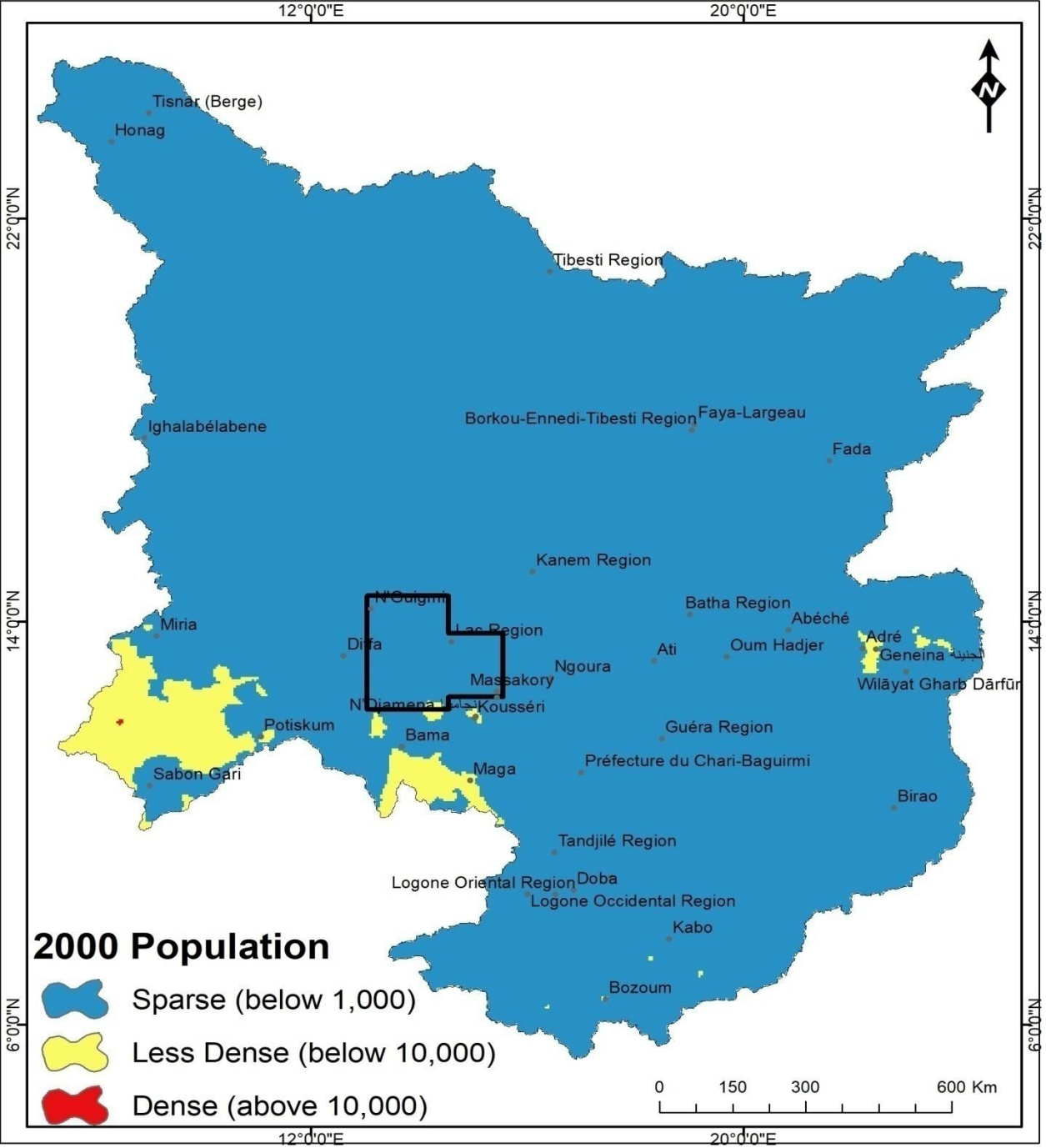








TIME SERIES GRAPH & LULC OF LAKE CHAD(1972 - 2022)



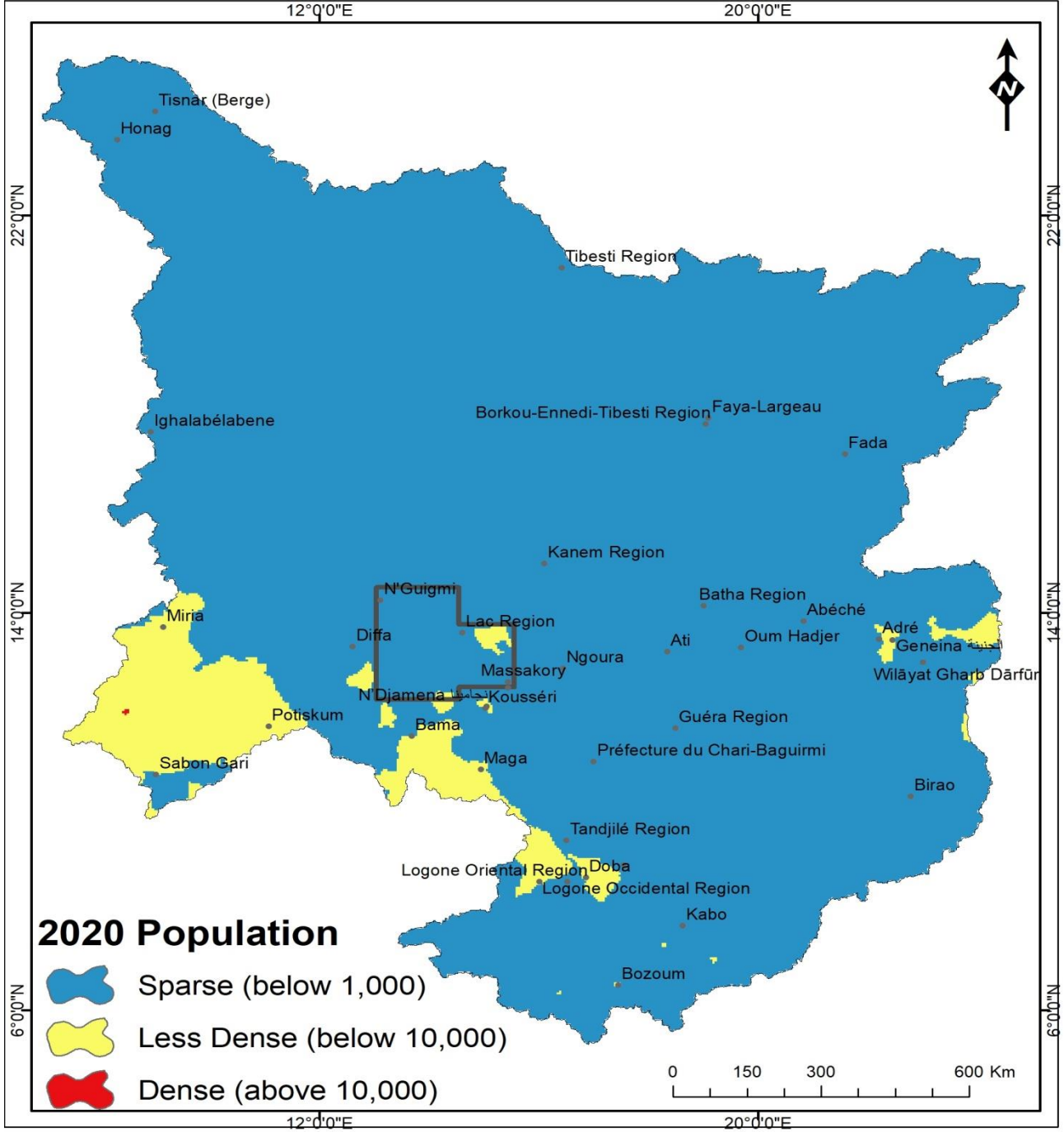
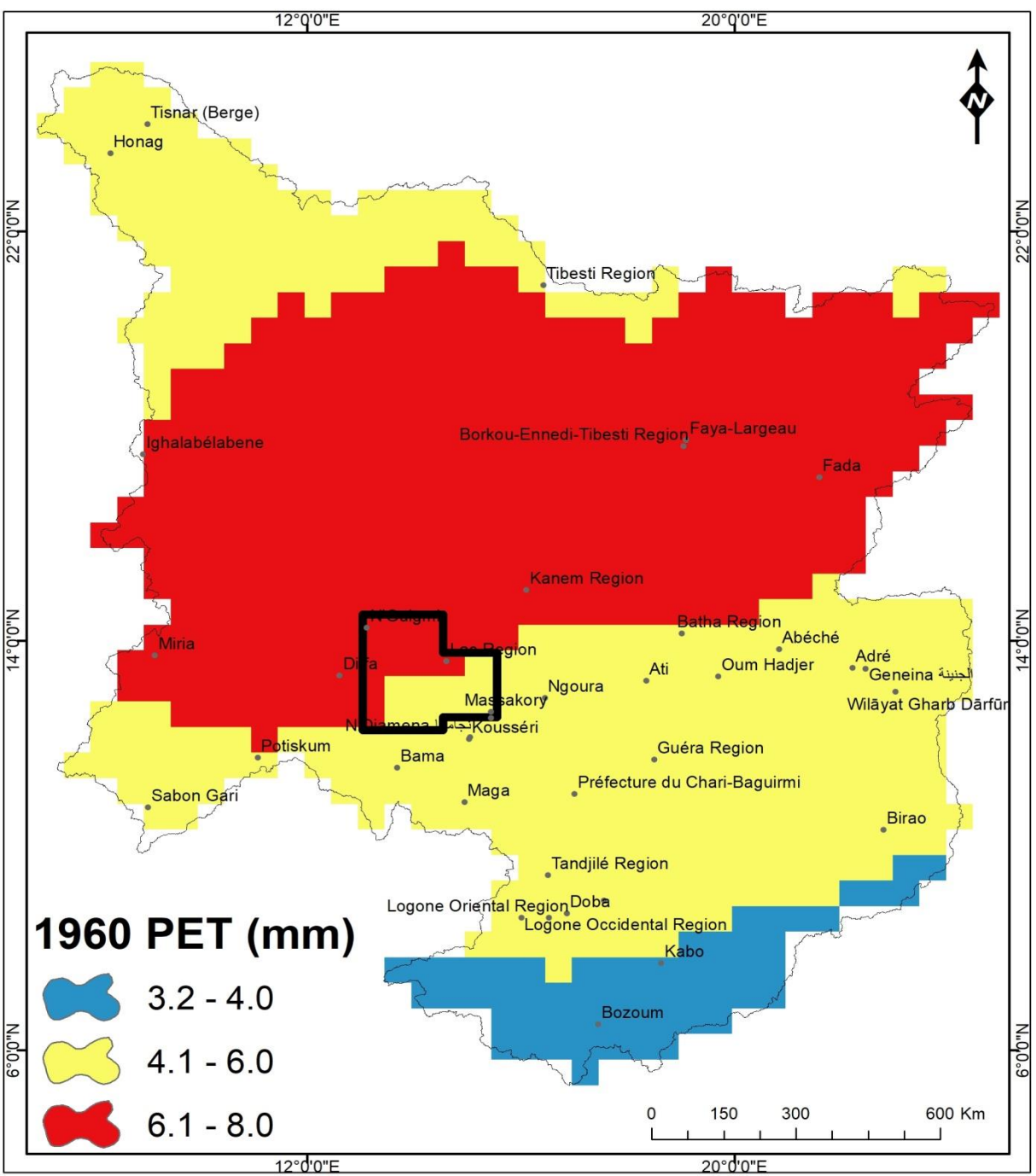


Fig. 3: SPATIAL TRENDS OF POPULATION (2000 - 2020)



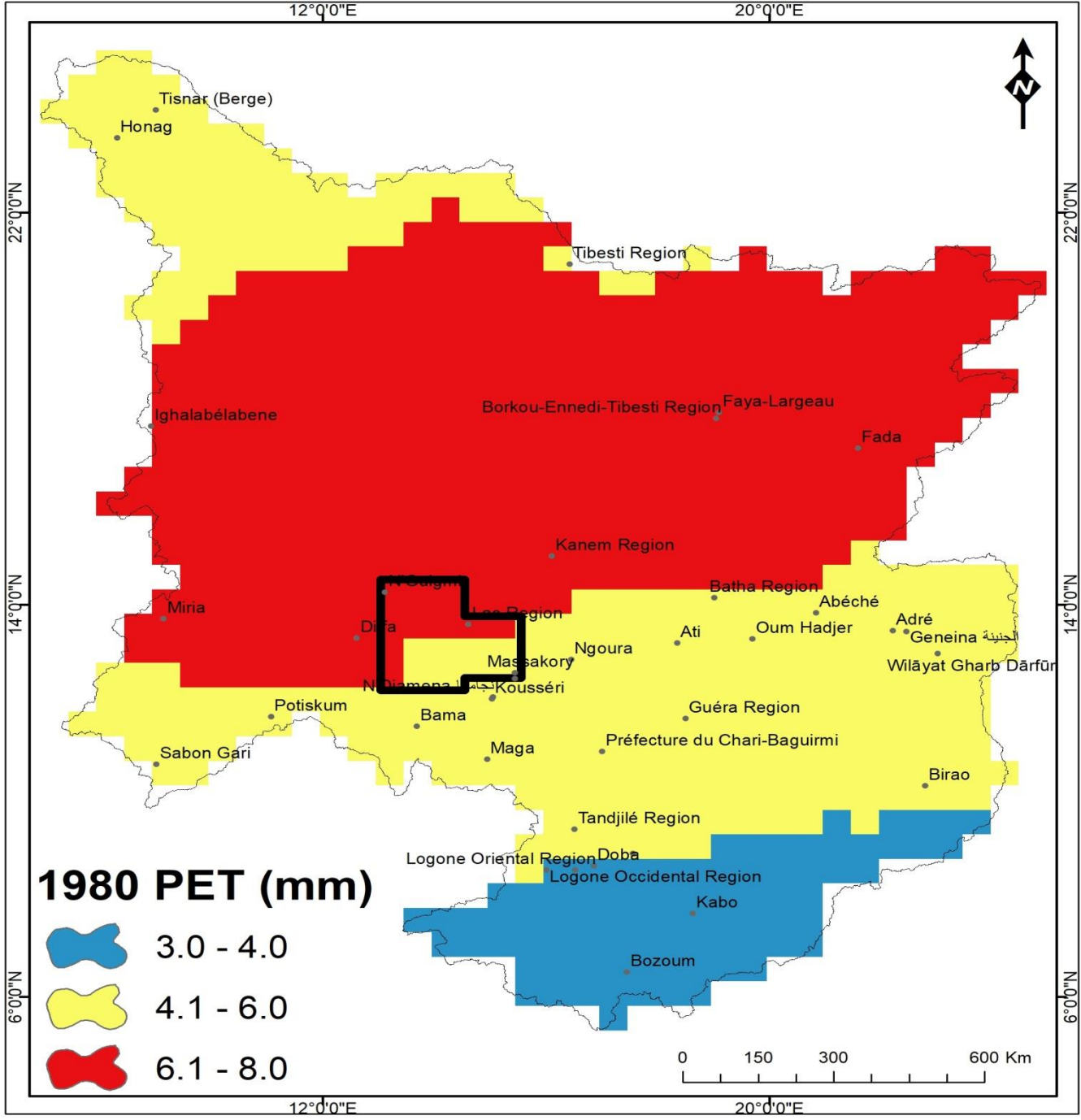
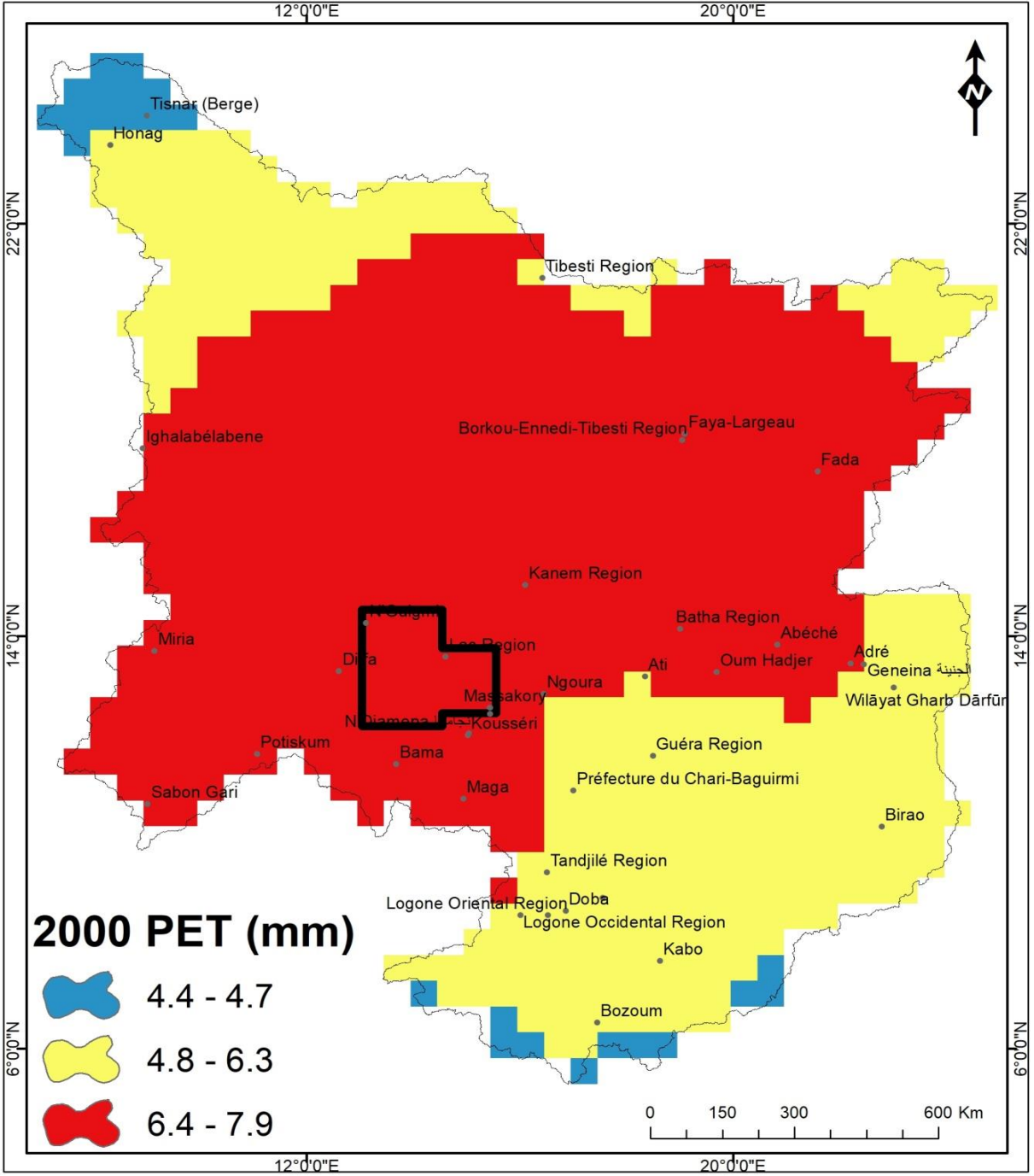
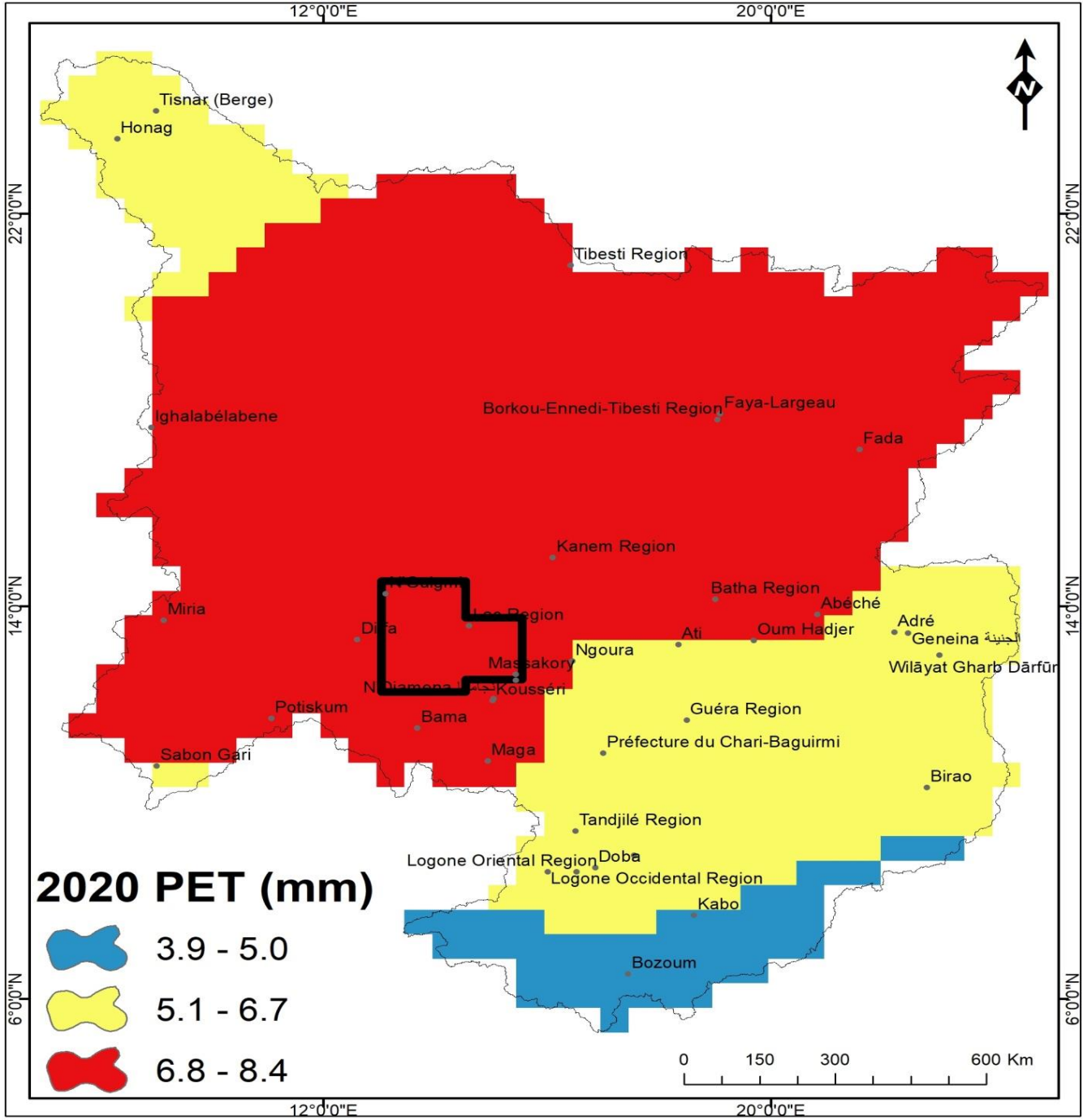


Fig.3b SPATIAL TRENDS OF POTENTIAL EVAPOTRANSPIRATION (1960 - 1980)





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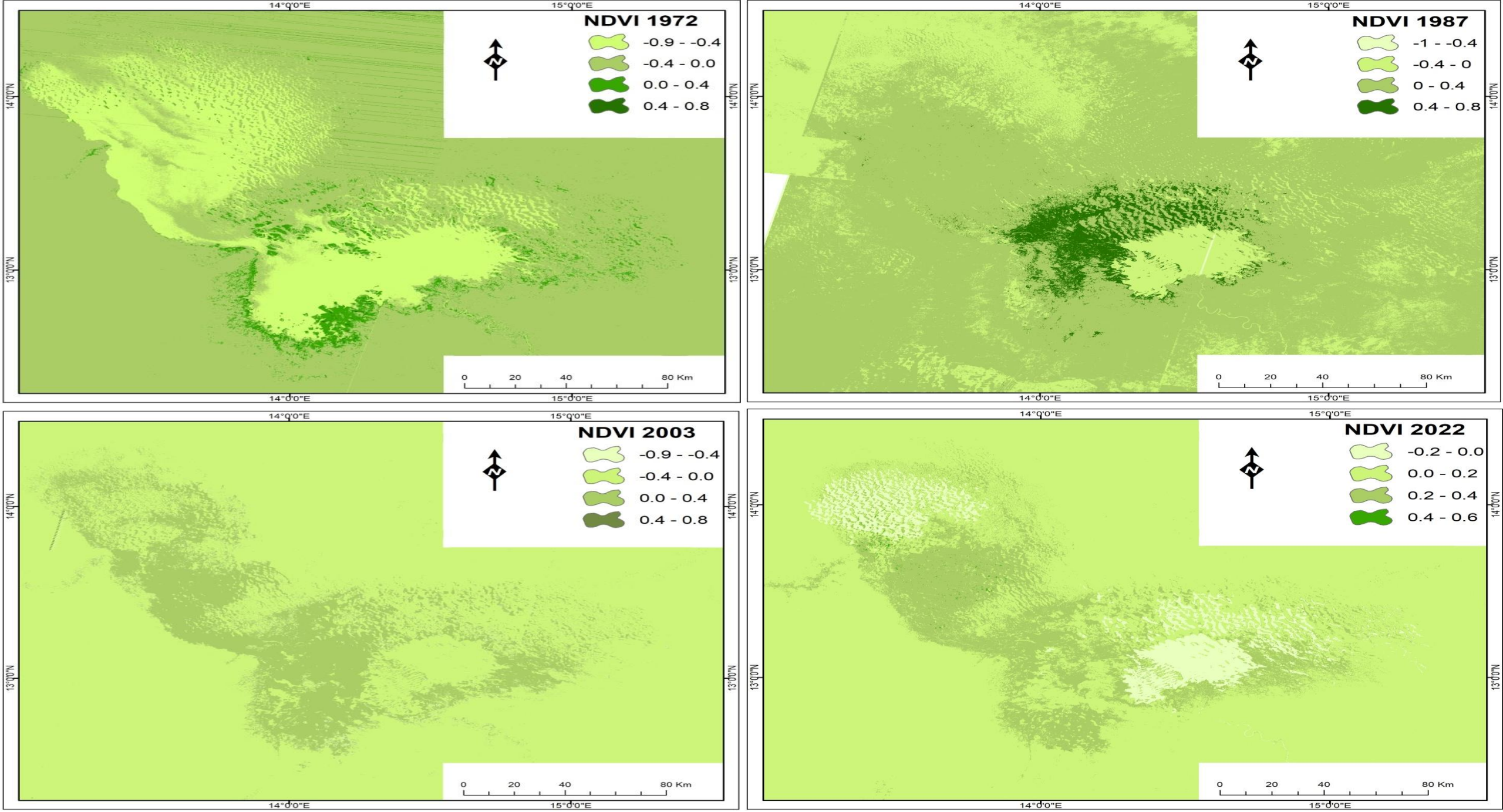


Fig. 4 NDVI-BASED VEGETATION MAPS OF THE STUDY AREA (1972 - 2022)

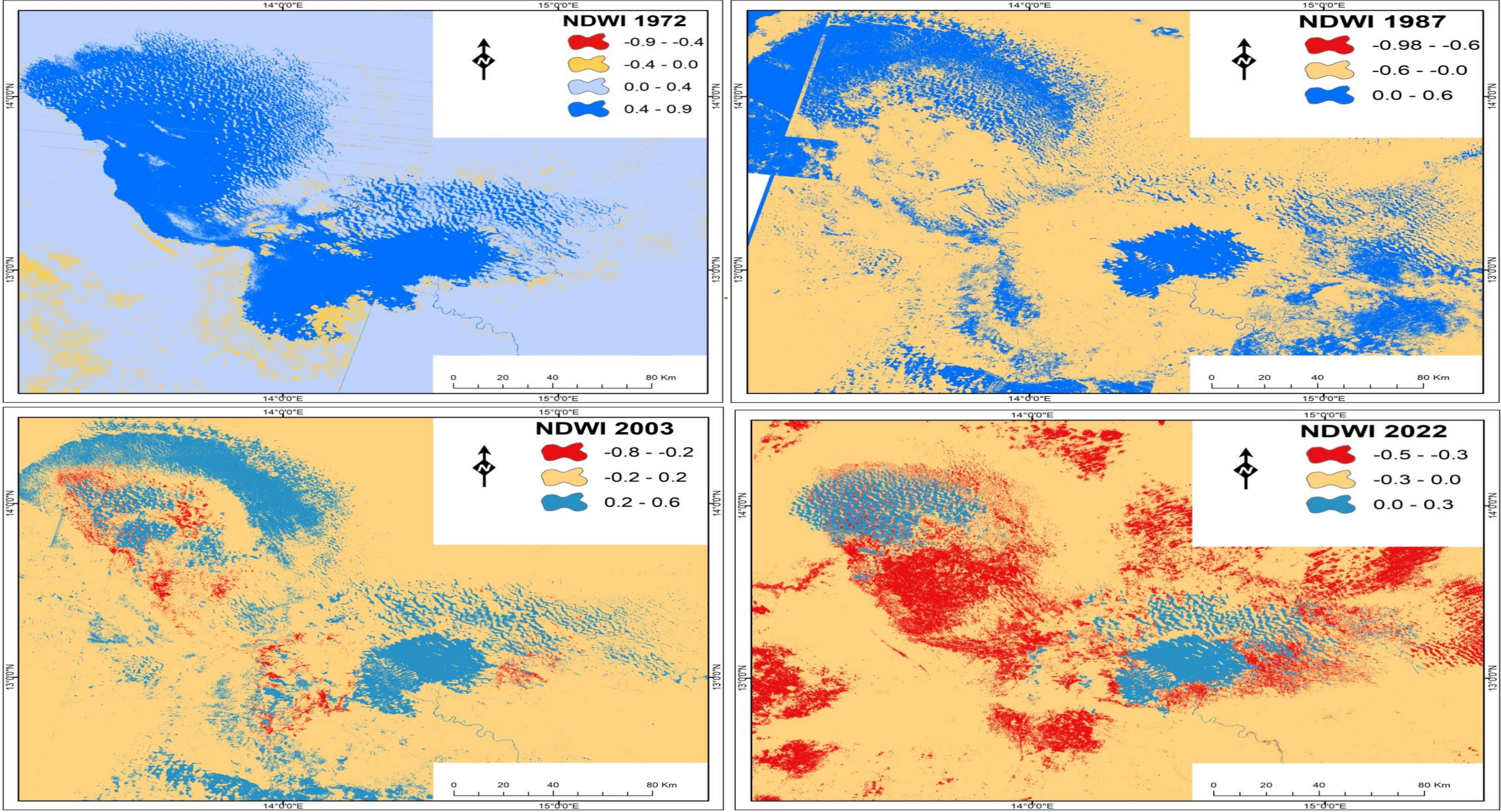
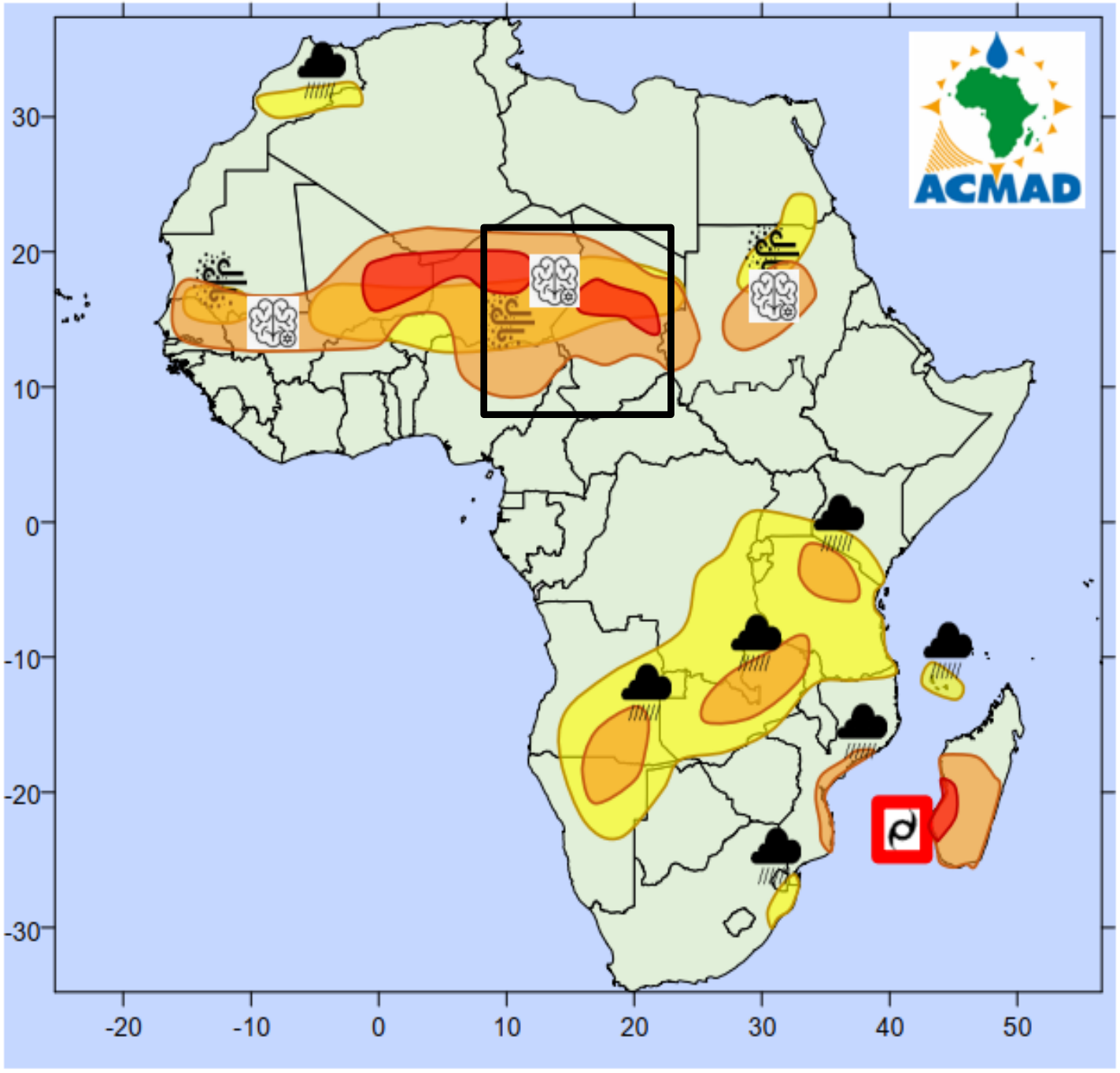


Fig. 4 NDWI MAPS OF THE STUDY AREA (1972 - 2022)

CLIMATIC EFFECTS OF DUST & MENINGITIS OVER THE STUDY AREA



MULTI-HAZARD OUTLOOK

Validity: 2022-02-06

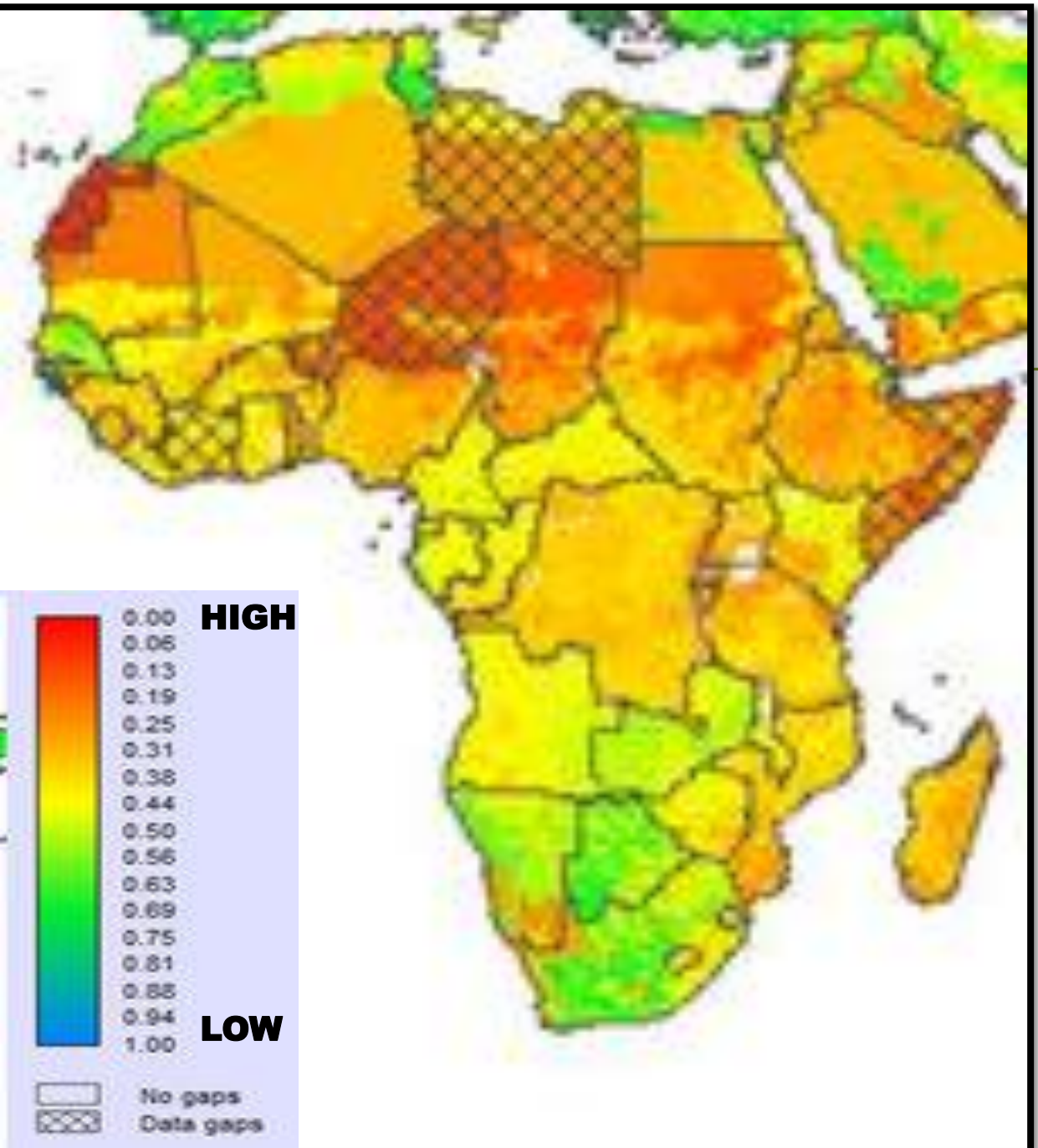
issued on 2022-02-03

Rain	Wind	Dust	Meningitis
Very heavy >100mm	Very strong >80kmh^{-1}	Very heavy >1000µg m^{-3}	Very likely
Heavy 50-100mm	Strong >65kmh^{-1}	Heavy >600µg m^{-3}	Likely
Moderate 10 - 49mm	Moderate >50kmh^{-1}	Moderate >400µg m^{-3}	Less likely
Light 1 - 10mm	Light <50kmh^{-1}	Light <200µg m^{-3}	

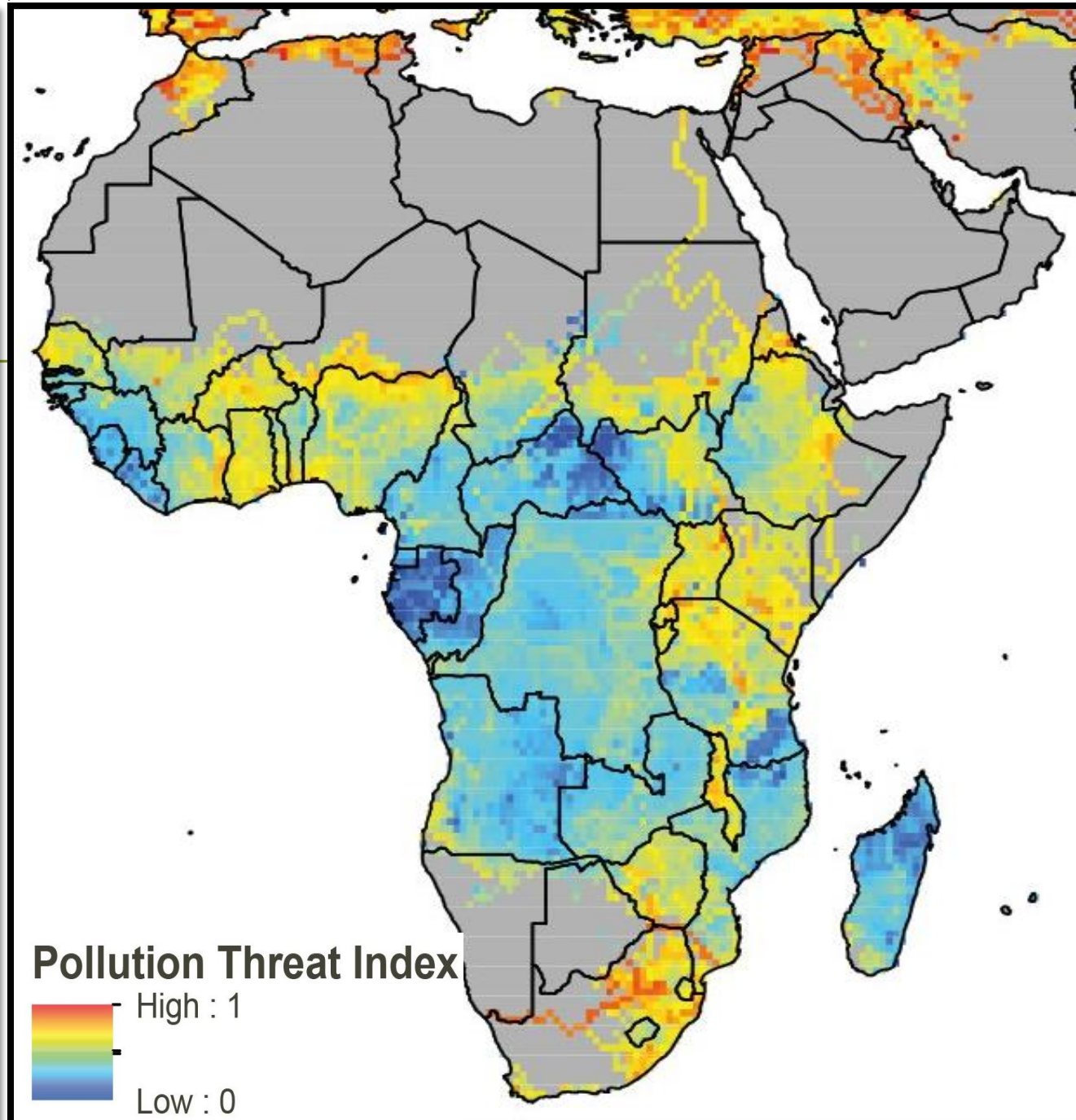
Tropical Cyclone

Source: ACMAD/ClimSA

Aggregated Water Security Index (Animesh *et al*, 2016)



Water Pollution Threat Index (Oxford Water Network, 2015)



CONCLUSION AND RECOMMENDATION

- The satellite-based monitoring of the Lake Chad Basin has further enhanced water resources management, which are reservoirs operations, surface water dynamic detection, and drought effect monitoring, shrinkage extent extraction, and with promising abilities in the future.
- Hence, with the applications of remote sensing techniques, policy makers and researchers can have alternate means of managing surface water as well as provide suitable answers for present concerns.
- Some of the technologies and methods presented are well established, while others hold promise but require **extensive field testing** and **validation**, and **scaling**.
- Overall, combining methodologies and integrated database management would surely provide a comprehensive and instructive depiction of WASH usage.
- Therefore, considering future climate change adaptation plans, further **extensive field experiments** over the Study Area is highly recommended.

THANK YOU