KATHMANDU UNIVERSITY

DHULIKHEL, KAVRE

Land Use and Land Cover Change Analysis

in Kailali District (2014 - 2023)

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1. Introduction

1.1 Background

Land Use and Land Cover (LULC) changes are critical for understanding environmental transformations, urban expansion, deforestation, and agricultural shifts. This study analyzes LULC changes in Kailali District over a period of nine years (2014-2023), with an interval of five years, using multi-temporal satellite imagery.

1.2 Objectives

The objectives of this study are:

- To classify the LULC of Kailali District for the years 2014, 2019, and 2023.

- To assess the changes in land cover over time.

- To analyse trends of urbanization, deforestation, and land conversion.

- To provide insights for sustainable land-use planning and environmental management.

2. Data and Methodology

2.1 Data Collection

Satellite images were acquired from **USGS Earth Explorer**, ensuring:

- Cloud cover <10%.

- Same seasonal timeframe for all years.

- Landsat 8 (OLI/TIRS).

2.2 Image Preprocessing

- Preprocessing: The images were georeferenced and projected to WGS 84 / UTM Zone [X].

- Land Cover Classification: A Supervised Classification method was implemented to categorize LULC classes:

    i.   Water Bodies
    ii.   Vegetation
    iii. Settlement
    iv.   Agricultural Land
    v.   Bare Soil

- Software Used: ArcGIS Pro was employed for classification and visualization.

- **Clipping:** The study area was extracted using an AOI shapefile.

2.3 Supervised Classification

- Training samples were selected for key LULC classes: Water Body, Vegetation, Settlement, Agricultural Land, and Bare Soil.

- Interactive Supervised Classification was done.

3. Results and Discussion

3.1 Land Cover Maps

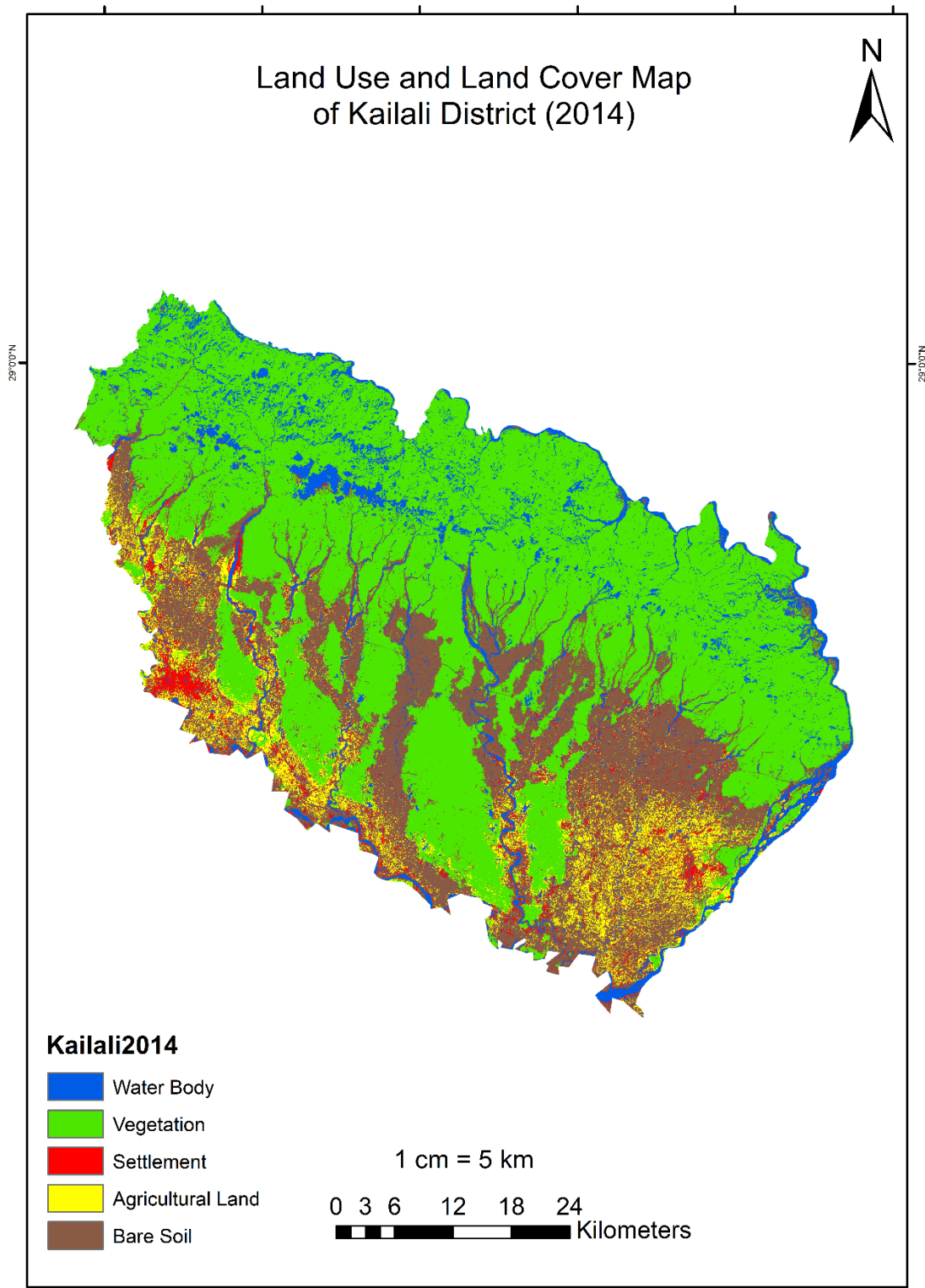The classified LULC maps for the years **2014, 2019, and 2023** are presented below:

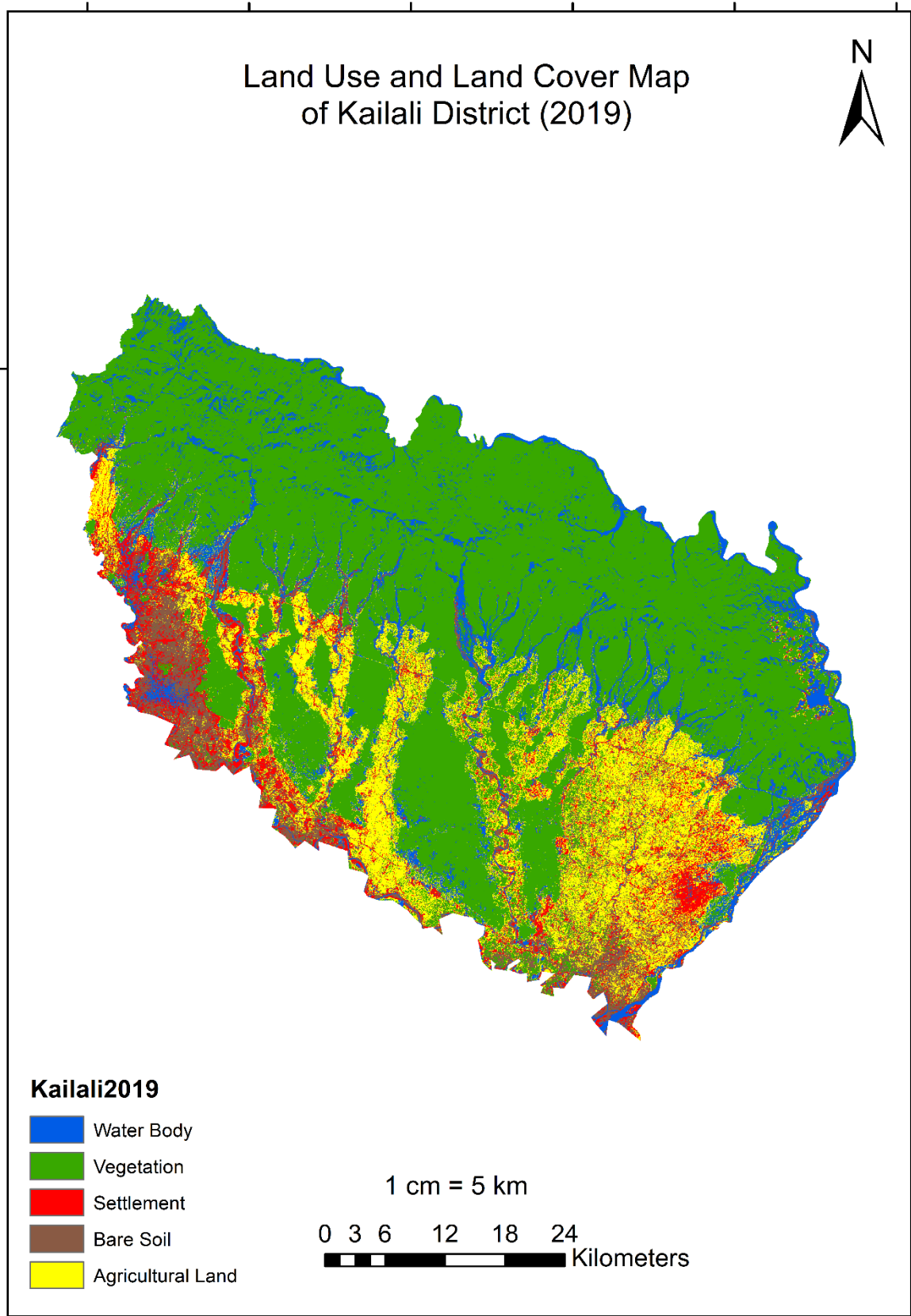*Figure 1: LULC Map for year 2014*
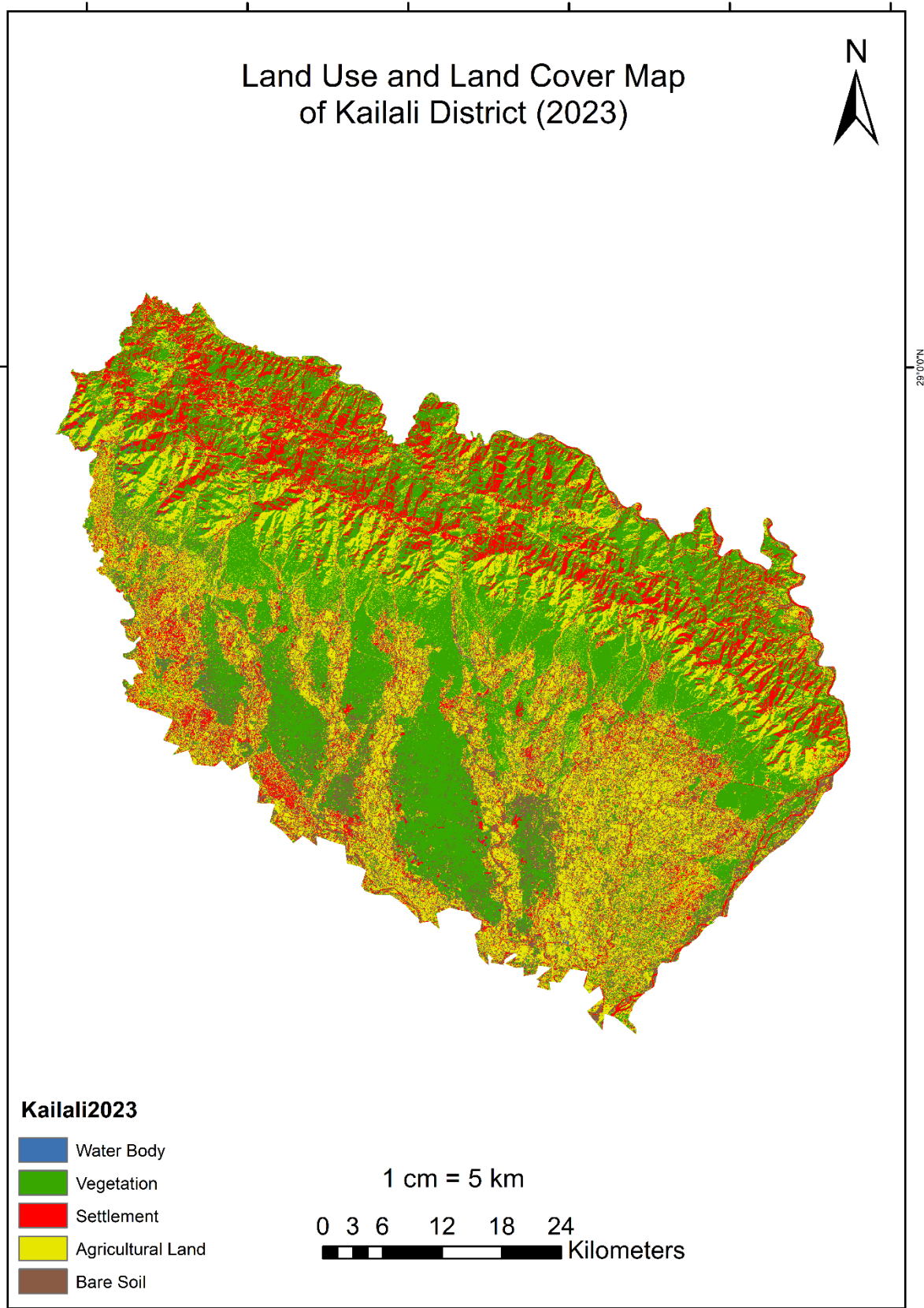
Figure 2: LULC Map for year 2019

Land Use and Land Cover Map
of Kailali District (2023)

N

Kailali2023

- Water Body
- Vegetation
- Settlement
- Agricultural Land
- Bare Soil

1 cm = 5 km

0 3 6   12   18   24
Kilometers
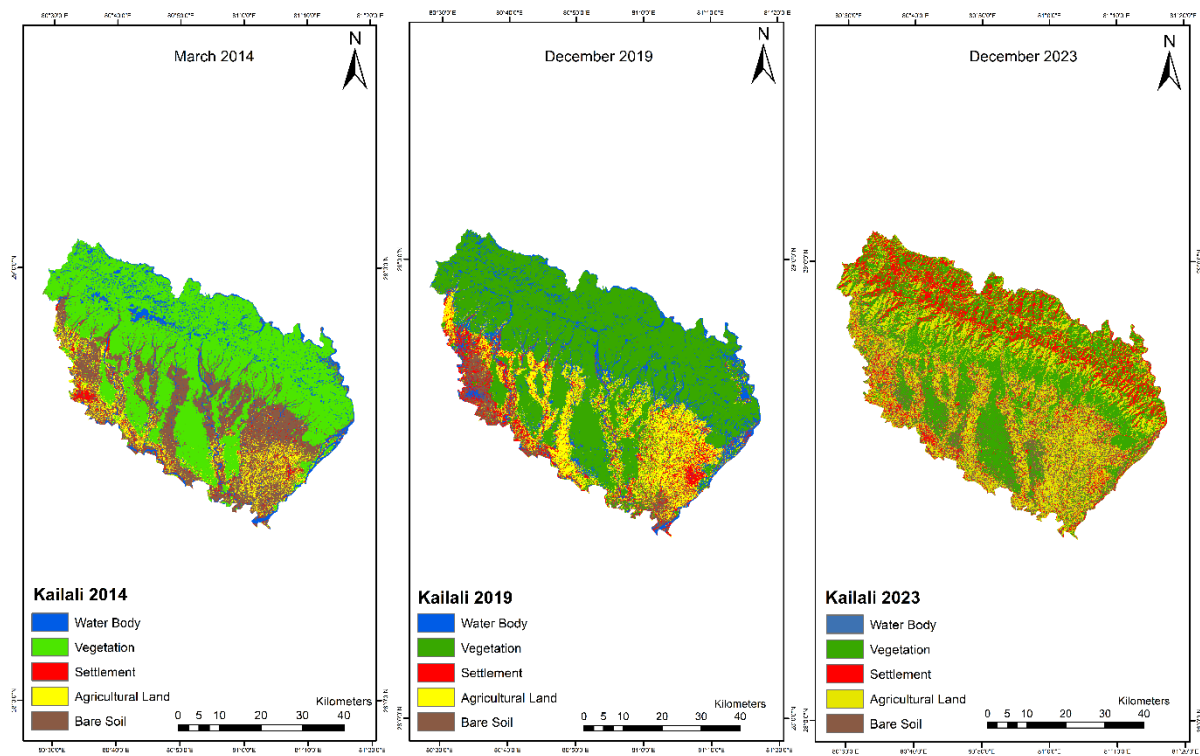
Figure 3: LULC Map for year 2023

Figure 4: Spatio-Temporal Map of Kailali District

3.2 Observed Changes

- **Urban Expansion:** Significant increase in settlement areas, indicating population growth and infrastructure development.

- **Deforestation:** Reduction in vegetation cover, likely due to urbanization and agricultural expansion.

- **Agricultural Land Changes:** Increase in cultivated areas, possibly due to shifts in land management practices.

- **Water Bodies:** Minimal or moderate variations due to seasonal or climatic influences.

4. Conclusion and Recommendations

4.1 Conclusion

Over the **2014-2023 period**, Kailali District has experienced substantial **land cover changes**. **Urban areas have expanded**, while **vegetation cover has decreased** due to human interventions. These trends suggest increasing environmental pressure, necessitating **sustainable land-use policies**.

4.2 Recommendations

To promote sustainable land use while balancing development and conservation, the following measures are suggested:

- **Planned Urban Expansion:** Proper zoning and urban planning should be enforced to regulate settlement growth while maintaining ecological balance.

- **Reforestation and Afforestation:** Large-scale tree plantation initiatives should be implemented to counteract the loss of vegetation.

- **Water Resource Conservation:** Lakes, rivers, and wetlands should be protected from encroachment and pollution through sustainable water management policies.

- **Enhanced Research and Analysis:** Future studies should integrate **high-resolution satellite imagery** and **machine learning techniques** to improve classification accuracy and provide quantitative assessments of LULC changes.

Land Cover Changes Over Time: A Study of Kailali District (2014 - 2023)