Assessing spatial-temporal patterns of rain-fed and irrigated agriculture using time-series earth observation in Baringo, Kenya

Faith Kandie[1] , Bartholomew Kuria[1] , Mark Boitt[1] , Harison Kipkulei[2]
[1]Dedan Kimathi University of Technology, Inst. of Geomatics, GIS & Remote Sensing, Kenya
[2]Leibniz Centre for Agricultural Landscape Research (ZALF), Land Use and Governance, Germany

Introduction

- Global ***food security*** is linked to agricultural land management practices such as irrigation.
- Global map of irrigation area mapping (GMIA) exposed a 311 % **underestimation** in Kenya, disparity attributed to **inadequate** and **unreliable** statistics.
- Baringo county is a marginalized ASAL faced with ***food insecurity*** and remarkable ***LULC changes.***
- Food security threat is alarming with 46%, 32% and 21% households have ***zero, stressed*** and **crisis** coping mechanisms.
- Baringo south sub county, ranked worst in food security, has the highest **irrigation potential** of 180 Km ^{2} , 15.8 Km ^{2} documented while the small scale irrigation remain unaccounted.
- This study monitors spatial and temporal agricultural land use trends, and extents of irrigated land for a **framework** towards irrigation.

Objectives

i. Monitoring existing agricultural land-use employing Landsat time series for 1989,2002, 2012 and 2022.

Study area and Methods

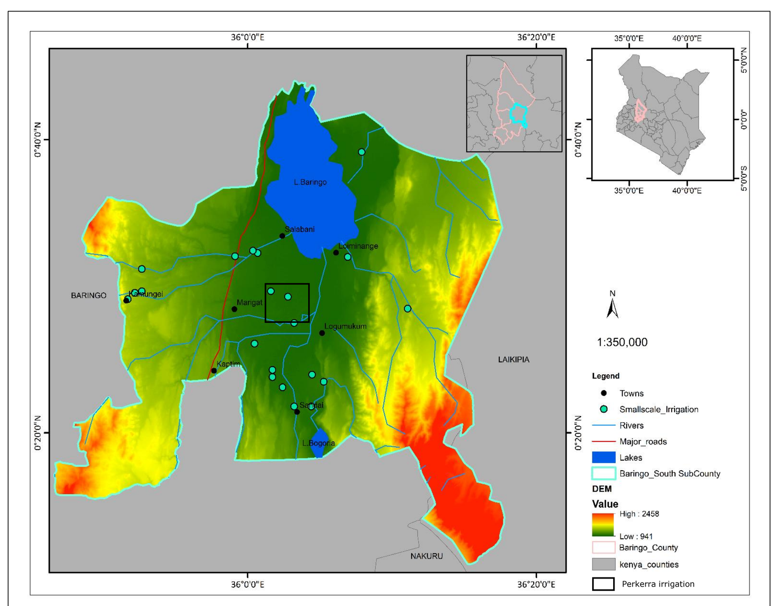

Figure 1. Baringo south sub county, Kenya

- Marginalized and ASAL area
- Total area of 1,678 Km ^{2} ,180Km ^{2} potential for irrigation, 15.8 Km ^{2} irrigated land
- Average rainfall in the lowlands is 600 & 1000-1500mm in the highlands
- Temperatures in the lowland reach 35°C & 10°C in highlands

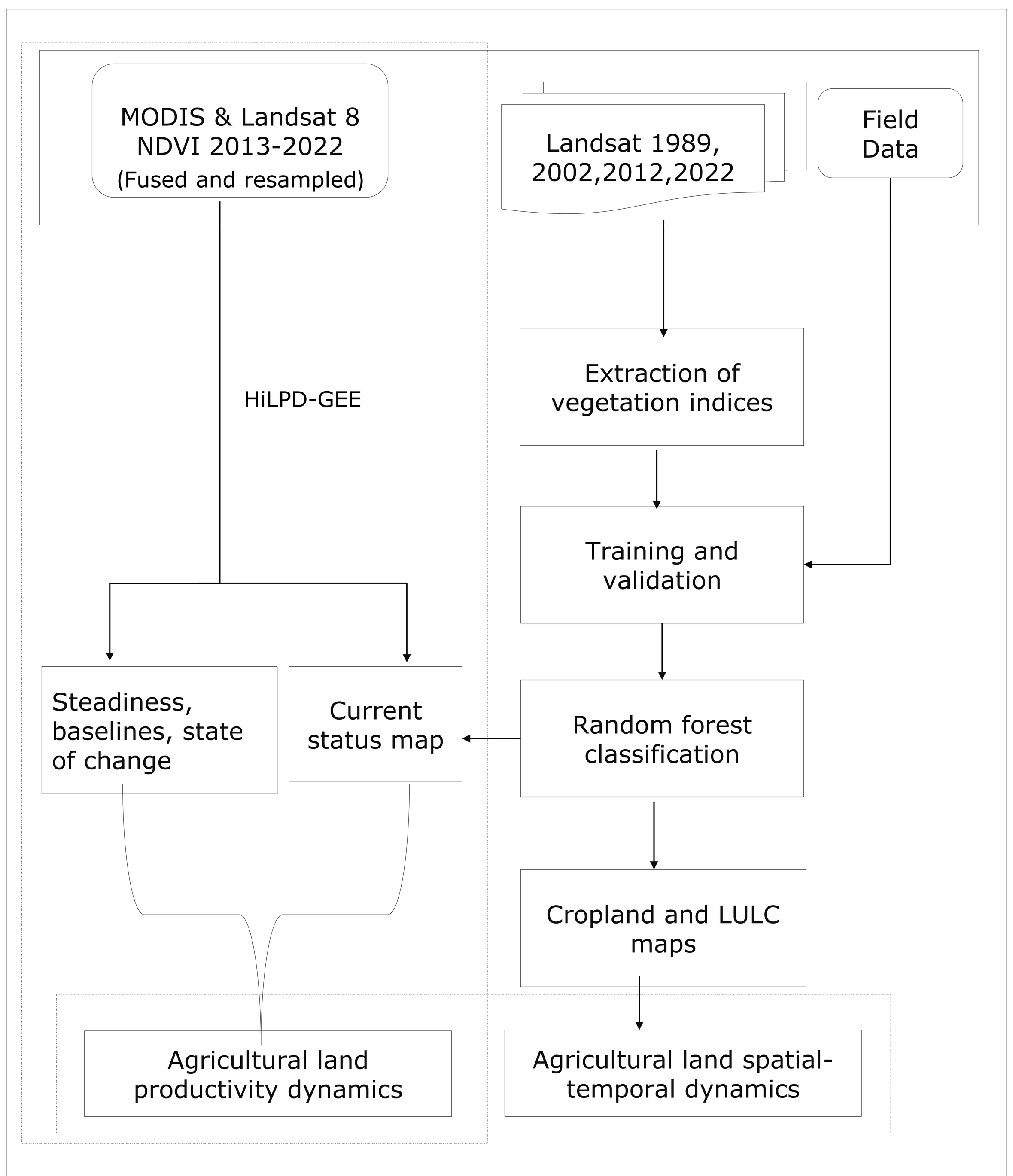

Figure 2. Methodology workflow

Results

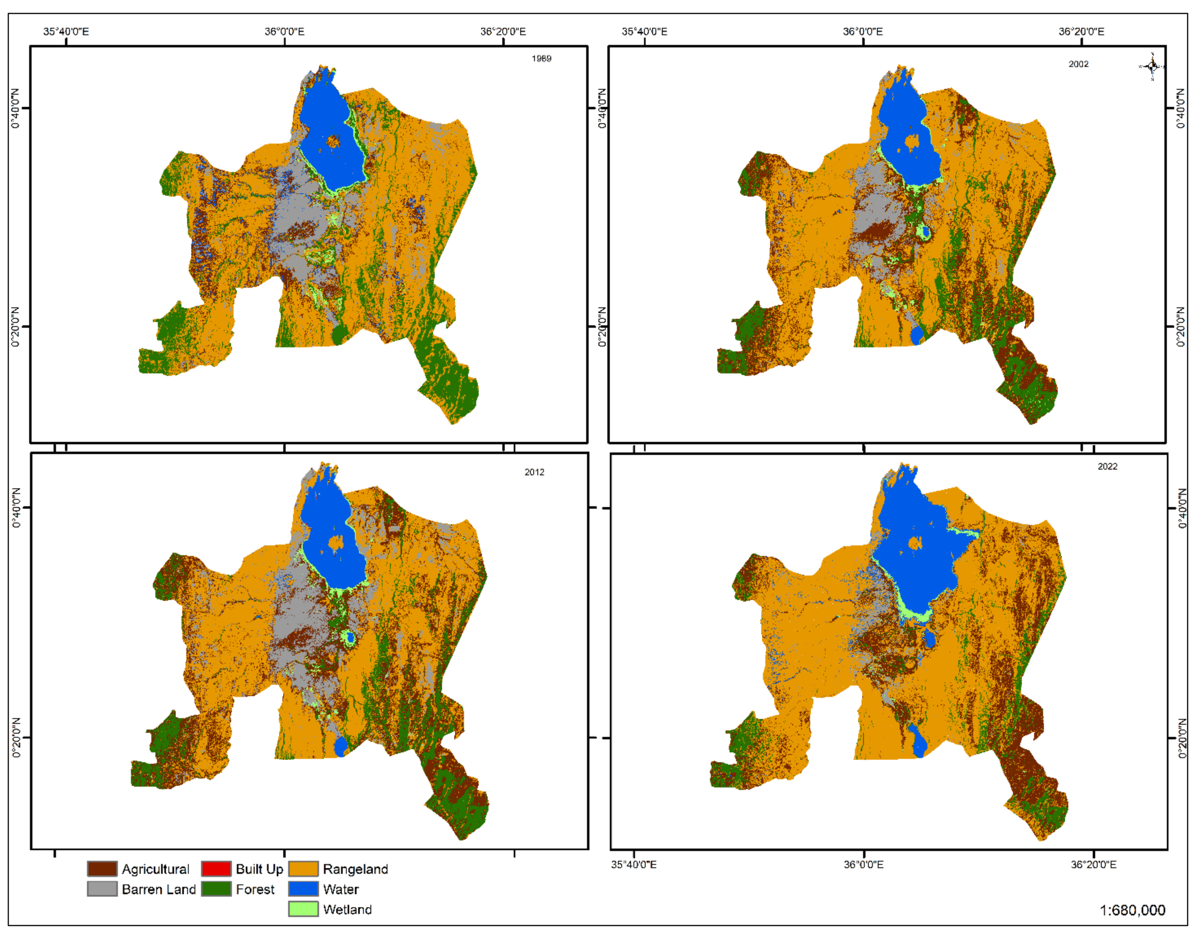

Figure 3. Maps showing agricultural land and other LULC spatial patterns

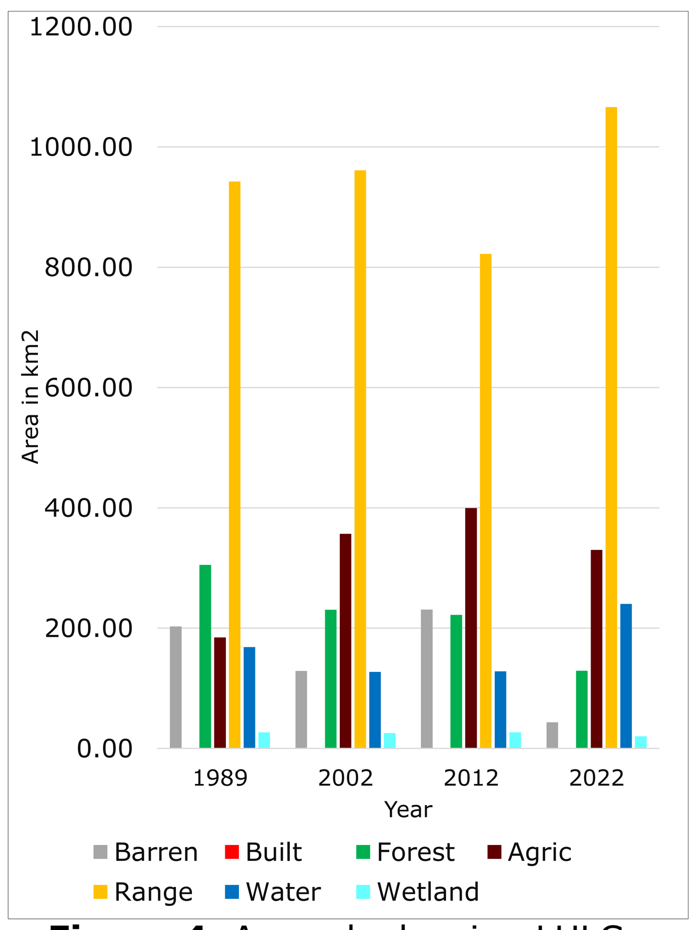

Figure 4. A graph showing LULC areal coverage over the years

- ✓ In **Fig.3**,the most dominant land cover is the range land, agricultural land and forest.
- ✓ Agricultural land is dominant in the highland areas and at the central lowlands
- ✓ Agricultural land has increased from 1989 to 2012 where there is a decline
- ✓ The current land is 333km^2 whereas the total arable land documented is 418km^2

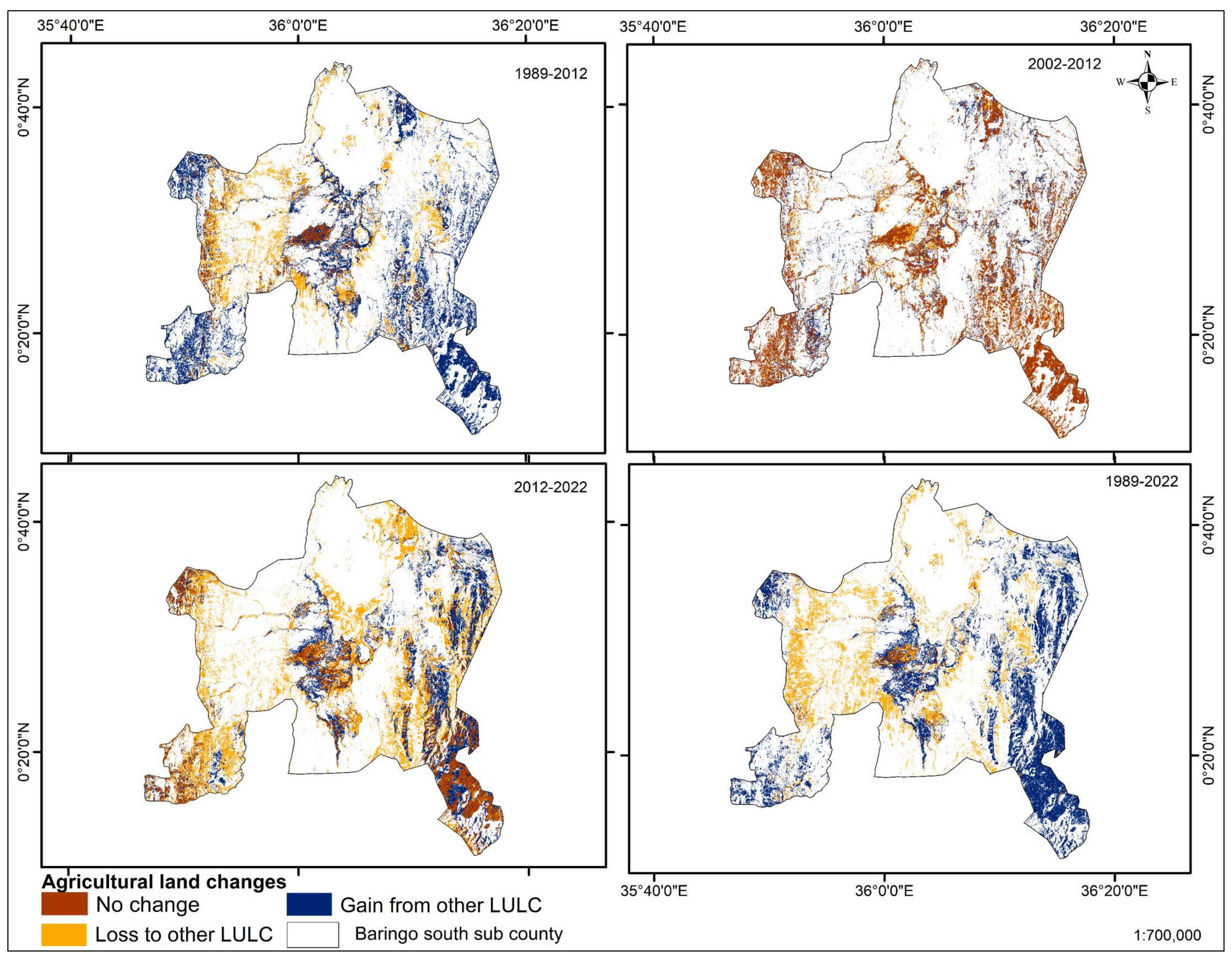

Figure 5. Maps showing agricultural land change analysis

- ✓ Agricultural land experiences variability through the years
- ✓ Agricultural land was most stable in 2002-2012**, Fig 5**
- ✓ The most stable area centrally located in the study is at the Perkerra irrigation scheme
- ✓ In **Fig 6**, the greatest loss and gains to agricultural land occur with rangeland

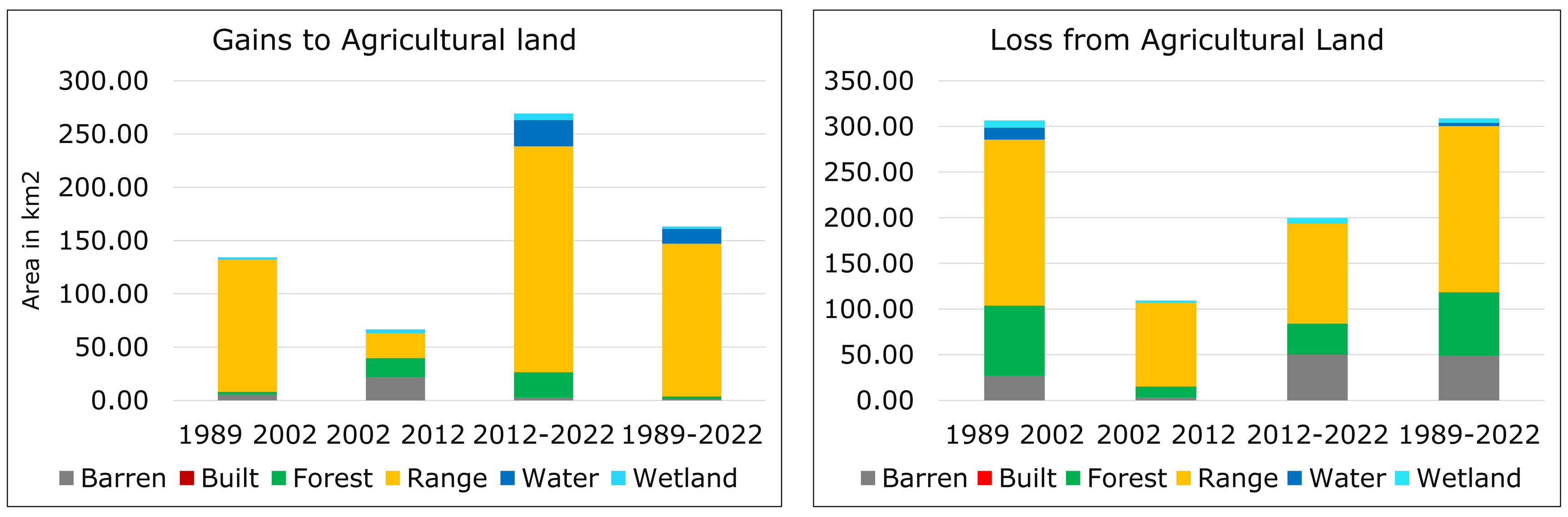

Figure 6. Graphs showing agricultural land mutual conversion with other LULC

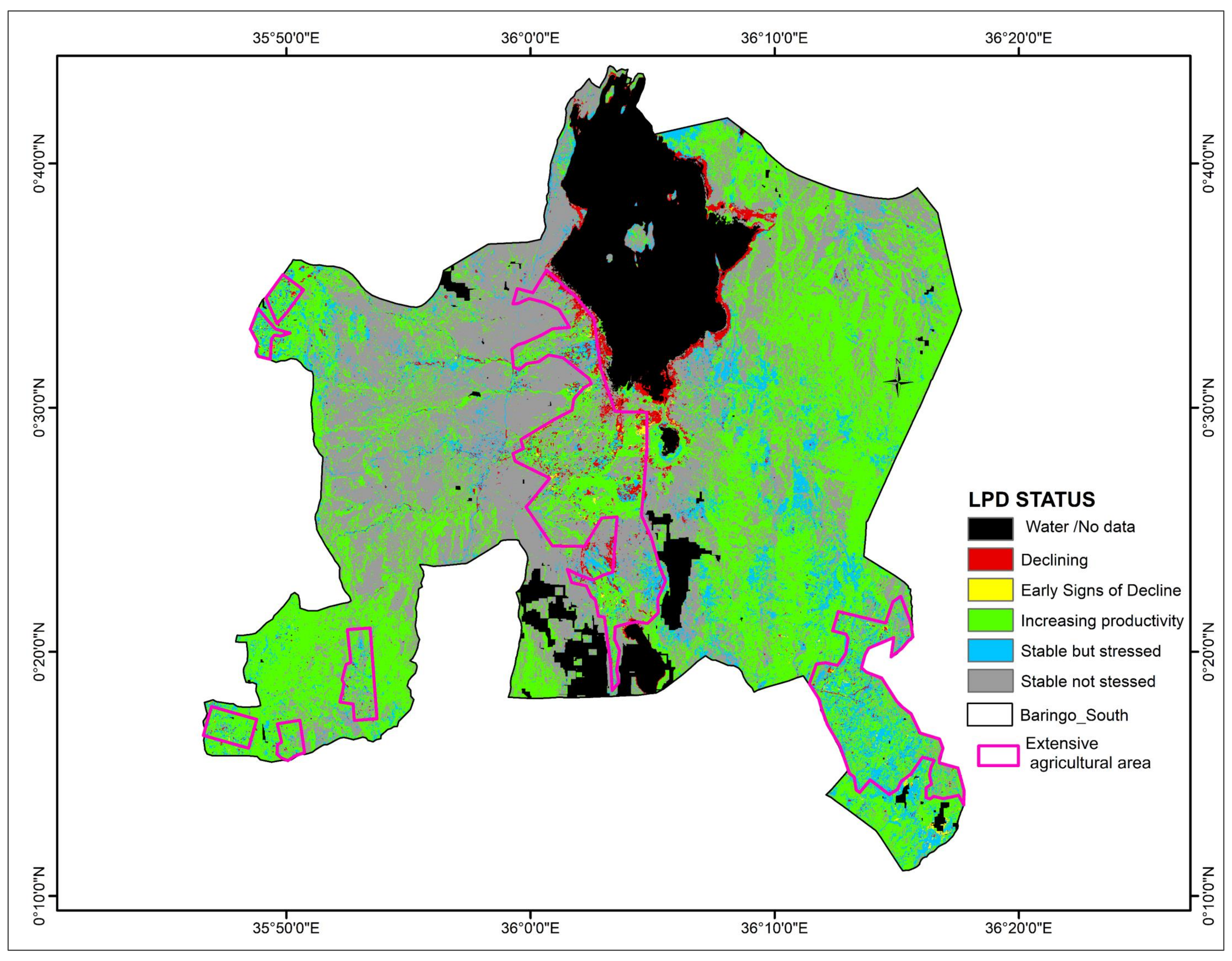

Figure 7. Map showing agricultural land productivity Dynamics

Agricultural land productivity is largely in increasing productivity, stable not stressed and few areas showing stability but stressed

Discussion & Conclusion

- Agricultural land has fluctuated over time with highest increase and decrease in (1989-2002) and (2012-2022).
- Rangeland, barren and forest have the highest inter-class encroachment rates with agricultural land.
- Agricultural land is dominant in the highlands which experiences high rainfall and in the lowlands where irrigation infrastructure exists.
- 42% of agricultural land shows increasing productivity, 36% stable not stressed, 10% stable but stressed, decline and early signs of decline at 2% and 0.4% respectively.
- Agricultural land variability is a function of rainfall and irrigation water availability and socio-cultural activities in the area.

References

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