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Detecting Land Cover Changes in the Kabbe South Constituency of the Zambezi Region, Namibia: A Remote Sensing Approach

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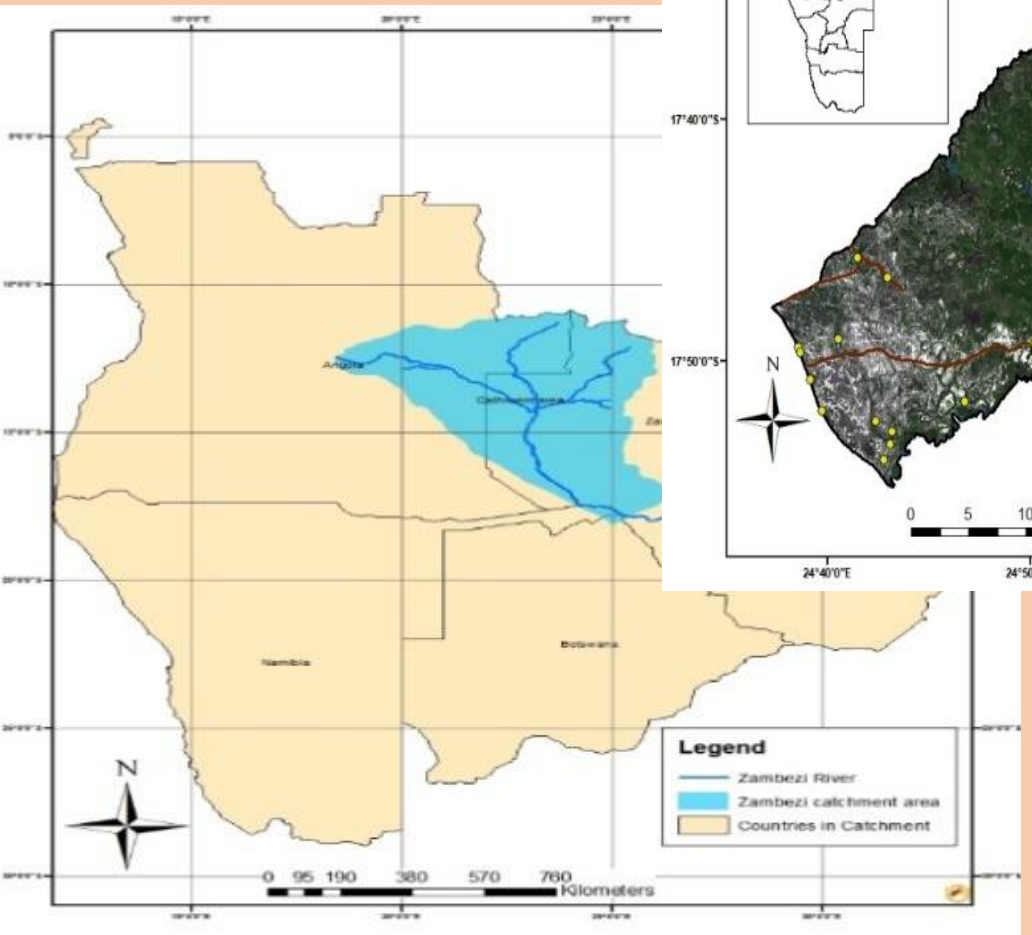
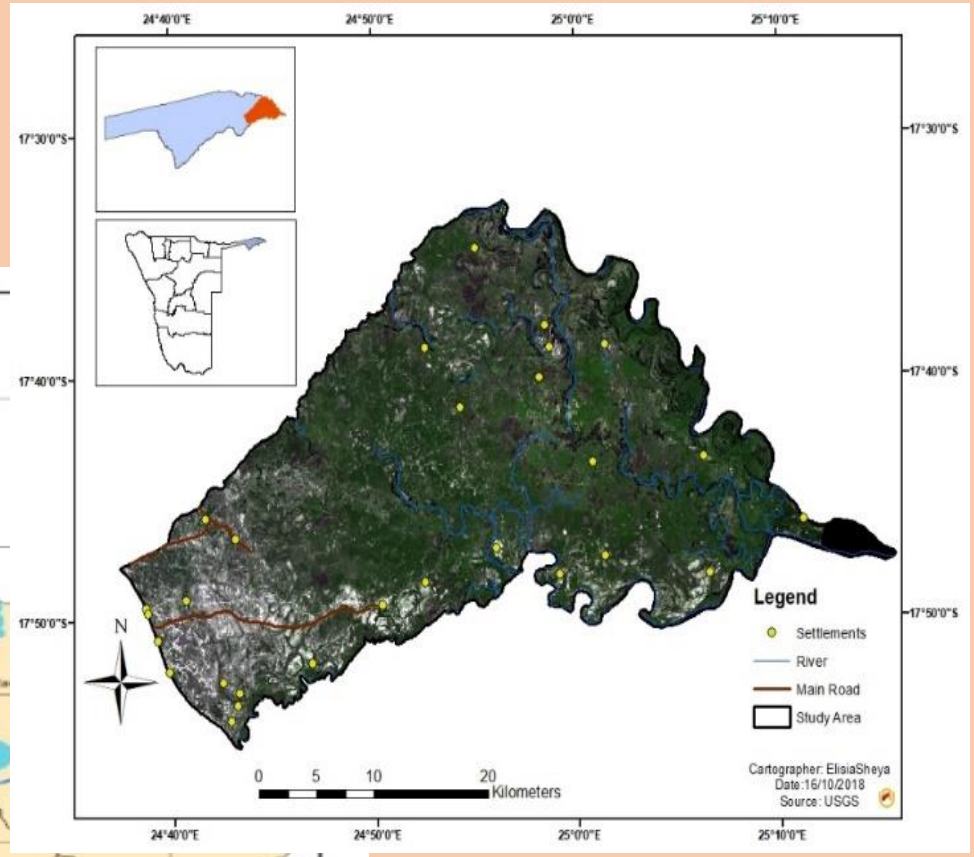
1. Introduction

- Land cover change detection in geographic science is a method of understanding how a given area changed between two or more time eras.
- Change detection involves equating of the changes between images taken over different time periods that cover the precise same geographic area (Amna, Rabia, Sheikh & Neelam, 2015).
- The detection of such changes requires in depth analysis of time series fine-scale multi-temporal satellite images to analyse the historical effects of an incidence quantitatively (Amna, et al., 2015); and
- Thus helps in defining the changes associated with the land cover with reference to multi-temporal datasets using remote sensing techniques.

2. Background





- The Zambezi region has about 400 animal species;
- deciduous woodlands such as wild seringa, copalwood and Zambezi teak.
- **Kabbe South Constituency** is the eastern most of the eight constituencies of the Zambezi Region of Namibia;
- the constituency is approximately 1250 KM^2 and has about 19 villages.
- Kabbe south has huge water body which includes the Zambezi river, the biggest river basin in southern Africa at almost 2600 km in length and which has a catchment area that covers 5 countries,
- The constituency has a vast wetland ecosystem.

2. Background …

- This study signifies the importance of land cover change detection in the Kabbe South Constituency, which integrates remote sensing technique of supervised image classification and GIS.
- Mainly to detect the land cover change and assess the effects of such changes in the years of 2000, 2008 and 2015 (month of March) using multi-temporal Landsat Thematic Mapper (TM) images of the respective years.
- Wetlands have been threatened globally mostly by human activities or climate change (Karwariya, Goyal, Goyal & Thomas, 2014).
- These changes are reflected in wetland area shrinkage or vegetation cover or land cover changes and degradation of area (Meng, Jing, Chunlei & Jiawei, 2017).

3. Methods

- The different Landsat images were downloaded from the United States Geological Survey website.
- Band combination of 5, 4, 3 false colours infrared was used.

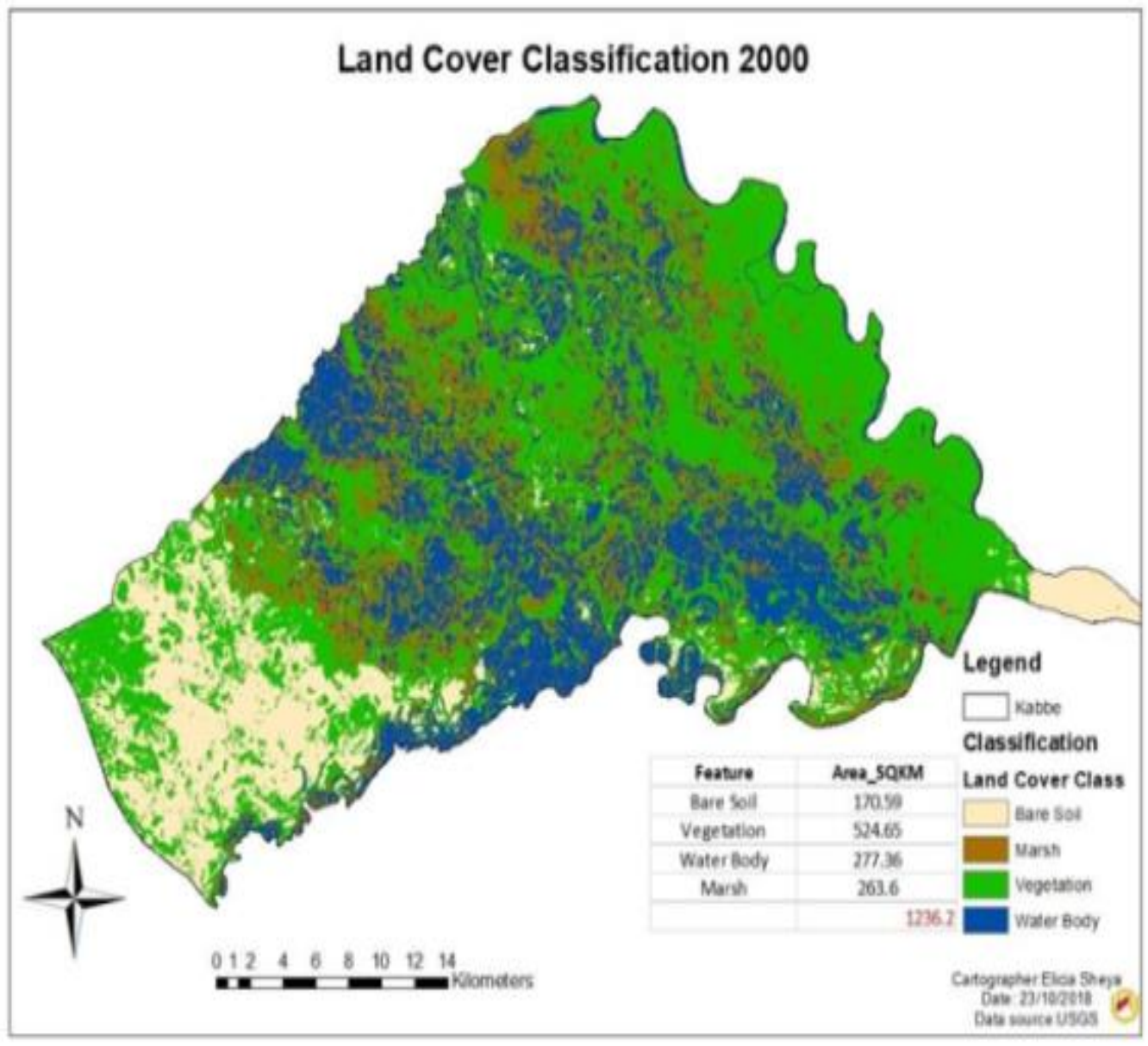
Satellite Imagery Acquisition Information			
Date of Acquisition	March 2000	March 2008	March 2015
Satellite	Landsat 5	Landsat 5	Landsat 8
Sensor ID	TM	TM	ETM
Path/row	174/72	174/72	174/72
Spatial Resolution	30 m	30 m	30 m

3. Methods …

- Band combination of 5, 4, 3 false colours infrared was used for image pre-processing and enhancements.
- For image classification, supervised classification was used to generation False Colour Composite (FCC) of remote sensing data bands green, red and NIR.
- A signature file was created for each class, the number of cells in the class, and the variance or covariance matrix for the class.

Classification classes	Description
Vegetation	Forests, bushes, grassland and farming areas
Bare soil	Gravel roads Barren soil with no vegetation
Marsh	Wetland that is treeless and dominated by grasses and other herbaceous plants
Water body	Rivers, lakes and dams

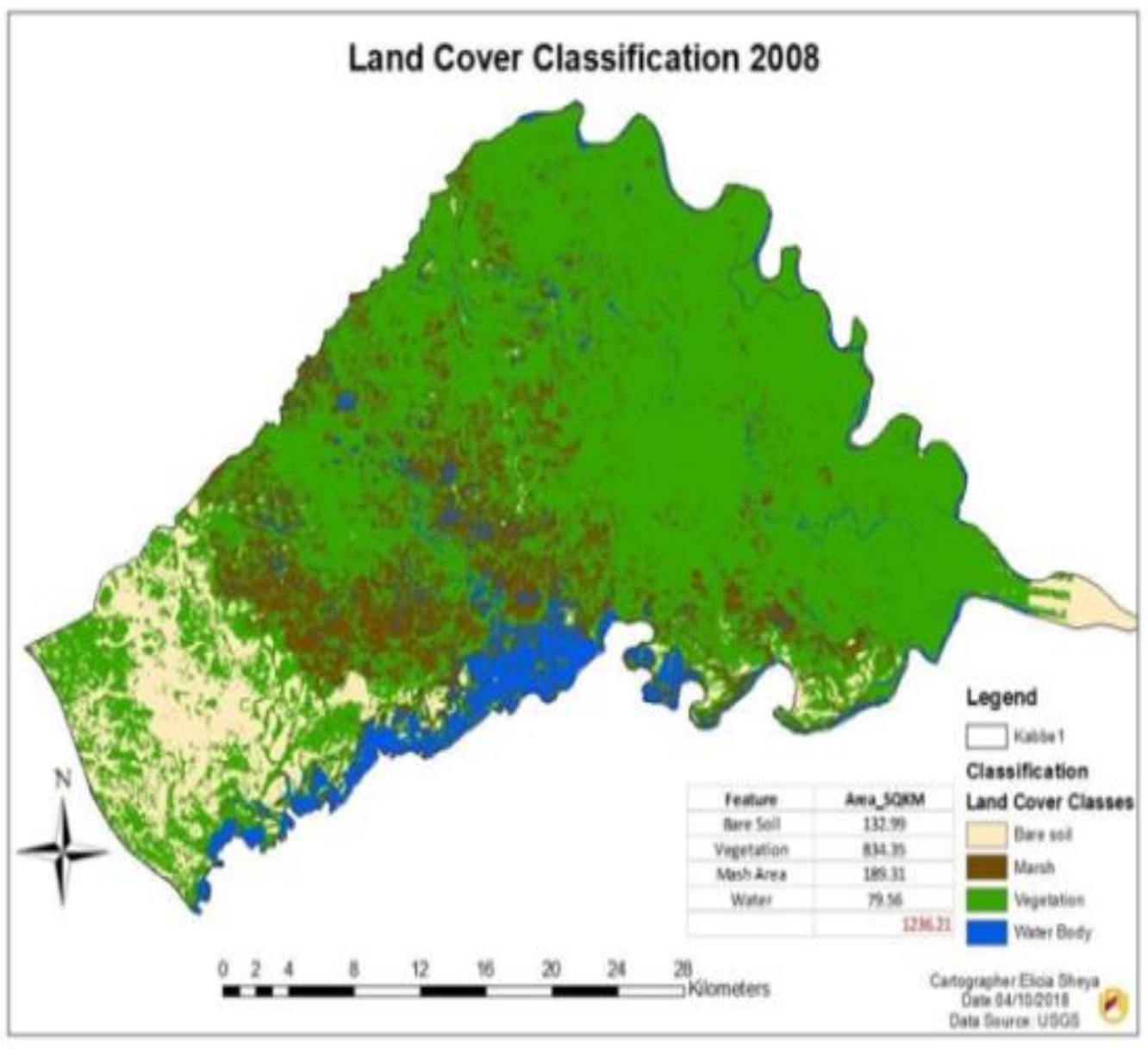
4. Results



Land cover map 2000

- Vegetation consisting of grassland, trees, shrub land and farmland which is displayed in green is the most dominant land cover type in the south west of the constituency.
- There is more bare soil compared to the rest of the constituency.

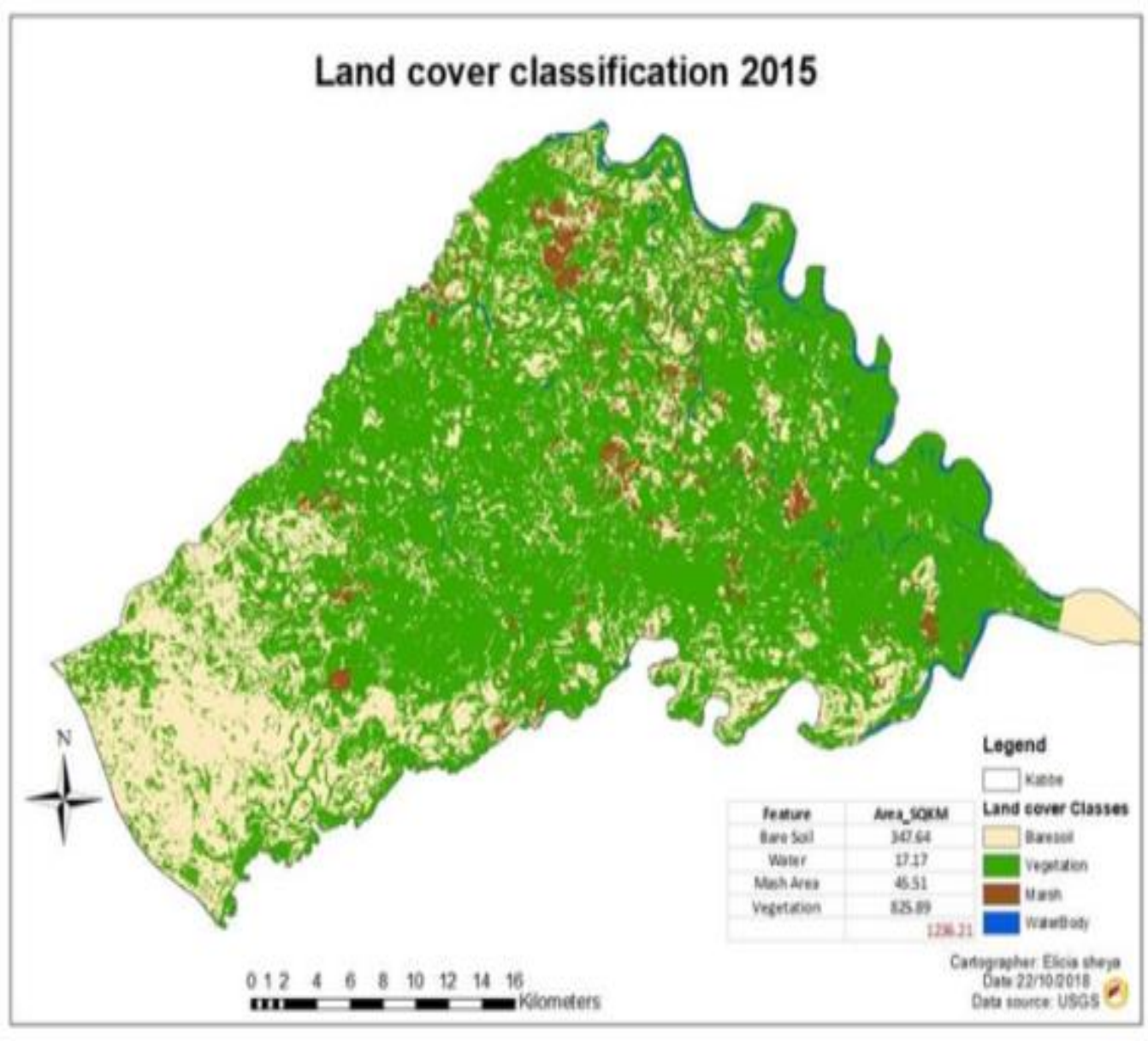
4. Results …



Land cover map 2008

- A change over a period of 8 years with the most change being in water body which decreased drastically.
- Vegetated areas also increased in 2008.

4. Results …



Land cover map 2015

- The land type bare soil land cover type has increased across the whole constituency.
- Water and marsh area decreasing significantly over a 7 years' period.

4. Results …

Land cover detection on area

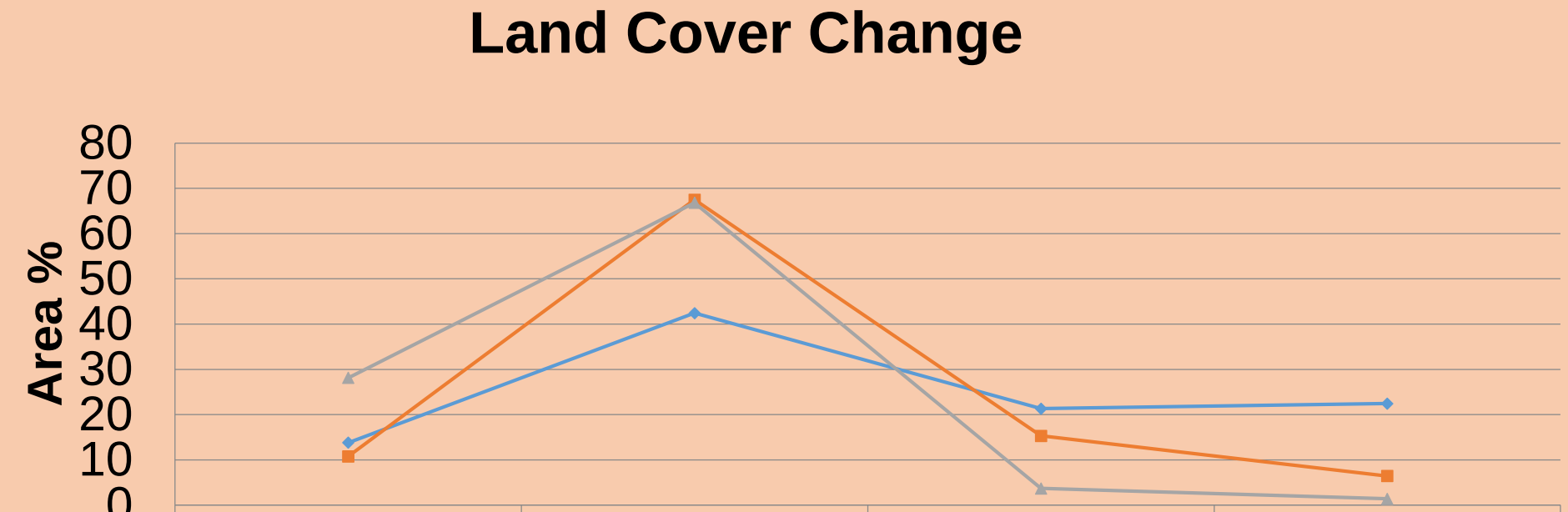
- In 2000 the vegetation had the highest percentage with 42.2%, followed by the water body 22.44%, mash area 21.32% and bare soil with 13.80%. *Perhaps due to flood!*
- In 2008, vegetation increased to about 68%, *perhaps due to the increase in farming areas in the constituency*, water body fell to 6% bare soil also slightly decreased to 10.76% and marsh area also decreased to 15.31%.
- In 2015, vegetation decreased again to 66.81%, bare soil increased significantly to 28.12%. *Perhaps due to settlement & deforestation!*

4. Results …

Area under different land cover for 2000-2015

Land cover type	2000 (sqkm)	Area %	2008 (sqkm)	Area %	2015 (sqkm)	Area %	Difference
Bare Soil	170.59	13.80	132.99	10.76	347.64	28.12	17.36
Vegetation	524.65	42.44	834.35	67.49	825.89	66.81	-0.68
Mash Area	263.6	21.32	189.31	15.31	45.51	3.68	-11.63
Waterbody	277.36	22.44	79.56	6.44	17.17	1.39	-5.05
Total	1236.21	100	1236.21	100	1236.21	100	

4. Results …



	Bare Soil	Vegetation	Mash Area	Waterbody
2000	13,8	42,44	21,32	22,44
2008	10,76	67,49	15,31	6,44
2015	28,12	66,81	3,68	1,39

5. Conclusion

- The continuing decrease of water body and marsh would result in the shrinkage of the wetland and its ecosystem, this could have been caused by many factors which may include *human induced factors* because the percentage of bare soil also increase which might be *caused by clearing of land for wood and housing*.
- The approach to use a pixel bases supervised image classification method provides valuable information, it has *sufficient rigor to be used as a planning tool* to help priorities wetland.
- Land cover change detection of Kabbe South Constituency shows *fast and slow variation in both water body, bare soil and vegetation* land cover types.
- *More studies using remote sensing* should be made to detect change because given that land cover and land use accounts for the largest share of cost of land degradation.

References

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THANK YOU