Assessment of Land Cover Change in Tokar-Delta Eastern Sudan Using Landsat TM and OLI Data

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ABSTRACT

Land degradation is a negative trend in land condition, caused by direct or indirect human-induced processes including anthropogenic climate change, expressed as long-term reduction or loss of at least one of the following: biological productivity, ecological integrity, or value to humans(1). In 1980, Mesik species (Prosopis chilensis & Prosopis juliflora) were introduced to Tokar area as shelterbelt to combat desertification and wind erosion , but after while; it spread out to the delta area and became an invasive plant to the agricultural lands . The aim of the study is to detect the change on land use and land cover (LU/LC) in relation to drought and land degradation processes in different decade. And identify changes and adaptations that have occurred between 2002 and 2019.Change detection is a method of understand how given area has changed between two or more years.I conducted analysis with supervised classification and change detection, normalized difference vegetation index (NDVI) and Change vector analysis (CVA). Landcover change between 2002- 2019 compared and displayed in geographical or map format.

The study area

Tokar Delta is a name given to a small delta of approximately 161,000 hectares situated in the southern area of the Red Sea in Eastern Sudan between the coordinates 18°25′31″N 37°43′45″E and 18.42528°N 37.72917.

Data and Method

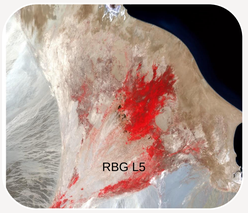
1-Remote sensed data

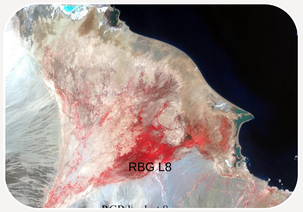
The tow temporal satellite imagery were acquired and download from the USGS.gov website. These include Landsat 8 for the year 2019 and Landsat Thematic Mapper (TM) for the year 2002.

All data were exported to the Qgis open-source software and reprojected in the WGS84 catographic system.

2-Pre-processing

Conversion of raster bands from DN to Reflectance.



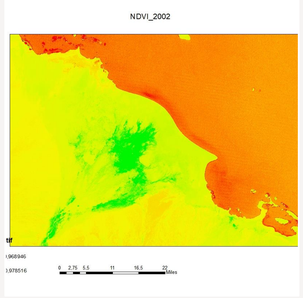


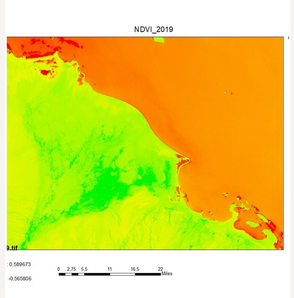
3-Image classification

3.1 Normalized Difference Vegetation Index (NDVI)

NDVI is one of the most widely used vegetation index and it is defined as

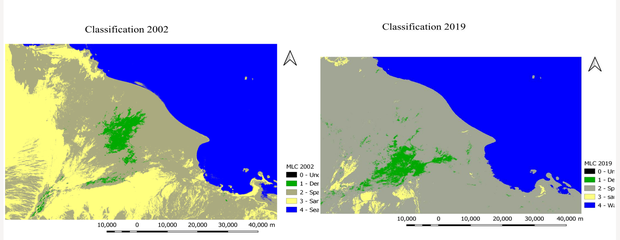
NDVI = (NIR - RED)/(NIR + RED)





3.2 Maximum likelihood classification (MLC)

During classification, all unclassified pixel are assigned to class membership based on the relative likelihood (probability) of the pixel occurring with each class probability density function .



3.3 Change detction

Is a method of understand how given area has changed between tow or more time periods.

Tow change detection techniques were used image differencing for NDVI map and Post-classification comparison for MLC data.

4- **Change vector analysis (CVA)**

The first step of the CVA method was to apply a Tasseled Cap transform (2), which generates the components Greenness and Brightness, in order to reduce the amount of redundant information of orbital images to be analyzed.

Result

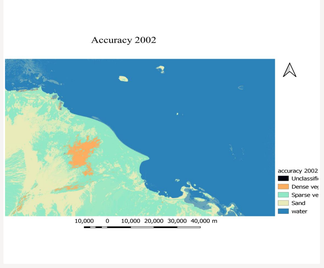
1. NDVI

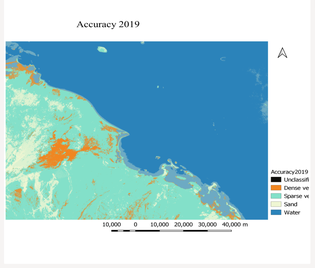
In 2002 show the highest values in the central area of Delta Tokar . In 2019 show the highest values in many areas of Dalta Tokar.Generally an increase in vegetation is obsorved in 2019.

2. MLC

Four classes were defined taking into consideration the landsat spatial and spectral resolution : sea ,sand ,dense vegetaation and sparse vegetation .

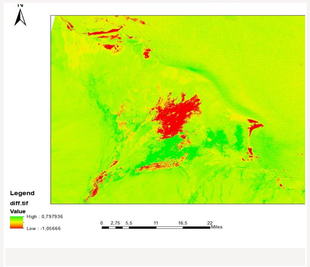
In 2002 landsat image, dense vegetstion class can be seen in the central area and sparse vegetation can be seen in the central and eastern area. In 2019 landsat image ,dense vegetation has high coverage in central and in the Northwestern area. Sparse vegetaion increase in many areas in Delta Tokar.

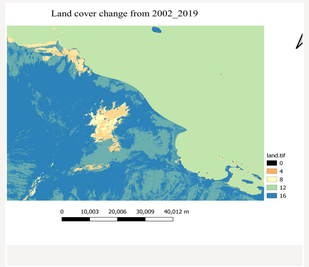




3. Change detection

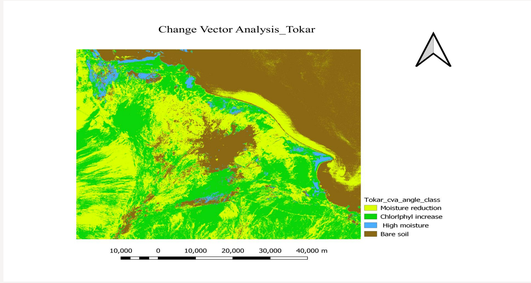
Increase in both dense and sparse vegetation referred to reforestation activities carried out from 1980.Which could be due to spread of meskit trees.





4. Change vector analysis (CVA)

Increase in Greenness and decrease in Brightness, represents a direction of the vector that is mainly related to the growth of vegetation biomass.



Conclusion

Results obtained by the analysis between 2002 and 2019 showed increase in dense and sparse vegtation in Delta tokar . Probably , this increase in vegetation refer to the spread of Meskit trees in Delta Tokar. By now mesquite covering most of the fertile land in the Delta and became risk to the environment and livelihood of the people in the area. Not only that but also the Sudan National Forest Sector (FNC) reported that about 1.5 million ha in irrigated areas are affected by mesquite (3) .

REFERENCES

1. Montanarella, L., R. Scholes and A. Brainich, 2018: The IPBES Assessment Report on Land Degradation and Restoration. Secretariat of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, Bonn, Germany. 744 pp. doi: 10.5281/zenodo.3237392.
2.Kauth, R. J.; Thomas, G. S. (1976) Tasseled Cap – a graphic description of the spectral-temporal development of agricultural crops as seen by Landsat. : Proceedings of the Machine Processing of Remotely Sensed Data Symposium, Purdue University, West Lafayette, Indiana, p. 4b41 – 4b51.
3. Abdalla Gafaar, 2011. Forest Plantations and Woodlots in Sudan. Sudan National Forest Corporation (FNC) . the paper prepared for: African Forest Forum Working Paper series 2011. African Forest Forum, Nairobi, GPO KENYA. www.afforum.org

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