

DETECTION OF LAND COVER CHANGES IN EL RAWASHDA FOREST, SUDAN: A SYSTEMATIC COMPARISON

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ABSTRACT

This paper reviews the different change detection methods and results primarily in forest ecosystems. A variety of digital change detection techniques has been developed in the past three decades. Basically, the different algorithms can be grouped into the following categories: algebra (differencing, rationing, and regression), change vector analysis, transformation (e.g. principal component analysis, multivariate alteration detection, Chi-square transformation), classification (post-classification comparison, unsupervised change detection, expectation-maximization algorithm) and hybrid methods. Reviews on the most commonly used techniques are given by i.e. [1-3].

In our study, we focused on various approaches: simple differencing techniques, change vector analysis, multivariate alteration detection, supervised change detection using pixel- or object-based post-classification comparison.

All change detection procedures were applied to a case study in tropical forest (El Rawashda forest reserve, Gedaref State, Sudan), and their results and accuracy were discussed.

Landsat 7 Enhanced Thematic Mapper (ETM+) data acquired on March 22, 2003 and Aster data acquired on February 26, 2006 were used for analysing an area covering approximately 1.101.789 km² as area of interest.

The Gedaref State is located in the eastern part of the Sudan. It covers area between longitudes 33–36° E and latitudes 14–16° N with an area of approximately 78,000 km². It lies between two major tributaries of the Blue Nile: the Atbara river on the east and the Rahad river on the west. Climatologically (natural forest reserve in Gedarif State) Elrawashda lies in the semi-arid zone, with summer rains and warm winters, characterized by a unimodal rainfall pattern ranging from 400 to 800 mm with an annual average of 600 mm. A study carried out in the Gedaref State reported that the rainfall pattern in the area is characterized by its variability from one year to another [4]. Gedaref State experiences a dry season for about eight months of the year. Rainfall in the state is markedly seasonal in character; the length of the rainy season fluctuates around the four months between June and September reaching its peak in August. Most of the rains fall from June/July to October/November. Gedaref State lies in the zone of low rainfall woodland savanna on clay. El Rawashda forest is located near the transition between two main vegetation types of low-rainfall woodland savanna on clay: *Acacia mellifera* thorn land and *Acacia seyal*-*Balanites aegyptiaca* woodland.

The study proved that all tested techniques produced satisfactory approaches to map land cover changes over time. Simple differencing techniques and change vector analysis and multivariate alteration detection help to pinpoint the relevant changes and provide a significant basis for the analysis. Supervised change detection using pixel- or object-based post-classification comparison enable the user to interpret and quantify the changes.

Generally, the results show a noticeable increase in both close forest and open forest areas with decrease in grass lands for the study area between 2003-2006. More than one third of grassland (36%) was converted to close forest, one fourth (24%) to open forest areas. In the three-year period, 9076 hectares of open forest, (8% of the investigation area), were transformed to close forest.

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