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"Bridging the gap between increasing knowledge and decreasing resources"

Monitoring Vegetation Index Dynamics in Semi-Arid Rangelands Using Rainfall, Ground Survey and MODIS Data

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Abstract

Vegetation in the rangelands are greatly altered by human activities such as grazing pressure, deforestation, encroachment of land for cultivation and natural factors such as spatial and temporal variability in rainfall. Interaction of man-made and natural factors predominantly affects vegetation structure and composition in the ecosystem. Among the major concern that faces Eastern Africa rangelands is the growing of land degradation attributed to the increase of cultivation activities. This is a serious concern because rangelands are getting more fragile and vulnerable to environmental changes, thus threatening the pastoralists' livelihood. It is, therefore, imperative to understand the extent and magnitude of changes in vegetation composition over time. This is central for improving landscape conservation. The present research was aimed to examine the extent of vegetation composition changes for Borana plain, in southern Ethiopia. The study assessed the temporal phenological changes of vegetation index (VI) in the croplands and that of natural vegetative land. Rainfall and ground survey data supplemented with MODIS NDVI satellite images with 250 m spatial resolution of 16 days composite of January through December 2002 and 2012 were used to analyse vegetation index employing pixel based approach.

Results showed higher vegetation index (VI) in April, May, November, December and lower VI between March, July, August and September in the grass, bush, shrub, crop land covers with exception of the woodland. The fluctuation in VI is significantly correlated with rainfall (p¡0.003) in 2002 and ($p < 0.017$) in 2004 (Pearson Correlation Coefficient test). There is also significant differences ($p < 0.000$) in mean VI in cropland (0.345), grassland (0.365), bushland (0.388) and woodland (0.525), (One way ANOVA), as vegetation growth passes through various phenological stages. The results suggest that the higher VI between April, May, November and December correspond with precipitation trend of the same study area. Temporally, the mean VI varied over years, 2002 (0.386), 2003(0.432), 2004 (0.411), 2006 (0.419) and 2012 (0.380). This variation is attributed to conversion of natural rangelands in other uses e.g. cultivation and variability in rainfall. The study demonstrates that pixel based and crop phenology are robust approaches for discriminating and classifying crops from natural vegetation, i.e. forestry, woody trees, grass and herbs.

Keywords: Crop cultivation, crop phenology, remote sensing, vegetation changes

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