MONITORING OF SAVANNA DEGRADATION IN NAMIBIA USING LANDSAT TM/ETM+ DATA

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Savannas cover 54% of Southern Africa. They are of high importance for the rural communities as they provide food, medicinal plants, timber, fuel wood, and range land for livestock (Scholes 1997). However, about 31% of the savannas in the semi-arid Africa are affected by degradation processes, that may lead to significant declines in ecosystem functioning and services, biomass production and economic productivity (Sefe et al. 1996). Degradation symptoms in savannas include decreases in vegetation cover or complete loss of vegetation, shifts in species composition towards annual plants, as well as the increase of single bush species which results in dense species-poor thickets (bush encroachment). These processes have been observed in semi-arid landscapes globally, which has prompted international interest in the detection and quantification of degradation processes as a first step towards developing preventive and mitigatory actions/policies.

The accurate assessment of savanna degradation using remote sensing techniques has proven to be challenging, as the described processes are frequently overlapped by ecosystem-inherent variability in response to highly variable rainfall patterns (Wessels et al. 2007). Furthermore, local vegetation decrease is frequently a result of recent livestock grazing impact at the time of image acquisition, rather then true vegetation degradation.

In the presented work, we aimed to develop a bitemporal change detection approach that takes into account the above mentioned issues. The test site was a landscape mosaic of different types of thorn bush savanna in central Namibia. Using a set of 7 Landsat TM and ETM+ images covering the study area in +/- 5 year intervals from 1984 – 2003, we developed a <u>spectral</u> decision tree classifier that is sensitive to increases or decreases in vegetation, while being independent of vegetation type. This enabled us to assess changes without detailed knowledge of the observed vegetation, which is difficult information to obtain for many regions of Namibia. Additionally, we used structural *change* features to distinguish between different processes that provide similar spectral change properties. Structural information was derived by segmentation of the continuous spectral change data (eCognition). The use of structural change parameters enabled us to distinguish between land use related vegetation loss, such as recent grazing impact on single land units, and natural decrease processes indicating degradation.

In order to identify areas where observed changes were likely to be phenology-driven, long term precipitation data from approximately 20 farms in the study area were analysed. This enabled us to estimate on the local scale the impact of degradation versus rain fall.

We concluded that central Namibian savannas are affected, to a small extent, by degradation in terms of vegetation loss. Bush encroachment was detected as a major degradation process during the observed time period. However, the largest amount of detected change was caused by phenology.

The results show that the use of structural change information can improve the distinction between natural and anthropogenic change and degradation processes. Interpretation of local rain fall data aided the understanding of spatial and temporal patterns of vegetation response.

References:

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