Land degradation is of great concern in South Africa particularly in the Inkomati catchment. Here a mosaic of different land use types such as plantation agriculture, subsistence farming, irrigated commercial farming, rural and urban settlement, as well as nature conservation affect the natural ecosystems in different ways and magnitudes. The National Land Cover (NLC2000) project mapped degraded areas in the catchment, but the results lack a differentiation of magnitude of degradation.

The Issue

The NLC2000 product provides general information on land cover degradation. This information is derived from Landsat ETM+ satellite data based on “brightness” values. Degradation is recognized on the basis of “sparse vegetation cover”. For many applications this simple labelling “degraded” vs. “non-degraded” (Figure 1) is not sufficient.

Within a research project involving several CSIR research groups involved in modeling the flow of benefits to people from ecosystem services within the Inkomati River Catchment (Figures 2 & 3), the need for a differentiation of degrees of ecosystem degradation (from intact towards totally degraded) arose.

Methodology

The methodology applied is summarised in Figure 5. Landsat 7 ETM+ images from 28 April and 21 May 2001 (four scenes) were used. The images were radionometrically and geometrically corrected (preprocessing) to provide general spectral comparability of the scenes and to enable mosaicking of the four Landsat scenes covering the catchment. Transformed areas such as cultivated, urban or built-up areas as well as plantations (blue categories) were used. The images were radiometrically and geometrically corrected (preprocessing) to provide general spectral comparability of the scenes and to enable mosaicking of the four Landsat scenes covering the catchment.

The challenge was to define an albedo-based scheme that stratifies degradation depending on the natural land cover type.

Rationale and Challenge

For modelling of benefit flows from ecosystems a distinction of areas that are heavily degraded in contrast to only slightly affected areas is necessary. Therefore within a research project of the CSIR a method shall be developed to refine the degradation information of the NLC2000. Preliminary results using remote sensing derived albedo data are presented. The result will be used for modeling ecosystem benefits and their flows, with degraded areas playing an obvious role in defining ecosystems benefits.

Preliminary Results

Comparison between NLC2000 (Figure 6) and the Landsat subset (Figure 8) such thresholds for land cover classes that are heavily degraded (high albedo) and naturally open vegetation (low albedo) thresholds for four classes: 1. non degraded, 2. slightly to moderately degraded, 3. heavily degraded areas.

Results derived from Albedo and NLC2000 indicate the levels (magnitude) of degradation (Figure 9). The levels of degradation in the study area were not clear. The levels of degradation were not distinct and no degradation class was found. Different areas are found to have different levels of degradation.

Discussion

The research is on-going, and the next stage is to validate the results in the field, taking into consideration the season of acquisition for the images used. A stratified random sampling approach will be adopted for validation purposes. Recent rainfall events (prior to image acquisition date) can influence albedo through soil and grass activity, as can intimal damage to vegetation in Kruger National Park, human harvesting of vegetation as well as other human perturbations like the timing of burning and livestock grazing intensity. Therefore, the location context of high albedo (degradation) pixels needs field verification. Ground truthing will also enable the evaluation of the accuracy of a method employed.