LAND USE CHARACTERIZATION AND CHANGE DETECTION ANALYSIS FOR HYDROLOGICAL MODEL PARAMETERIZATION OF LARGE SCALE AFFORESTED AREAS USING REMOTE SENSING

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The major objective of the research study is the assessment of the hydrological impact of large scale pine afforestations on the regional water balance in the semi-arid Umzimvubu catchment (19.845 km²), Eastern Cape, South Africa. During the last ten years some 60.000 ha of the former range land in the headwater catchments of the Umzimvubu river have been afforested. The impact of this remarkable land use change on hydrological process dynamics such as evapotranspiration, interception and runoff generation is still quite unknown. Water resources managers and local authorities, however, demand such informations which at present can only be supplied by a thorough hydrological systems analyses and prognostic modelling of the hydrological dynamics.

Spatially distributed and updated land use information and consequent land use parameterization is a prerequisite for such a physically based, distributed hydrological modelling. A hybrid classification approach has been applied to multitemporal Landsat TM data from 1995 and 1999 to derive land use and vegetation patterns and their temporal changes. As a result different land use maps of various scales and accuracies of about 86 % were produced. These information has been utilized to generate land use change maps using the GIS ARC/INFO and to quantify the areal increase of afforestation on a subcatchment level. For the selected test catchment of the Mooi river it was found that the extent of areas used for afforestation increases up to 23 % reducing the range land respectively. In addition, the dynamics of the LAI distribution were monitored by exploring the NDVI information derived from the Landsat TM data sets. The comparison of land use and LAI has shown, that there is a remarkable correlation between both parameters due to their spatial and temporal patterns.

All data layers have been validated successfully using land use data and empiric plant physiological data (height, crown density, biomass, LAI, etc.) derived from ground truth as well as data from the forestry data base. They will be input for the hydrological modelling of the catchment, which in turn is realized by applying the concept of distributed Hydrological Response Units (HRUs).