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An assessment of land cover changes in Nkayi District 1990-2009

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Abstract

Land degradation is a major constraint to many land users in the semi-arid areas of Zimbabwe, yet the majority of the population (60%) is directly dependant on agriculture (Moyo 2000). Humans have been modifying land to produce food and other essentials for thousands of years. However, current rates, extents and intensities of Land Use Land Cover Change (LULCC) are far greater than ever in history, driving unprecedented changes in ecosystems and environmental processes at global, regional and local scales (FAO 2006). These changes and the associated drivers need to be understood in order to develop sustainable dry land management strategies which are governed by informed policies. In this thesis, temporal land cover maps for Nkayi District were developed as a tool for estimating the current rates and the extent to which land cover has changed for the past nineteen years beginning from 1990 to 2009. Multi-temporal images of Landsat TM/ETM scene p171r74 covering Nkayi District between March and May 1990, 2000 and 2009 were georeferenced and co-registered to one another before being analysed using the supervised Spectral Angle Mapper classification technique. The Participatory GIS exercises carried out in four selected wards, namely ward 4, 6, 19 and 20, have confirmed the distribution of land covers observed from analysing satellite images. A geospatial modelling technique was also used to extrapolate future land cover changes up to the year 2028. Four main land cover types were identified, namely woodland, deforested land, cultivated land and water bodies. Woodland and deforested land were also permanently used as rangelands, while croplands were used for growing crops during the wet season and were opened for grazing after harvesting. In 1990, woodland covered 58% of the total land area in Nkayi District while deforested land, cultivated land and water bodies covered 31%, 11%, and 0.2% respectively. From 1990 to 2009, the area under woodland declined to 50% while water bodies also declined to 0.1% of the total land area in the district. Areas under deforested land and cultivated land increased to 14.9% and 35% respectively during the same period. The major drivers of land cover changes ranged from increase in household numbers, which were associated with woodland clearing for agriculture, soil infertility that led to extension of fields into rangelands, and overgrazing by livestock. Other drivers were noted as poverty, policy issues, inefficient cropping systems and poor livestock management practices. Cropland expansion into woodland was expected to continue into the future as highlighted by the extrapolated results in this thesis. The study also confirmed that land cover changes over the nineteen years to 2009 followed a process, in which there were widespread conversion of woodlands into croplands, a highly unsustainable process. Work with local people during Participatory GIS to assess land cover changes helped to integrate local people's views and comments on social and economic factors with computer-based land cover change analysis, which further helped to explain the physical changes seen over time. The research found that it was crucial in detecting the problems of forage shortages and poor rangelands, to call for a rangeland audit that would ascertain the amount of forage the natural rangeland produced. The study recommends that the expanding fields must compensate for the loss of rangeland by producing more biomass in the form of high value crop residues to cater for the loss of rangelands. Also, better ways of sustainable land use intensification, such as using crop residues as livestock feed, using dual purpose sweet sorghum varieties and intercropping conventional crops with fodder crops, should be introduced. These are known to increase the productivity of the crop system and at the same time they produce fodder, which is used as livestock feed.