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The spatio-temporal dynamics of woody biomass supply and demand in response to human utilisation in an African Savanna woodland

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2013-01-31
http://hdl.handle.net/10539/12339

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Abstract

The thesis presents a thorough, in-depth study that fills some of the gaps in the knowledge of the impacts of woodland utilisation in communal areas. The chosen case study villages are in Bushbuckridge, a government gazetted Integrated Sustainable Rural Development programme node, making the results pertinent to sustainable energy policy reform in South Africa. A case-study of two villages was used to investigate the spatial and structural changes in fuelwood supply in response to fuelwood extraction as well as the changes in use-patterns over time. A survey of the structure and composition of the woody vegetation and wood harvesting patterns around the villages was conducted and compared against historical data, spanning 17 years. Total wood stock in the communal woodlands of both villages declined over the study period; the loss being greater in Welverdiend. Significant, negative change in the structure and species composition, particularly of species that are commonly harvested for fuelwood has occurred in Welverdiend but not in Athol. The absence of negative impacts in Athol implies that harvesting regimes here are more sustainable but it is more likely that this is due to the lower human population and lower fuelwood extraction pressure. The changes in woodland structure were linked to landcover change patterns that occurred in the villages over the last 44 years, from their creation through forced resettlements on old farms in the area. Landcover change patterns were similar in both villages since 1965 but there was significantly greater woodland loss in Welverdiend (48% woodland loss) in comparison to Athol (25% woodland loss). The systematic loss of woodland areas to agricultural fields was linked to expanding residential areas due to human population growth. Deforestation occurred where woodlands were already impacted through selective harvesting. The physical changes in woodland structure and landcover were linked to a detailed socio-economic analysis of the two villages, providing critically important data for the sustainable management of woodlands in South Africa. The impact of access to electricity on fuelwood consumption rates was carried out through analysis of the economic, time and opportunity costs of fuelwood collection, compared against the different fuelwood availability in each village. In Welverdiend demand for fuelwood has so far proved inelastic; households have adjusted their fuelwood collection regimes, going on fewer collection trips but spending longer times for each trip but ultimately household investment is similar to that in Athol. Fuelwood demand is maintained in Welverdiend by the availability of purchased

fuelwood and harvesting in new sites. A model to predict the socio-economic factors at the household and per capita level which affect fuelwood consumption was developed. Revealing in the process that households with access to electricity used less fuelwood annually and the amounts of fuelwood used were influenced by the household perceptions of fuelwood scarcity in the village, Household population size had a direct bearing on the likelihood of households switching to electricity with every addition to the household size decreasing the likelihood of switching by 48%. This study has major implications for the government's on-going rural electrification programme. Interventions are required that raise awareness about fuelwood availability trends, based on landscape developments and targeting women as the main users of fuelwood.