ETHNOPEDOLOGIC SOIL MANAGEMENT TECHNOLOGIES AND THEIR IMPACT ON BIODIVERSITY IN SMALL SCALE FARMS OF ARUMERU, ARUSHA, TANZANIA

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Soil management diversity involves land transforming operations which influence the behavior of soil physical and chemical aspects, surface and near surface biological, hydrological and microbial processes. Within PLEC, management diversity is one of the major components of agrodiversity assessment carried out on small scale farmers fields. This paper addresses small-scale farmers ways of coping with soil related problems in sub-humid and semi-arid Arumeru, Arusha, Tanzania and their effect on biodiversity.

Crop production levels in Tanzania are generally below potential, averaging about 905 kg/ha maize and 458 kg/ha beans. Overall the amount of nitrogen and phosphorus removed from the soil every year by the main crops was estimated to be 251,448 tons N, 115,112 tons /ha P_2O_5 by year 2000. Of this only 21% and 14% of N and P removed respectively was projected to be replaced through fertilization. Use of fertilizers however is still very low and production still depends on inherent soil fertility and low external input technologies.

Agroforestry is the dominant cropping system of the sub-humid site. It is known to be stable for decades due to the intimate multispecies and multistorey associations that ensure good soil productivity through provision of continuous ground cover and nutrient recycling. Crop nutrient removal in the combined crop of banana and coffee (excluding residues) removes 14.9, 1.2 and 8.7 kg of N,P and K respectively. This is equivalent to 10, 0.8 and 6 kg of N, P and K respectively from an average farmer's field of 0.68 ha and requires 2 tons farmyard manure the main nutrient source for the system to offset the loss. In semi-arid Kiserian maize/beans intercropping is one of the major cropping systems where the legume is relied upon to fix nitrogen. A modest maize/beans crop removes 57.6. 12.5 and 55.5 kg/ha N, P and K from each hectare respectively. There is also a large nutrient drain in this system. Besides fertility, other constraints include soil moisture stress and soil erosion.

Farmers use different indicators to assess soil quality. Soil quality indicators include: soil colour, solum depth, topsoil depth, waterholding capacity, soil tilth, texture, biological activity, indicator plants for soil fertility and infertility, etc. Different types of crops, types and intensity of inputs and management methods to be employed are also based on assessment of the soil. Most important crops are mostly assigned to high quality soils. Due to the level of management in good quality soils, species diversity is also high.

Most farmer management methods are multipurpose in nature, addressing most soil related constraints at the same time. Rich farmers with more land had more management methods but less species richness compared to poor farmers with little land. For any cropping system, erosion control measures indicated to contribute to species diversity on-farm irrespective of farmer category. Traditional biophysical soil conservation structures contained more species than modern/improved biophysical ones. One traditional biological structure had 24 species with diverse uses that included social and cultural community moderating uses besides the common uses of soil productivity improvement for improved structures. Small scale commercial farming on steep slopes in Ng'iresi village was also associated with biodiversity conservation. This was contrary to large scale commercial farming effects on biodiversity.

Chemical soil data taken with increasing distance from the indigenous structure showed a decreasing trend of fertility in terms of acidity, nitrogen and organic matter content and nutrient holding capacity of soil (CEC). Chemical properties of soils in major land use types in both sites indicated that inherent fertility and microdial activity was higher in sub-humid than semi-arid soils. In the semi-arid site, nutrient concentration was highest in the top 20cm soil depth. The results suggested a high sensitivity of soils to mismanagement and climatic variability for semi-arid than sub-humid site. Overall, the data suggest that ethnopedologic methods of soil management do enhance and conserve biodiversity.