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Smallholder Investment in Woodlot Perennials and its Potential to Food Security and Soil Fertility in a Changing Climate

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Abstract

Inadequate land management practices coupled with long lasting monoculture practice has led the soil in Ethiopian highlands to massive degradation through erosion and nutrient depletion. This soil degradation combined with high population growth in the rural areas engender deforestation and force agriculture into marginal lands and steep slopes. Following the success of Eucalyptus Globulus as a multi-purpose exotic perennial in the country, Acacia Decurrens was introduced to the Ethiopian highlands in the early 1990s for short rotation forestry as part of the government's plan not only to meet the increasing demand for firewood in the urban areas but also to reduce deforestation and increase soil fertility in rural areas. And thereby help smallholders' smooth consumption, improve food security and reduce poverty specially at times of climate variability-induced shocks. Attracted by its dual benefit smallholders started converting their croplands to Acacia woodlots and making significant portion of their livelihood from it. With such higher rate of land use conversion, (i) understanding the impact of investment in woodlots on food security in current and future climate and price variability and (ii) assessing impact on soil fertility and possible deviance to annual crops is imperative. This research applies household level microsimulations to analyse the role of smallholders' investment in woodlot perennials to food security and soil fertility in the presence of climate and price variability. We use agent-based simulation package Mathematical Programming-based Multi-Agent Systems (MPMAS) to capture production consumption and investment decisions at farm household level. We developed a recursive dynamic intertemporal planning model using plot level data collected from 354 farm households in Ethiopian highlands in 2018 to capture farmers' multiperiod investment in woodlot perennials alongside their annual non-separable production and consumption decisions. As a result, we are able to show how climate and price variability changes farmers' land use and consumption decisions and thus their food security status. We also assessed plot level soil dynamics and intertemporal deviance back to annual crops.

Keywords: Acacia Decurrens, agent Based Modelling, Agroforestry, Climate Variability , MPMAS

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