

Bio-economic Modelling of Soil Resource Conservation in Mid Hill Region of Nepal

Summary by Romy Dass

Soil degradation is a serious threat to agricultural sustainability in Nepal. Increased anthropogenic activities in an inherently fragile ecosystem with unstable geology, steep slopes and intense monsoon rains have accelerated various processes of soil degradation and caused loss of soil and its fertility. In this context, present research comprehensively analyses the soil degradation issues in mid hill region of Nepal and assess strategic management options such as minimum tillage, hedgerow intercropping and legume integration from biophysical as well as socio-economic perspectives. The study was conducted in Kavrepalanchowk district which represent the typical biophysical and socio-economic characteristics of mid hill farming system where soil degradation is the key issue. Primary data on socio-economic, agriculture production and soil conservation was collected from 280 households. Similarly, biophysical data such climatic condition, agronomic and soil parameters as well as soil degradation was collected from various research trials conducted in the district. Furthermore, soil sample analysis was done for selected sample households to get information on the initial soil condition.

The study coherently integrates biophysical process model and economic analysis under the framework of bio-economic modelling. First, it analyzes the soil nutrient use under existing farming system estimating the balance of three macro nutrients; Nitrogen, Phosphorus and Potassium using nutrient budget model. The household level socio-economic factors influencing each nutrient balance has been determined employing Seemingly Unrelated Regression (SUR) analysis. Second, the biophysical model, Soil Change Under Agroforestry (SCUAF) has been calibrated for study area based on location specific data on climatic, agronomic and soil condition. The model then simulates the impact of conventional as well as various improved soil conservation technologies on soil erosion, soil nutrients and crop yield over the period of 30 years. The results of biophysical model have been integrated into the cost benefit analysis to assess the economic feasibility of these conservation technologies at the farmers' level over the period of time.

Important findings have emerged out from this study. The nutrient balance analysis reveals that there is imbalance in soil nutrients status of farms whereby it shows surplus of nitrogen and deficit of phosphorus and potassium implying unsustainable pattern of production. The result of biophysical model suggest that such negative trend can be ameliorated by various soil conservation and fertility management technologies such as minimum tillage, hedgerow technology, legume integration and improved nutrient management techniques. More specifically, these technologies are found efficient in reducing soil erosion, maintaining soil fertility and thus sustaining crop yield with their varying impact over time. However, they are not economically viable at the farmers level in short run implying that there is trade-off between short term and long term economic returns from these technologies.

The study results have important implications at the policy level. First, necessary steps needs to be taken towards availing farmers with sufficient nutrient inputs to reverse the trend of nutrient mining and maintain soil fertility. Second, farmers should be provided with economic incentive to minimize the economic trade off and thus motivate them adopt conservation technologies to achieve sustainable agriculture production in hilly region.