

**Sustainability of Agriculture Land Use in Eastern Bhutan In Relation to
Climatic, Topographic and Social Factors**

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Abstract

Agriculture provides livelihood to about 70% of the people in Bhutan. Therefore development of agriculture is a central policy of the nation. In recent years agriculture land in Bhutan and elsewhere has often been abandoned or changed to other forms. Worldwide it is recognized as a result of complex interactions among climatic, topographic and socio-economic factors although findings differ according to the place, scale and land use. Hence, this study examines the impact of these factors on three common types of agriculture land use in Eastern Bhutan: dry land, mixed land and wet land.

Vector land use data for 1994 and 2005 were arranged into those with the same categories, and their change in area between the two periods was analyzed. It was observed that all the three types of agricultural land use had decreased; with mixed land fastest and wet land slowest. For detailed analyses, the land use data for 2005 were converted into raster data. Then climatological data (temperature, rainfall and the moisture index), topographic data (elevation, slope, aspect, and distance to river), soil data and social data (distance to town, distance to road and rural population) were extracted in raster. All these operations were conducted using ArcGIS 9.3.1, a GIS software package. Then a binary logistic regression was used to build a predictive model of the probability of land use occurrence in each sampled grid cell using the climatic, topographic, soil and social data as predictor variables. Finally to study the potential impact of climate change, the probability of agriculture land use in the year 2050 was predicted using the projected climate data.

This study shows that agriculture land use is affected by the combination of climatic, topographic and social factors indicating the need for a holistic approach for its sustainability. The climate variables including temperature and rainfall play a greater role in determining land use, pointing to the vulnerability of agriculture to climate change. The three types of land use were affected differently: wet land was found to be the most sensitive to climate, while dry land the least. It was also observed that changes in temperature and rainfall tended to differ by locations. Thus understanding of both global and local physiographic conditions is useful for adaptation to future climatic change. The knowledge about land use and its controlling factors is essential for the sustainable use of land resources. Hence, this study has provided useful inputs to the policy makers and land managers in Bhutan.

Keywords: Agriculture land use, Eastern Bhutan, Climate variables, Food security, Sustainability