

## Chapter 9

# Land Use Land Cover Dynamics in Ribb Watershed and Its Implication to the Sustainability of Ribb Dam: South Gondar, Ethiopia

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### ABSTRACT

*Land use land cover dynamics is a widespread phenomenon in many parts of Ethiopia and in Ribb watershed. The main objective of the research was assessing land use land cover dynamics and its implication to the sustainability of Ribb Dam in 1973, 1986, 2001, and 2016 by using Landsat image and household questioner. During the last 44 years, cultivated and settlement land and forest cover showed an increment from 26.29% to 54.89% and 9.45% to 12.86%, respectively. The bush land, grazing land, water body, and wetland, however, showed a relative decrement from 29.48% to 17.09%, 21.45% to 12.70%, 4.64% to 2.39%, and 8.70% to 0.08%, respectively. Population pressure, poverty, weak policy and institutional enforcement, and tenure insecurity revealed as a major cause of the change in land use land cover. Soil erosion, lack of fuel wood, and impact on livelihood are major consequences of land use land cover change.*

### INTRODUCTION

Our use of land has a profound effect and results in an observable pattern in the land use land cover (LULC) over time (Opeyemi, 2006). As human kind alters the land surface, the landform, hydrologic budget, and stream processes are ultimately affected (DeBarry, 2004). The mix of landforms of Ethiopia, which ranges from high mountains to rugged and flatlands, and the rainfall regime coupled with various geological factors have contributed to the formation of various sizes of a watershed in the country.

DOI: 10.4018/978-1-5225-5939-9.ch009

Ethiopia has a total land area of about 1.1 million square kilometers and is divided into 12 river basins. Tana sub-basin comprises three main watersheds, namely Megech-Seraba (352,522.93ha), Gumara-rib (471,236.18ha), and Gilgel Abay (453,618.53 ha) (Tadesse and Solomon, 2014).

DeBarry (2004) said that a watershed is an area of land that captures water in any form, such as rain, snow, or dew, and drains it to a common water body. Watersheds face great challenges and they are subjected to LULC change. Watersheds face a range of degradation challenges associated with human activities. Also, the way in which they are managed can have a profound cascading effect on natural resources and communities in the wider basin (Bach *et al.*, 2011).

Analysis of LULC dynamics helps us to understand the characteristics and interdependencies of the components that constitute spatial systems. This research used Geographic information system (GIS) and Remote sensing (RS) techniques (in conjunction with a socio-economic and historical assessment) to analyze the dynamics of Ribb watershed LULC and its implications to the sustainability of Ribb dam.

The study attempted to gain a better understanding of LULC changes in Ribb watershed. The study is significant because the Ribb watershed is an area with many development activities, which includes Ribb dam construction. The irrigation scheme is planned to irrigate about 14,460 hectares of land and benefits about 11,500 households. There are also wetlands in the watershed, which made the research very important. The study recognizes that accurate information on LULC dynamicity, the cause (and consequence), the perception of households on LULC and the implication of LULC change on the sustainability of Ribb dam are essential to advance and support development interventions. These sorts of data are also important to decision makers in terms of developing strategies for natural resource management and monitoring of environmental changes in the study area and areas that have a similar geographic setting.

## **STUDY AREA AND METHODOLOGY**

### **Study Area Description**

The Ribb watershed, which is part of Lake Tana sub-basin, has an area of about 1972 km<sup>2</sup>. Geographically Ribb Watershed is located in northwestern Ethiopia and stretches between 10°43'11.53'' N latitude and 37°35'50.22'' E. The area has a chain of the mountain, and at the low-lying area, it has wide flat floodplain of Fogera. Figure 1 shows the location of the Ribb watershed in Ethiopia, Amhara region, South Gondar Zone and five bounding *woredas* (districts).

Ribb irrigation project is intended to transform rain-fed subsistence agriculture into irrigated commercial agriculture. It is proposed to irrigate up to 14,460 ha of land found in the watershed and about 11,500 households are expected to be benefited from the irrigation scheme. The water stored behind the Ribb Dam (which is under construction) is planned to be released into the Ribb River and then distributed by gravity. This is expected to allow improved cropping in the dry season. Associated drainage and flood protection measures are also expected to improve conditions for wet season agriculture.

### **Data Source and Method of Data Analysis**

The major data that was used in this study was Landsat images, household data and ground control points collected using handheld GPS. To analyze the change in LULC in the watershed, Land sat MSS, TM,

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