Assessment of Traditional Soil Fertility Classification and its Management Practices in the Five Districts, Northwestern Highlands of Ethiopia

Gizachew Ayalew
Amhara Design and Supervision Works Enterprise (ADSWE), Bahir Dar, Ethiopia
E-mail:gizachewayalew75@yahoo.com

Abstract
This study was conducted to classify soil fertility status locally in three slope classes of 0-2, 2-5 and 5-8% of Dera, Achefer, Mecha, Burie wemberma and Jabi Tehnan districts, Northwestern Ethiopia. From each slope class about 65 farmers who had good knowledge of soils were selected and primary data were collected through interviews and group discussions. Based on the analysis, soil color, texture, water holding capacity, fertilizer requirement, slope, the soils' depth and workability were identified as local criteria to classify soil fertility status. The criteria for this classification were the soils' potential to produce crops. Farmers preferred black and clay soils to white and sandy soils due to their high water holding capacity and inherent fertility. Farmers' soil classification assessment was found to be more holistic than that of researchers. The study concludes that in making interventions in soil management, there should be active participation of local stakeholders, primarily the farmers. There is a need to relate farmers' soil fertility classification and management practices with scientific ones used in research and extension for efficient dissemination.
Keywords: Soil fertility, management practices, Ethiopia

1. INTRODUCTION

Declining of soil fertility is a fundamental impediment to agricultural growth and a major reason for slow growth in food production in Sub-Saharan Africa (SSA) (Sánchez *et al.*, 1995). Soil fertility decline has become a major concern of policy makers worldwide. In sub-Saharan Africa, the issue has taken on a note of urgency as declining food production is linked to subsistence crises. This problem has often been attributed to the improper utilization and under management of natural resources by the traditional farmers. Due to increased population pressure, farmers are either entirely abandoning the traditional practice of using natural fallow to restore soil fertility, or unable to leave land fallow for long enough for it to be effective. Sustaining soil fertility therefore, has become a major issue for agricultural research and development in SSA (Smaling and Oenema, 1997).

Scientists recognize that indigenous (local) people have managed the environments in which they have lived for generations, often without significantly damaging local ecologies. Often the soil classification a soil scientist makes in a development is meaningless to the local people. If the resulting soil maps ever reach the farmers, they are usually on a scale not relevant to small farms, and advices about suitability of a soil for a specific crop are often not of interest to farmers who want to be able to grow multiple crops. If soil surveys would start with indigenous soil classification, research and development efforts would gain time and insight and communication between farmers and scientists and extensionists will be greatly improved if local soil nomenclature is used. It is also important to build on local systems of knowledge, as they relate to specific locations and are based on experience and understanding of local conditions of production. Many development projects and policies have collapsed because of a failure to understand local knowledge, and how this influences the way farmers manage natural resources.

Recognizing, empowering and incorporating indigenous knowledge in participatory rural development projects have been considered a means of ensuring socially, environmentally and economically sustainable natural resources management. There is a need to consider indigenous knowledge as a means to develop situation-specific and sustainable soil management measures. In past development effort, less attenuation was given to indigenous practices and farmer's competence to solve their problems in Ethiopia. The role of indigenous knowledge system in current soil classification and management practices and its contribution in reducing land degradation and ecosystem management has been undermined.

Local farmers have acquired knowledge from generations of experience and experimentation, as they had to adapt their agricultural systems using limited resources under harsh and insecure conditions. Hence, in order to design more appropriate research and development programs geared to improving integrated nutrient management practices, researchers need to understand farmers' knowledge and perceptions of soil fertility (Corbeels *et al.*, 2000).

Agriculture is the backbone of the Ethiopian economy and is given special attention by the Government to ensure food self-sufficiency. However, this sector is characterized by low productivity of land. In addition, declining soil fertility is the major constraining factor on crop production in Ethiopia, improved soil fertility management cannot be overemphasized (Eyasu, 2002; 2009). Ethiopia's agriculture is characterized by low productivity of land. In addition, land degradation in general and soil fertility decline in particular still remains major challenges that are adversely affecting the agricultural performance of the country (Woldeamlak, 2003). In order to design more appropriate research and development programs geared to improving soil nutrient management practices, understanding farmer's knowledge of soil is indispensable (Corbeels *et al.*, 2000). However, little effort has been made to characterize local soil fertility classification and its management practices in Amhara Regional State in general and study districts in particular. This study was, therefore, conducted to classify soil fertility using local criteria and assess indigenous soil management practices in Mecha district of West Gojam Zone, Northwestern Ethiopia.

2. MATERIALS AND METHODS

2.1 Description of the Study District

The study was conducted in ten kebeles from Dera district (South Gondar), Mecha, Burie wemberma and Jabi Tehnan district (West Gojjam) to answer traditional soil classification and fertility management practices. The study districts are located about 480 km far from capital city of the country, Addis Ababa. The altitude varies from 713 to 3215m.a.s.l with rainfall 900-2000mm/annum (Figure 2). Agro ecologically the districts have 80% *woyna dega* (warm) 12% *dega* (cool) and 8 % *kola* (semi-arid) areas (Figure 3).

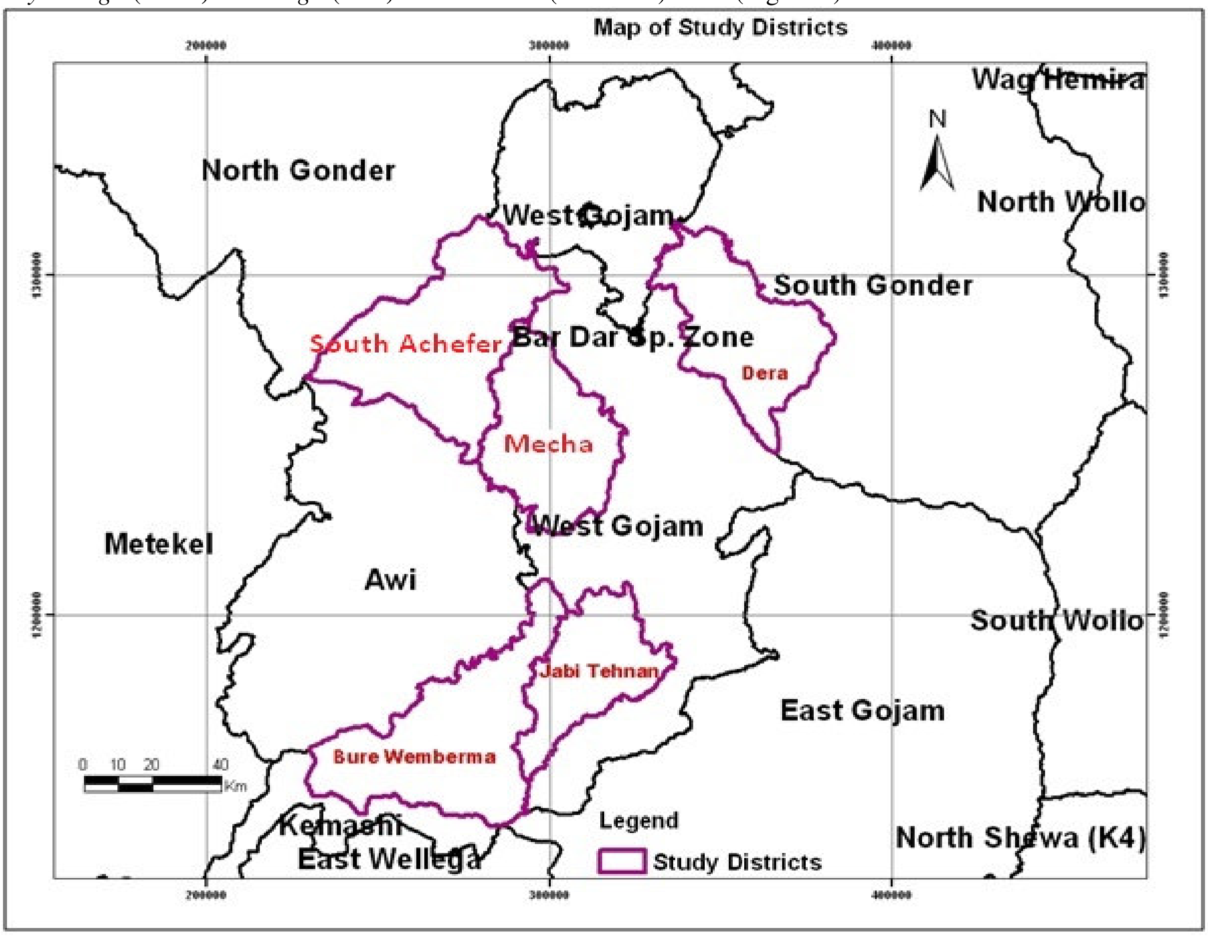

Figure 1: Location map of the study districts

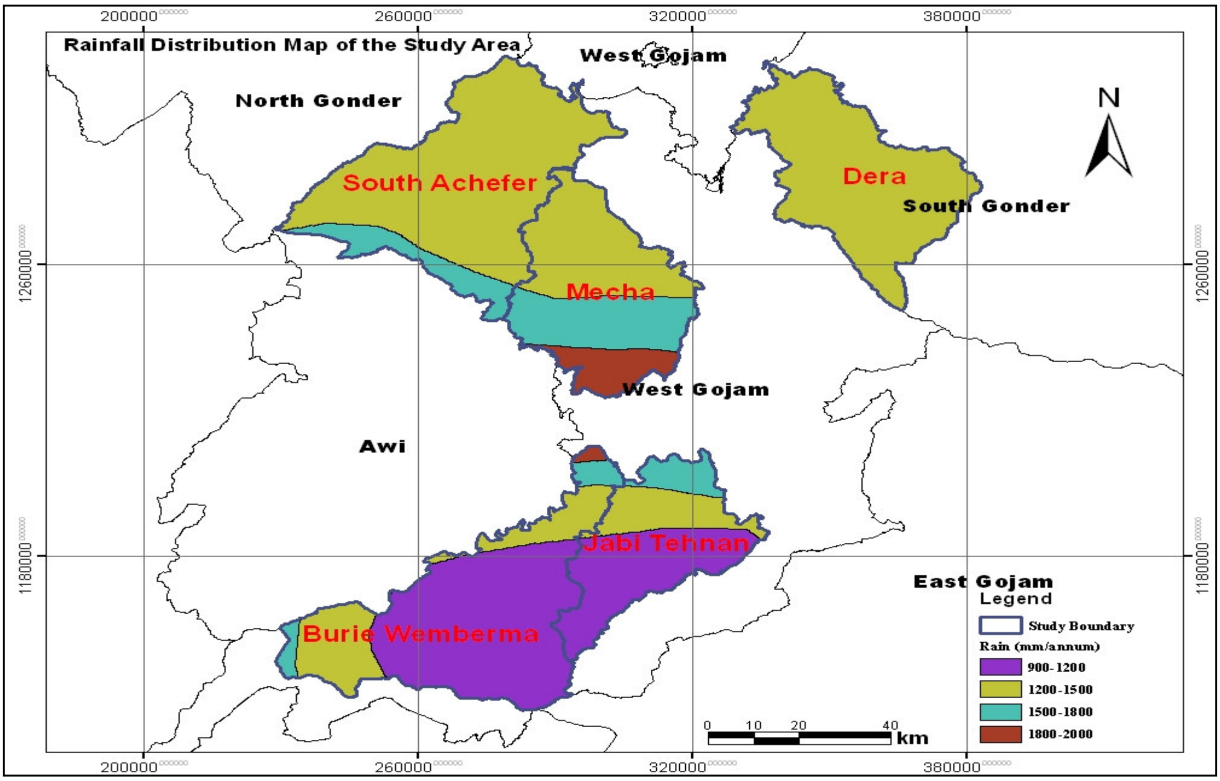

Figure 2: Rainfall distribution map of the study districts

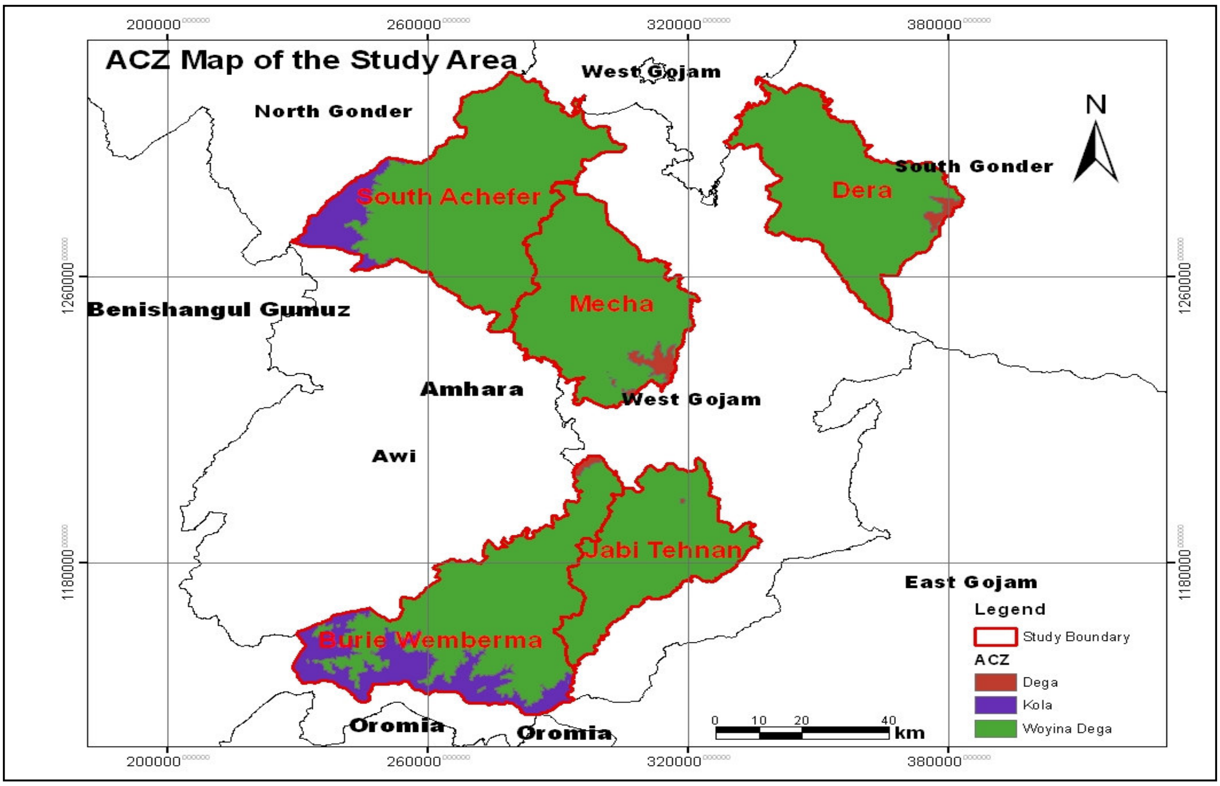

Figure 3: ACZ map of the study districts

The predominant agricultural practice is small-scale mixed subsistence farming some are engaged in subsistence mixed farming with trade as subsidiary activity. The study districts has a monomodal rainfall with long rainy season (*kiremit)*, is from June to September. So farmers can grow one rain-fed crop per year. The study districts are mainly characterized by the tertiary of volcanic basalt rocks (DSA and CSA, 2006). The natural vegetation cover in the study districts, like other parts of the region, is highly disturbed through human intervention for cultivation. Average land-holdings are less than one hectare. Land is prepared with an ox drawn plough, the *maresha*, and the main crops are maize, teff and finger millet and raise indigenous breeds of cattle, goats, sheep and poultry. Farmers rely on crop rotation, crop residues and animal manure for soil fertility management. The topography varies from flat to sloppy (Figure 4).

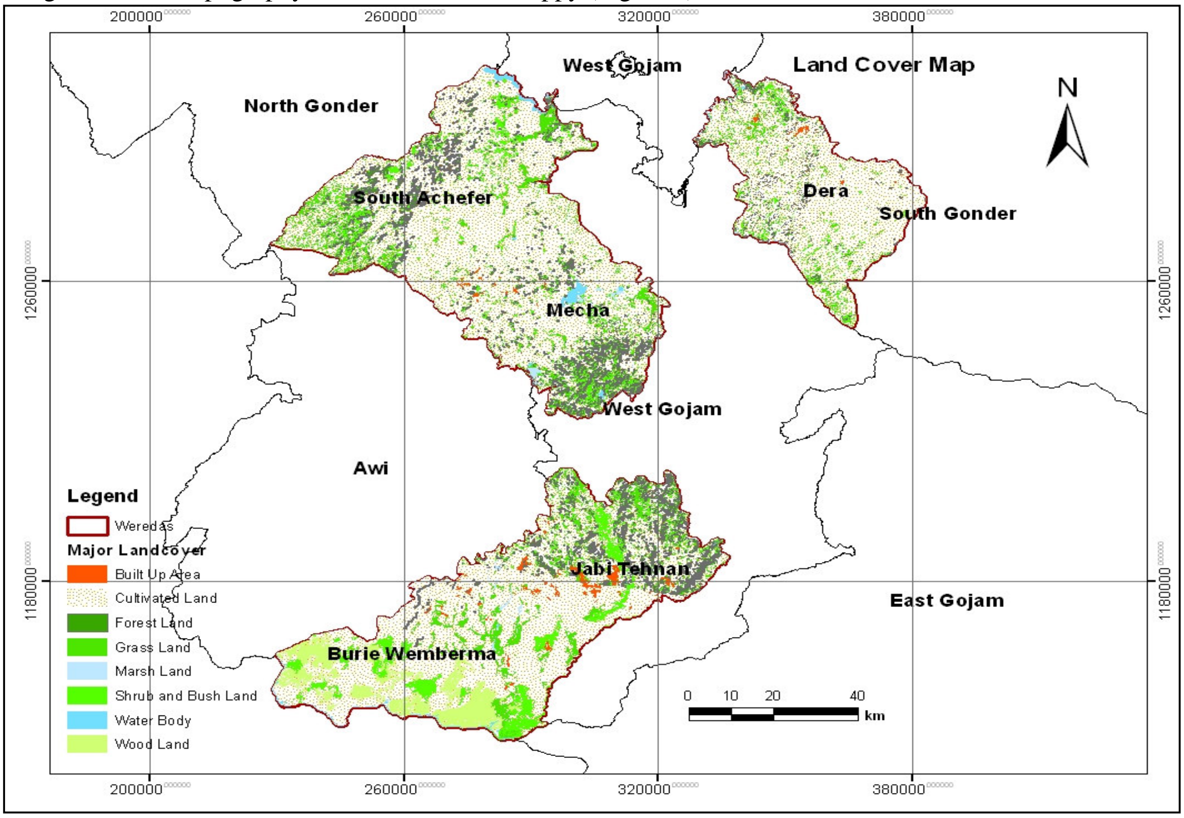

Figure 4: Land cover map of the study districts

2.2 Methods

This study was conducted to classify soil fertility status locally in three slope classes of 0-2, 2-5 and 5-8% of Dera, Achefer, Mecha, Burie wemberma and Jabi Tehnan districts, Northwestern Ethiopia. From each slope class about 65 farmers who had good knowledge of soils were selected and primary data were collected through interviews and group discussions.

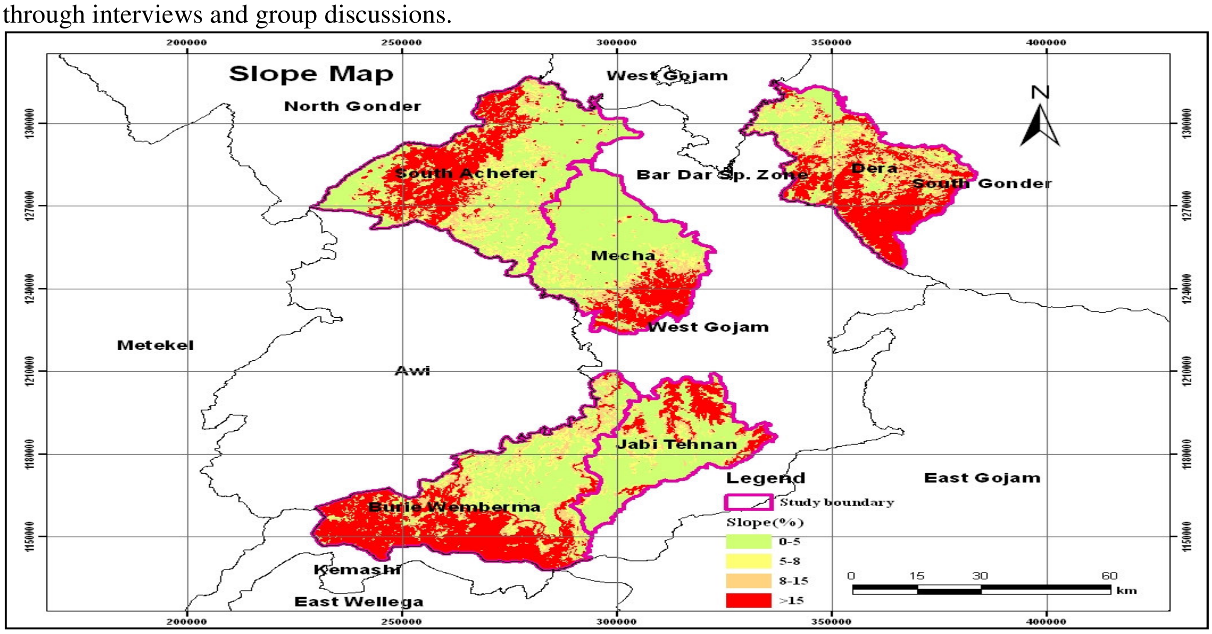

Figure 5: Slope map of the study districts

3. RESULTS AND DISCUSSION

Farmers classified their land into three classes: *reguid meriet* (fertile), *mehakelay meriet* (moderately fertile), and *rekik meriet based on* the soil's depth (infertile). The farmers' criteria for classification are yield, the topographic position, the soil's depth, colour and texture, its capacity to hold water and the presence of stones. Farmers ranked these criteria in the following order: yield > topography > soil depth/colour/texture/water holding capacity/stoniness. Yield is the most important criterion, and farmers are also aware that soil productivity is closely related to its position within the landscape. Topographical position is often a criterion in local soil classification systems. It is also found that farmers defined soil fertility as the soil's capacity for sustainable crop productivity, tillage and manure requirements and how easy it is to work.

It is clear that farmer fertility assessment is mainly concerned with food security which is highly dependent on land productivity. Results showed that farmers' fertility perceptions are more holistic than those of researchers. It was confirmed that farmers use a variety of inter-related criteria to characterise their soils with soil colour being dominant. Other factors included texture, depth consistency and moisture retention capacity, slope and management implications, all related to soil productivity potential. Overall, it appears that soil colour and texture are the two basic determinants for many indigenous soil classifications. Texture and colour are not only physically salient characteristics, people also highly associate them with other soil qualities, such as organic matter content, moisture retention and drainage and workability. Other aspects of soil that can be visually perceived and used for classification are organic matter, moisture condition, and earthworm casts. In general, dark soils are considered more fertile than light soils, associated with their organic matter content.

According to Corbeels *et al*. (2000), soil color was an important criterion for farmers, as it often reflected the soil's hidden parent material which determines the specific soil characteristics. Farmers ranked '*Koticha' or 'Guracha' (*meaning black soil*)* to be the best soil in terms of productivity in the years of moderate rainfall. Many development projects had failed because of ignorance of local knowledge systems. Indigenous soil classifications in this regard might provide a cheaper method of understanding soils than formal soil surveys. In addition, local soil classifications could facilitate communication between farmers, extension workers and researchers. Farmers mentioned that black soils were fertile and had high water holding capacity, while white and red soils were most commonly used to infer poor soil

4. CONCLUSIONS AND RECOMMENDATIONS

Farmers in the study area perceive soil fertility as a broader concept than the soil's nutrient status and closely related to crop productivity. The local system for classifying soils, which determines soil fertility management practices, is based mainly on soil colour, texture and depth. The findings of the research seem to show that the districts are experiencing the decline in soil fertility. It can therefore be concluded that in making interventions in soil fertility management practices, there should be active participation of local stakeholders, primarily the farmers. This helps to integrate indigenous soil management practices with the new techniques and enhance easy adoption and sustainable use of effective introduced practices. However, in designing sustainable soil management programs, local specific factors need to be given due attention.

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