Improving Land Use Classification Using Fuzzy Approach: In Suluh River Basin, Ethiopia.

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Abstract: The study's goal was to use an object-based fuzzy classification approach to classify land-sat images in the SRB. An accuracy value ranging from 88-90% and 0.87-0.89 for overall and kappa coefficient accuracy has been attained.

1. Introduction

Part of the northern highlands of Ethiopia, the Suluh River Basin topography is hilly with steep to gentle slopes, heterogeneous features, fragmented LULC, high shadow, and significantly degraded, with farmed areas and naturally protected church woodlands coexisting with heavily altered land use.Objective of the study was too use overall and kappa matrix to evaluate the accuracy of multispectral Land sat TM, ETM+, and OLI-TIRS images.

2. Materials and Methods

2.1. Suluh River Basin-is found the northeastern part of the Tigray region, northern Ethiopia.

2.2. Sources of Data

For the LULC change analysis of SRB, free satellite images from the 1990s (Landsat-5 TM), 2002 (Landsat-7 ETM+), and 2018 (Landsat-8 OLI-TIRS) were used. Using ERDAS 2014 software; a thorough pre-processing and processing were performed.This study used eCognition Developer 9.2 for nearest neighbor fuzzy classification(Eq.1) .

$$A=\{(X, \mu A(x)); x \in X\}, \text{ Where } \mu A \rightarrow [0,1] \qquad (1)$$

Where A=fuzzy set X=a space of objects X=elements belonging to space X μ – membership function.

2.2.4. Accuracy Assessment

In this study, overall accuracy and Kappa coefficient) were used to assess the accuracy of the classified images.
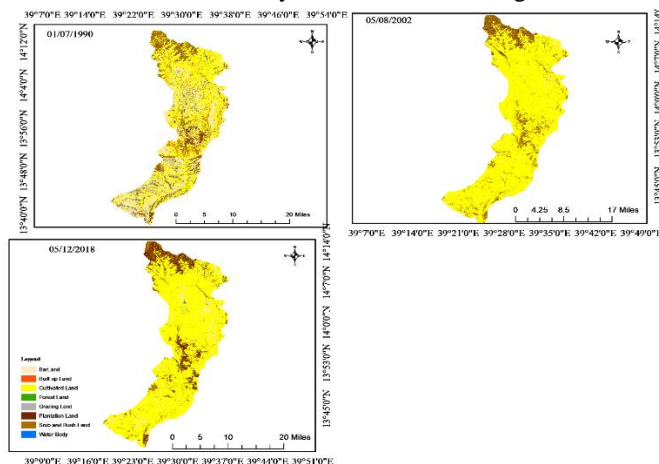

Figure 1. *Classified images (LULC maps) for 1990, 2002 and 2018 years*

3. Results

3.1. Land Use/Land Cover Classes

The trends LULC change from 990-2018 showed the expansion of Agricultural and settlement at the expense of vegetation cover and WB(Figyre 1).

3.2 Accuracy Assessment

An accuracy value ranging from 88-90% and 0.87-0.89 for overall and kappa coefficient accuracy has been attained.

4. Discussion

4.1. LULC class

Supporting Studies: Similar trends observed in various Ethiopian highland studies (Gessesse & Bewket, 2014; Gebrelibanos & Assen, 2015; Solomon et al., 2018; Demissie et al., 2017; Hassen & Assen, 2017). **Contrasting Studies**: Bewket (2002) and Fikir et al. (2009) noted an increase in forest cover due to community afforestation programs.

4.2. Accuracy Assessment

. Numerous studies (Yan, 2003; Salman et al., 2008; Al Fugara et al., 2009; and others) confirm that fuzzy classification generally outperforms pixel-based and object-based methods. As noted by Kuta & Comber (2015) and others, this approach is effective and applicable to other Landsat datasets.

5. Conclusions and Recommendations

. Despite the high degree of heterogeneity in the study area, a general classification value ranged from 88-90% and 0.87-0.89 for overall and kappa coefficient accuracy has been achieved, respectively. Thus, the fuzzy (nearest neighbor) classification approach is effective and can be explored and implemented for other studies in other areas using Landsat data.

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