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A Novel Remote Sensing Technology on Land Analysis Use Change Detection

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***Abstract* - Change location is helpful in numerous applications identified with land use and land cover changes, for example, moving development and scene changes, arrive corruption and desertification. Remotes sensing technology has been utilized for the location of the adjustment in land use arrive cover in upper Rib watershed. The fundamental target of this examination was to identify the land use change utilizing Remotes sensing for manageable land use arranging in Upper Rib watershed. The two satellite pictures for the year 2007 and 2018 were downloaded and utilized for recognizing the land cover changes. Most extreme probability arrangement was utilized in ERDAS Imagine device for characterizing the pictures. Ground truth focuses were gathered and utilized for check of picture arrangement. This was identified with the proceeded with extension of developed and settlement over years in River watershed. The information about the adjustment in land use is so fundamental for the organization and land use arranging exercises in upper Rib watershed. This is so for, the expansion and profitability of Rib repository by decreasing the upland disintegration through powerful land use arranging and soil preservation rehearses. Consequently, this examination uncovered that there is an expansion of horticultural land which needs due consideration towards soil protection for the improvement of the helpful existence of the supply.**
***Keywords:* Land Use Change, Remote Sensing, Upper Rib Watershed, ERDAS Imagine, Change Detection, Supervised Classification**

I. INTRODUCTION

Remote sensing data coupled with geographical information system (GIS) [1], offer good opportunities to monitor [3] regional ecosystem processes in tropical environments that are undergoing rapid change. Land cover, land utilize and land change are the recognition in the woodlands [5] and tried a set up on the translation of satellite pictures previously examined information, picture handling, characterization and understanding [6]. A reasonable multi-worldly investigation, and all measurements figured on a scene (from zone scope by vegetation classes to patches shape and size) are sensible to geometric mutilations [4]. Picture handling can be embrace radiometric and geometric remedy. Radiometric adjustment was used to make the tried pictures to be unmistakable and further more keep away from the discovered out comes being invalid (i.e. to lessen the impact of irregularities in picture splendor esteems that may restrain a capacity to translate). In this manner, the geometric adjustment of elevated photographs is for better information extraction, the procedure raises and builds up the nature of pictures. Geometric revision was additionally used to expel inner and outside mutilations so as to ask the area of every pixel on the earth by overlaying with other reference information, for example, land maps.

A. Objectives

Most of the land cover changes of the present and the recent past are due to human actions. Man kind's presence on the Earth and his modification of the landscape has had sound effect upon it. Land use/cover change involves either direct or indirect modification of the natural habitat and impact on the ecology of the area [5].

Population pressure has been found to have negative effect on land use-cover of the area [11]. It is planned to discover the territories of fast change, extent of progress and survey the over a significant time span of Land Change and Land Cover to comprehend the elements and pattern of progress [12]. Monitoring of land change by using ground based methods has become a difficult proposition due to insurgency. Satellite remote sensing is a better option under such situations. Remotes sensing technology has been used for the detection of the change in land use land cover (LULC) upper Rib watershed [13]. Poor land use practices and improper management systems have played a significant role in causing high soil erosion rates, sediment transport and loss of agricultural nutrients [14]. The effect of land cover change has caused the loss of fresh and portable water needs loss in the area alongside occupational dislocation [15].

Main objective of this study was to detect the land use change using remote sensing for sustainable land use planning in Upper Rib. Land and water resources degradation are the major problems in the watershed [17]. In addition to evaluate the nature, significance, and rate of land change from 2007 to 2018 [17]. The results in the loss of productivity, loss of organic matter rich surface soil (topsoil) is known to decrease soil quality which in turn reduces productivity. These problems are currently taking place in different landscape, where sedimentation patterns in downstream area shave significantly changed mainly due

to land use change. In addition, seasonal, extreme meteorological phenomena have caused significant soil losses and sediment deposited in newly built irrigation reservoir. Land use/land cover (LULC) changes are major issues of global environment change [6, 10]. The satellite remote sensing data with their repetitive nature have proved to be quite useful in mapping land use/land cover patterns and changes with time. Quantification of such changes is possible through GIS techniques even if the resultant spatial data sets are of different scales/ resolutions [8].

II. STUDY AREA

The derivation of land-cover information increasingly relies on RS technology due to its ability to measure land surfaces at various spatial and spectral scales. Classification is one of the major approaches to find land-cover information from remotely sensed imagery. This review illustrates the most important algorithmic developments and applications in the domain of RS research, emphasizing the achievements obtained by the RS research community. However, we would like to point out that most of the approaches in this article cannot be grouped into a comparative meta-analysis because each study has been developed on the basis of different experimental methodologies, and it applies learning algorithms differently. We have identified 55 research articles in seven leading journals, including some other sources related to the RS applications from 2007 to 2018[17, 18]. A number of existing and proposed policy instruments specifically include the use of land to capture information. Remote sensing is a very powerful tool in the provision of such information. Ribb dam site is found in South Gonder zone of Amhara National Regional State between FartaWoreda and Ebenatworeda; at a specific geographic grid reference location of 12°02’ 11.11” N and 38°02’ 18.2” E at an altitude of 1869 m.a.s.l. Ribb Watershed is situated mainly in FartaWereda (with small part engulfing into Ebinatwereda) of South Gonder Zone in Amhara Region. It is located at a distance of 625km north-of Addis Ababa [18].

III. MATERIALS AND METHODS

Remote detecting strategies connected in land changes thinks on conceded techniques. Remote detecting systems, for example, basic visual translation of the satellite symbolism, surface and specialized other land changes displaying have been effectively actualized for the recognition and measurement. Traditionally, remote detecting techniques have effectively been utilized to distinguish various land changes, because of land leeway for agribusiness or dairy cattle farming or urban expansion.

A. Satellite Image Classification: Image classification refers to the task of extracting information classes from multiband raster images [21]. There are two types of classification:

1. Supervised
2. Unsupervised

1. Supervised Classification in Remote Sensing: Supervised classification is the technique most often used for the quantitative analysis of remote sensing image data. At its core is the concept of segmenting the spectral domain into regions that can be associated with the ground cover classes of interest to a particular application. Supervised classification follows the steps:

a. Select training areas
b. Generate signature file
c. Classify

2. Unsupervised Classification in Remote Sensing: Unsupervised classification is different because it does not provide sample classes. First, the user identifies how many classes to generate and which bands to use. Next, the software then clusters pixels into the set number of classes. Finally, the user then identifies the land cover classes. Unsupervised Classification follows the steps:

a. Generate clusters
b. Assign classes

In unsupervised classification, it first groups pixels into “clusters” based on their properties. In order to create “clusters”, analysts use image clustering be that as it may, inconspicuous deforestation coming about because of such exercises as specific logging which targets singular tree species is a pivotal segment of deforestation and has to a great extent remained un-quantified especially applying remotely detected techniques [13]. Remote Sensing (RS) has been connected to independent and guide arrive cover and land utilize changes with different strategies and informational collections [14]. As deforestation, is one of the greatest threats to biodiversity world-wide, particularly within tropical ecosystems these are the land use alter. The microbial communities drive key ecosystem processes, and disturbance has long-term effects on microbial community composing in terrestrial ecosystems. For understanding the long-term effects of land use alter on ecosystem functions needs knowledge of microbial responses, and to that end, a raising number of studies have quantified the response of bacterial communities to land use change in tropical systems as a result.It is hoped that this review will provide guidelines to future researchers to enhance further algorithmic developments in RS applications.

B. Remote Sensing Image Analysis: RS image analysis is an interesting area of research because information embedded in remotely sensed data are used in many applications, including agriculture, forestry, urban monitoring, disaster management, robot navigation, and many others. This interest is due to the high quality of information that can be derived from RS images using suitable machine-learning algorithms. The advances in imaging sensors and satellite technologies are capable of providing very-high-resolution (VHR) images from airborne and satellite platforms. These images, including both airborne and space borne sensor data vary in spatial, radiometric, spectral, and temporal resolutions. The user’s need determines the nature of

classification and the scale of the study area, thus affecting the selection of suitable spatial resolution of remotely sensed data. To accommodate such a growing interest, there is a continuous demand for sophisticated algorithmic methods for the accurate mapping of high-resolution RS images. Readers can find more information about RS systems. Our expectation is that this will motivate researchers to design new techniques to study complex and ill-posed RS data[22].

C. Machine Learning: The optimization of a performance criterion using data instances based on past experiences is the goal of machine learning. In addition to the importance of data instances, modeling and optimization are very critical factors in machine learning. Modeling is a method to represent the separating boundary or probability distribution of the given training set, and then the optimization techniques are used to seek the best parameters of the chosen model.

D. Unsupervised Learning: In machine learning, the problem of unsupervised classification is to identify hidden patterns in unlabeled data. In unsupervised learning, we are given a set of instances X and we let the algorithms discover interesting properties of this set. Most unsupervised learning algorithms are based on the idea of discovering similarities between elements in the set X. Let X = {x1,…..,xn} be a set of examples, where xi∈ X for all i ∈ [n]: ={1,…,n

E. Supervised Learning: The problem of supervised classification can formally be stated as follows: an unknown function f:X→ Y that maps input instances x ϵ X to the class labels y ϵ Y and a training data set S = (x1, y1), (x2 , y2),…., (xi , yi), which is assumed to represent accurate examples of the mapping f, produces a function h:X →Y that approximates the correct mapping f as closely as possible. The learning algorithms help in identifying the class boundaries in the training set as correctly as possible by minimizing the training error. Traditional supervised classification techniques include the nearest neighbor rule, naive Bayes classifier, decision tree, and SVM.

F. Semi Supervised Learning: The area of SSL has experienced three different adopted models in its evolution. SSL is now a promising field of research and a review of SSL learning techniques is available in Semi supervised algorithms are designed using the following models:

*1. Generative Models: R*eproduce observable data randomly, given some hidden parameters. These models are used either for modeling data or as an intermediate step to framing a conditional probability density function. These approaches first estimate p(x | y), the distribution of data points belonging to each class. Hence the probability p(y | x) with a given pattern x and an unknown y is proportional to p(x | y) p(y), according to the Bayes rule.

2. Discriminative Models: deal with modeling the dependence of an unobserved variable y on an observed variable x. Within a probabilistic framework, this is achieved by modeling the conditional probability distribution p (y | x), which is able to predict y from x.These models do not permit sample creation from the joint distribution of x and y. Classification and regression tasks do not use joint distribution, and, therefore, discriminative models can provide good performance for these tasks.

3. A Low-Density: Separation approach attempts to push boundaries in regions where there are few labeled or unlabeled patterns. In this learning paradigm, each cluster of samples is assumed to belong to a single class label, which is called cluster assumption.

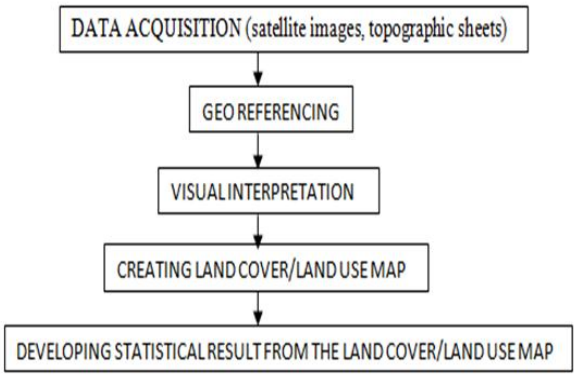

Fig. 1 Flow Chart of the Methodology

IV. RESULT AND DISCUSSION

A. Accuracy Assessment of Land Covers Classification

Classification accuracy assessment is important to check for individual classification if the resulting data are to be useful in change detection analysis [17]. A classification accuracy assessment was performed based on 280 random points that were identified and located using a stratified random method in ERDAS software to represent the different LULC classes of the area. For performing a proper accuracy assessment, the number of generated random points should total 250 or more. Producers accuracy is the total number of correct pixels in category that divide by the total number of pixels of that category as derived from the reference data. The kappa factor is given by:

$$\text{kappa (K)} = \frac{P0-Pe}{1-Pe} \qquad (4.1)$$

Where: Po = is the proportion of correctly classified classes. Pe = is the proportion of correctly classified values expected by chance. In Land cover change detection there are two broad methods of Change Detection Techniques includes- a) Pre-Classification Method, b) Post Classification Method. Pre-Classification method analyses the change without classifying the image value. The most common and widely used pre-classification method is ‘‘Vegetation Index Differencing (NDVI)”. Various index has developed after NDVI e.g. NDWI, MNDWI, Change Vector Analysis (CVA) etc.

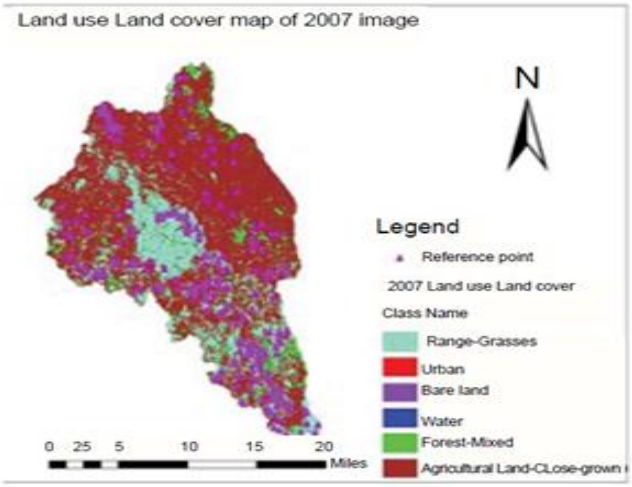

Fig. 2 (a) Land use land cover map of 2007 in upper Ribb dam watershed

The user's accuracy or reliability is the probability that a pixel classified on the map actually represent that category on the ground. User's accuracy is when the total number of correct pixels in a category divided by the total number of pixels that were actually classified in the category (row total); the result is a measure of commission error. The accuracy assessment checked for satellite image classification has presented in Table I as follows.

The consequences of the examination demonstrated that there was an emotional land use arrive spread change more than 11 years timeframe in Upper Rib watershed. There was an expansion of agrarian land by 13.78%, and a diminishing of meadow by 15.97% from 2007 to 2018.

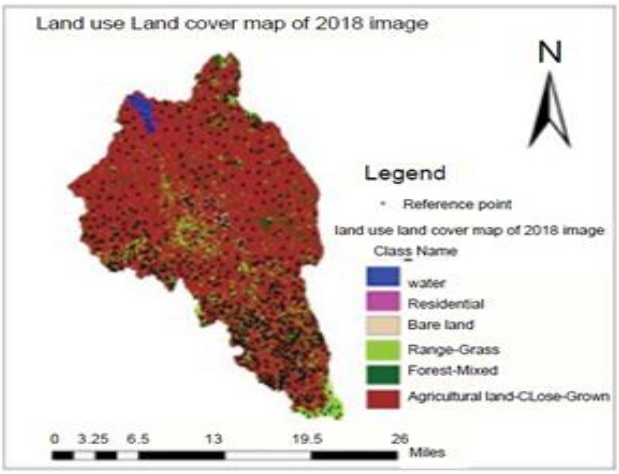

Fig. 2 (b) Land use land cover map of 2018 in upper Ribb dam watershed

The grassland was fundamentally changed to agricultural land because of an expansion of populace development prompts extreme interest for cropland in the territory. This was identified with the proceeded with development of developed and settlement over years in Ribb River watershed. The information about the adjustment in land use is so fundamental for the organization and land use arranging exercises in upper Rib watershed. This information is graphically represented as follows:

TABLE I THE SUMMARY OF THE LAND USE OF UPPER RIBB WATERSHED IS GIVEN IN THE BELOW

Land Cover type	LULC 2007		LULC 2018		Change in % from 2007 to 2018
	Area (km2)	% of area	Area (km2)	% of area	
Grasses	158.7	23.56	51.05	7.59	-15.97
Urban	0.124	0.018	0.93	0.14	0.122
Bare land	1.531	0.23	0.93	0.93	0.7
Water	0.94	0.14	5.63	0.84	0.7
Forest	26.24	3.89	35.99	5.35	1.46
Agricultural	485.99	72.16	577.94	85.94	13.78

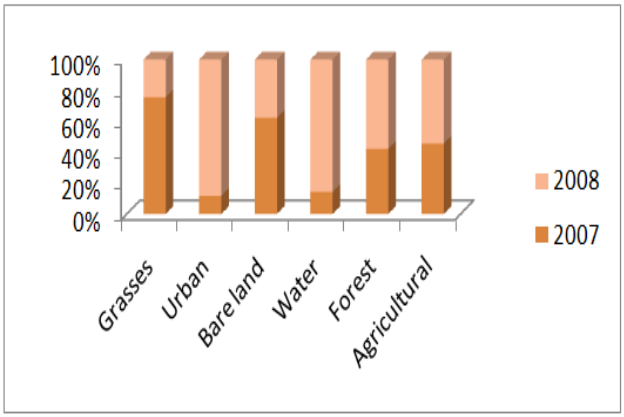

Fig. 3 Land use land cover graph for both 2007 and 2018

V. CONCLUSION

There is critical extension of developed territory took note. Then again there is decline in horticultural region; water spread region, and backwoods zones. This examination plainly demonstrates the noteworthy effect of populace and its advancement exercises on LU/LC change. This study demonstrates that reconciliation of GIS and remote detecting innovations is successful apparatus for urban arranging and the board .This paper centers around LU/LC changes in urban regions, utilizing remote detecting information and GIS Technology. Our outcomes obviously demonstrate that LU/LC changes were huge amid the period from 2007 to 2018.This investigation demonstrated a few remote detecting change discovery techniques with Landsat

pictures. Remote detecting innovation is the generally connected innovation utilized for land use change discovery examination. The land use arrive spread change location for Rib watershed had been done from satellite pictures downloaded and grouped utilizing ERDAS Imagine programming. This is so for, the expansion and efficiency of Rib repository by decreasing the upland disintegration through successful land use arranging and soil protection rehearses. Hence, this study uncovered that there is an expansion of rural land which needs due consideration towards soil preservation for the improvement of the valuable existence of the supply.

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