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A Literature Review on Land Use Land Cover Changes Detection using Remote Sensing and GIS

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Abstract: The current paper addresses the phenomenon of land use and land cover (LULC), which has undergone continuous changes over the last few decades as a result of significant environmental variations caused by anthropogenic and natural factors. A detailed review of the studies conducted so far has revealed a declining trend in land use land coverage. It has also been discovered that land use has an effect on land cover and vice versa.

Understanding the relationships and interactions between human and natural phenomena depends on the precision of change detection on the earth's surface. Remote sensing and Geographic Information Systems (GIS) have the potential to provide reliable data on changes in land use and land cover.

We look at the most common methods for detecting changes in land use and land cover. Eleven methods for detecting changes are examined. The most commonly used tools, according to a review of the literature, are post-classification comparison and principle component analysis. The effects of atmospheric and sensor variations between two dates can be minimised using a post-classification comparison. Although image differencing and image ratioing are simple to use, they do not always produce accurate results. Hybrid change detection is a useful method that combines the advantages of many methods, but it is complicated and dependent on the features of the other techniques, such as supervised and unsupervised classifications. Change vector analysis is difficult to enforce, but it is helpful in determining the magnitude and direction of change. Artificial neural networks, chi-square, decision trees, and image fusion have all been used in change detection in recent years. Change detection research that incorporates remote sensing data and GIS has also risen.

Keywords: Remote Sensing; GIS; Land Use and Land Cover Change; Change Detection Techniques; mapping; image processing; classification, accuracy.

I. INTRODUCTION

A place on which all human activity takes place is referred to as land. People's use of land resources results in "land use," which varies depending on the purposes it serves, such as food production, shelter, recreation, material extraction and processing, and the bio-physical characteristics of the land itself. As a result, land use is shaped by two broad sets of forces: human needs and environmental features and processes. Land cover is the biophysical state of the earth's surface differences in order to efficiently use them in land and immediate subsurface research (Turner et al. 1995). It refers to the physical condition of the land surface, such as cropland, mountains, or forests (Meyer, 1995 in Moser, 1996). The quantity and type of surface vegetation, water, and earth materials that make up land cover are discussed (Meyer and Turner, 1994). i.e., man-made structures (buildings, etc.), the kind of material used in the construction of housing structures (Parveen, 2017). Land cover initially referred to the type of vegetation that covered the land surface, but it has since expanded to include other elements of the physical environment as well, such as soils, biodiversity, and surfaces, as well as groundwater (Moser, 1996). Changes in land use and land cover are occurring in landslide-prone areas as forests and the vegetative cover that binds the top soil are being destroyed at an increasing rate, and forest land is being converted into agriculture and horticultural holdings (Khan et al., 2017).

The method of detecting changes in the state of an object or phenomenon by watching it at various times is known as change detection [1]. The speed and precision with which changes are detected on the earth's surface should help us better understand the relationships and interactions between human and natural phenomena, as well as provide advice in resource management. To investigate the temporal effects of the object or phenomenon in change detection applications, multi-temporal datasets are required. [2]. Remote sensing and Geographic Information Systems (GIS) have become effective methods for identifying objects and phenomena change, thanks to improved computing capabilities and data availability. The ability to detect change on the earth's surface using space-borne sensors is known as remote sensing [3].

The use of satellite imagery on a regular basis, as well as the increase in image quality, may aid in the detection of changes [4]. Scientists can use temporal and spatial resolutions to monitor and identify changes on a large scale, and planners can use them to collect or retain information on a variety of phenomena, including changing farming patterns, crop stress, disaster monitoring, and changes in land use and land cover [5].

A Geographic Information System (GIS) is a useful tool for comparing two or more time periods. It should integrate data from multiple sources into a change detection platform [2]. Multiple layers, such as classified images, topographical maps, soil maps, and hydrological maps, for example, increase the ability to collect valuable information about changes over a specific area. Furthermore, by modelling the available data and employing statistical and analytical functions, GIS can determine the patterns in these changes. The advantage of GIS is that it provides a variety of outputs in various formats (e.g., maps or tables), allowing users to choose the best output for extracting the desired information.

Land use and land cover changes are often detected using remotely sensed data and geographic information systems (GIS). Many studies have sought to detect land use change using remotely sensed data and GIS, for example [6-9]. To detect changes in land use and land cover, a number of processes or techniques based on Remote Sensing technologies are used. Some studies have used remote sensing techniques, while others have combined remotely sensed data with GIS data, for example. [10-12]. Furthermore, several studies [1,2,5,13-15] have analysed and summarised the different change detection strategies. These change detection strategies are discussed in the articles reviewed here in a variety of applications, including land use and land cover changes, vegetation and forest changes, urban changes, environmental changes, crop tracking, forest fires, and deforestation, among others We begin by providing an overview of the major land use and land cover change detection techniques, such as image differencing, image ratioing, change vector analysis (CVA), principal component analysis (PCA), chi-square, post-classification comparison, decision trees, image fusion, hybrid change detection, artificial neural networks (ANN), and Geographic Information Systems (GIS). Second, we look at case studies, literature on land use/land cover change research, and remote sensing and GIS techniques for detecting land use and land cover change.

II. LAND USE AND LAND COVER CHANGE TECHNIQUES

A. Image Differencing

Image differencing, also known as image delta [16], is a basic and straightforward method for detecting and interpreting changes [17]. It splits the pixels in an image into two categories: change and no change. These results are obtained by subtracting the digital number of a pixel on the image for date one from the digital number of the corresponding pixel on the image for date two. In image differencing, the general technique for finding a change in two dates is to extract the change of the image of date 2 from the image of date 1. (e.g., image of date 1—image of date 2) [18]. In this technique, thresholds must be chosen to determine the altered area [16,19]. The image differencing method, on the other hand, cannot provide enough information about the change itself. The results of image differencing may be influenced by atmospheric and other non-surface radiance features [20].

In the geographical climate, image differencing is commonly used for change detection [16,21-23]. It's been used as a single-band distinction [24] or as a three-band colour composite [25]. Sohl [22] used Landsat Thematic Mapper (TM) data to investigate five different change detection methods, including univariate image differencing, “enhanced” image differencing, vegetation index differencing, post-classification differencing, and change vector analysis, to detect landscape change in the Abu Dhabi Emirate. When compared to other methods, he discovered that "enhanced" image differencing provided the most precise values of change, while change vector analysis was helpful for providing rich qualitative detail about the nature of the change. Image differencing, image regression, tasselled cap transformation, and chi-square were used by Ridd and Liu [26] to compare four methods for change detection in an urban setting. The regression of TM band 3 was found to be the most accurate methodology for detecting change, while image differencing of TM 4 was found to be the least accurate.

Red band picture differencing is more effective than the Normalized Difference Vegetation Index (NDVI) for detecting vegetation change in arid and semi-arid settings [27]. Pilon and Howarth [28] also came to the conclusion that visible red band data provided the most reliable identification of spectral change for their semi-arid:

B. Image Ratioing

Image ratioing is the process of retrieving information from two or more different images using the same bands from those images. To calculate changes between two times using band 2, for example, a simple image ratioing procedure could be used: (Band 2 of t1 divided by Band 2 of t2). It's used to draw attention to slight differences in the pixels of different land covers. For both dates with a grey level, the untouched pixel gets the same number in image ratioing.

The value of the altered pixel changes, and it appears brighter or darker. In image ratioing, choosing an acceptable threshold value is critical for displaying the differences between two or more images. For retrieving vegetation cover information, the image ratioing method is helpful. The effect of shadows, radiation change, image noise, and sun angle can all be minimised using this method [29]. However, there are two significant drawbacks: determining the threshold value is difficult, and the kinds of changes cannot be determined. [2].

Howarth and Wickware [30] used image ratioing to create three different colour enhancements: a band 5 overlay, band 5 and 7 ratios, and a vegetation index. The results showed that using band ratioing and band 5 overlay, which provided extra information about the change, the main change was highlighted, while the vegetation index improvement results provided less information about the change. To determine the most suitable method for detecting changes due to gypsy moth defoliation, Nelson [31] tested three change detection strategies, including image differencing, image ratioing, and vegetation index differencing. The results showed that the vegetation index difference and the band 5 ratio were more precise than other single bands or band combinations for delineating forest canopy changes. Image ratioing and the normalised difference vegetation index image were used by Prakash and Gupta [32], who discovered that image ratioing offered very useful land use mapping information.

C. Post-Classification Comparison

Land use and land cover information can be extracted using a tool called post-classification comparison. It's a popular technique for detecting changes. Post-classification necessitates a comparison of modifications that were categorised separately. It's possible that the resulting map depicts the entire matrix of changes by coding the classification results for times 1 and 2. Furthermore, the subset of changes is detected by grouping the classification results selectively. The images are classified separately, pixel by pixel, on two dates in post-classification contrast, reducing the atmosphere and sensor differences between the two dates. Furthermore, this method reduces the issue of correct registration of multi-date images [1]. However, doing a post-classification comparison takes a lot of time and knowledge, and the quality of the classified image for each date has an impact on the final accuracy.

Two scheme classification and unsupervised classification algorithms are compared after classification. The analyst chooses a number of regions for an image and then detects the type of each phenomenon on the computer screen using supervised classification.

The computer recognises the features of the data that constitute each type and classifies the most comparable remaining image pixels based on the phenomenon found by the analyst. [14]. Supervised classification normally necessitates the use of training data and prior knowledge of the objects to be classified. Unsupervised classification [14] is a method in which a computer partitions data without prior knowledge and then assigns thematic labels. Unsupervised classification usually does not necessitate any additional training data or initial feedback from the analyst. [15].

The most common approach for detecting changes is post-classification contrast. (6), 21, 41, 63-69. Mas [70], who compared six change detection approaches to monitor land cover change, accepted the benefit of post-classification. Image differencing, vegetative index differencing, selective PCA, direct multi-date unsupervised classification, post-classification differencing, and a mix of image enhancement and post-classification contrast were among the methods used.

He came to the conclusion that the most reliable method was post-classification comparison, which also had the benefit of implying the nature of the changes. Schulz and Cayuela [71] investigated land cover modifications in dry-land woodland landscapes in Central Chile using post-classification. For multi-date classification, the maximum likelihood algorithm was used to provide a coherent classifier.

They claimed that after using the post-classification process, the classification accuracy improved. In some experiments, combining classification with other methods, such as NDVI classification or PCA and CVA classification, has been used to improve classification accuracy and prevent the leakage of training sample sets for image classification. To avoid overestimation of the amount of change, Li and Yeh [72] combined interactive controlled maximum likelihood classification with combined PCA. Abd El-Kawy, Rd [73] used map interpretation to increase classification accuracy and locate areas with efficient irrigation and private land reclamation.

Macleod and Congalton [74] used Landsat TM data to conduct unsupervised classification to quantify the change in eelgrass meadows. Post-classification, image differencing, and PCA were among the procedures used. For each image, classification was done independently using both supervised and unsupervised techniques.

Brink and Eva [75] used an unsupervised classification algorithm to track the dynamics of land cover change in Africa over a 25-year period.

D. Artificial Neural Networks (ANNs)

A neural network is a type of computer that solves problems using an unstructured approach based on adjusting the weights that connect the neurons in a network. The study of biological neural processing inspired the idea of a neuron. [76].

In most cases, an artificial neural network (ANN) is found in three layers: an input layer, a hidden layer, and an output layer. The multispectral reflectance values for each pixel with their texture, such as elevation, slope, and aspect, can be represented by neurons in the input layer. The use of neurons in the hidden layers allows for the simulation of nonlinear patterns in the input data. Finally, the neuron represents a single thematic map for each individual land cover class, such as agricultural or urban, in the output layer Each of these layers is made up of nodes that are linked to one another. Because of this interconnection, various types of information will flow in various directions [15]. The multi-layer perceptron neural model is trained using the back-propagation algorithm. [2].

The ANN allows training and testing classifications to extract valuable information from remotely sensed data and ancillary data [15]. An ANN, on the other hand, is sensitive to the amount of training data used and needs a long training period. ANNs are also uncommon in remote sensing software. [2].

Many scholars have acknowledged the value of using ANNs in remote sensing [34,35,77-80]. They've also been used in a variety of applications to detect changes. For example, Foody and McCULLOCH [34] used a feedforward ANN with a variant of the back-propagation algorithm to classify agricultural crops from synthetic aperture radar data and discovered that the ANN was better than discriminant analysis at identifying classes.

For identifying urban change, the ANN was used to classify image data into from-to classes. Prior to the ANN-based change detection, principle component analysis was used to extract the salient characteristics and minimise the dimensionality of the input data. The precision improved more when an ANN was used instead of a post-classification comparison. Change detection accuracy was also increased using principle component analysis [38]. With a combination of satellite sensor data and GIS, artificial neural networks were used to map land use and land cover change. From ancillary and spectral data, the ANN technique was used to derive land use and land cover classes [81]. When compared to spectral classification alone, this combination improved classification accuracy and developed relationships between land use and land cover, as well as environmental factors unique to the mapped area.

E. Hybrid Change Detection

A hybrid technique detects a change by combining two or more strategies (e.g., supervised and unsupervised classification, PCA and CVA). Hybrid strategies are divided into two categories. The first is procedure-based hybrid analysis, which employs various detection methods in various detection processes. The second type is result-based hybrid analysis, which entails employing a series of different change detection strategies before evaluating the results. To achieve meaningful change detection results, this method makes full use of the advantages of a variety of methods. The hybrid change detection approach, on the other hand, is sophisticated, difficult to implement, and ineffective because it is dependent on the features of other methods. [82].

Three Landsat Thematic Mapper Plus (ETM+) photos from the year 2000 in three Eastern European countries were used to create a land cover map using hybrid change detection, which combines the benefits of supervised and unsupervised classification (Slovakia, Poland and the Ukraine). The findings were more precise than if the methods were used individually [7]. Zhang, Ma [83], who used hybrid change detection and a decision tree classifier based on a data mining algorithm, got similar results. Individual change detection methods were found to be less accurate than the results obtained using this method.

F. Image Fusion

Image fusion is a technique that combines two or more images captured in different sensors and wavelengths from the same region. In general, various spectral and spatial resolutions are beneficial when discriminating land use and land cover type, whereas high spatial resolution is beneficial when detecting terrain characteristics and the earth's structure. Image fusion is used to provide extra information to assist users in detecting and identifying targets on the earth's surface. To obtain more precise information and at high resolution, image fusion can be used in conjunction with PCA, the intensity hue-saturation (HIS)transform, Brovey’s methods, and wavelet transformation. [61].

The benefit of using image fusion for change detection is that fusion methods can provide high spatial and spectral resolution, allowing users to extract land use and land cover information quickly and efficiently. It is apparent, however, that resizing and registering images derived from various sensors may be difficult to enforce. In a fusion image from Landsat TM and a SPOT-5 image, for example, the TM image is resampled to the SPOT size, and the two images are then registered before image fusion. [61].

As a result, people should consider this before engaging in fusion technique operations. Image fusion has been used to identify land use and land cover change over urban areas in a change detection context. For example, Zhou and Huang [40] compared three techniques for land cover classification of shaded areas in an urban setting, including combined spectral information, linear-correlation correction, and multisource data fusion, using high spatial resolution images.

When compared to combined spectral information and linear-correlation correction, the results showed that data fusion provided better precision. Different temporal SAR and optical image fusion algorithms for land cover change detection were introduced by Zeng and Zhang [85]. SPOT-5 imagery and RADARSAT-1 data were used in their analysis. Peijun and Sicong [44] combined simple change detectors and built an automated change detection process using feature and decision level fusion. Multi-temporal CBERS and HJ-1 images were used to validate this approach. The outcomes were satisfactory and more successful than those obtained from other techniques.

G. Decision Tree

A decision tree classifier is an algorithm that uses a series of decisions to label an unknown pattern [61]. A decision tree's structure is made up of guidelines, conditions, and theories, with the rules and conditions being assessed in order to test the hypotheses. When each theory appears as the tree's trunk, each rule as a limb, and each condition as a leaf, the idea of a hierarchical (or top-down) decision tree is used [15]. A decision tree breaks down a complicated decision into several smaller ones, resulting in a solution that's easier to understand. [86].

A decision tree can be designed in one of two ways. The manual design approach is the first; it is based on the user's experience and entirely on user interaction. The second method is based on a computer programme. The manual design approach is time-consuming and does not produce satisfactory results, particularly when there are a large number of classes and spectral overlap between them. [61]. Using data from the Advanced Very High-Resolution Radiometer for 1992-1993, Hansen and Defries [87] used a decision tree to characterise land cover (AVHRR). From 1987 to 2007, Yang, Ren [88] used Landsat TM and ETM+ imagery to compare post-classification and knowledge-based decision tree (K-DT) classification to estimate land use and land cover alterations in the Inner Mongolia Autonomous Region of China's watershed. Over the course of 20 years, the findings revealed dramatic changes in land use and land cover in the watershed.

H. Geographic Information Systems (GIS)

All of the methods discussed above are based on pixel-by-pixel change detection analysis of satellite imagery, and they are all image-based. It's critical to take advantage of collateral data like digital elevation models, hydrology, and soil maps [15], which can be combined with data derived from remotely sensed imagery and loaded into GIS platforms. As a result, combining remotely sensed data with GIS data has the potential to increase results accuracy. The primary benefit of GIS is that it can detect changes more clearly than other methods that use multi-source data. Using different source data with different formats and accuracies, on the other hand, may have an impact on the change detection outcome. [2].

In recent years, remote sensing and geographic information systems (GIS) have been frequently combined for studying and mapping changes in land use and land cover [9,11,12,89]. Using supervised classification algorithms and remotely sensed software, land use and land cover change maps have been driven into GIS applications [90,91]. When ancillary data (such as digital elevation models and soil maps) is combined with satellite imagery, it improves the accuracy of change detection. [92]. GIS has also been identified for identifying and mapping improvements in land use and land cover. Change detection has been accomplished using spatial statistical analysis and advanced functions (such as hotspots) [93]. In addition, earlier land use and land cover maps, as well as screen digitising of satellite imagery, have been used to identify land use and land cover change. [94, 95]

III.REVIEW OF LITERATURE

Over the last few decades, our understanding of land-use/land-cover change has progressed from simplicity to realism and complexity. The studies were initially focused on the physical aspects of the change, but eventually became part of the research agenda on global environmental change. Because of land use/cover change, scientists recognised that land surface processes have an impact on climate. Land cover change modifies surface albedo and hence surface atmosphere energy exchanges, which has an effect on regional climate, it was identified in the mid-1970s. (Otterman, 1974;

Sagan et al., 1979; Charney and Stone, 1975). Land-use/cover change has a much wider range of effects on ecosystems, products, and services, according to the study. Impacts on biotic diversity globally (Sala et al. 2000), soil degradation (Trimble and Crosson, 2000), and biological systems' ability to support human needs (Vitousek, 1997; Praveen, B. 2017) are all major concerns.).

Humans have always altered land to achieve the necessities of life, but the rate of exploitation was not as high as it is now. At local, regional, and global scales, recent rapid exploitation has resulted in unprecedented changes in ecosystems and environmental processes. Climate change, biodiversity loss, and emissions of water, soil, and air are all issues that land use/land cover changes are currently addressing. Researchers and policymakers all over the world are working to monitor and mitigate the negative effects of land use/land cover change while maintaining the production of key resources (Erle and Pontius, 2007). Human activities that degrade the quality of water in the environment are becoming a major environmental issue. The relationship between landuse and water quality aids in determining threats to river water quality (Ding et al., 2015) and provides insight into why sanitation is so important for human survival (Parveen et al., 2015). (Praveen et al., 2017).

A. Existing Literature on Land Use/Land Cover Change Studies

The majority of the terrestrial biosphere has been turned into anthropogenic biomes as a result of human populations and land use. Such change has resulted in the emergence of a variety of new ecological patterns and processes, and it has been notable for over 8000 years (Ellis, 2011). The causes, effects, and effects of LULC change have recently piqued the interest of a diverse group of researchers, ranging from those who prefer modelling spatiotemporal patterns of land conversion to those who attempt to understand the causes, impacts, and consequences. (Verburg et al. 1999; Brown et al. 2000; Theobald, 2001) Land use has an impact on land cover, and alterations in land cover have an impact on land use. However, a change in one is not always the consequence of the other. Changes in land cover as a result of land use do not always conclude that the land is being degraded. However, land cover changes are a result of several changing land use patterns caused by a variety of social factors. These changes have an impact on biodiversity, water and radiation budgets, as well as other mechanisms that affect climate and biosphere. (Riebsame et al. 1994).

Despite physical constraints, human activities, which are primarily influenced by socioeconomic factors, cause changes in non-built-up and built-up land (Long et al. 2007). A considerable part of the earth's land surface has been changed by land use change, including land transformation from one type to another and land cover alteration through land use management. The goal is to meet humanity's immediate needs for natural resources. (Meyer and Turner, 1992; Vitousek et al. 1997). The need to provide food, fibre, water, and shelter to more than six billion people is driving global changes to forests, farmlands, lakes, and air. In recent decades, croplands, pastures, plantations, and urban areas have all extended globally. This expansion is accompanied by significant increases in energy, water, and manure consumption, as well as significant biodiversity losses. (Foley et al. 2005).

Other than anthropogenic forces would affect land cover. Natural events such as weather, floods, fire, temperature fluctuations, and ecosystem changes, for example, can all cause changes in land cover. Other human activities have incidental effects on land cover, such as forest and lake damage from acid rain caused by fossil fuel combustion, and crops near towns being affected by tropospheric ozone caused by vehicle exhaust. (Meyer, 1995).

Land cover change analysis of the Gurur Ganga watershed in Uttaranchal was conducted by Bisht and Kothyari (2001). The study found that the area under agriculture and settlement increased between 1963 and 1996, while the area under forest and barren land decreased. During 1986 to 1989, Dhinwa et al. (1992) analysed land use change in the Bharatpur district, finding that forest cover has been exhausted while wasteland undulating terrain with or without scrub and rock out crops has improved.

Various land use changes may have an impact on one another. The majority of the ecological repercussions of land use change are the result of interactions between various land use changes. Deforestation, for example, has resulted in the degradation of freshwater habitat due to river siltation. As a result of interactive consequences between deforestation, afforestation, and reforestation, the role of the Asian forest as a carbon sink and source varies from year to year or from place to place. As a result, understanding the relationships of various land uses along their change trajectories is a 53 challenge. The human environmental sciences face a research challenge in understanding changes in land and habitats and their consequences for global environmental change and sustainability. (Omenn, 2006; Turner et al. 2007).

B. Land Use/Land Cover Studies Using Remote Sensing and GIS Techniques

It is important to have information on current land use and land cover in order to make the best use of land. It's also crucial to have the ability to track the evolving dynamics of land use as a result of both shifting population demands and natural forces shaping the landscape. As a result of a variety of natural and man-made processes, land is constantly changing. Understanding the evolution of urban systems and studying spatiotemporal patterns of intra and interurban form are also main goals of urban studies.

As a result, information about change is required for updating land cover maps and natural resource management (Xiaomei and Rong Qing, 1999).

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The process of detecting changes in the state of an object or phenomenon by watching it at various times is known as land use/land cover change detection (Singh, 1989). Because it offers quantitative analysis of the spatial distribution of the population of interest, change detection is an essential procedure in tracking and controlling natural resources and urban growth. Four facets of change detection are critical when tracking natural resources, according to Macleod and Congation (1998). They include, first and foremost, detecting the changes that have occurred; second, defining the nature of the change; third, measuring the change's area extent; and, finally, evaluating the change's spatial pattern. Changes in land cover result in changes in radiance values, which can be remotely sensed, which is the basis for using remote sensing data for change detection. As digital data manipulation has become more versatile and computer power has increased, so has the number of techniques for change detection with satellite imagery.

Land use mapping done on the ground is labour intensive, time consuming, and done infrequently. With the passage of time and in a rapidly changing climate, these maps quickly become obsolete. Satellite remote sensing methods have been developed in recent years, and they have proven to be extremely useful 54 for preparing accurate land use/land cover maps and tracking changes over time. Despite the problems of spatial and spectral heterogeneity in urban areas, remote sensing appears to be a credible source of information about the many aspects of the urban environment (Jensen and Cowen, 1999; Herlod et al. 2003). As a result, current geospatial information on patterns and trends in land use/land cover is playing an important role in the interpretation of drastic changes in land use/land cover at global, continental, and local levels, as well as in determining the extent of future changes.

Remote sensing imageries are a quick and easy way to get data on temporal patterns and the spatial distribution of urban areas, which is useful for interpreting, modelling, and projecting land changes (Elvidge et al. 2004). In the case of inaccessible areas, this technique may be the only cost- and time-effective way to collect the necessary data (Olorunfemi, 1983). Unlike aerial photography, satellite imagery can provide more frequent data collection on a regular basis. Although aerial photography can provide more geometrically precise maps, they are limited in terms of coverage and cost. Olorunfemi recognised the value of remote sensing technology in 1983 when using a classical method of surveying, aerial photography, to monitor urban land use in developing countries, with Ilorin in Nigeria as a case study.

A remote sensing device records a reaction based on a variety of land surface features, including natural and artificial cover. Tone, texture, pattern, shape, size, shadow, site, and association are all used by interpreters to deduce information about land cover. The generation of remotely sensed data/images by various kinds of sensors flown aboard various platforms at varying heights above the terrain and at various times of the day and year does not result in a straightforward classification system. It's a common misconception that no single classification can be applied to all kinds of imagery and scales. Anderson made a successful effort in 1976 to create a general-purpose classification scheme compatible with remote sensing data, which is also known as the United States Geological Survey (USGS) classification scheme.

Land use/land cover studies have been conducted on various scales for various users since the launch of the first remote sensing satellite (Landsat-1) in 1972. NRSA, for example, used Landsat multi spectral scanner data from 1980 to 1982 to map garbage land in India on 1:1 million 55 scales.

According to the study, 16.2 percent of waste lands are estimated to exist. Landsat Thematic Mapper has been shown to be suitable for general widespread synoptic coverage of large areas over time through a series of studies. As a result, the need for costly and time-consuming ground surveys for data validation is reduced.

Landsat TM data was used by the Maryland Health Resources Planning Commission to establish a land cover data set for their Maryland Geographic Information (MAGI) database. In 1985, the United States Geological Survey conducted studies to create 1:250,000 scale land cover maps for Alaska using Landsat MSS data (Fitzpatrick et al. 1987). A 21-class land cover map was created using all seven TM bands (EOSAT, 1992).

In 1992, the Georgia Department of Natural Resources finalised a mapping of the entire state of Georgia using Landsat Thematic Mapper data to detect and quantify wetlands and other land cover types. (ERDAS, 1992). Similarly, the Lands Resources Conservation Commission of the State of South Carolina created a comprehensive land cover map with 19 classes based on TM multi-temporal and multi-spectral data. (EOSAT, 1994).

In Indonesia, a land use/land cover pattern analysis was carried out using remote sensing methods to determine the index of changes using a combination of MSS Landsat and land use map (Dimyati, 1995). This was accomplished by superimposing land use/land cover images from 1972, 1984, and 1990 on top of land use maps. Adeniyi and Omojola (1999) used remote sensing and GIS methods to research changes in the two dams (Sokoto and Guronyo) between 1962 and 1986 in their land use land cover change Assessment in the Sokoto–Rima Basin of North–Western Nigeria. The research discovered that land use/land cover classes changed over time, but settlement remained the most common.

IV. CONCLUSIONS

It is very important to study land use land cover, which changes and degrades day by day due to natural causes such as climate variability or climate change, which results in floods and droughts, or anthropogenic causes such as industrialization and urbanization, which are all explained in the literature review and tells clearly how land use land is affecting.

Many methods, such as remote sensing, GIS, and GPS, are used in the monitoring and appraisal of land use and land cover.

Based on a review of the literature, it appears that no single approach is appropriate for all situations. The characteristics of the study area, the spatial resolution of the sensor, atmospheric impacts, and sun angle are all factors to consider when choosing an appropriate method for detecting change in an object or phenomenon on the earth's surface. Furthermore, before choosing a method, the qualities of the objects themselves should be considered, as some of these strategies have proven to be more potent in some cases than others. Image differencing, for example, is more effective than the Normalized Difference Vegetation Index in locating vegetation cover in arid habitats. Post-classification contrast is also advantageous in two ways. It contains information about changes without requiring the user to choose suitable thresholds. These factors, as well as the resolution of spatial and spectral images, can influence the precision of change detection results.

The things that may affect the outcome of change detection research should be considered. Furthermore, along with their findings, researchers can provide a quantitative analysis of the findings. Because these analyses compare the performance of change detection methods, there was no ground reference for precision evaluation in many of the studies examined. It's crucial to connect the results of change detection methods to the actual changes taking place on the ground. Some earlier analyses failed to take into account real-world developments.

The majority of change detection research looked at the effect of urbanization on tropical and temperate habitats; however, few studies looked at changes in desert environments. Changes in a desert climate may be caused by a variety of factors, including urban expansion and natural factors. These alterations can be difficult to spot using satellite imagery. In a forested area, for example, vegetation cover can be readily determined from satellite imagery, but not in a desert region. As a result, more research into applying change detection strategies to desert environments is needed.

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