OPEN ACCESS Freely available online

ISSN: 2469-4134
Journal of Remote Sensing & GIS

Review Article

Analysis and Prediction Land Use Pattern in Awissawella Area Using Sattelite Image

Dissanayaka GDVC*, Pushpakumara TDC

Department of Civil Engineering, University of Moratuwa, Katubadda, Sri Lanka

ABSTRACT

Unplanned high urbanization has become a major problem in the world. Alternative areas for population migration are suggested and discovered by the countries at the moment. For population migration and potential development in those alternative areas, policymakers should introduce guidelines and regulations. Land use/land cover change analysis studies are effective and successful methods to determine regulations and guidelines. In those kinds of studies, remote sensing and GIS are mainly used. Landsat satellite images were used as digital images and GIS was used to digitizing and analyzing purposes. CA-Markov models were used to predicting purposes. This kind of study has not been conducted yet for the Awissawella area which has been suggested as an alternative to highly urbanized cities like Colombo and Kandy. So, this research will be helped to make regulations, guidelines, recommendations and potential development plans of the Awissawella area.

Keywords: Remote sensing; Geographic information system; Land use/land cover change; Markov models; Satellite imagery; Urban sprawl

INTRODUCTION

The 21st century has been called the urban century by the United Nations human settlement program which is the United Nations agency that responsible for sustainable human settlements. 50% of the global population lives in urban areas in the world in fact, according to specialists, this trend will continue exponentially in the future [1,2].

In Sri Lanka, we have the same situation with more or less. We can categorize Colombo and Kandy as the most critical urbanized cities in Sri Lanka. When focusing on the Colombo current population density is 16417 for one square kilometer and the growth rate is estimated as 1.06% [3]. As well as lack of land to use, natural hazards like landslides, environmental pollution like groundwater conditions and air pollution have become the negative impacts of urbanization. This pressure will result in unplanned and uncontrolled changes in land use and land cover

Therefore, as a developing country, Sri Lanka should focus on alternative cities for sustainable human settlement, lands for use, population migration and planning the future. For that, there should be proper guidelines, recommendations and potential development plans for selected alternative cities [4].

Awissawella is located between Colombo and Kandy which is introduced as an alternative to the above mentioned problems. It's easy to access from Colombo and Kandy to the Awissawella area as well as lands are available enough to use as needs. One of the objectives of this paper is to identify land use and land cover change pattern, population migration and potential development pattern for the last 40 years in this area. Guidelines, recommendations and potential development plans can be introduced by analyzing and predicting those data [5].

Previous studies about land use/land cover changes by using satellite imagery, analysis and prediction methods will be discussed from the rest of the paper.

LITERATURE REVIEW

Many assessments have been implemented in worldwide with regarding land use/land cover, urban sprawl change analysis and

Correspondence to: Dissanayaka GDVC, Department of Civil Engineering, University of Moratuwa, Katubadda, Sri Lanka, Tel/Fax: +94776117051; E-mail: vikumdisanayaka93@gmail.com

Received: 02-Aug-2022, Manuscript No. JGRS-22-17619; **Editor assigned:** 04-Aug-2022, PreQC No. JGRS-22-17619 (PQ); **Reviewed:** 16-Aug-2022, QC No. JGRS-22-17619; **Revised:** 01-Oct-2022, Manuscript No. JGRS-22-17619 (R); **Published:** 08-Oct-2022, DOI: 10.35248/2469-4134.22.11.266

Citation: Dissanayaka GDVC, Pushpakumara TDC (2022) Analysis and Prediction Land Use Pattern in Awissawella Area Using Sattelite Image. J Remote Sens GIS. 11:266.

prediction. Following steps have been used in their studies. Here onwards I will review past studies in order to following topics.

- Data acquisition.
- Image preprocessing and Image classification.
- Accuracy assessment of classified images.
- Results summarizing.
- Change detection by analyzing.
- Prediction for future.

Data

There are many kinds of data acquisition ways available in the world at the moment. When data acquiring, the spatial resolution should be considered. It will vary with the scale of the project.

According to the study of Liss III and cartosat-1 satellite images were used as digital images. Topographic maps and other secondary data were used to the study.

Liss III and PAN of IRS ID satellite images were acquired for the study of [6] these digital images have high spatial resolution (1 m, 8 m).

Landsat images were used by most of the researchers as the digital images [6]. A large area analyzed by the study of Reis S, (2008) which was about 2700 km^2 [7]. The spatial resolutions of those acquired satellite images were respectively 28.5 m and 79 m. Red, green blue bands and infrared bands were included in the analysis. Aerial photos and standard topographic maps were used for other works. The training data which has been used for the supervised image classification technique. Maps were digitized for creating a spatial database and supervise classification purposes. Standard topographic maps have been used to produce the Digital Elevation Model (DEM). ArcGIS 9.2 software was used to the DEM creation process. In addition, 50 m x 50 m pixel size slope maps were used [8].

Remote sensed imaginary and image pre-processing

Remote sensing is a way of gathering information about an object without having any touch of a person. Remote sensing helps to visualize, gather information and observe the spatial distribution of large areas [9].

Digital images georeferenced and correction of errors mainly were done as the images preprocessing part.

According to the study of Reis S, most recent satellite image was geo referenced (geographic coordinate system UTM, projected coordinate system WGS84) to a standard topographic map with a Root Mean Square error (RMS) of less than 30 m [8]. Nearest neighborhood resampling method was used to geo referenced process. The older satellite image was geo referenced by using an image to image registration method, with an allowable RMS error. The radiometric errors and systematic errors were corrected by the commercial data providers. After geo referencing of acquired satellite images, the area can be obtained by ArcGIS software. A rough idea can be obtained by comparing that area and the actual area about the accuracy of acquired images and image preprocessing [10].

If radiometric errors and systematic errors and atmospheric correction were not corrected by the commercial data providers calibrations should be done. Normally absolute atmospheric correction is done by considering digital numbers of the digital images. Presence of gases, solid and liquid particles are caused to from the atmospheric errors [10]. ERDAS imagine version 2015 was used for layer stacking purposes.

Image classification

Many researchers have used different kinds of image classification methods and accuracy assessment techniques according to the scale of the project. For image classification process supervised image classification technique and ERDAS imagine 9.1 software was used by most of them.

According to Reis S, the study area was classified into 7 classes such as agricultural lands, baren soil, shrub, deciduous, grass, urban area and water items [8]. Maximum likelihood algorithm has been employed to detect the land use/cover types in ERDAS imagine 9.1 software.

In some of those classified images, uneven distributing can be seen. Atmospheric errors, training data errors can be caused for that uneven distributions [2].

Accuracy assessment

Accuracy assessment is very important for maps generated by remote sensing. A supervised classification method has been carried out to image classification process. Errors could be occurred when training data collecting and digitizing. Therefore, accuracy assessment has been implemented by considering ground truth data [11].

Error matrix is generally used to check the accuracy of the classification results. Overall accuracy, user's and producer's accuracies and the Kappa co-efficient were also calculated [5].

Error matrices should be derived for two year (all images). Ground truth points should be collected without consisting of any training data as well as enough number of ground truth data should be considered [10].

Land use land cover change results summarizing and change detection

The land use and land cover classification results can be summarized by a simple table. Then those results can be compared by considering the summarized results. Furthermore, the relative change of land classes can be identified [12].

The change matrix was used as a technique in the study of Reis S, [8]. To obtain this kind of change matrix ArcGIS software can be used.

Two way cross matrix also can be used to describe the key change types in the study area. In addition, cross tabulation analysis was conducted in order to determine the quantitative conversions from a particular category to another land cover category and their corresponding area over the evaluated period on a pixel to pixel basis.

An improved change vector analysis was used to detect the land use/land cover changing. A comparison was done about other change detection methods using in the field [7].

Analysing land use/land cover changes according to topology

The relationship between land cover/land use and topology/elevation can be analyzed by considering digital elevation models of a set of years. A suitable digital elevation model was created by using ArcGIS software. The elevation values can be found by LIDAR surveying, drone surveying or a normal field surveying [13].

Analysis of population migration and potential development pattern

Population migration and development patterns can be identified by focusing on the urban sprawl and urbanization pattern of past years.

According to study of Guyer JP, a vector based geographic information system was used to analyze urban sprawl. As reported this study, GN division level population density data was processed and digitized the GN divisions within the district [13]. Population data in those GN divisions were collected from the census and statics department and a spatial database was made. The analysis was finally optimized by using ArcGIS 9.3 software.

Prediction

There were many land use/land cover prediction models. Those models can be categorized as GIS based, machine learning based and hybrid based models. SLEUTH, LTM, STSM, SELES, CLUE, LANDIS are examples for GIS based models. CA, MC, SVM, ANN, LR, Box Jenkins are examples for machine learning based models and MLP-MC, LR-MC, CA-MC, regression tree-CA, ANN-CA CLUE-MC can be introduced as hybrid models. By considering those, CA-Markov models can be identified as most used for land use/land cover prediction [14].

DISCUSSION

Markov chain analysis predicts future land use trends based on land use changes in the past. According to the study of the spatial patterns of future land use has been predicted based on the dynamic changes in land use. Landsat images were used as digital maps. Land use classification maps were obtained for each year. Then, the genetic transition probability was obtained by IDRISI software. Then based on the CA-Markov model, a predicted land use current map was obtained and it was validated by the actual land use results with a Kappa index. Finally, the land use patterns of for future in Jingle County were determined [12].

CONCLUSION

This literature review simply demonstrates the previous studies of land use/land cover change analysis, prediction and urban sprawl between time periods. For that remote sensing, satellite imagery, GIS, CA-Markov models and some softwares were used.

I was able to get a clear idea about the research, the importance of the research and methodologies. Lots of studies have been conducted regarding this type of research topic worldwide. Many development projects and constructions have been introduced by considering the results of those studies and these projects have been succeeded. Most of the studies were conducted only considering analysis or prediction. But I think both analyzing and prediction parts should be considered in one study.

I hope to do my research by considering all of the methodologies which I have previously mentioned. When choosing the methodology, I wish to choose a minimum defect, shortcoming and maximum accuracy method. This literature review was helped for identify those defects and short comings and techniques.

ACKNOWLEDGEMENTS

I would like to express my deep sense of gratitude to Mr. Pushpakumara TDC, for dedicating his time and knowledge in many ways toward for completion of this review.

REFERENCES

1. World Vision International. The 21st Century is an urban century. 2013.
2. Seto KC, Woodcock CE, Song C, Huang X, Lu J, Kaufmann RK. Monitoring land-use change in the Pearl River Delta using Landsat TM. International journal of remote sensing. 2002;23(10): 1985-2004.
3. World Population Review. Colombo Population 2020 (Demographics, Maps, Graphs). 2020.
4. Weeraratne B. Re-defining urban areas in Sri Lanka. Institute of Policy Studies of Sri Lanka. 2016.
5. Afify HA. Evaluation of change detection techniques for monitoring land-cover changes: A case study in new Burg El-Arab area. Alex Eng J. 2011;50(2):187-195.
6. Mallupattu PK, Sreenivasula Reddy JR. Analysis of land use/land cover changes using remote sensing data and GIS at an Urban Area, Tirupati, India. Scientific World J. 2013;2013:268623.
7. Chen J, Gong P, He C, Pu R, Shi P. Land-use/land-cover change detection using improved change-vector analysis. Photogramm Eng Remote Sensing. 2003;69(4):369-379.
8. Reis S. Analyzing land use/land cover changes using remote sensing and GIS in Rize, North-East Turkey. Sensors. 2008;8(10):6188-6202.
9. United States Geological Survey (USGS). What is remote sensing and what is it used for? 2020.
10. Hossen S, Hossain MK, Uddin MF. Land cover and land use change detection by using remote sensing and GIS in Himchari National Park (HNP), Cox's Bazar. Bangladesh. J Sci Technol Environ Inform. 2019;7(02):544-554.
11. Esri: ArcGIS Desktop. Accuracy Assessment for Image Classification. 2020.
12. Liping C, Yujun S, Saeed S. Monitoring and predicting land use and land cover changes using remote sensing and GIS techniques-A case study of a hilly area, Jiangle, China. PLoS One. 2018;13(7):e0200493.

13. Guyer JP. An Introduction to Survey Methods and Techniques. The Clubhouse Press, El Macero, USA. 2015.
14. Bounouh O, Essid H, Farah IR. Prediction of land use/land cover change methods: A study. IEEE Xplore, 2017 International Conference on Advanced Technologies for Signal and Image Processing, Fez, Morocco. 2017;1-7.