GIS BASED LAND USE CHANGE DETECTION OF BANDARAWELA D.S DIVISION

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Abstract:

Housing, cultivation, food production and resources depend on the quantity and quality of land that a community possesses. Civilization and culture are also intimately connected with land use pattern, ecology and nature. The scope of this study is to identify dramatically changed land use of study area. The study used both primary and secondary data. Data on land use and land cover changes that occurred from 1982 to 2015 in Bandarawela was analyzed by Geographic Information System (GIS) and Quantum Geographic Information System (QGIS). Conversion of land for individual income generation activities and urbanization have caused much of the land use changes in this area while population growth and policy development of government in relation to the economic development, particularly land and agricultural development policies have also contributed to their. Modernization under industrialization and commercialization is a new development that has considerable impact on land use changes in the area. If current trends are allowed to continue, natural covers will be endangered. In addition to this, overall natural vegetation health will be under question. Therefore, selecting appropriate land use systems that are suitable to the conditions of the study area will be important.

Keywords: *GIS, land use, housing, modernization*

1. Introduction

Land is one of the most valuable resources in the Earth. It is a complex and dynamic combination of factors: geology, topography, hydrology, soils, microclimates, and communities of plants and animals that are continually interacting under the influences of climate and human activities. The human landscape is a dynamic, ever changing phenomenon. It is the product of human occupancy of particular places for thousands of years. The visible landscape reflects a culture's organization of space, often over millennia.

Land use involves the management and modification of natural environment or wildness into built environment such as buildings, settlements and semi natural habitats such as arable fields, pasture and managed woods (Thilakaratne, et al, 2013). Land use is a term in the language of city planning (Albert Guttenberg, 1959). The land use can be generally classified into urban or build up area, agricultural land, rang land, forest land, water land, wetland, barren land, tundra and perennial snow or ice. Urban land and agricultural land are changing through the development (Gangodawila. C.D, 1988).

Land use change is a major issue in the world. There are two types of land use changes, direct anthropogenic (human caused) changes and indirect changes. Examples of anthropogenic changes include deforestation, reforestation, and afforestation agriculture and rural and urban development. Indirect changes include those changes in the climate. According to these types human activities play a major role in land use change. A Land use and land cover change (LULC) is a key driver of global environmental change and has important implication for many national and international policy issues **(**Andy Purvis, 2014).

Geographical Information System (GIS) is used to display, manipulate and analyze spatial (map) data. Map accuracy is high in GIS than the other map making methods. It provides accurate output in both object oriented and field oriented views of geographic variation. Using GIS, data is maintained in physical compact data files, large amount of data can maintain and extract with great speed. Therefore, in this study attempt has been made to map the extent of land use change in the study area using Geographic Information System.

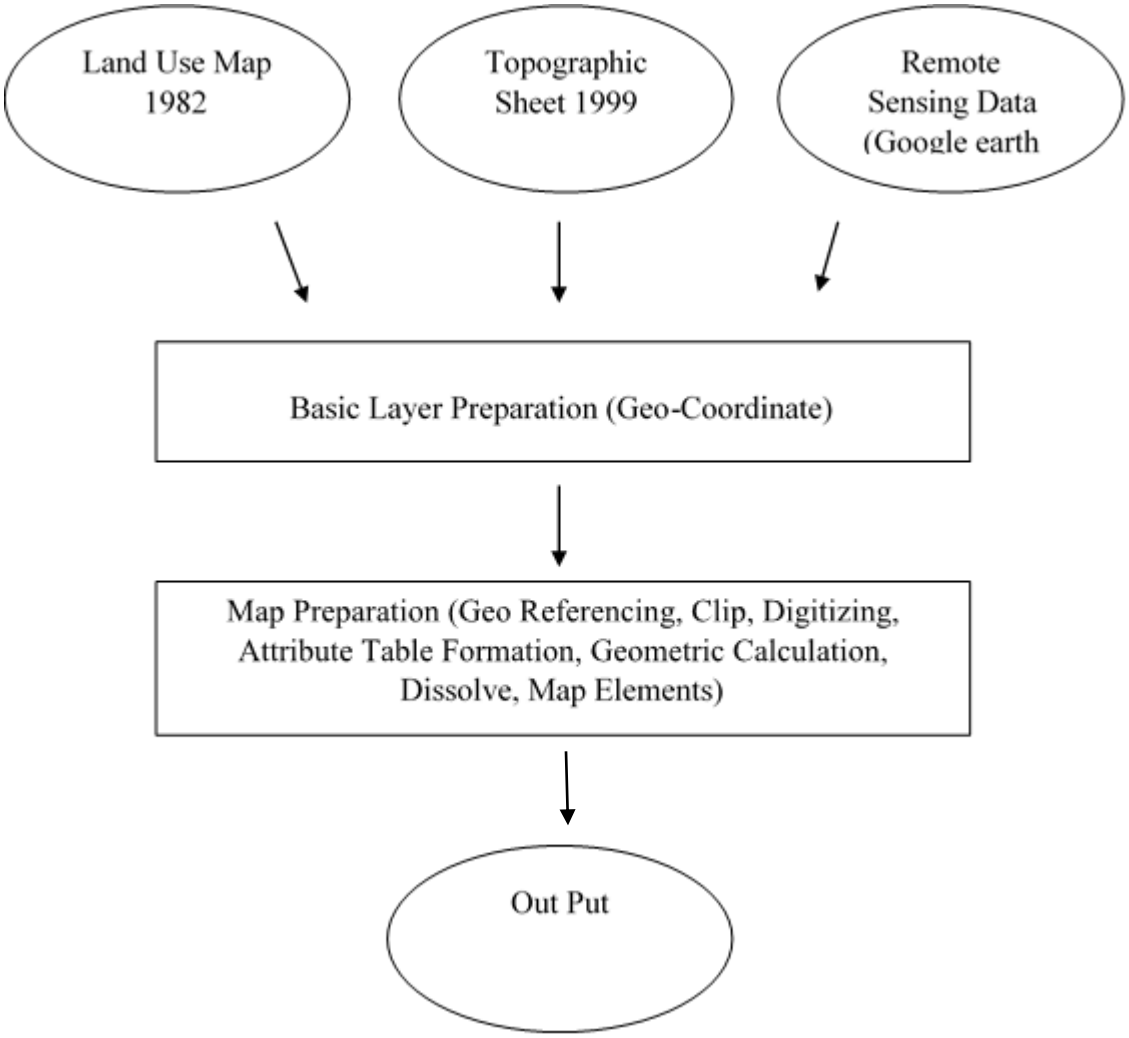
2. Objectives

The research was designed to achieve the following main and specific objectives. The main aim of the study was to identify dramatically changed land use patterns. The research also had the following specific objectives as to identify present and past land use pattern of Bandarawela D.S Division and to prepare past and present land use map for the study area.

3. Methodology

Bandarawela Divisional Secretariat is located in Badulla district. The study area has got both urban and rural regions and in this both areas land use patterns different from one to another. Urban area is committed with urbanization activities and rural areas are engaged with road developments and settlements. Because of these activities earth surface have shown changes. Land use changes have reduced agricultural productivity and increased environment pollution. GIS help to identify the dramatically changing land use in the earth surface.

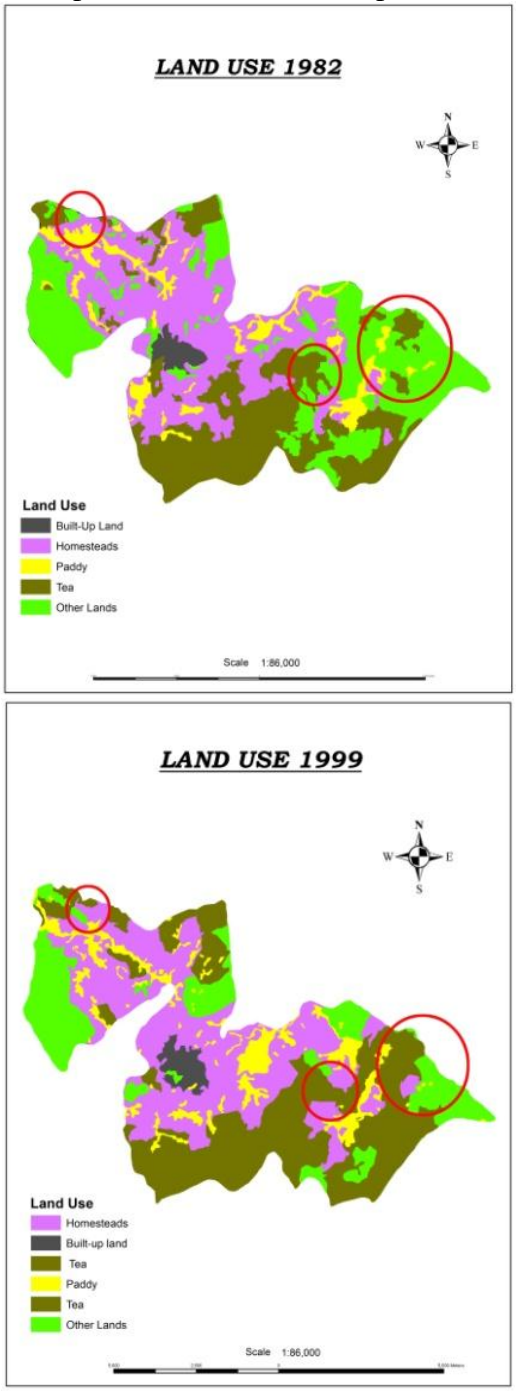
Random sampling method was used to collect data randomly. Questionnaire survey and discussions were conducted to collect primary data. Secondary data was collected from published and unpublished data sources. Statistical data had collected from Bandarawela D.S Division and got the basic map of geology and land use from Survey Department. Collected data was analyzed manually as well as by using Google Earth Pro, Arc GIS 10.1, Quantum GIS.
Following flowchart shows the methodology used in study.



Results and Discussion

Change detection is a process that measures how the attributes of a particular area have changed between two or more time periods. Change detection often involves comparing aerial photographs or satellite imagery of the area taken at different times. Following changes are detected for the two periods of concern.

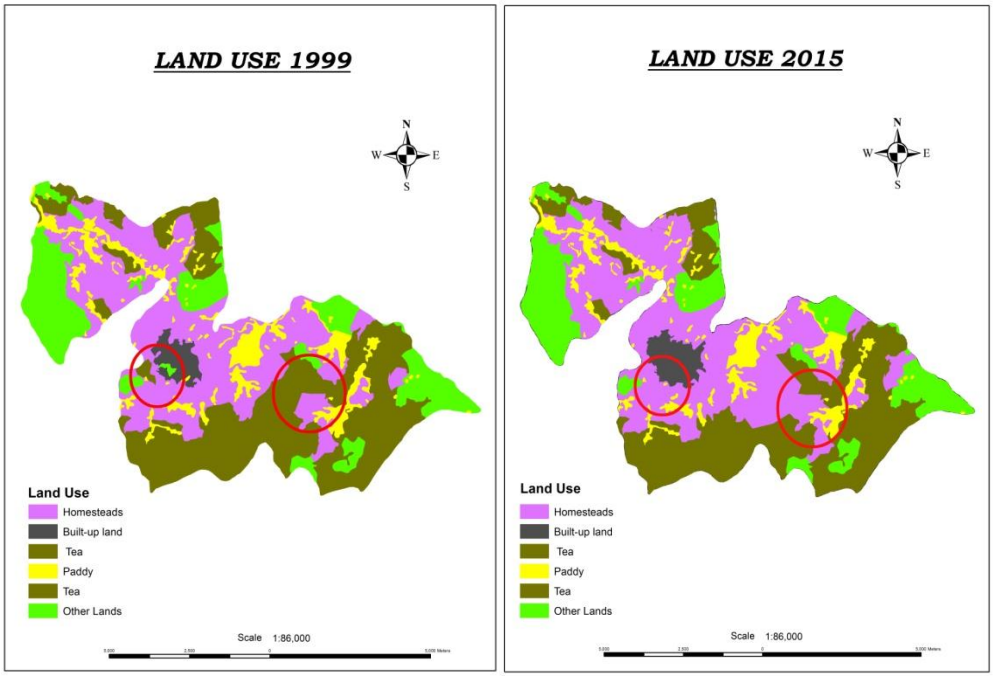
Figure 1: Comparison of Land Use Map from 1982 to 1999



Circled areas in above from left side to right side are Konthahela, Liyangahawela and Bambaragama. From 1982 to1999 notable changes have happened in these

areas. Tea enlargement proceeded to settlement for these areas. Liyangahawela area had importance to huge amount of settlement for transportation facility.

Figure: 2 Comparison of Land Use Map from 1999 to 2015



Areas which are circled in these maps from left to right are Ambathenna and Egodagama (Figure 02). Tea and other land covers of Ambathenna switched to homesteads due to urbanization of Bandarawela.

Table: 1 Land Use change (sq.km) of Bandarawela from 1982 to 1999

Land Use	1982		1999		Changes between 1982 and 1999		Mean change km^2/year
	Area	Percentage	Area	Percentage	Area	Percentage	
Build-up land	1.26	1.84	1.54	2.21	+0.28	+0.37	0.0164
Homesteads	22.71	33.19	23.4	33.68	+0.69	+0.49	0.040
Tea	18.76	27.41	24.94	35.90	+6.18	+8.49	0.363
Paddy	5.38	7.86	7.08	10.19	+1.7	+2.33	0.1
Other Lands	20.33	29.70	12.51	18.02	-7.82	-11.68	0.46
Total	68.44	100	69.47	100			

Table: 2 Land Use change (sq. km) of Bandarawela from 1999 to 2015

Land Use	1999		2015		Changes between 1999 and 2015		Mean change
	Area	Percentage	Area	Percentage	Area	Percentage	km^2/year
Build-up land	1.54	2.21	2.17	3.16	+0.63	+0.95	0.039
Homesteads	23.4	33.68	26.36	37.94	+2.96	+4.26	0.185
Tea	24.94	35.90	22.07	31.86	-2.87	-4.04	0.179
Paddy	7.08	10.19	6.8	9.78	-0.28	-0.41	0.0175
Other Lands	12.51	18.02	11.98	17.26	-0.53	-0.76	0.033
Total	69.47	100	69.47	100			

As indicated analyze of the study established that, the change detection was made based on the classified maps of 1982, 1999 and 2015. When 1999 land use classification compared with 1982 land us classification there is change that shows both decrease and increase in particular land use land cover. The land use categories shows increase are built-up land, homesteads, tea and paddy. The average rates of change for these are 0.28 sq.km, 0.69 sq.km, 6.18 sq.km and 1.7 sq.km respectively. On the other hand, the land use category other lands which include sparsely used crop land, natural forest and rangeland decreased by 7.82 sq km. Total land of the study area is 68.66 sq km in 1982. In this total land amount 16.67 sq km (24.35%) has changed in 1999. Estimate illustrate 0.98 sq.km changed as average rate per year.When the 2015 land use classification compared with 1999 land use classification, there were changes that showed decrease or increase in particular land use land cover. The land use land cover categories which showed increase are built up land and homesteads for 0.63 sq km and 2.96 sq km. also the average rate of change for these LU/LC classes was 0.039 sq km/ year and 0.185 sq km/ year correspondingly. On the other hand, the land use categories like tea, paddy and other lands showed decreasing pattern amounted to 2.87 sq km, 0.28 sq km and 0.53 sq km; also the average rate of change for these LU classes was 0.179 sq km/year, 0.0175 sq km/ year and 0.033 sq km /year respectively.

Socio Data Analysis

Construction and road expansion are main activities to change the land utilization in the area. Road expansion is a main process continues in both urban and rural parts. Study area have some land use change and it was agree by 80% of people and they

said human is the main influencing factor to change the land by building, road expansion. On the other hand some people build home in their vegetable garden and some were removed tea plantation in their own land and it was sold to settlement purpose. Study area's community willing to live in good environment. They confirmed that developments have both advantages and disadvantages. Advantages are known as good transportation facilities and settlement. Disadvantages are land conflict, loss of vegetation cover and quality of land. Due to human activities, slope land have converted into flat land it cause to land slide and rock fall. Especially in rainy season water absorption is low due to removed vegetation cover so slope land cause to heavy runoff and it is being a main factor to land degradation. Soil erosion and loss of soil fertility is high through heavy runoff.

Conclusion

Consequences of the land use change during last three decades in the area are very significant in this study. The land use change shows variation during the two periods, 1982 to 1999 and 1999 to 2015 that comparison had made. Some land use classes that show increasing change during first period comparison shows decreasing change during second comparison. These are tea and paddy. However, Built-up land, homesteads and other lands shows similar pattern of change, which other lands show decreasing change pattern and Built-up lands shows increasing change pattern during the two period of comparison. This indicates that there is constant decrease on other land classes and on the other hand there is constant increase on Built-up land and homesteads cover category.

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