

**Geographic Information System and Remote Sensing
Techniques for the Study of Land Use Changes in
Samanalawewa Catchment Area, Sri Lanka.**

By

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**Thesis submitted to the Faculty of Graduate Studies, University of Sri
Jayewardenepura for the award of the Masters Degree of Science in
GIS and Remote Sensing on 20th March 2016**

DECLARATION OF THE CANDIDATE

I do hereby declare that work described in this thesis was carried out by me under the supervision of Dr. Rev. Pinnawala Sangasumana thero and, Dr. Ranjith Premasiri and report on this thesis has not been submitted in whole or in part to any University or any other institution for another Degree/Diploma.

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ACKNOWLEDGEMENT

I am particularly grateful to Dr.Pinnawala Sangasumana thero, and Prof. R.M.K. Rathnayake, Dr.Ranjith Premasiri who provided me with so much clear-sighted help and creative guidance which helped me do my Research.

I am honestly thankful to Mr. Inoj kaushalya and the Friend of mine Mr.Champika Fonseka, Mr.Janaka Priyankara for their kind cooperation for the success of my research.

Also I am grateful to my loving Mother and my Brothers and sisters, who helped and motivated me in many ways to make this Research success.

I would also like to thanks all members Department of Geography University of Sri Jayewardenepura.who helped and motivated me in many ways to make this Research success.

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Abbreviations

DEM	Digital Elevation Model
ETM	Enhanced Thematic Mapper
GIS	Geography Information System
Ha	Hectare
Km	Kilo meters
LULC	Land Use Land Cover
MLC	Maximum Likelihood Classifier
MSS	Multispectral Scanner
RS	Remote Sensing
SQ	Square Meters
TIN	Triangular Irregular Network
TM	Thematic Mapper
USGS	United States Geological Service
VI	Vegetation Index

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ABSTRACT

This research mainly focuses on mostly used technologies such as Geographic Information System and Remote Sensing techniques used to study land use changes in Samanalawewa catchment area. Samanalawewa catchment area was situated in Sabaragamuwa province and the study area of this research belongs to Imbulpe divisional secretariat. The main objective of the research is to assess land use changes in Samanalawewa catchment area.

The researcher categorized the land use of the study area in to four major categories; Forest cover, Water area, home lands, and agricultural area. These categories consist of sub categories and the data was gathered and analyzed accordingly. According to the figures received through the sources, population had increased gradually in the area. Forest cover had reduced, home lands were increased, water area also increased from 1992 to 2014. The researcher also identified problematic areas which need direct involvement of the government such as deforestation, landslide threat, over population, forest and water sources conservation.

The reasons behind the changes and its impact on human lives were clearly identified by the researcher. Above mentioned techniques were used to analyze the gathered data. Findings and suggestions of the researcher were given accordingly and that will be much important to save natural resources and human lives. This research is with enormous importance with the findings social, economic, developmental and environmentally. Research knowledge in this area can be used to development projects, programs heading to land use planning.

Key Word: GIS, RS, Techniques, Land use changes, Samanalawewa Catchment, Imbulpe DSD

CHAPTER ONE

Introduction

1. Introduction

Land-use planning is the general term used for a branch of urban planning encompassing various disciplines which seek to order and regulate land use in an efficient and ethical way, thus preventing land-use conflicts. Governments use land-use planning to manage the development of land within their jurisdictions. In doing so, the governmental unit can plan for the needs of the community while safeguarding natural resources. To this end, it is the systematic assessment of land and water potential, alternatives for land use, and economic and social conditions in order to select and adopt the best land-use options. Often one element of a comprehensive plan, a land-use plan provides a vision for the future possibilities of development in neighborhoods, districts, cities, or any defined planning area. Wikipedia, the free encyclopedia

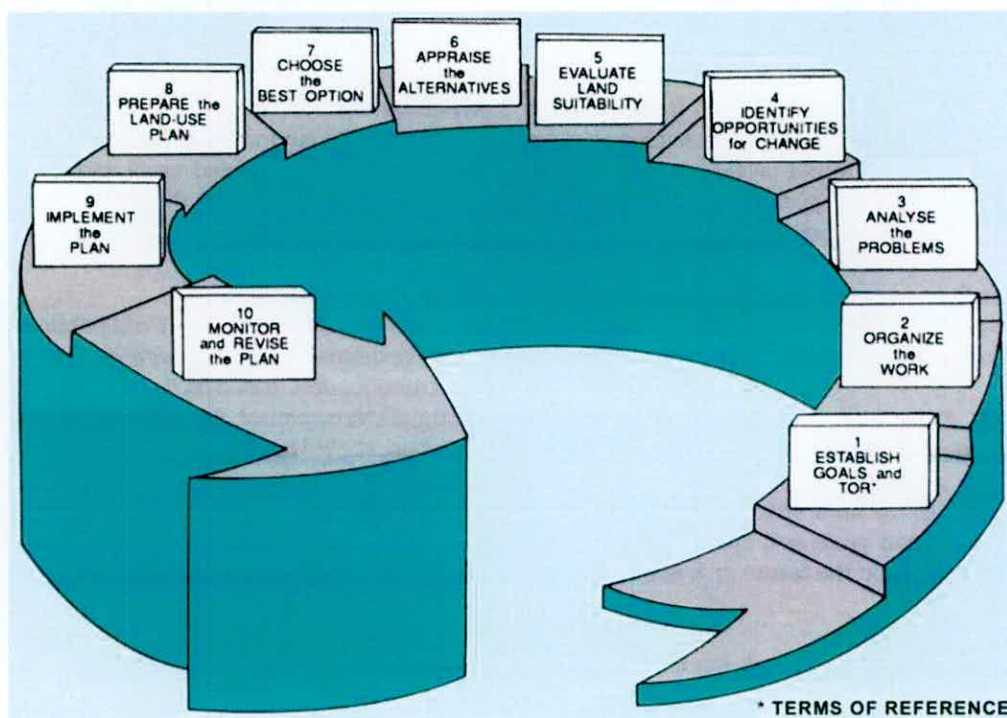
Land use can be defined as “the human manipulation and alteration of the land” (Alison, 2001). Land uses include settlement, cultivation, pasture, rangeland, recreation, and so on. In recent years, limited land resources in some countries could not meet increasing demands for land. In many developing countries, the demand for land becomes more pressing every year due to factors such as technical change, economic development and population increase. According to the guidelines published by FAO (1993), land use planning is the systematic assessment of land and water potential, alternatives for land use and economic and social

Conditions in order to select and adopt the best land use options. The purpose of land use planning is “to select and put into practice those land uses that will meet the needs of the people

best while safeguarding resources for the future” (FAO, 1993). Land use planning is applied to solve problems of conflicts between certain land use and sustainable environmental development. The 1987 Brundtland Commission Report promoted the concept of sustainable development, which was to become the central theme of the report.

Reasonable land use planning procedures are basic prerequisites for successful long-term land use development. Land use planning needs an integrated procedure to achieve this objective. The procedure of a relative comprehensive land use planning in “the Guidelines for Land Use Planning” (FAO, 1993) which includes land suitability assessment is illustrated in Figure 1.1 Each step represents a specific activity, or set of activities, where outputs provide information for subsequent steps.

Figure -1.1 The Steps of Land use Planning



Source: Food and Agriculture Organization-1993

Step 1 to step 4 are the foundation of the land use planning. They include establishing the goals of planning according to the needs of land users and the government and organizing the work plan of the planning group. Then land planners will analyze the existing land use problems and seek a variety of reasonable solutions, at last selecting the most promising one based on the consensus of land users, planners and decision-makers. During this process, planners and decision-maker will know about the problems of the planning area and identify the objectives they want to achieve.

The fifth step is evaluating land suitability. For this step, the planner will find out which areas of land are best suited for the specified kind of land use. First, the planners need to determine the requirements of a given land use type and conduct surveys to map land units with their physical properties. The land use type is a kind of land use described in terms of its products and management practice (FAO, 1993). The planners may modify the existing land use. Second, the planners compare the requirements of the land use type with the properties of the units to arrive at a land suitability classification.

Mapping land units and their characteristics, setting limiting values for land use requirements, and matching land use with land are the basis for this procedure. Lastly, the planners need to map land suitability for each land use type. The sixth step is appraising the alternatives. The evaluation carried out so far has been essentially in terms of physical suitability. In the seventh step, the planner has to summarize the results obtained from the previous steps and the decision-maker has to choose the best land use option that meets the planning goals

At the eighth step through the tenth step, the planners will present and implement the plan. The decision makers and the government may introduce regulations and plans to the land users to help the plan implementation. At the last step, the decision-maker and the planner will see how well the plan is implemented. For this way, the planning process comes full circle.

Van Ranst et al. (1996) suggested that derivation of physical land suitability should be a prime requisite for land utilisation planning and development. The suitability guides decisions on land utilisation for optimal utilisation of the land resources. The development of land use planning has included the use of long term strategic comprehensive plans at the local and regional level in the past decade in many countries. Their purpose is to indicate in broad terms the preferred dominant use of land for the foreseeable future, to provide coordination of individual decisions about smaller parcels of land and to allow efficient expansion of infrastructure and services (McDonald and Brown, 1984).

Land suitability analysis expresses how well a land unit matches the requirements of the land utilization type, and is seen as an appropriate way to quantify land development

constraints and opportunities and help planners cope with the land use plan design problem (Wu, 2000; Hu, 1995; McDonald and Brown, 1984).

Land use planning refers to the way we plan the physical layout, or land use, of our communities and is an essential component of a community's long-term resilience. It encompasses both the built and natural environment by shaping where development occurs and identifying areas for open space or preservation. The key components of land use planning include comprehensive planning, zoning regulations, and building codes.

Land use planning authority – including comprehensive planning, zoning, and adoption of building codes – is delegated to local communities by state laws and vary slightly by state. In general, municipalities (cities and towns) along with counties are given local land use planning authority and undertake planning along their respective jurisdictional boundaries. Municipalities and counties are referred to in this report as local communities

Sri Lanka is an island with a land of about 6.5 million ha where topographically the county has tow distinct features consisting of center highland area rising above 2500 meter and low land plain which surround it land extent to the coastal regions. The climate is tropical and monsoon seasons. The Southwest monsoon during May to September and the Northeast Monsoon during October to January. Based on the men annual Rainfall three major rainfall zone as the wet zone (<2500mm), intermediate zone (2500-1750mm), and Dry zone (<1750mm) are recognize from the total Land are 63.6% is found in the dry zone 23.2% is in the Wet zone and the remainder of 13.2% is in the intermediate zone.

From the total Land area only about 3 million ha, are arable due to unsuitable terrain in 1870 when the population was 2.7 million the per capita land area was 2.7 ha, Based on the present estimated population of 19 million, the per capita availability of arable land reduced to about 0.15 ha, indicating heavy pressure on agricultural lands (Nayakekorale 1980).When the land use is the viewed from the forestry perspective, forest cover has been declining throughout the years in Sri Lanka. The forest cover, which was 90% during 1900 million, has declining to less than 20% at present which is much less than world average of 30% forest cover. The world's total forest area is just over 4 billion