LAND CAPABILITY CLASSIFICATION SYSTEM IN THE STUDY AREA OF KALYANDURG, BRAHMASAMUDRAM AND SETTURU MANDALS OF ANANTAPUR DISTRICT, AP, INDIA: USING REMOTE SENSING AND GIS TECHNIQUES

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Abstract

The Present study Area comprising three Mandals Namely Kalyandurg, Brahmasamudram and Setturu Mandals of Ananthapur district of Andhra Pradesh. It is located in the middle of the peninsular region and is confined to southwestern part of Andhra Pradesh and it is located in the drought prone area of Rayalaseema region; the total geographical area of the study area is 1101.25 Sq Km. The present paper examines the Land Capability Classification System in the study area of Kalyandurg. The Land Capability classes identified using LISS-IV Satellite Data (2012), Soils Maps, SOI Topo Maps and Other Resource Maps. Satellite Data Collected from National Remote Sensing Centre, Balanagar, Hyderabad, Soil and other Resource Maps Collected from Agriculture Department and Soil testing Laboratory and Topographical Maps collected from Survey of India. In this study 6 Land capability classes identified namely 1. Class- lls-llle- It covers about 17.85%of the study area. 2. Class-IIIs- It covers about 60.54 % of the study area. 3. Class-IIIes- It covers about 10.09 % of the study area. 4. Class-VI- It covers about 1.63 % of the study area. 5. Class-VII- It covers about 4.86 % of the study area. 6. Class-VIe-VIIes- It covers about 5.03 % of the study area. In this study, land capability classification provides broad generalization of lands based on soil potentialities, limitation in land use and management problems in the study area.

Keywords: Land Capability Classification, Soil, Study Area, Remote Sensing and GIS.

Introduction

The concept of land capability- Capability is the inherent capacity of land to perform at a given level for a general land use. Land can be classified on the basis of capability indices according to their potentials and limitations for sustained production. The doyen of such a classification system is the land capability classification of the USDA, conservation service (klingebiel and Montogomery, 1961). This system is one of a number of Interpretative groupings of soil mainly based on (i) the inherent soil characteristics, (ii) external land features, and (iii) environmental factors that limit the use of land. The capability classification provides three major categories of soil groupings, (i) capability unit (ii) capability sub-classes, and (iii) capability classes.

According to this system the first category, capability unit, is a grouping of soils that have about the same responses to systems of management of common cultivated crops and pasture plants. This is the smallest category of the land capability classification system, and considers the long time estimated yields, which should not vary, more than about 25 per cent in one land capability unit. Yields are one of the criteria used in establishing capability units within a capability class and are estimated under the common management practices. The soils in a capability unit are sufficiently uniform to (a) produce similar kinds of cultivated crops and pasture plants with similar management practices, (b) require similar conservation treatment and management under the same kind and condition of vegetative cover, (c) have comparable potential productivity. Information provided in a capability unit can be used for planning individual tracts of land, field by field.

The second category, the capability sub-class is a grouping of capability units having similar kinds of limitations and hazards. Four general kinds of hazards and limitations are recognized and the symbol given with each are used as suffix to the concerned land capability class, (1) erosion and run-off (including risk of erosion and post-erosion damage)-e, (2_ excess of water (wetness, high water table, problem of drainage, overflow)-w, (3) root zone limitations (shallow depth, low water holding capacity, salinity or alkalinity)-s, and (4) climatic limitations-c.

Where soils have two kinds of limitations, both can be indicated the dominant one being used first. Where two kinds of limitations are essentially equal, priority is to be given to e, followed by w and then s. Land capability sub-classes have been used widely in many parts of the world with slight modifications mostly incorporating local hazards.

The third and the broadest category in the capability classification is the capability classes, eight of which are recognized. "The risk of soil damage or limitations in use becomes progressively greater from class I to VIII. Soils in class I to IV are capable of producing adapted plants, such as forest trees or range plants, and the common cultivated field crops and pasture plants. Soils in classes V,VI and VII are suited to the use of adapted native plants. Soils in class VIII do not return onsite benefits of inputs of management for crops, grasses, or trees without major reclamation" (klingebiel and Montgomery, 1961). In other words class I to IV land are regarded as suitable for cultivation, class V to

VII as suitable for pasture and Forestry and class VIII land as suitable for wildlife and watershed.

Review of the Literature

Pioneering work is done in India by shafi (1969) on the method and techniques in land use planning, land classification and land capability. Singh (1970) determined the land capability classes with the help of physical and economic factors, that is, physiography, soil fertility, power-input, land use type, agricultural intensity and its productive capacity. Singh (1970), Bhan (1973), Biswas (1978), Das and Bhattacharya (1978), Duggal (1978), Sharma and Sharma (1980), Das and Das (1981), Singh (1985) have made land capability studies at micro level.

Recently using Aerial Photographs and High Resolution Satellite Imageries studies land capability have been carried out at micro level. Rao and Vaidyanathan studied the land use capability of the Krishna delta in Andhra Pradesh.

Study Area

The present Study Area of Kalyandurg consisting of Kalyandurg, Brahmasamudram and Setturu Mandals of Ananthapur district, Andhra Pradesh. It Lies between 14^0 17' and 14^0 40' north latitude and 76^0 50' and 77^0 24' east longitude. It is located in the middle of the peninsular region and is confined to southwestern part of Andhra Pradesh. It is bounded by Gummagatta, Beluguppa, Atmakur, Kanaganapalli and Kambadur Kundurphi mandals of the same district and western side bounded by Karnataka state. The total geographical area of the study area is 1101.25 Sq Km., According to 2011 census the total population is 1, 76,297 of which urban population is 32,335 (18 %), with literacy rate of 60.92 % and the sex ratio of total population is 964.

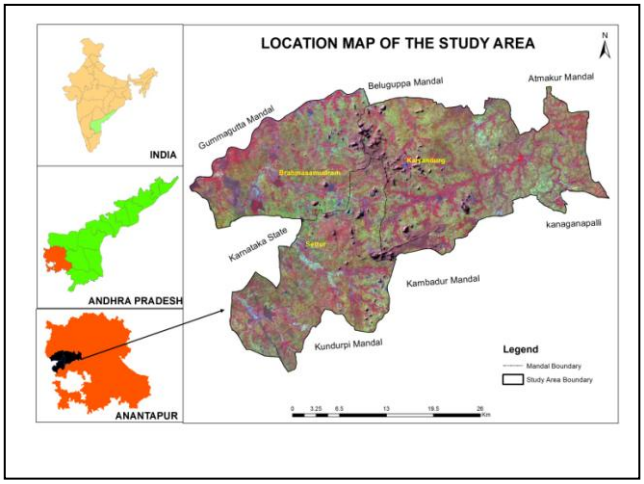

Fig1.Location Map of the Study Area of Kalyandurg.

Kalyandurg area is the most chronicle drought prone part and also the most backward area located on western side of Anantapr district. Annual temperatures vary between 21 and 42^OC. In summer, temperatures will reach up to 42^OC for three months from March to May. Annual average rain fall varies between 370 m.m. and 760 m.m. Soil cover in the study area is predominantly red loamy soils followed by black soils and alluvial soils. Natural vegetation is very thin and scanty and mostly thorn scrub jungle type. The terrain is largely undulating and closely disclosing the characteristic feature of plateau topography.

Methodology

In the present study an Endeavour is made to consider the capability of the land according to slope, climate, physical characteristics of the soil (thickness and texture), vegetative cover and arable land use. Using high resolution satellite data of LISS-IV + Cartosat-1, Wasteland map of Andhra Pradesh prepared by National Remote Sensing Centre (NRSC), 1:50000 scale Toposheet and other sources, prepared Land Capability map.

Results and Discussions

Spatial pattern of land capability

The study area 6 classes identified. The land capability classes are used to show more detailed information about the location, extent and general stability of the land for agriculture use, the sub-classes provides information about the kind of conservation problems or limitations involved in the land use. These classes provide the general information about the limitations and problems involved for broad programmes planning and conservation studies. The capability unit indicates the land class that is enough alike to be suited to the same crops and pasture/grazing, to require similar management, and to be similar in productivity and in other responses to management. The area under different land capability classes are shown in table 1 & Fig 2 and 3

Table.1. Area under different Land Capability classes in the Study area

S.No	Land Capability class	Area in sq.km.	Area in Hectares	Percentage (%)
1	lls-llle	196.59	19659.27	17.85
2	llls	666.73	66672.84	60.54
3	llles	111.07	11107.14	10.09
4	Vl	17.97	1796.84	1.63
5	Vll	53.55	5354.85	4.86
6	Vle to Vlles	55.34	5533.91	5.03
Total		**1101.25**	**110124.84**	**100**

*Area estimated based on Land Capability map using Arc Map software.

The land capability classes are as follows:

1. Class- lls-llle:

Moderately deep, well drained, good cultivable lands having erosion and soil problems due to heavy texture. Class also includes fairly good cultivable lands having erosion and soil problems. Some areas need simple soil and water conservation measures; all climatically adapted crops can be grown. The land classes included in this category are the alluvial plain of the Pennar and Hagiri River valleys filled with alluvium which have gentle slopes (1-2) and susceptible to slight to moderate erosion. The soils in this class require more management practices than soils in class-I. It covers about 17.85%of the study area.

2. Class-IIIs:

The lands in this class have severe limitations that reduce the choice of plants and require special conservation practices. Moderately shallow, well drained, moderately good cultivable lands having soil problems of shallow rooting depth, gravelliness slightly eroded and gentle slopes; need simple soil and water conservation measures; all climatically adapted crops can be grown. It covers about 17.85%of the study area. It covers about 60.54 % of the study area.

3. Class-IIIes:

Moderately deep to shallow, well drained. Good cultivable lands with problems of erosion, shallow rooting depth, gravelliness and stoniness and gentle slopes; need intensive soil and water conservation measures; all climatically adopted crops can be grown**.** It covers about 10.09 % of the study area.

4. Class-VI:

The lands in this class have severe limitations that make them generally unsuitable for cultivation and limit their use largely for grazing and forestry. The moderately steep slope quartzite hills (cuesta), covered with moderate to dense vegetation are included in this class. The shallow to moderately deep, coarse textured soils with moderate to severe erosion and poor groundwater potential are the limiting factors in this class. These lands are best suited for forestry. It covers about 1.63 % of the study area.

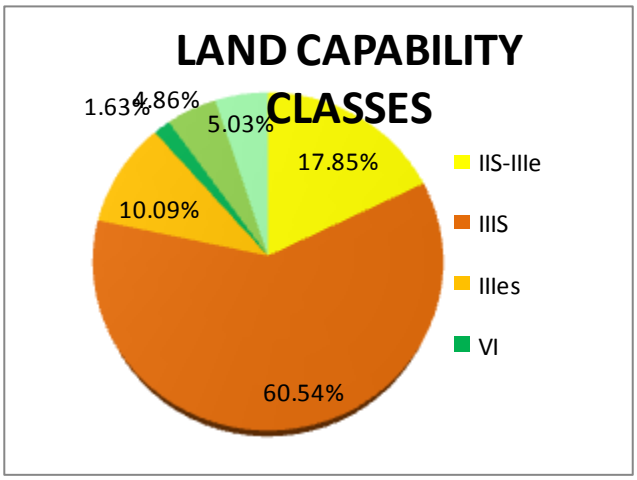

Fig.2. Distribution of Land Capability classes in the study area.

Plate.1.A view of the Red soil covers which is predominant soil type in all over the study area

Plate 2. A view of the Banana Plantation in red soil belt near Chapari Village in Kalyandurg Mandal

Plate 3. Ground Crop cultivation using Drip irrigation system in the study Area

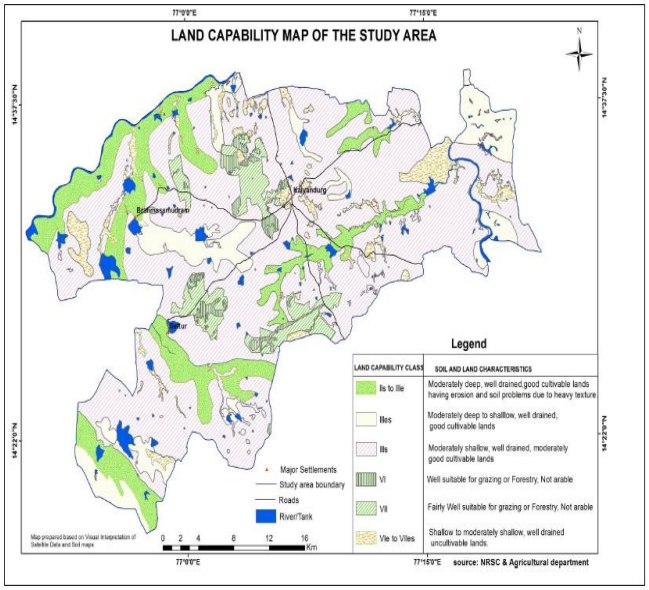

Fig.3. Land Capability Map of the study area.

5. Class-VII:

The lands in this class have very severe limitations that make them unsuited to cultivation and restrict their use largely to grazing and forestry. The steep to very steep hills of granite gneiss and quartzite with sparse vegetation cover

(scrub) and severe erosion are included in this class. The shallow gritty soils, poor to nil groundwater potential and severe erosion are the major limiting factors in this class. These are best suitable for forestry and should be brought under vegetation in order to control the erosion. It covers about 4.86 % of the study area.

6. Class-VIe-VIIes:

Shallow to moderately shallow, well drained uncultivable lands with very severe limitations of erosion, shallow rooting depth, gravelliest and stoniness, steep to moderate slopes; need intensive soil and water conservation measures; suitable for forestry, pasture and semi pasture. It covers about 5.03 % of the study area.

Conclusions

The above land capability classification provides broad generalization of lands based on soil potentialities, limitation in land use and management problems in the area. Each capability class can be further grouped into different land suitability classes for specific type of crops or vegetation. This requires detailed soil survey information, irritability etc. A detailed soil survey may be carried out for the study area to study the land suitability for the specific crops etc.

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