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Development of Small Urban Center, Using Remote Sensing and Gis

KEYWORDS

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ABSTRACT *This research focuses on the development of small urban center or agropolitan that is agricultural-based small urban areas in rural regions with the aim of sustainable regional development. A method to make an agropolitan master plan is by using a technological tool like Remote Sensing (RS), Geographic Information System (GIS), and Global Positioning System (GPS), in combination with Analytical Hierarchy Process (AHP) playing a major role in developing effective information systems for regional development to realize the scientific management of agropoitan. The objective of this study is to identify criteria and alternative of agropolitan and select locations for constructing and development of an agropolitan area. The result of this study shows that the Eastern part of the district is a very suitable area for agropolitan in Prakasam district and Ongole region is best priority which is indicated by most potential area of primary commodity. In the other point of view, the agropolitan with agricultural business activities could generate all potencies in Ongole and the surrounding area that can improve the life situation of local people. Finally, development of agropolitan area leads to improve linkage between rural and urban to increasing prosperous rural society.*

INTRUDUCTION

According to the 2011 census, the total number of Villages in India by states and Union territories are 638, 365 and in Andhra Pradesh 28,123. Prakasam is an administrative district of Andhra Pradesh state, India. In India, Rural Development is one of the most significant factors for the development of the Indian economy. India, basically, is an agriculture-based country. Agriculture contributes nearly one-fifth of the gross domestic product in India. In order for development of agriculture, the government has planned several programs related to rural development in India. The "Agropolitan" or small urban center approach was firstly introduced by Friedmann and Douglass in 1978; they proposed that rural/village development could be best pursued by linking rural to urban/city development at the local level. Setting an agropolitan development process in motion is requiring attention to at least three critical issues: access to agricultural land and water, devolution of political and administrative authority to the local level, and a shift of national development policies in support of diversified agricultural production (Friedmann and Douglass, 1975).

OBJECTIVE OF THE STUDY

The specific objectives of the thesis are:

- Finding the high suitability location of agropolitan in Prakasam district.
- To generate GIS and management information system digital database for the study area.
- To collect soil samples for physico-chemical analysis and develop soil and Agriculture assessment in the study area to provide an agriculture suitability map.
- To study of infrastructure facilities in the target area to provide an infrastructure suitability map.
- To study of population indicators in the target area to provide human resources suitability map.
- Preparation of action plan for development of agropolitan project in the study area.

STUDY AREA DESCRIPTION

Prakasam is an administrative district of Andhra Pradesh state, India. This district occupies an area of 17,626 km². The district headquarters is located at Ongole and has a population of 3,059,423 of which 15.28% were urban as of the 2011 Census.

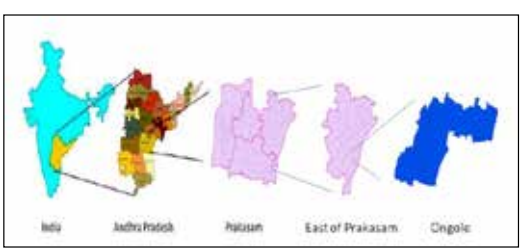

Figure 1.1: Location Map

MATERIALS AND METHODOLOGY

Data were collected in several methods: site surveys, interview and from existing data. There are two types of data:

1. Spatial Data: Satellite imagery data, aerial photography, administrative map, Topographic data.
2. Non Spatial Data: Demography, agriculture, building, mining, industry, transportation, financial, education, drainage, social, economy, hydrology, climate and Infrastructure.

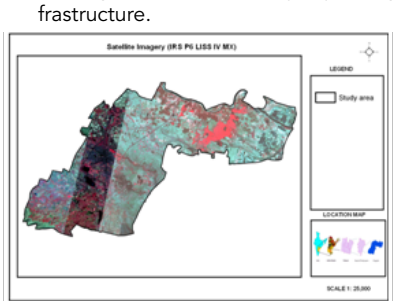

Fig: 1.1: satellite imagery (IRS P6 LISS IV MX)

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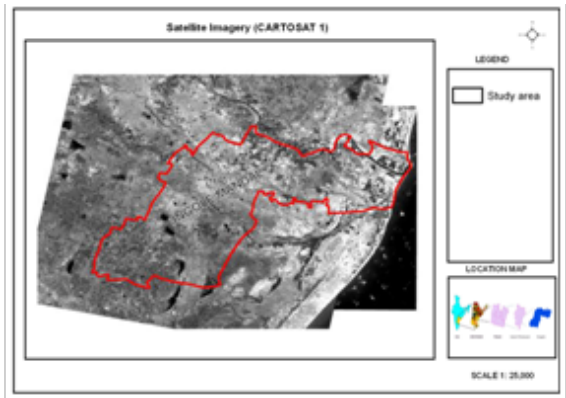

Fig: 1.2 satellite imagery (IRS P6 LISS IV MX)

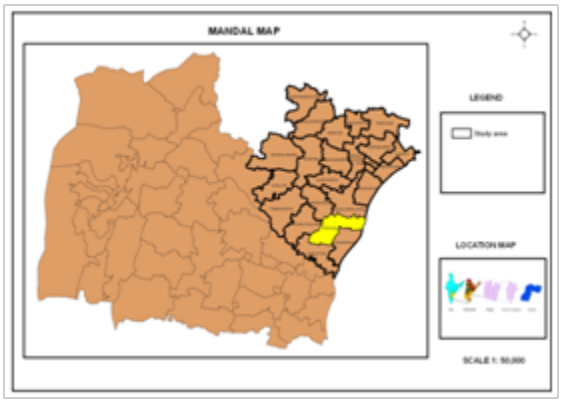

Fig: 1.3 Mandal Reference Maps of the Study Area

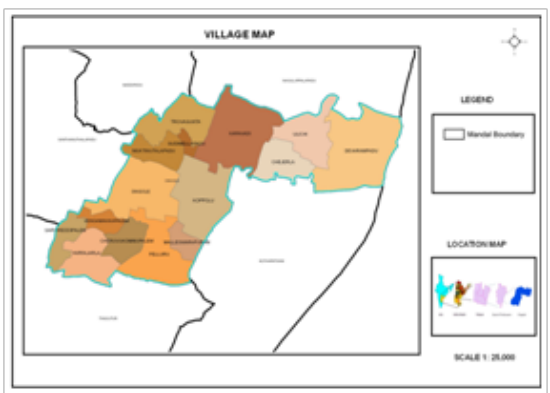

Fig: 1.4 Village Maps of the Study Area

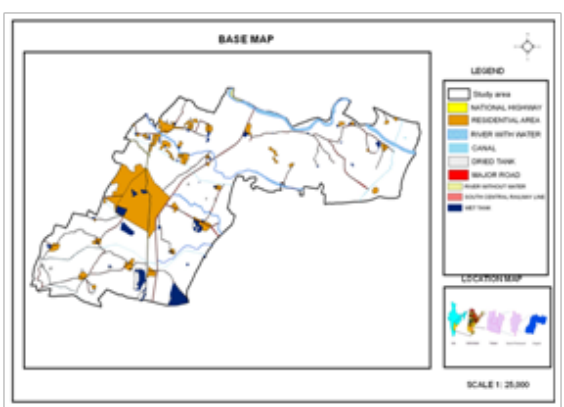

Fig: 1.5 Base Map of the Study Area

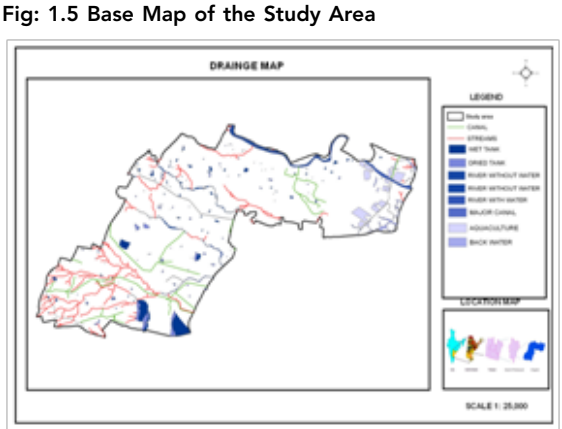

Fig: 1.6 Drainage Maps of the Study Area

GIS will be used based on a set of criteria derived from the spatial aspects, environment, social, agricultural and infrastructure aspect. With GIS capabilities, spatial analysis techniques will be done to determine the objective of this research. This study performs a GIS Spatial analysis using ArcGIS model builder. In the model building process the convert these themes to grid themes using the raster conversion process. Models are represented as sets of spatial process (overlay techniques). Each of the input themes is assigned a weight influence based on its importance, and then the GIS overlay process can be used to combine the factors in the form of a weighting overlay process. The result of GIS will display on a map of the agropolitan area as final recommendation.

GENERATION OF SPATIAL DATABASE

The generation of database needs the source information comprising non spatial data and a spatial data. The spatial data is comprised of land use/land cover, drainage, base details and soil maps, etc. The non-spatial or attribute data is composed of climatic parameters, crop pattern, etc.

Creating a GIS spatial database is a complex operation, which involves data capture, verification and structuring processes. Raw geographical data are available in many different analogue and digital forms such as toposheets, aerial photographs, satellite imageries and tables. Out of all these sources, the source of toposheet is of much concern to natural resource scientist and an environmentalist. In the present study, the base layers generated from toposheet are:

(i) Base map, (ii) Drainage map, (iii) Transportation Network map, (iv) Watershed map, (v) Slope map, (vi) Physiography map, (vii) Ground water.

These paper-based maps are then converted to digital mode using scanning and automated digitization process. These maps are prepared to a certain scale and show the attributes of entities by different symbols or coloring. The location of entities on the earth's surface is then specified by means of an agreed co-ordinate system. It is mandatory that all spatial data in GIS are located with respect to a frame of reference. Although using remote sensing satellite data and survey of India toposheets for making thematic maps as well as topographical maps is very attractive, serious attention is paid to develop maps showing:

(i) Agriculture suitability, (ii) Infrastructure suitability, (iii) Human resource suitability, (iv) Agropolitan suitability.

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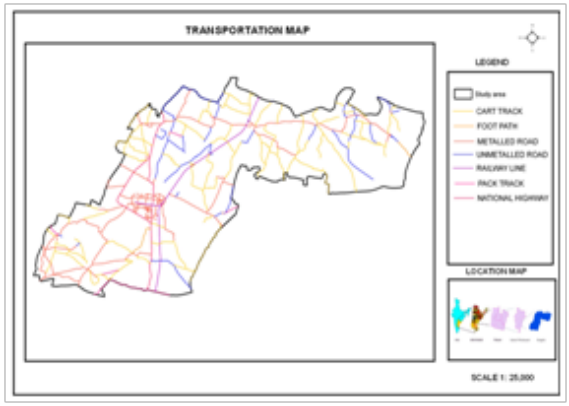

Fig: 1.7 Road Network Maps of the Study Area

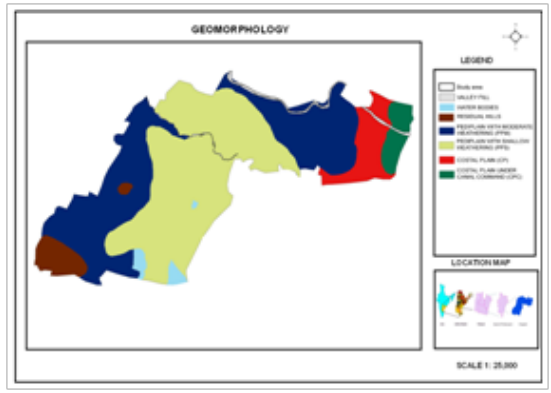

Fig: 1.11 Geomorphology Maps of the Study Area

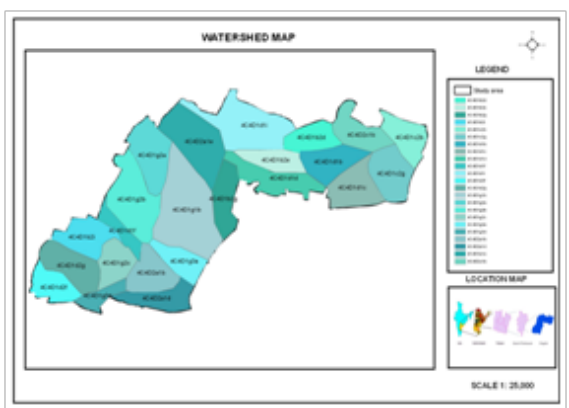

Fig: 1.8 Watershed Map of the Study Area

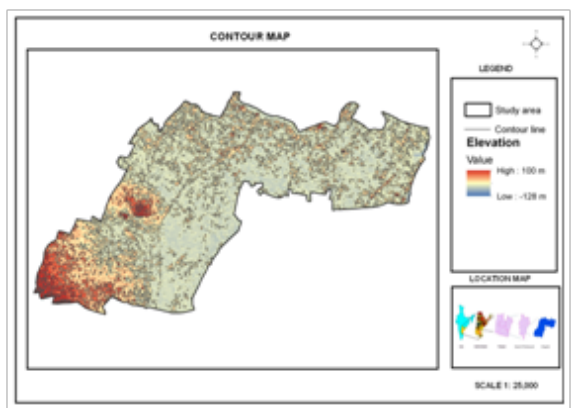

Fig: 1.12 Contour Map of the Study area

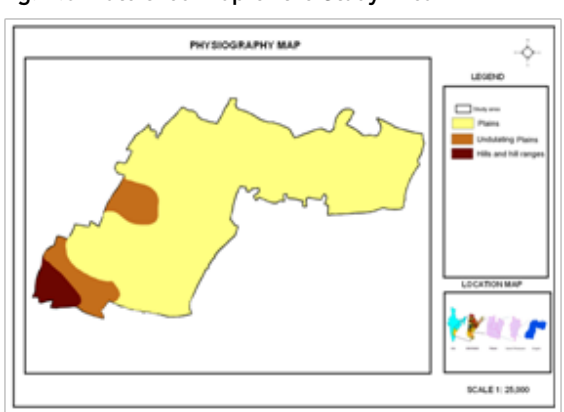

Fig: 1.9 Physiography Map of the study Area

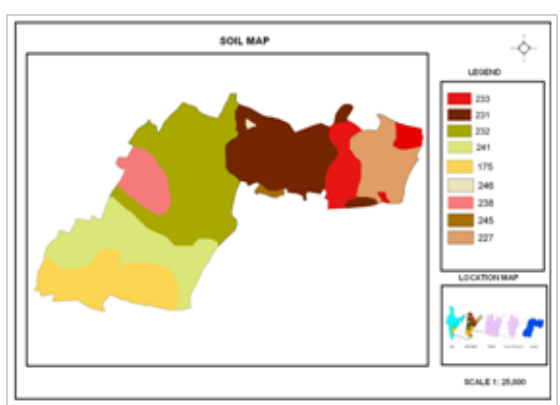

Fig: 1.13 Soil Map of the Study area

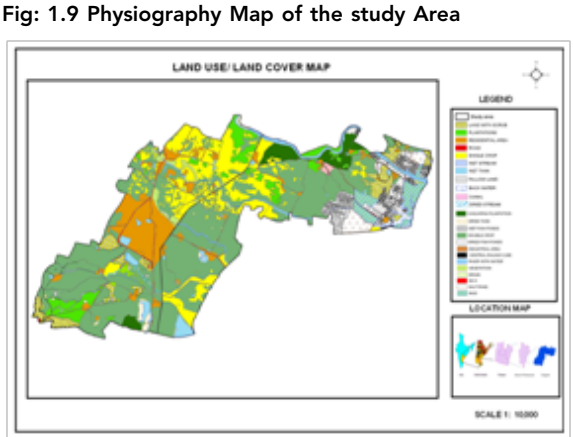

Fig: 1.10 LU/ LC Maps of the Study Area

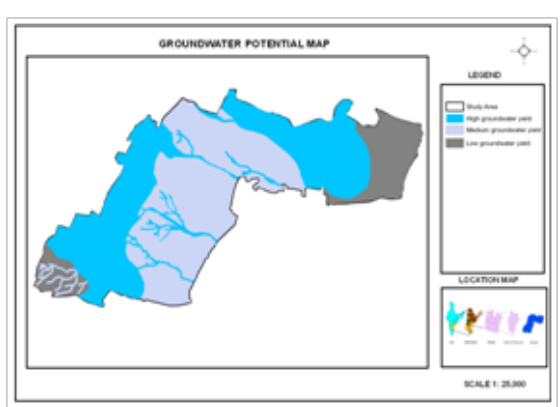

Fig: 1.14 Ground water Map of the Study area

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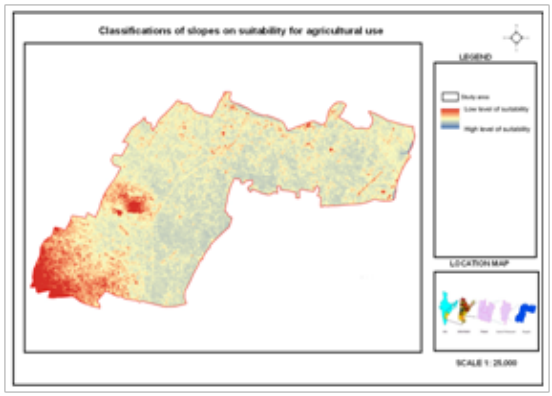

Fig: 1.15 slopes on suitability for agricultural use

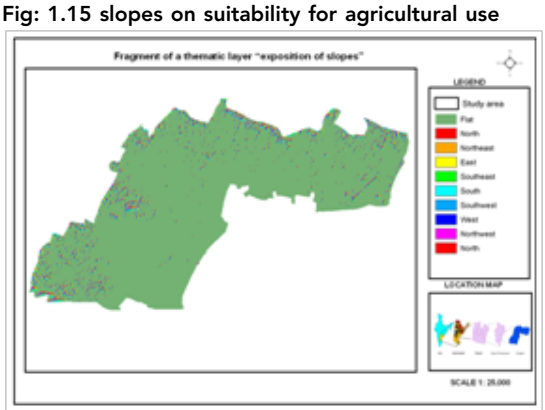

Fig: 1.16 thematic layer "exposition of slopes"

AGRICULTURE SUITABILITY

Through integration of remotely sensed, GIS, GPS and field data, agriculture suitability are being developed and executed. Agriculture suitability in this study includes: soil, climate and topography. Agriculture suitability showed that soil quality assessment can analyze the physic-o chemical characteristics of the study area for development, agriculture management.

INFRASTRUCTURE SUITABILITY

Through integration of remotely sensed, GIS and field data, infrastructure suitability are being developed and carries out. The main purpose of the Infrastructure Planning Study was to identify suitability for large scale industrial development, markets, banking facilities and financial center, education, services section, and process industry, also road and infrastructure connections. Based on the density of these factors, areas of developable infrastructure were identified, which is divided into four areas include: high suitable, moderate suitable, marginal suitable and not suitable. The infrastructure analysis informed indicative layouts for suitability infrastructure has been concentrated in Ongole city. Findings The Infrastructure Planning Study reached a number of conclusions that will help guide proponent and government planning for future development and services in the agropolitan of Ongole. The study found that approximately 206 km^2 of land within the 15 km^2 study area suitable for large scale industrial, market, services and process industries development and associated infrastructure. The geotechnical conditions for large sections of the study area are generally suitable for development of infrastructure with large foundation loads.

HUMAN RESOURCES SUITABILITY

Human resources are the set of individuals who make up the workforce of an organization, business sector or an economy. In this reseach based on agropolitan definition, human resources are included three factors: A) total population, B) cultivators and C) agro-labour. Based on these factors, areas of developable human resources were identified through more density in population, which is divided into four areas included: high suitable, moderate suitable, marginal suitable and not suitable. The human resources analysis showed that the high suitability was located in Ongole city and also the moderate area was located nearby Ongole city.

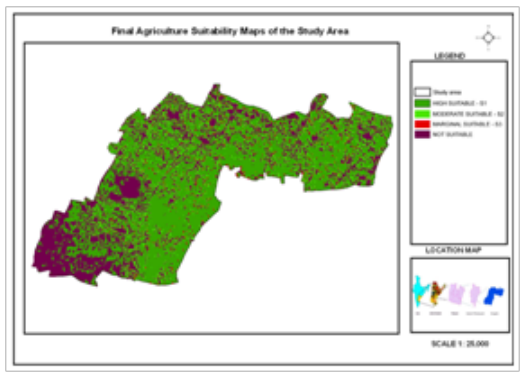

Fig: 6.24 Agriculture Suitability Maps

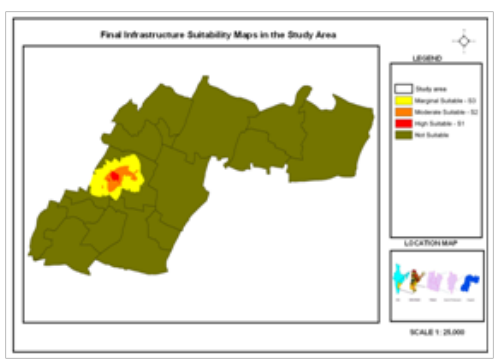

Fig: 6.25 Infrastructure Suitability Maps

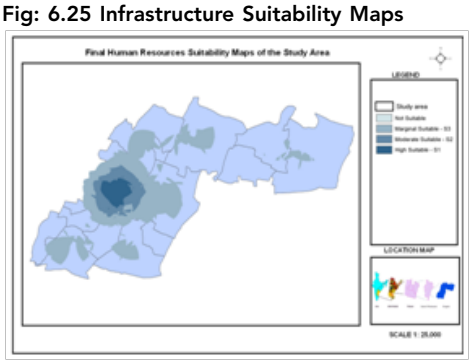

Fig: 6.26 Human Resources Suitability Maps

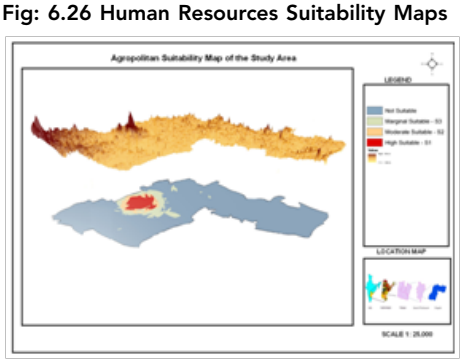

Fig: 6.27 Agropolitan Suitability Map

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AGROPOLITAN POTENTIAL AREA

The result of a GIS process of development of agropolitan area is Prakasam district showed that Ongole Mandal has a most suitability to setup and development of agropolitan project. According to GIS result that showed, Ongole city as a very suitable area of agropolitan. Very suitable because this area has all the criteria to construct an agropolitan area. The farmer after they produce raw agriculture commodities in center production, collecting the commodity and send to the center of agropolitan area that consist of the market. This area also is near from business center and transportation infrastructure. Otherwise, the farmer can storage their raw commodity in cold storage. The agropolitan project in these districts will automatically give multiply effects, for example increasing farmer's income level will generate more social economic activities in rural areas. Also better socioeconomic conditions will a positive impact to another sector such as education, health, political stability, sustainability and the general quality of life. The farmer in these areas can also have more abilities to increase their productivity of many primary agricultural products. Then, agro-industry will be developed in agropolitan areas, which means that the area can produce manufactured products such as packing industries and food process. These products will then be marketed to urban cities, as larger markets in the regions.

CONCLUSION AND RECOMMENDATION

The salient conclusions drawn on the present investigation titled are summarized below:

1. Geographic Information System (GIS) is one of the main tools to help decision maker in determining an agropolitan area.
2. The early development stage of the agropolitan, is determining the location of agropolitan based on several factors such as: commodity, infrastructure, human resources and natural aspect.
3. Suitable area for agropolitan were obtained by overlay and dissolve process, environmental factors used and weighted for analysis. A suitable area can be classified into four classes: high suitable, moderate suitable, marginal suitable and not suitable.
4. East Prakasam can be considered as a very suitable area for agropolitan. Ongole has first priority which is shown by most potential area of the primary factors like: commodity, infrastructure, human resources and natural aspect.
5. Survey of India (SOI) toposheet of 1:25000 scale and Satellite imagery is found to be useful in providing reliable, accurate baseline information about agropolitan suitability modelling, large areas and spatial distribution of land classification is possible by satellite imagery (IRS P6 LISS IV MX- 5.8 meter Resolution) because of its synoptic view.
6. The spatial distribution maps for all the physico-chemical analysis parameters of soil samples are developed. These maps are useful for identification of suitable sites.
7. The cropping pattern and land use constraints on soil quality are identified and seven types of soils exist in the study area red shallow calcarious gravelly loam, red shallow gravelly clay, red calcareous clay soils, sandy soils, red clay soils, alluvial soils, swampy and marshy soils.
8. The land capability classification model has been developed based on soil characteristics, external land factors and environmental factors. The agriculture suitability is developed based on LCC, FII, ground truth and field checks a suitability criteria are developed for each individual crop and suitability ratings are given for each village in the study area.
9. The human resource and infrastructure facilities are developed respectively, based on total population, cultivators and agro-labour population, transportation, marketing system, agriculture equipment, bank facility, process industry and electronic networks.

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