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PREPARATION OF SOIL MAP USING REMOTE SENSING AND GIS TECHNOLOGY

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Abstract: For efficient utilization of soil and water resources, reconnaissance survey of watershed Godavari valley-5 (GV-5) was carried out in Nashik Soil Survey unit No. 2 for providing comprehensive information characteristics. Representative soil samples from each of eight villages of the sub-catchments of Gangapur were collected. From the record of the area sampled, a sample sketch map for reference was made with the help of magnetic needle. Simultaneously, GPS data was recorded for transferring these points on map/satellite image. The soil samples were tested in laboratory for determining various soil properties viz. soil color, mechanical analysis, liquid limit, plastic limit, soil ph, soil electrical conductivity, soil organic carbon, available nitrogen, available phosphorus, available potassium & soil calcium content. Vector map was prepared from revenue boundary of village under the guidance of MERI, Nashik. From the results obtained from the analysis of vector map, a soil map & land use land cover map was prepared using ERDAS Imagine 8.7 software.

Key words: *GPS, vector, soil, land use land cover map, ERDAS Imagine 8.7 software.*

INTRODUCTION

Agriculture is the backbone of the Indian economy, hence to strengthen the economy agricultural activities should be more productive and precise. More production

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can be achieved, if soil and water are efficiently used. For efficient utilization of these resources, detailed map of soil with all sub-unit is essential for the management purposes.

Soil survey is a study and mapping of soil in its natural environment. It is the systematic examination, description, classification and mapping of an area. It is one of the best tools for the management of soil resource. Laboratory analysis by testing of soil for various properties is carried out to support and supplement the field observations. Mapping of soils is done for establishing and drawing soil boundaries of different kinds of soil on standard topographical base map. Survey reports make predictions about the potential of soil for alternative uses like agricultural crop, grasses, fruit forestry or potential crops and ascertaining their management requirement for sustained production. The reconnaissance survey was undertaken to prepare resources inventory of large areas. It identifies kinds of soils and their extent of distribution.

Remote sensing is the science of acquiring information about the earth's surface without being in physical contact with it. This is done by sensing and recording reflected or emitted energy and processing, analyzing and applying that information. It is the process that involves an interaction between incident radiation and the target of interest.

GIS is a collection of computer hardware, software, and geographic data and display all forms of geographically referenced information. A geographic data is data about land and water resource and human activities.

Vector map is characterized by use of point, line and polygon. Vertices are use to define line segment. Point features are defined by one coordinate pair, a vertex while a polygon features by a set of closed coordinate pairs.

Land use reefer's to man's activity and various uses which are carried on the land, whereas land cover refers to natural vegetation, water bodies, rock/soil, artificial cover and other resulting due to land formations.

GPS (Global Positioning System) is a satellite navigation system designed to provide instantaneous position, velocity and time information almost anywhere on the globe at any time and in any weather condition. GPS gives the longitude, latitude and altitude of particular point on the earth surface. A standard soil map is a two-dimensional presentation on paper gives attribute as well as spatial information.

Appropriate scale soil maps and research data are required to develop interpretation at capability or irritability unit level, particularly to determine the suitability of area for irrigated cropping and long range behavior of soil under irrigation. Hence present study was undertaken to prepare detail soil map in GIS environment and to prepare the land use land cover map using Remote Sensing data.

MATERIAL AND METHODS

Reconnaissance survey of watershed Godavari valley-5 (GV-5) was carried out in Nashik Soil Survey unit No. II (sub-catchment of Gangapur) for providing comprehensive information characteristics. Representative soil samples from each of eight villages viz Anjanneri, Kachurli, Khambale, Metghar Killa, Pimpled Trimbak, Sapgoan, Talwade Trimbak & Trimbakeshwar were collected in Feb 2008. Single representative soil sample were collected from each village except Khambale, as this village had red alluvial soil and black soil in equal proportion. The samples from the soil

surface to plough depth 0-22 cm weighing approximately 6 kg were collected. Then the information sheet label was placed inside the gunny bag and then sewing of bag was carried out. From the record of the area sampled, a sample sketch map for reference was made with the help of magnetic needle. Simultaneously GPS reading were also taken for transferring these points on map/satellite image. The soil samples were tested in laboratory for determining various soil properties viz. soil colour, mechanical analysis, liquid limit, plastic limit, soil ph, soil electrical conductivity, soil organic carbon, available nitrogen, available phosphorus, available potassium and soil calcium content using standard methods. [2] [8] Village boundaries were digitized, demarked and traced on toposheet having scale 1:50,000. Toposheet was scanned from vector map and georeferenced with original toposheet. Using ERDAS 8.7 software, image analysis was carried out. Then using GPS latitude, longitude and altitude were defined and demarked on vector map.

For preparation of land use land cover map the IRS (Indian remote Sensing Satellite) P6 software was used [1], which had resolution of about 24m x 24m and image size about 148 km x 148 km. This false colour composite (FCC) image was procured by National Remote Sensing Agency (NRSA), Hyderabad. This raw image was georeferenced with already georeferenced image and with this image, the required image was selected by taking the subset of whole image using ERDAS software. Then image classification was done by supervise classification. By using reconnaissance survey, the classes of barren land, hills and vegetation were demarked.

By using the results of mechanical and chemical analysis, the soil map was prepared in GIS environment.

RESULTS AND DISCUSSION

Different soil properties of eight villages were determined and are shown in Tab. 1.

Table 1. Different soil properties of eight villages

Sr. No	Village	Soil type	Soil pH	Soil EC ($dS \cdot m^{-1}$)	Soil Organic Carbon Content (%)	Soil Calcium Carbonate Content (%)	Soil Nitrogen Content ($Kg \cdot ha^{-1}$)	Soil Phosphorus Content ($Kg \cdot ha^{-1}$)	Soil Potassium Content ($Kg \cdot ha^{-1}$)
1	Anjanneri	Loam	5.90	0.888	1.260	7.4	664.76	406.00	616.0
2	Kachurli	Silty Clay	6.27	0.108	0.461	5.6	212.46	23.54	112.0
3	Khambale pit-1	Clay	6.00	0.312	2.420	5.0	1310.00	35.32	548.8
4	Khambale pit-2	Silty Clay	5.86	0.232	1.150	4.7	600.00	25.50	358.4
5	Metghar Killa	Sand	6.41	0.101	0.920	5.8	470.00	29.43	246.5
6	Pimpled Trimbak	Clay	4.98	0.229	0.346	4.8	147.84	18.81	123.2
7	Sapgoan	Sandy loam	6.27	0.251	2.420	5.6	1310.00	343.39	817.6
8	Talwade Trimbak	Sandy loam	6.05	0.616	0.807	7.5	406.30	74.56	313.6
9	Trimbakeshwar	Clay loam	6.87	0.231	1.150	6.5	600.15	276.67	712.8

The soil pH for eight villages ranged from 4.98 to 6.87. The electrical conductivity of soil was found to be normal, ranging from 0.101 to 0.888 $dS \cdot m^{-1}$. The organic content of soil was found to be high in all eight villages and it ranged from 0.346 to 2.42 %. The nitrogen content of soil ranged from 147.84 to1310.0 $kg \cdot ha^{-1}$, the phosphorus content ranged from 18.81 to 406 $kg \cdot ha^{-1}$ and the potassium content ranged from 112.0 to 817.6 $kg \cdot ha^{-1}$. The calcium carbonate content of soil was found to be normal or sufficient, which ranged from 4.7 to 7.5 %.

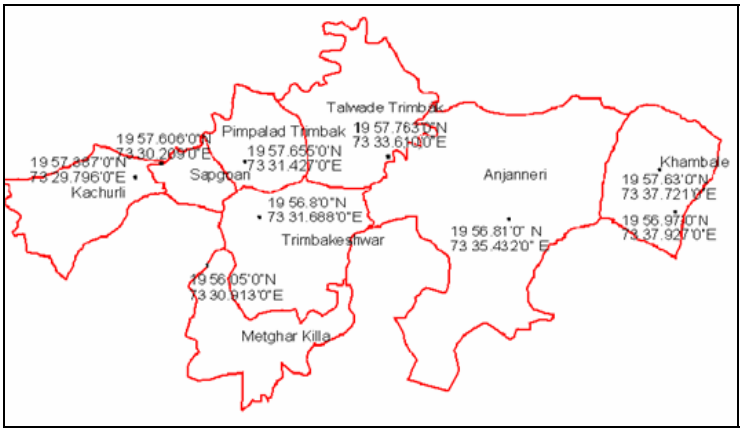

Figure 1. Vector Map of Ganagapur Sub-catchment

Vector map was prepared, which showed the marked boundary of eight villages of GV-5 along with latitude, longitude & position as shown in the Fig. 1.

Then the Satellite imagery for the selected catchment was prepared, which showed 95 to 58 paths and rows as shown in the Fig. 2.

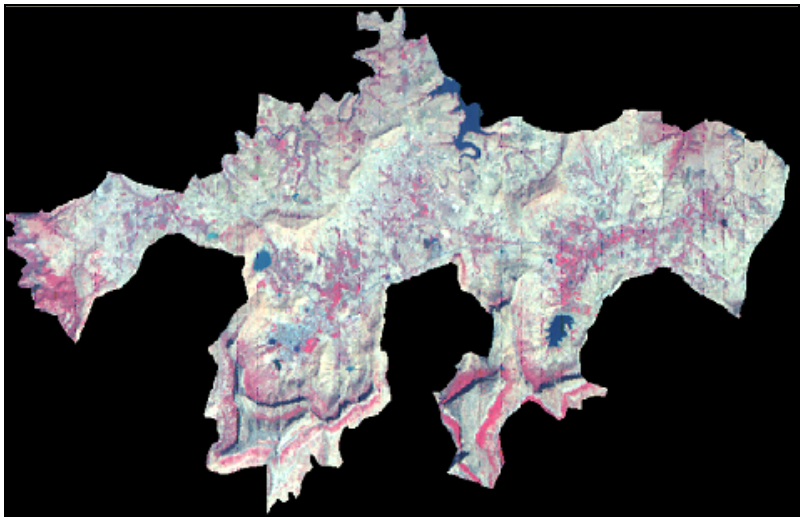

Figure 2. Satellite image of Gangapur Sub-catchment

Land Use Land Cover Map was prepared, showing the supervised classified image with different types of classes such as water bodies, barrier land, fallow land, green vegetation etc. as shown in the Fig. 3.

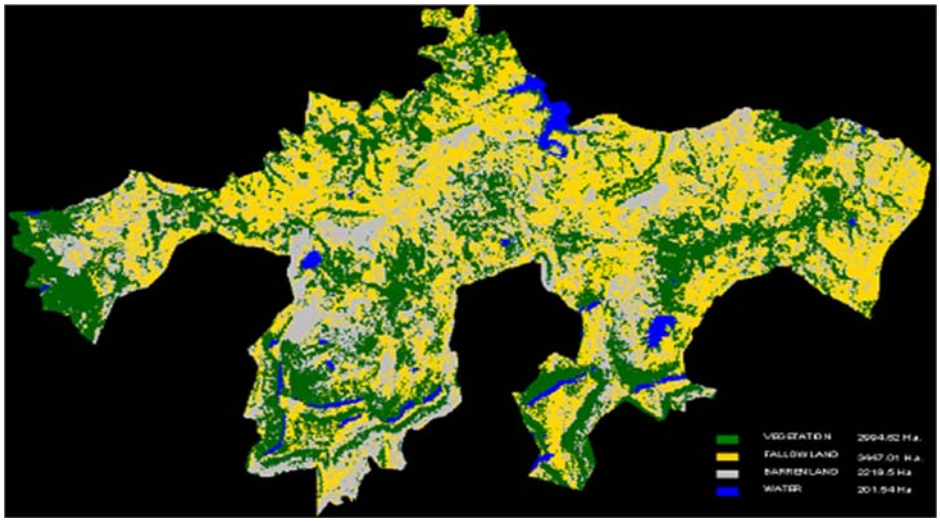

Figure 3. Supervised Classified Land Use/Land Cover image of Gangapur Sub-catchment

Finally, Soil Map showing different types of soil in different colour was prepared, as shown in the Fig. 4.

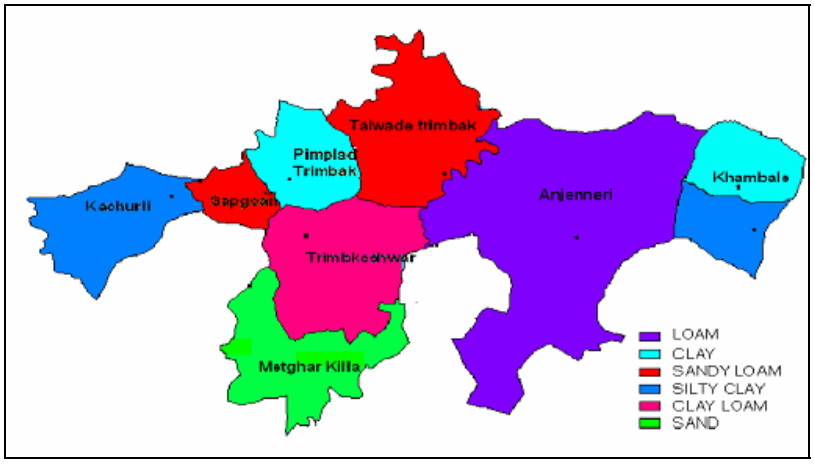

Figure 4. Soil Map of Ganagapur Sub-catchment

It was revealed that from the satellite imagery, one can ascertain the different types of soil classes and determine their acreage, so that planning for different crops can be

done [3] [4] [5] [6] [7]. By overlapping the soil map and classified image one can draw conclusion about soil type and vegetation pattern.

CONCLUSIONS

From the present study it was concluded that the soil maps are helpful for farmers in deciding cropping pattern, developing land use plans, demarcating agriculture, forestry and degraded land, allocating land for residential use, roads, parks, waste disposal etc. They are also used for watershed development, in understanding the kinds of the soil for recommending various management practices, to conserve soil and water resources and ensuring their rational use. At Agriculture research stations, soil maps are useful in selecting representative soils for conducting field trial before transferring agro technology to other areas having comparable soil site characteristics and at the research laboratories, in selecting representative pedons for their detailed investigation.

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PRIPREMA ZEMLJIŠNE MAPE KORIŠĆENJEM TEHNOLOGIJE DALJINSKE DETEKCIJE I GIS

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Sažetak: Za efikasnu upotrebu zemljišnih i vodenih resursa izvedeno je prethodno ispitivanje rečnog sliva Godavari doline-5 (GV-5) u Nashik pregledu zemljišta, čime su dobijene opsežne informacije o karakteristikama. Sakupljeni su reprezentativni uzorci zemljišta iz svakog od osam sela područja Gangapur. Iz podataka o uzorkovanoj oblasti napravljena je referentna mapa uzoraka. Istovremeno, GPS podaci su memorisani radi transfera ovih tačaka na mapu/satelitski snimak. Uzorci zemljišta su testirani u laboratoriji radi određivanja različitih zemljišnih karakteristika: boja, mehanička analiza, granična lažnost, granična plastičnost, kiselost, elektroprovodljivost, organski ugljenik, dostupni azot, dostupni fosfor, dostupni kalijum i sadržaj kalcijuma. Napravljena je vektorska mapa na osnovu katastarskih granica sela pod vođstvom MERI, Nashik. Analiza vektorske mape, zemljišne mape i mape upotrebe i pokrivenosti zemljišta izvedena je upotrebom programa ERDAS Imagine 8.7.

Ključne reči: *GPS, vektor, zemljište, mapa upotrebe i pokrivenosti zemljišta, ERDAS Imagine 8.7 program.*

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