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GIS and Remote Sensing For Site Specific Farming Area Mapping

Shailendra Raj, Dr. Avadhesh Kumar Koshal

Abstract-The application of current latest technologies and agronomic principles to manage spatial and temporal variability associated with all aspects of agricultural production for the purpose of improving crop performance and environmental quality. Visual and digital interpretation methods were used to prepare pre-field interpreted map. The detailed soil-site study was undertaken in each soil-mapping unit by general traversing and by collecting surface soil and sub surface soil (0-30 & 30-60 cm) observations at intervals depending on soil variability. The generated theme can be implemented for further planning of the site specific cropped urban and rural area.

***Keywords*: GIS, GPS, IRS, Remote Sensing & Site Specific Farming.**

I. INTRODUCTION

The site specific is a system to better manage farm resource or we can say it is information and technology based management system. It is possible because several technologies are available to agriculture for betterment. These include GPS, GIS, Remote sensing, plant, soil and pest sensors, and nutrient test sensor. In the India, where population growth rate outstrips agricultural productivity, the need to produce more food on a sustained basis is evident to ensure food security. Site –specific farming is used to measure hat is different, record the differences at distinct and specific locations, and then direct differences in management or input based on site –specific information. So Site –specific farming is a different way of thinking about the land. A surveyor and a legal description define a field boundary. Scientifically can say, Site-specific farming is doing the right thing at the right place at the right time. Geographic Information Systems (GIS) and remote sensing methods have become ubiquitous in site-specific management applications. It is expected that consultants and other practitioners have knowledge of and access to a GIS and remotely sensed data such as digital photographs or satellite imagery.

Remote sensing and GIS are integrated system of information gathering and analysis of alternative method for natural resource management. The recent development in the field of remote sensing and GIS based site specific management is due to the successful launching of a series of remote sensing satellites equipped with advanced sensors. The use of Remote Sensing and Geographic Information System (GIS) gave scope for immense opportunities in the field of large-scale mapping, updating of existing geographical maps, project planning, decision-making and natural resource management.

In India, production forecasting of certain crops, crop yield modeling and crop stress detection are done using remote sensing data. India has launched INSAT series satellites (INSAT-1B, INSAT-1C, INSAT-2D, INSAT-2E and INSAT-3E etc.) are in geo-stationary orbits. A GIS consists of two major elements namely hardware (processing unit, plotter/printer and graphic display system) and software (ARC GIS, ILWIS, IDRISI, MAPINFO & GRASS etc.). A fully functional GIS can be used to analyze characteristics between layers to develop application maps or other management options [1]. The GPS (Global Positioning System) instrument is use for field location and stored in form of latitude and longitude. GIS can be aid in better understanding of interaction between rainfall and crop related factors [2]. For analysis and processing of remote sensing images requires ground information, collected in the field at a variety of sites and often at various times throughout the crop production season. IRS 1C/1D & IRS P6 (Resourcesat-1) satellite imageries are give information about land surface particular related to agriculture land. Although developments have been broadly based across many divergent disciplines, there is still much work required to develop remotely sensed images suited to natural resource management, refine techniques, improve the accuracy of output, and demonstrate and implement work in operational systems [3]. Remote Sensing and GIS techniques can be applied effective measure to generate data and information for site-specific management & development. After more than twenty-five years of satellite-based land remote sensing experimentation and development, these technologies reached almost all sectors. The use of remote sensing data and derivative information has ever promise of entering into mainstream of governing at local and regional level. The application of current latest technologies and agronomic principles to manage spatial and temporal variability associated with all aspects of agricultural production for the purpose of improving crop performance and environmental quality. The intent of precision agriculture is to match agricultural inputs and practices to localize conditions within a site-specific area management and to improve the accuracy of their application.

II. OBJECTIVE

This paper seeks to demonstrate the usefulness of GIS technology in conjunction with Remote Sensing for site-specific faming area.

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Materials and Data: Satellite Data- IRS P6- LISS III and LISS IV, Resource Sat, CartoSat and other latest data used for site-specific area mapping. Image Processing Software's are ERDAS Imagine, Geomatica & MGE workstation and GIS software's are ARC GIS, Map info, Arc View & ILWIS used for analysis of remote sensing data [4]. Collateral Data used for GIS analysis-topographic map, cadastral map geology map, soil map, rainfall map etc.

III. METHODOLOGY

Input data: The satellite data of the study area are procured from IRS-P6, LISS-III & LISS-IV and has been used for Geology, Soil, Vegetation and Land use Land cover studies. Published soil maps, topographic maps, climatic data etc. are also collected and used as collateral data.

Data Processing: The IRS P6 satellite data were geo-referenced and suitable Image enhancements are applied to facilitate the delineation and interpretation of different thematic information.

Data Interpretation: Visual and digital interpretation methods were used to prepare pre-field interpreted map. The satellite data is interpreted based on photo elements like tone, texture, size, shape, pattern, aspect, association etc. These pre-field interpreted maps and digitally enhanced satellite data are used on the ground to identify different elements of various themes.

Field Verification and Data Collection: Suitable field sampling designs in terms of line transects/ quadrants are used to assess the interpreted elements and relate with satellite data. The field data collections are aided by GPS (etrax, Garmin, or Topcon and differential GPS) in order to locate the ground verification points on the image and for further incorporation of details. For the all the sample collection and field points visited attribute information on vegetation, geomorphologic, soil and topographic parameters are also collected. The detailed soil-site study was undertaken in each soil-mapping unit by general traversing and by collecting surface soil and sub surface soil (0-30 & 30-60 cm) observations at intervals depending on soil variability. The sample points were decided based on the Geomorphological / soil heterogeneity mapped from the satellite data.

Finalization of Maps: Based on the pre-field interpretation, ground truth verification and available secondary information final maps were prepared (Fig.1). Towards this both visual and digital approaches are conjunctively used.

Discussion on Land use\ Land cover: The land use and land cover map is prepared using remote sensing satellite data. The classification scheme was designed keeping in view of the management practices addressing each land use/ land cover parcel, amenability of these parcels for identification/mapping in dataset. All the LULC classes were visually interpreted based on tone/texture, contextual and ground information.

Vegetation: The vegetation cover map is generated using FCC. The vegetation in the study area is regulated by desert climate, seasonality, physiographic, geomorphologic and soil regimes. The vegetation is broadly demarcated into natural and managed vegetation. The managed vegetation mainly consisting of avenue plantations, grasslands and mixed plantations. The analysis was carried out after collecting sufficient number of sample data from the natural vegetated areas. Further different categories of vegetation under each of the community has been extracted and analyzed to understand the percentage of vegetation present to that of vacant land. Such information on spatial distribution in qualitative and quantitative terms would be useful in further exploring and analyzing the aspects of biodiversity and ecological conservation

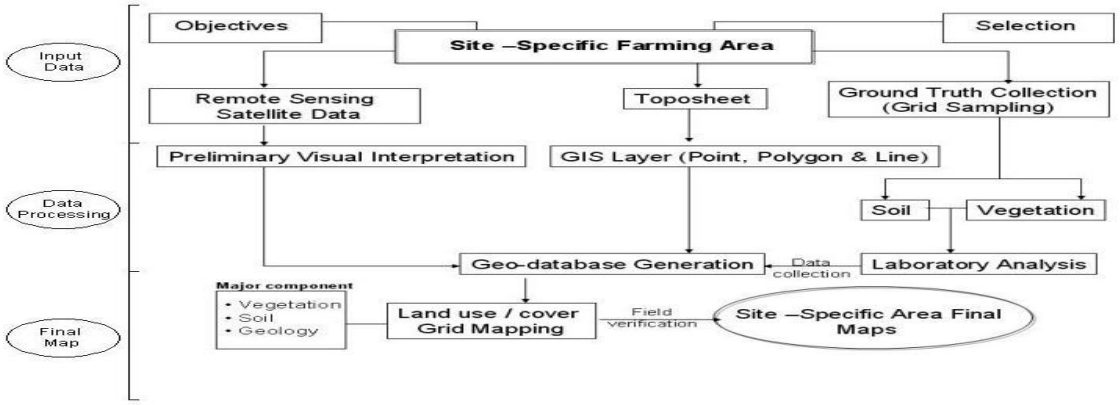

Fig.1 GIS and Remote Sensing For Site Specific Area Mapping

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Soil: The soil is mapped using remote sensing satellite data. The soils of the study area were classified upto series level and their association's level as per the Keys to Soil Taxonomy [5]. Essentially soil survey is a study and mapping of soils in the field. It is the systematic examination, description, classification and mapping of soils of an area. For soil fertility information, sampling is the best method to gather data. There are two types of sampling methods-grid sampling and zone sampling. Grid sample is good for site specific farming it found to be consistently reliable. Grid sampling uses a systematic method to direct where samples are taken. The samples are taken densely enough so that when the sample results are mapped, the represent the fertility patterns in the field

Geology: The geo-referenced satellite digital data was used to carry out 'on screen' vectorization of geological parameters.

IV. RESULTS AND CONCLUSION

The generated theme can be implemented for further planning of the site specific cropped urban and rural area .The action plan report can be created using the Geodata database and total decision support system can be developed to depict location and type of action / control measures recommended for management and developmental plan of site specific area.

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AUTHOR BIOGRAPHY

I have worked as a Project Scientist under national level UPCAR project, Dept. of Biotechnology, S.V.P.U. A. &T. Modipuram, Meerut, U. P. I have done Ph.D. (Botany) specialization in RS & GIS from Department of Botany, C.C.S. Univ., Meerut. I have life memberships of national scientific societies – Indian Science Congress Association (ISCA), Kolkata, and Indian Society of Remote Sensing. Dehradun, Society for Recent Development in Agriculture, Meerut & Hi-Tech Horticultural Society, Meerut, U.P. I have more than nine years experience in RS and GIS especially in agriculture, soil and ecology fields.