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Assessing agriculture area using geospatial technologies: A case study of part of Gumla district, Jharkhand

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Abstract
The present study was carried out to evaluate the agriculture crop using on screen visual interpretation of Landsat image. The study of conducted in part of Gumla District, Jharkhand India. The study area covers overall area of around 96424.75 hectare. Landsat scene recorded on 1st February, 2018 and 29th September 2018 was downloading from USGS website, Image was geometrically and radio metrically corrected. On screen visual interpretation techniques was applied to classified satellite data in different agriculture classes. Using visual interpretation of satellite data seven different aviculture crop is mainly classified i.e. kharif Crop, more than two crop, Rabi crop, Two crop, Current Fallow, other crop and water bodies. It has been found that about of 53.63% of the area is covered by Kharif crop, followed by more than two crop that is 0.61%, Rabi crop 0.24%,Two crop 5.94%, current fallow 15.25%, Other area was found to be 14.99% and also area of water bodies is find to be 9.27%. Different classes were also mapped that is other than agriculture and water Bodies classification scene were adopted according.

Keywords: Landsat, agriculture crop, visual interpretation

1. Introduction

Agriculture practices play an important role not only for the survival of human being but also the premise for the development of human society (Jihua and Bing-fang 2008; Vibhute and Gawali 2013; Ennouri and Kallel 2019) [6, 9, 2]. However change of natural ecosystem by anthropogenic activities ultimately alteration in the Agriculture Land is principally. Simultaneously, alteration in the Agriculture Land can also be brought about by forces other than anthropogenic i.e. natural events"' such as weather, floods, fire and climatic fluctuations. Therefore, spatial distribution of Agriculture land and its change is desirable for any planning, management and monitoring programme at local and national levels. Planning means the assessment of future and making provisions, for it for ensuring sustainable developments. Both globally and in India agriculture land today is altered primarily by direct human use. Any concept of global change must include the persuasive influence of human action on land surface condition and processes.

Therefore it is necessary to monitor the ongoing changes in pattern over a period of time. Agriculture land data are needed by government and local agencies for water resource inventory, flood control, water supply planning and waste water treatment. Many agencies need current comprehensive inventories of existing activities on public lands combined with the existing and changing uses of adjacent private lands to improve the management of public lands. However traditional method of using plot yield data collected under a complex sampling design on the bigger scale is an expensive and time-consuming procedure.

Remote sensing (RS) is very promising in monitoring agricultural at both the spatial and temporal characteristics. Remote sensing, with varying degrees of accuracy, has been able to provide information on land use, crop type, biomass development, crop yield, crop evapotranspiration, salinity and water logging (Bastiaanssen, 2000) [1]. Major developments are now taking place in the integration of remote sensing data and GIS due to the increased demand for the spatial information. There are three main ways in which remote sensing and GIS technologies are complementary to each other (Wilkinson, 1996) [10]. Remote sensing can be used as a tool to gather data sets for use in GIS. GPS is also use for locating position of objects. The integration of remote sensing data, GIS and GPS known as Geospatial analysis is crucial tools for the challenges resources manager face now a day.

Geospatial analysis involves interaction of a variety of data and derived parameters in desired fashion. The geographic analysis allows us to study and understand the real world process by developing and applying manipulation analysis, criteria and models to carry out integrated modeling. Geospatial technologies will useful for farmer to monitor their crops before they got damage, yield estimation, as well as precision farming. Commodity brokers are also very interested in term of both quantity and quality of yield estimates for worldwide trading and now a day crop insurance (Goswami 2012) [3]. Many previous studies have demonstrated the applications of geospatial technologies to assessing agriculture area (Kussul, 2010; Maurya, 2011; Shelestov, 2013; Salmon, 2015) [7, 5, 7, 8].

2. Materials and Method

2.1 Study area: The study area lies between latitude 23.0441°N and longitude to 85.5379°E. According to the 2011 Population Census in India, the Gumla district has a population of 1,025,656. The Gumla district has a population density of 193 inhabitants per square kilometer. Temperature ranges from maximum 40 to 20 °C during summer and minimum 21 to 3 °C during winter. The annual rainfall is about 1450 mm. From June to September the rainfall level is about 1,150 mm. Soil of Gumla district is Alfisol (42.8%), Inceptisols (40.3%) and Entisols (16.2%).

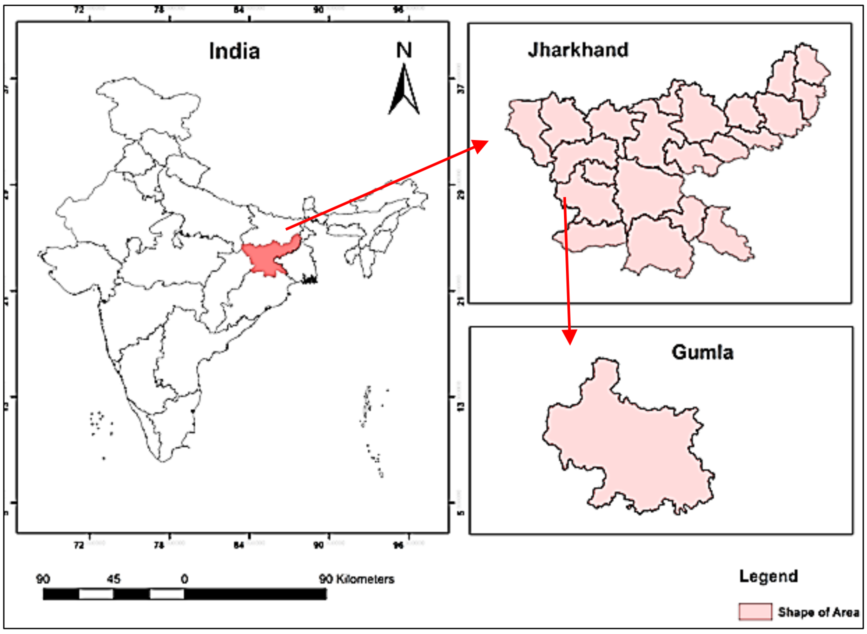

Fig 1: Location Map of study area

2.2 satellite data used in the study

The Ortho-rectified Landsat images of year 2018 were downloaded from United States Geological Survey (USGS) portal (http:// www.usgs.gov/in) and details are given in Table 1. Dark Pixel subtraction method was used to make the image more faithful.

Table 1: Satellite images information

Sat Satellite data	Year date	Row/path	Number of band used	Spatial resolution(m)
Landsat8 OLI	1st February 2018	44/141	2,3,4,5	30
Landsat8 OLI	29th September 2018	44/141	2,3,4,5	30

2.3 Classification of agriculture land

After the image processing satellite data was interpreted in False color composite (FCC). On screen visual Interpretation of satellite data has been done and types of agriculture crop was prepared using ArcGIS10.4. Field visit was also conducted for both date data that is rabi and kharif season data. Interpretation key used in this study is tone, texture, size, shape, pattern and association which are shown in table 2. Two crops and more than two crops were identifying in satellite data using the field visit.

Table 2: Interpretation key used in this study

S. N	LU/LC Category	Tone	Size	Shape	Texture	Pattern	Association
1	Rabi Crop	Bright red to red	Small to big	Regular to irregular	Medium to smooth	Contiguous to noncontiguous	Proximity to rivers/canal/streams and settlements
2	Kharif Crop	Bright red dull red	Small to big	Regular to Irregular	Medium to smooth	Contiguous to noncontiguous	Proximity torivers/canal/streams and settlements and lowland areas
3	Water Body (Reservoir/Lake tank/canal)	Light blue to dark blue	Small medium to large	Regular to irregular	Smooth to mottled	Dispersed	low lands, reservoirs with hilly terrain and rivers, Near settlements and Amidst arable lands
4	Water Body(River/Stream)	Light blue to dark blue	Long narrow to wide	Irregular sinuous	Smooth to medium	Contiguous, non-linear to dendritic/subdendritc	Hill slopes, flood plains, uplands etc.,
5	Current fellow	greenish blue	Small to big	Regular to Irregular	Medium to smooth	Contiguous to noncontiguous	Amidst or near to crop land

Results and Discussion

The modern techniques of satellite image processing have been applied to extract the Information about the area statistics of different Agriculture land cover classes. The Agriculture land categories such as Kharif crop, more than two crop, rabi crop, current fallow, other area and Water bodies have been identified on reflectance of land sat image through the on screen visual interpretation and field visit.

The study area covers 96424.82 ha of land out of which 51766.68 ha is come under Kharif Crop. In this respect, the agriculture area covers about 53.69% of the total area. It has also been found that about 589.43ha (0.61%) of area is covered by more than two Crop. The *rabi* crop comprises of 228.98 ha (0.24%). The area covered by two crop is 5727.079 ha (5.94%) and current fallow is 14706.76ha (15.25%) Besides this the area covered by the water bodies is 8943.09 ha (9.27%) and other area includes 14462.73ha (14.99%) Table3 and figure 2 shows the area statistics of the various agriculture lands and the maps showing the distribution of agriculture land of study area.

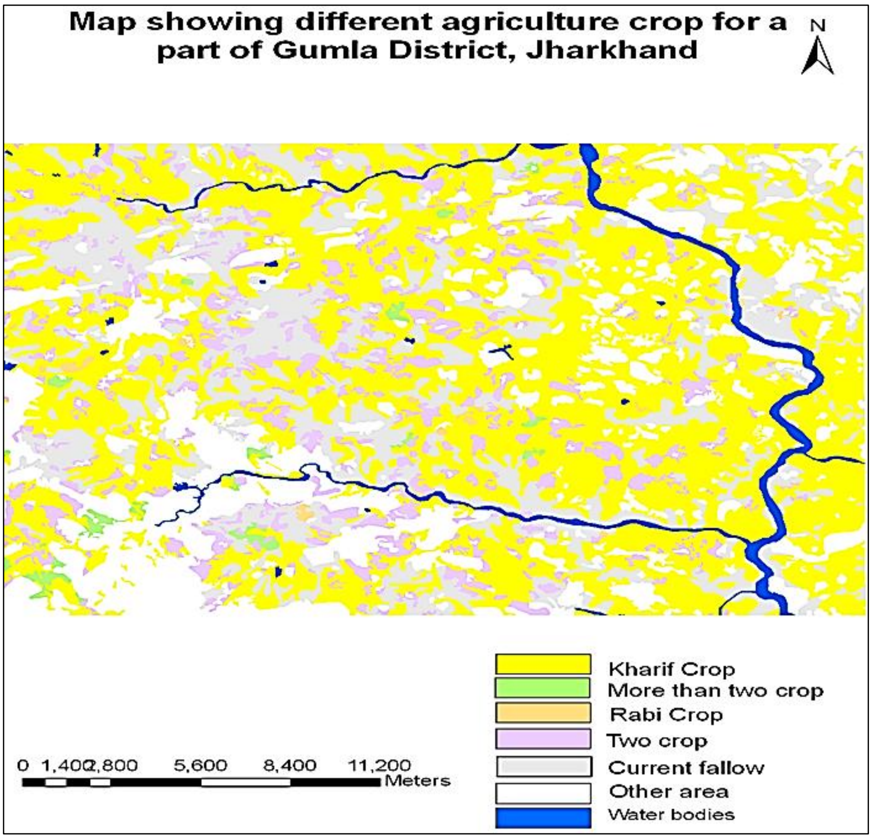

Fig 2: Agriculture crop for a part of Gumla district, Jharkhand

Table 3: Area statistic of Agriculture Land crop

Agriculture Land Cover	Area (ha)	Area (%)
Kharif Crop	51766.68	53.69
More Than Two Crop	589.43	0.61
Rabi Crop	228.98	0.24
Two Crop	5727.08	5.94
Current fallow	14706.76	15.25
Other Area	14462.73	14.99
Water Bodies	8943.09	9.27
Total area	96424.75	100

Conclusion

This study analyzed the spatial and temporal identification of agriculture crop using two time satellite data. Aim of the study was to identify crop types using landsat data which is having 30 m spatial resolution. Therefore onscreen visual interpretation has been used in this study as this technique gives more faithful information than digital classification techniques. The ground truth verification was made to verify the results.The study demonstrates the importance of remote sensing technologies used in agriculture field to identify the types of crops. This type of work is important for local administered to understand technology to identify agriculture crop type of the state as Jharkhand is agriculture dependent state. Technology used in this study will help landscape planner for further development of the region.

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