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"THE ROLE OF ICT FOR ASSESSMENT OF CROP AREA AND YIELD ESTIMATION FOR VAIJAPUR TEHSIL"

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ABSTRACT
The present study demonstrates the application of remote sensing for the estimation of areas corresponding to crop covered in the vaijapur tehsil district of Aurangabad, The aim of this study is to Estimate seasonal crop type on tehsils level specifically Sugarcane and Maize using Landsat 8 band OLI (Operational Land Imager) data; for finding the actual crop area covered by Vaijapur Taluka. The detail design objective of said study is given below:

Keywords

IRS-P6 Advanced Wide Field Sensors, Knowledge Classification, Maximum Likelihood Classification, Crop, Accuracy Assessment.

1. INTRODUCTION

Agriculture is the backbone of our country. It is the only major source of food production and supply so that can raises income and employment of rural populations. Agriculture plays major role in global economic development. It can help reduce poverty for 75% of the world's poor, who live in rural areas and work mainly in farming. It mainly contribute major portion in our national and global income. [1].

Now a days population is tremendously increases the demand of food are also increases. The 80% peoples livelihoods are depend on agriculture sector. The demands of the food requirements are not fulfil with the traditional methods. Thus ICT a new automated methods were introduced. These new methods satisfied the food requirements and also improved yield production. [2]. Agriculture faces a range of modern and serious challenges, particularly in Developing countries due to climate change, irregularity in rainy season and continually increasing the settlement areas and urban infrastructure. It is in this context that ICTs play a crucial role in helping people meet the demand for increased food production. ICTs can play a very crucial role by broadcasting information to farmers to help them make better well informed decisions. Through ICTs people can obtain the latest up-to-date information, learn and practice sustainable farming. It is in this regard that these case studies have been documented in this report to understand the various unique pathways through which ICTs can play a crucial role in promoting agricultural development at regional as well as Tehsil level. [3].

2. STUDY AREA

This chapter explores the study area data used their preprocessing and the overall methodology adopted for the study. This chapter explores the study area data used their preprocessing and the overall methodology adopted for the study.
The area taken for this study was Vaijapur Taluka (19° 55' 12" N 74° 43' 48" E) region. Located on the Narangi River. It is bordered by the Nasik districts to the west, Kannad Tahsil to the north, Gangapur Tahsil to the east, and Ahmednagar districts to the south. Vaijapur is the headquarters of Vaijapur Tahsil and also known as the Gateway of Marathwada. It is the Maharashtra provenance of India with temporal variation through temporal multispectral sensors images. In this study remotely sensed images of Landsat USGS satellite were selected for crop identification. All data has been be collected through the multispectral remote sensing sensors Landsat 8 band OLI(Operational Land Imager) time series 2 months such as September and October 2014.
Agriculture is the main economic activity in the region and local people are dependent on water availability from Narangi River and Nandur-Madhmeshwar Canal.
The most important soils of the Vaijapur Taluka are the black clayey soils on plains interspersed with occasional stretches of shallow soils on ridges. In the north, the soils are shallow and poor and in the south they are deep and fertile and particularly so in the Godavari valley. They are all derived from Deccan trap. The soils can be classified as light, medium and heavy according to the depth, texture and location. Soil has very dark brown clay, blocky, hard and quartz throughout the layer. Below 30 cm partially decomposed murum layer is seen.
There are two main cropping seasons: KHARIF, from June, July to October and Rabbi from November to April. The main crops grown in the area; where Wheat, Onion, Cotton, Sugarcane, Maize, Bajra, Jwar, Groundnut, Moong Beal (green gram) and several different vegetables.
The major KHARIF crops of the study area are sugarcane; maize and cotton while Bajra, Moong, onion, groundnuts are grown occasionally (depend on monsoon nakshtra). For these crops the Field (land) is prepared in April and May and the seed are sown at the start of rains in June. The crops are ready for harvesting by the beginning of November. The major rabbi crops in Vaijapur Taluka are Wheat, Onion, Jawar, Chana. The farmers prepare the ground at the beginning or end of October depending on monsoon if sometimes beginning of November and harvesting starts in early march.

3. METHODOLOGY

Satellite Data

The study is based on the utilization of multi-resolution senor characteristics for identification of specific crops. For this purpose a variety of remotely sensed images, from different sensors, that offer a range of spatial and spectral resolution, were taken. As study is concentrated on Discrimination of sugarcane and Maize at Taluka level.The images of two dates are acquired i.e crop growth stage (28th September, 2014) and Harvesting stage (30th October, 2014). The images of Landsat 8 band OLI (Operational Land Imager) sensors are acquired, which offers spatial resolutions of 30m, or 15m including Pan band respectively.

The OLI data quality was slightly better than the ETM+ data quality in the visible bands, especially the near-infrared band of OLI. Moreover OLI data were a reliable data source for monitoring land cover and provided the continuity in the Landsat earth Observation.

The study is conducted to identify specific crop sugarcane and maize using Landsat 8 OLI data and to demonstrate its application for land cover classification Vaijapur Sub-District, Aurangabad, Maharashtra.

Satellite data Acquisition

The two Landsat 8 OLI data (path/row:147/46 and 147/46,45) for the study area on September 28, 2014 and October-30, 2014 were downloaded from the United States Geological Survey (USGS) websites(http://landsatlook.usgs.gov). The clouds were nearly absent in the obtaining data. There for the quality of multispectral data was good.

As this study is based on utilization of multi-sensor characteristics to detect identify the crop area accurately, it was mandatory to acquire the Landsat 8 band satellite datasets of same dates. The medium resolution Landsat 8 OLI sensor is 30m, having the receptivity of 16 days. Data were projected in WGS 84 Datum.

Sensor	Acquisition Date	Path	Row	ID	Cloud Coverage	File Format
OLI	2014-09-28	147	46	LC81470462014271	1%	GeoTiff
OLI	2014-10-30	147	46	Lc81470462014303	0%	GeoTiff

Sensor Characteristic's

Landsat 8 carries two instruments: The Operational Land Imager (OLI) sensor includes refined heritage bands, along with three new bands: a deep blue band for coastal/aerosol studies, a shortwave infrared band for cirrus detection*, and a Quality assessment band. The Thermal Infrared Sensor (TIRS) sensor provides two thermal bands. These sensors both provide improved signal-to-noise (SNR) radiometric performance quantized over a 12-bit dynamic range. This translates into 4096 potential grey levels in an image compared with only 256 grey levels in previous 8-bit instruments. Improved signal to noise performance enable better characterization of land cover state and condition. Products are delivered as 16-bit images (scaled to 55,000 grey levels).

Landsat 8 images have a large file size, at approximately 1 GB compressed

Band	Description	Wavelength (micrometers)	Resolution (meters)
1*	Violet-Deep Blue	0.43 – 0.45	30
2*	Blue	0.45 – 0.51	30
3*	Green	0.53 – 0.59	30
4*	Red	0.64 – 0.67	30
5	Near Infrared	0.85 – 0.88	30
6	Shortwave Infrared	1.57 – 1.65	30
7	Shortwave Infrared	2.11 – 2.29	30
8*	Panchromatic	0.50 – 0.68	15
9	Cirrus clouds	1.36 – 1.38	30
10**	Thermal infrared	10.62 – 11.19	30
11**	Thermal infrared	11.50 – 12.51	30

* Within the visible spectrum
**100-meter resolution data interpolated to 30 meters

Table 1:Sensor Characteristics Landsat 8 Imaging Sensor

Layer Stacking

Remote sensing sensors record the spectral properties (radiance, emitance, and backscatter) of terrain features in different wavelength regions. Different features reflect differently in different bands. Therefore, the selection of bands for any study will depend on the band in which it gives distinct responses. So, even if there are many bands in a sensor system, all may not be useful for our purpose and selection of wrong bands will lead to incorrect interpretation. Stacking is a process of combining in layers the bands required for any study into a single output file[2].

In this step the downloaded satellite image bands were stacked for creation of multispectral image. Hence 8 separate bands were imported in ERDAS Imagine 2013 using layer stacking option and selected eight bands individually.

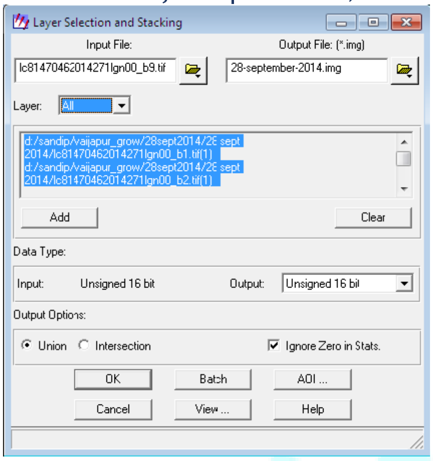

Figure 1: Layer Stacking of Landsat 8 Band

Software Used

ERDAS IMAGINE is a remote sensing application with raster graphics editor abilities designed by ERDAS for geospatial applications. The latest version is 2013, version 13.0.2. ERDAS IMAGINE is aimed primarily at geospatial raster data processing and allows the user to prepare, display and enhance digital images for mapping use in geographic information system (GIS) or in computer-aided design (CAD) software. It is a toolbox allowing the user to perform numerous operations on an image and generate an answer to specific geographical questions

ArcGIS is a comprehensive system that allows people to collect, organize, manage, analyze, communicate, and distribute geographic information. As the world's leading platform for building and using geographic information systems (GIS), ArcGIS is used by people all over the world to put geographic knowledge to work in government, business, science, education, and media. ArcGIS enables geographic information to be published so it can be accessed and used by anyone. The system is available everywhere using web browsers, mobile devices such as smartphones, and desktop computers.

Masking-out Study Area

The vector layer of Area of Interest was prepared and then this layer was used to subset the study area from whole Landsat scene, as shown in Figure 4.4

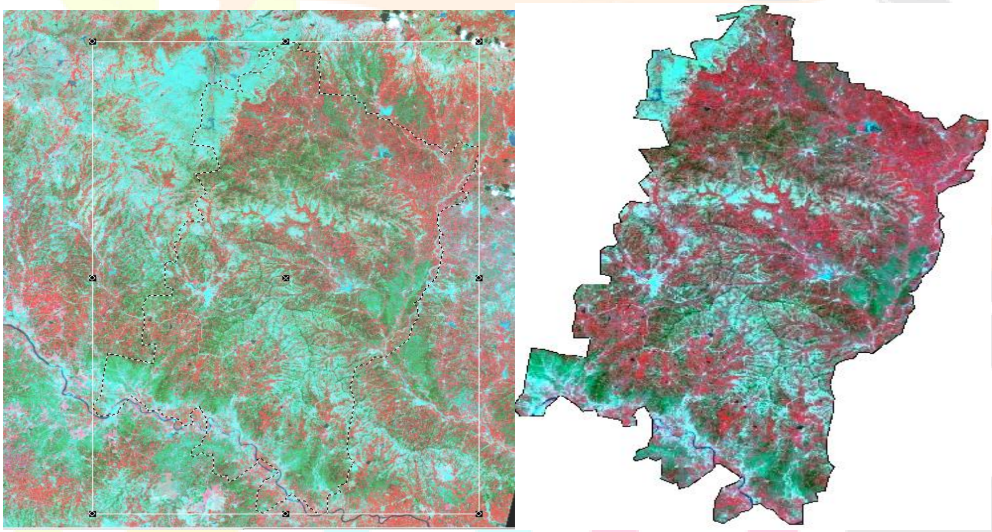

Figure 2: Landsat 8 Image Subset of Study Area

4. ACCURACY ASSESMENT

we have included final classification results and an alternative method of accuracy assessment as well as detailed discussion about the results achieved. As it has mentioned before, a generalization techniques was adopted for all the classification results. Sometimes a classified result contains data that is erroneous or irrelevant to the analysis at hand or is more detailed than it requires, For instance, if a small isolated areas that are misclassified. We have performed various techniques to overcome this problem. The overall accuracy result is shown at the end of the chapter.

Image Classification & Analysis

The results of the image classification are obtained using four different supervised classifiers. The accuracy of the classified images was assessed with error matrices, percentage of producer, user's accuracies and Kappa statistics. The results of this study show that, classification of remotely sensed imagery gives valuable information in the agricultural yield. The crop acreage estimation analysis is done by Maximum Likelihood, Mahalanobis Distance Classifier, Knowledge Classifier and Fuzzy Classifier approaches [1][2][3][4]. The classification is done through assigning seven classes such as Sugarcane, Maize, Other Crops, Barren Land, Fellow Land, Settlement and Water. The ground truth points were collected through *GPS*Receiver Device. The figure 6 shows photograph of *GPS* receiver [5][6].

Figure 3: GPS Receiver

For the image classification and analysis we have used *LANDSAT* 8 *OLI* images. The original images are shown in figure 7 and 8.

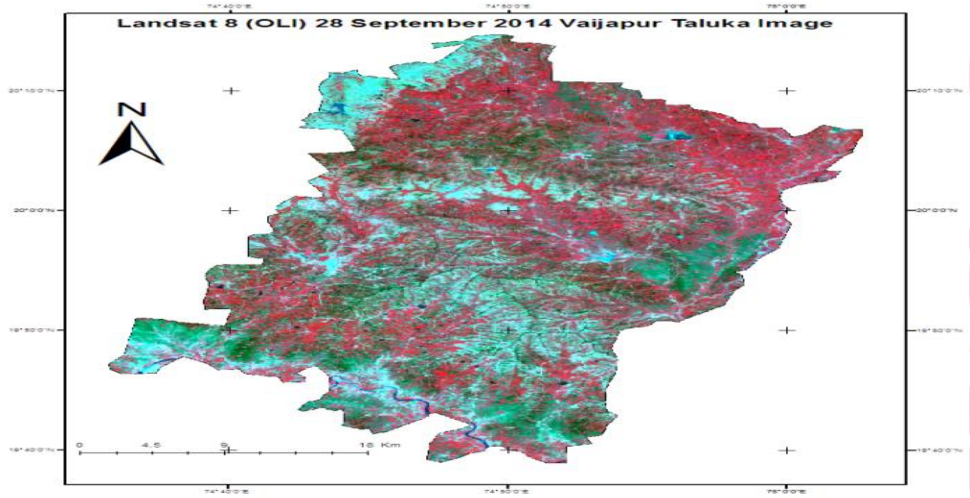

Figure 4: Landsat 8 band (OLI) FCC image of 28 September 2020

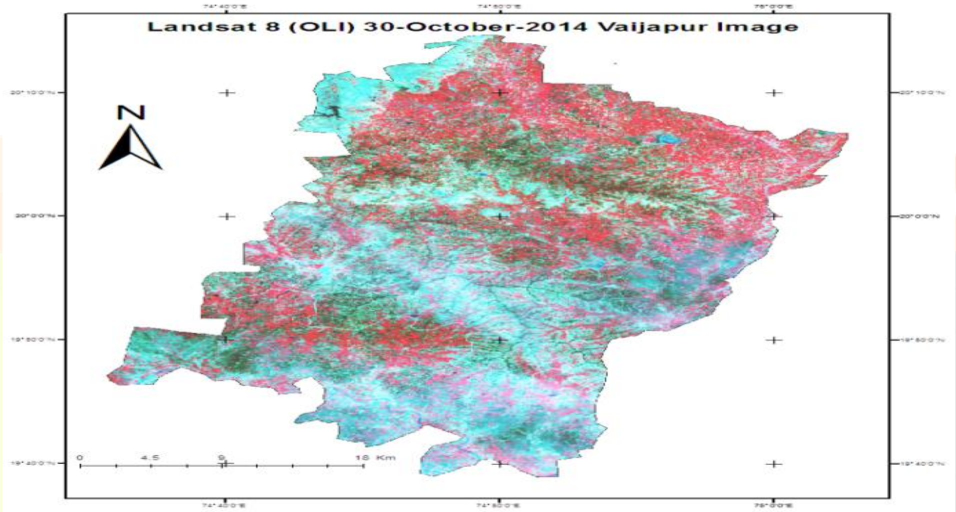

Figure 5: Landsat 8 band (OLI) FCC image of 30 October 2020

5. CONCLUSIONS

The study carried out in this thesis potential of remote sensing sensor approach in the temporal analysis studies. Study demonstrated that to estimated actual area covered by the crop specifically Sugarcane and Maize from Landsat 8 band OLI satellite data, and comparing the results achieved by the maximum likelihood, Mahalanobis classifier. It is demonstrated that MLC classifier is more suitable for temporal images from finding the specific crop.

The Landsat 8 Band OLI a new generation of Landsat series satellites to supply data for the worldwide Community of researchers and educators. To assess the data performance, Landsat 8 OLI was also investigates for land cover classification (identification of specific crop) in Vaijapur Taluka, Aurangabad Maharashtra. The Landsat data performance was good especially in the NIR band of the OLI data, where a clear improvement was found.

The result about crop cover area in hector using Maximum Likelihood are 9283.41 ha Sugarcane and 21140.3 ha Maize in the month September. The areas of 10989.8 ha Sugarcane and 3687.12 ha with Maize for the month of October have been occupied from overall 159473.4ha of Vaijapur geographical area. In the month of October sugarcane area was slightly increased as per month of September. As per maize the maximum area was harvested during the month of October that's way the occupied area was shown decreased.

The study was time bound and of a shorter duration, only a few areas in the temporal discrimination of crops could be actively explored. Since the remote sensing data used in this study was of the period 28-Sept, 30-Oct-2020 and field work was conducted as same time. It was mainly done based on two classification techniques and ancillary information about crop growth pattern and the agricultural land survey record of the area. The hypothesis test shows that the Maximum likelihood, Mahalanobis Distance Classifier, gave promising results for estimating smallest area count of crop area for Vaijapur Taluka using Landsat 8 OLI imagery.

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