

# AREA ESTIMATION OF PADDY CROP IN HARYANA BY DIFFERENT SENING PLATFORMS

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## Abstract

Over the several decades, remote sensing has emerged as an efficient tool to monitor crop land over a variety of climate condition and location. Remote sensing based vegetation indices show better sensitivity than individual band reflectance and hence are more preferred for crop vigor assessment, crop discrimination, crop monitoring etc. in the present study, spatial extent of paddy crop in Haryana State (India) was estimated by remote sensing data. Moderate resolution imaging spectrometer's (MODIS) 19 day composite land surface reflection product MOD09Q1 data 250m spatial resolution and multispectral time series images of landsat 8 were used for the identification of paddy crop. The pixel based (Iterative Self-Organizing Data analysis Technique) ISODAT classification technique used to discriminate the different crops. In Haryana, rice crop found concentrated in northern parts of state. Karnal, Kurukshetra, Ambala and parts of adjoining districts had vast area under rice. Landsat data gives good quality interpretation because of high resolution but cloud cover remains a problem for rice analysis as it is grown in monsoon (*kharif*) season. MODIS proved a good alternate for this.

**Key words :** Remote Sensing, Paddy Crop, Landsat 8, MODIS, NDVI

## Introduction

Increasing populations as well as human activities are intensifying pressure on land especially for food grain production. These ever increasing demands could be met through systematic information of the spatial change in different crops area, evaluating their potentials for wide range of land use options, formulating land use plans and reduce land degradation. A notable feature of changes in cropping pattern in Haryana is the enhanced share of the cereals, occupying two third of total cropped area (Ramphul, 2012). With advances in information and communication technology, computer based decision support models have been developed towards land evaluation (Rosa *et al.* 1992). Satellite images provide a powerful tool for distribution of different crops and spatial changes in crops area. Satellite data can be integrated in GIS to obtain different thematic information for using in land evaluation techniques. Fine resolution paddy rice maps are usually generated from a single or a few images obtained during growing season. In recent years

FAO has been developing GIS in linkage with its agro-ecological zoning and similar models, applying these to tackle issues of land at regional levels (Sarkar A, 2008) Due to the frequent cloud cover and long revisit cycle (16-days for Landsat); it is difficult to obtain a dense time series for most of multi spectral remote sensing data. Thus, rice mapping using a time series is usually focused on coarser resolution data such as MODIS. The combined use of fine and coarse resolution images potentially increases the data availability for better tracking of crop phenology and efficient paddy rice mapping. Therefore, it has a great potential to improve paddy rice classification if temporal features of coarse resolution data are used in classifying finer resolution data (Kumar.S. *et al* 2018).

The present study summarizes the remote sensing application in area estimation of paddy and identifies the shifting agriculture of rice crop in the Haryana state.

## STUDY AREA

As per Planning Commission of India, the state comes under the 'VI' agro-climatic region (Trans-Gangetic plain region). Haryana lies within the geographical coordinates from 27°39' N to 30°55' N latitudes and 74°27' E to 77°36' E longitudes (Fig.1). Total geographical area is 44212 Sq.km (1.37% of country's geographical area) and 85% of it is available for agricultural use. Rest of 15% is covered for non agricultural purposes say built up, barren land or forests etc. The state has population of 25 million (2% of India's Population) as per census 2011. More than 70% of the population of Haryana is dependent on agricultural sector for their livelihood. Average annual rainfall of the state is 617 mm and below for arid/semi arid regions. The net cropped area is 3.64 million hectares. About 86% of the area is arable, and of that 96% is cultivated. About 75% of the area is irrigated through tubewells and an extensive system of canals. Wheat is the major crop of state and grown in whole state in rabi season (October to March). In western agro climatic region of state (Fig. 1) cotton is also grown along with paddy. For kharif crops, the ground is prepared by the end of May or the beginning of June and the crops are harvested by mid of October to November.

Paddy in Haryana is mostly concentration in the northern-eastern part of the Yamuna Ghaggar flood plain, which is 29 of the total agriculture area of the state Ten major districts namely Ambala, Fatehabad, Jind, Kaithal, Karnal, Kurushetra, Panipat, Sonapat and Yamuna Nagar these districts contribute 84 percent area of the state. In these districts, for the four years 2007-2011 varied between 267 mm in Western districts to 964 mm in most northern districts. For all these wheat is major crop during the rabi season and paddy is major crop during the kharif season. Therefore, to find out exact location and area under rice crop in state of varied topography, remote sensing technology is best way and used in the present research.

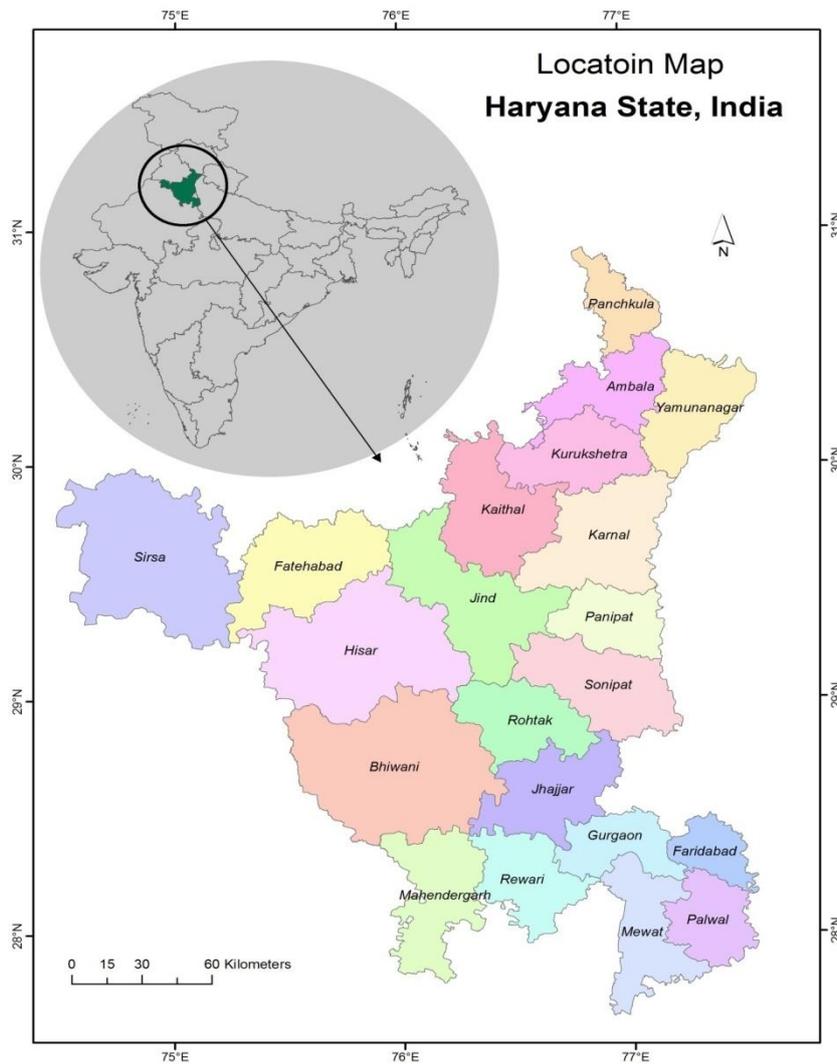


Fig. 1 District map of Haryana

### Material and Methods

Step by step methodology starting from importing of data to classification is presented in following flow chart (Fig. 3).

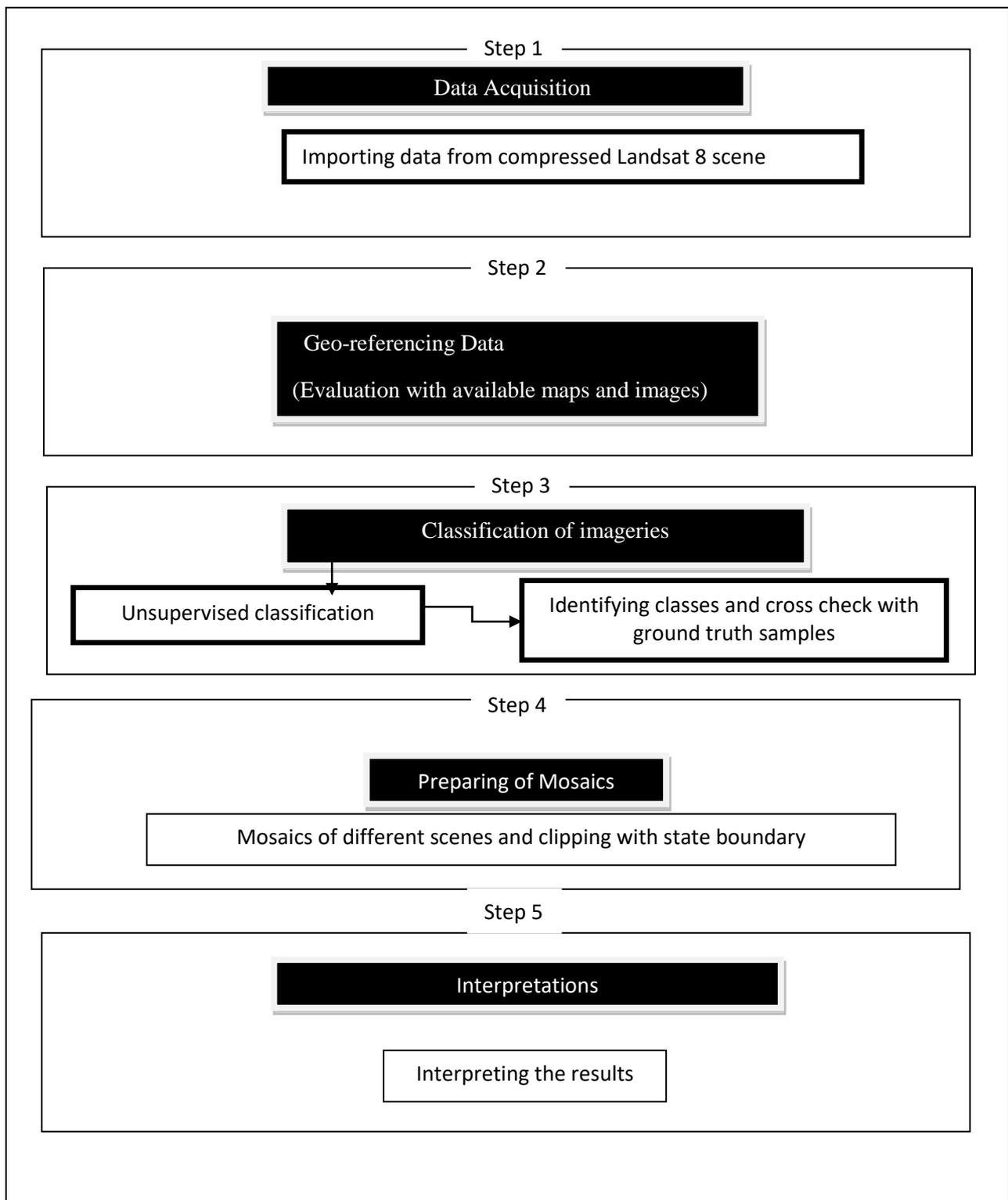


Fig. 2 Flow chart for methodology

## Methodology

Digital image analysis was carry out in Erdas imagine and Arcgis software, the Geotiff data was import to Erdas imagine format.l Landsat and Moderate resolution imaging spectrometer (MODIS) images for *kharif* season 2015 and 2016 respectively were used for analysis. Growing season of paddy (June to October) coincides with monsoon season. Therefore, MODIS data used for study when cloud free images

were not available. . Using this algorithm, the analyst input the number of clusters desired with confidence threshold. MODIS 19 day composite images for *Kharif* season were clubbed to identify crop area. Area under the crop could be estimated with an overall accuracy of 90% or more by Landsat and MODIS images. Government records of recent past revealed that about 5% area had been increasing every year under rice crop in the state.

Collateral Data: Ground truth data collected using the handheld GPS in October month .This ground truth information was used to identification of different crops and land features.

## Result & Conclusion

Multispectral classification is an information extraction process that analyzes the spectral signatures and then assigns pixels to classes based on similar signatures. For example, all of the pixels which represent an area of forested land on a TM image should have roughly the same spectral signature. Classification procedures attempt to group together such similar pixels.

This way, a layer can be generated with each land cover type represented by a different class. The detail of the classes depends on the spectral and spatial resolution characteristics of the imaging system. Landsat imagery is usually good for creating a general land cover classification map. Unsupervised classification is a method in which the computer searches for natural groupings of similar pixels called clusters.

In ERDAS unsupervised classification is performed using an algorithm called the Iterative Self-Organizing Data Analysis Technique (ISODATA). Using this algorithm, the analyst input the number of clusters desired and a confidence threshold. The computer or software, then build clusters iteratively, meaning that with each new iteration, the clusters become more and more refined. The iterations stop when the confidence level (or a maximum number of iterations specified by the user) is reached (Jensen, 2009). For example, if the user wants 30 clusters at 95% confidence, the computer will iteratively build the clusters until it is 95% confident has attained the best distribution of pixels into 30 clusters.

For identifying the classes, each class was highlighted at a time and then determines which of the landuse it belonged to by interpreting the original multispectral image. Fig. 2 shows classification of all scenes in. Figure 7 show that paddy area in Haryana. In addition to MSS, NDVI of the image was also prepared and compared with each class to identify vegetation. Then each class was given a color such as water as blue. Finally, the image was exported to map as shown below. To get the results for Haryana, an

AOI layer was created in ERDAS and final classified image was cropped (subset) for Haryana AOI layers. Figure 3 and 4 represents the paddy crop map in kharif season 2015.

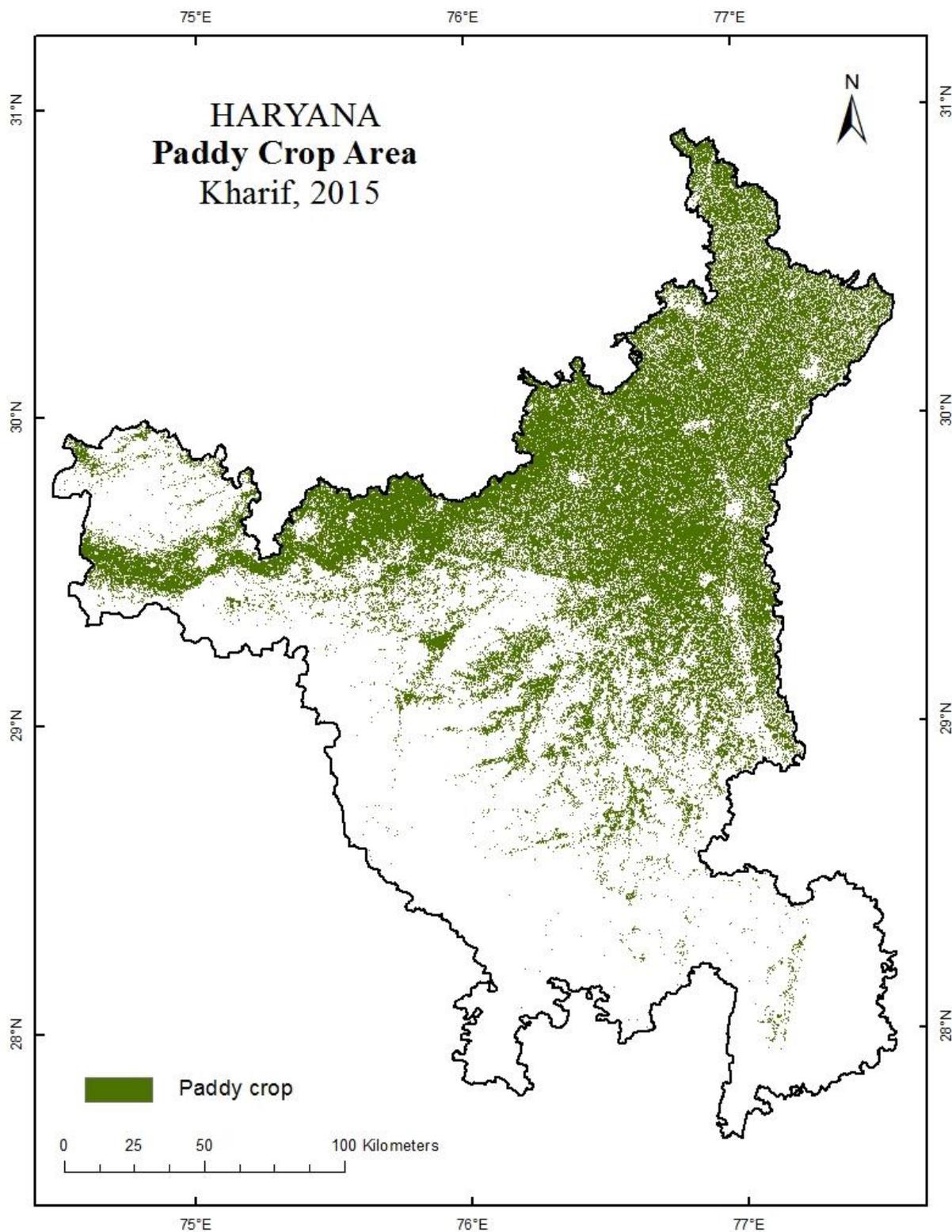


Figure 3 Paddy area in Haryana.

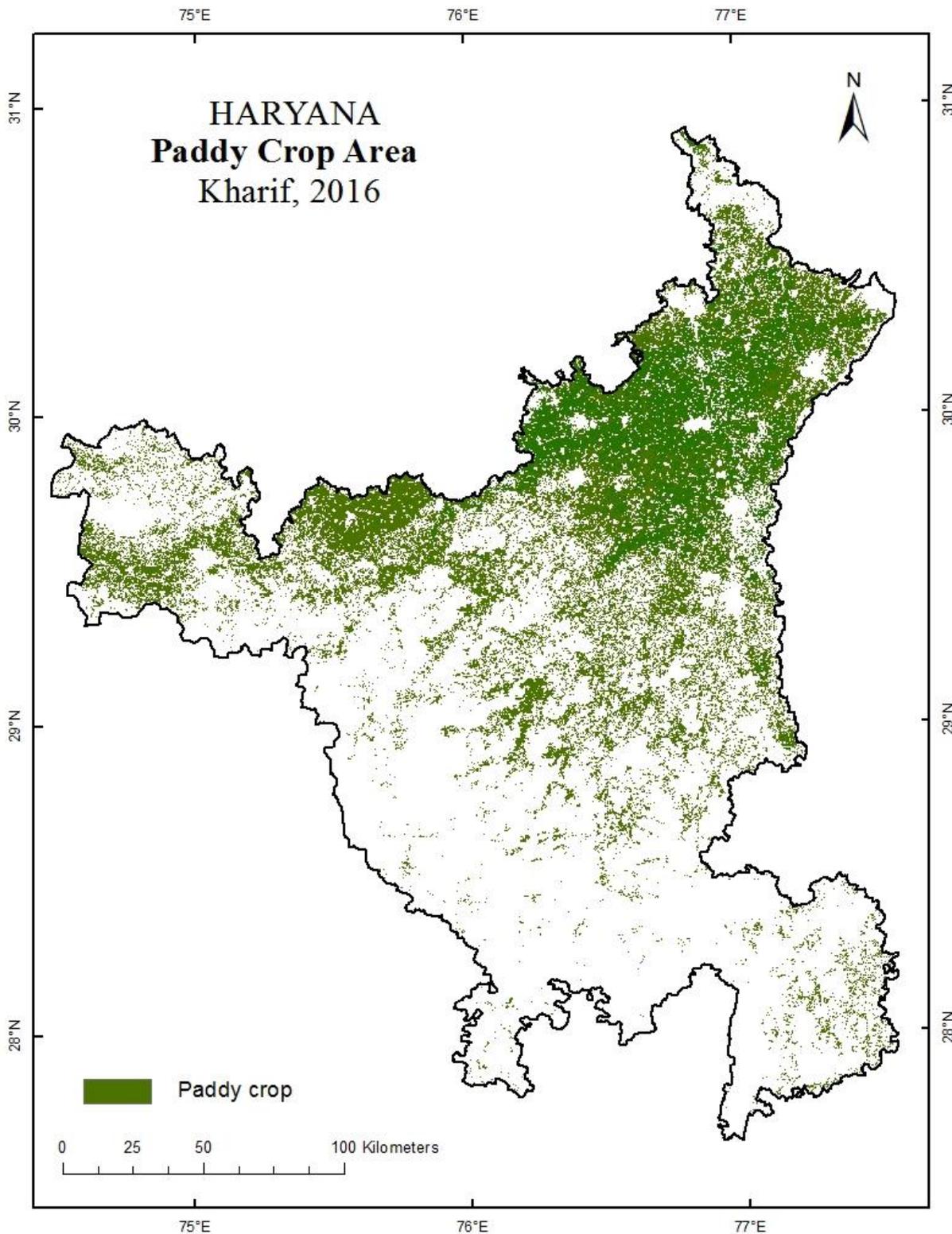


Fig.4 MODIS scene (H29V2556 and H24V6006) of Haryana

The landsat 8 data has resolution of 30 meters (Table 1). Therefore each pixel cover ground area measuring 30x30 meter or 900 sq. meters or 0.09 hectare or .0009 sq. km.

By adding the all wheat classes (i.e. class paddy to paddy2) the total wheat pixel in the image were

$$13393387 \text{ paddy pixels} \times 0.0009 \\ = 12054.04 \text{ sq. km.}$$

$$\text{Total classified area: } 49230833 \text{ pixels} \times 0.0009 \\ = 44307.75 \text{ sq. km.}$$

This is 29.74 % of total geographical area of Haryana

On the basis of above analysis it is concluded that paddy is grown over 29.74 geographical area of Haryana

On the basis of above analysis it is concluded that Paddy is grown over 27.2 % geographical area in Haryana.

## Results

Paddy in Haryana is mostly concentration in the northern-eastern part of the state which is a fertile flood plain of Yamuna Ghaggar Rivers. It is 29 percent of the total geographical area of the state. Ten districts viz. Ambala, Fatehabad, Jind, Kaithal, Karnal, Kurukshetra, Panipat, Sonipat and Yamuna Nagar contribute 84 percent paddy area of the state. Districts of Fatehabad, Hisar, Gurugram (Gurgoan), Palwal, Mewat and some parts of Faridabad, Sonipat and Sirsa of Haryana fall under marginally suitable area (Parveen *et al.*2017). Rainfall is low but irrigation facility is better owing to which rice is grown in some parts of this zone. In Sirsa, rice is cultivated in *Ghaggar* river belt.

There has been a sharp shift in area under the paddy crop. Paddy is a major consumer of irrigated water and almost paddy area in Haryana falls under the irrigated condition. Many district of Haryana experiencing sharp decline in the ground water table that may invite adverse environmental consequences (Parveen *et al* 2017).

The research also confirms the applicability of remote sensing to find out distribution and area under paddy crop in varied geographical conditions.

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