

# ACREAGE ESTIMATION OF SUGARCANE CROP IN SITAPUR DISTRICT, UTTAR PRADESH USING MICROWAVE SENTINEL DATA

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**Abstract** - Sugarcane is a high-value commodity farmed mostly in India during the Rabi season. The constant cloud cover during this season complicates the calculation of sugarcane crop area using space-borne remote sensing. Because of its capacity to gather photos under hazy conditions, microwave remote sensing can assist in resolving the problem. In the current study, temporal Sentinel-1B SAR data were used to distinguish the sugarcane crop from other competing Rabi season crops in the Sitapur area of Uttar Pradesh in 2021. To analyze the geographical distribution of sugarcane crop in the Sitapur area, the random forest classifier achieved an overall accuracy of 87.12 percent with the sugarcane classification accuracy of 86.60 percent.

**Key Words:** Microwave Remote Sensing; sugarcane crop; acreage estimation; temporal; random forest classifier

## 1. INTRODUCTION

Sugarcane is one of India's most significant cash crops, contributing Rs.75, 000 crore to the Budget each year. Advance predictions of sugarcane crop area and production rates are critical since 5 crore farmers and their families rely on this commodity. Final production estimates based on comprehensive enumeration of area and yield through crop cutting trials are available only after the crops have been harvested. However, the government requires output forecasts in advance in order to make numerous policy decisions on price, marketing, export/import, distribution, and so on. Given the true need for crop predictions well before the crops are harvested for different policy considerations, a timetable for publishing advance estimates has been developed (Anonymous, 2014). Crop estimates are generated and issued at four stages during the year, as listed below. The prior advance estimates for both the Kharif and rabi seasons are firmed up/validated using data from the State Agricultural Statistical Authorities (SASA), remote sensing data from the Space Application Centre in Ahmadabad, and the CWWG sessions (Anonymous, 2008). When working with extremely varied regional distributions of growth circumstances, estimating sugarcane biomass is problematic. Accurate and up-to-date land cover change data is required to comprehend and analyzed the environmental repercussions of such changes (Kumar et al., 2012). The possibility of time-series Sentinel-1 backscatter data for sugarcane crop mapping is investigated in this work. To assess the backscatter behaviour of the sugarcane crop, we analyzed multi-temporal C-band VH polarized Sentinel-1 SAR data to fine-tune the sugarcane map in Sitapur district, Uttar Pradesh state.

### 1.1 Objective

The principal objective of this study is to find total area in the District under sugarcane crop cultivation using SAR Data.

## 2. STUDY AREA

Sitapur is a district in Uttar Pradesh's Upper Gangetic Mid-Plains, bordered on four sides by the districts of Lakhimpur Kheri, Bahraich, Barabanki, and Hardoi in the north. The district is made up of 19 blocks and about 2,000 settlements. The district encompasses an area of 5743 square kilometres. Sitapur district is located in the Indian state of Uttar Pradesh, and the district seat is Sitapur town. The city is situated on the 'Sarayan' river's bank. Sitapur, Biswan, Mishrikh, Laharpur, Mahmoodabad, and Sidhauri are the six tehsils that make up the district. With two parliamentary constituencies (SC) in Sitapur and Mishrikh and nine assembly constituencies (SC) in Sewta, Biswan, Mahmoodabad, and Sidhauri, the district is divided into 19 blocks.

The overall population of the district is 28.57 lacs. Sitapur is located at 27.57°N 80.68°E. The average elevation is 138 metres above sea level (452 feet). It is located on the Gangetic Plain, with elevations ranging from 150 metres to 100 metres above sea level in the north and south, respectively. It is divided by several streams and ravines, as well as numerous small ponds and natural reservoirs. The five rivers that go through Sitapur's district are the Gomti, Kathana, Pirai, Sarayan, Ghaghra, and Sharda.

The rainy season lasts from July through October, with an average yearly rainfall of roughly 975 mm. The rest of the year will be fairly dry.

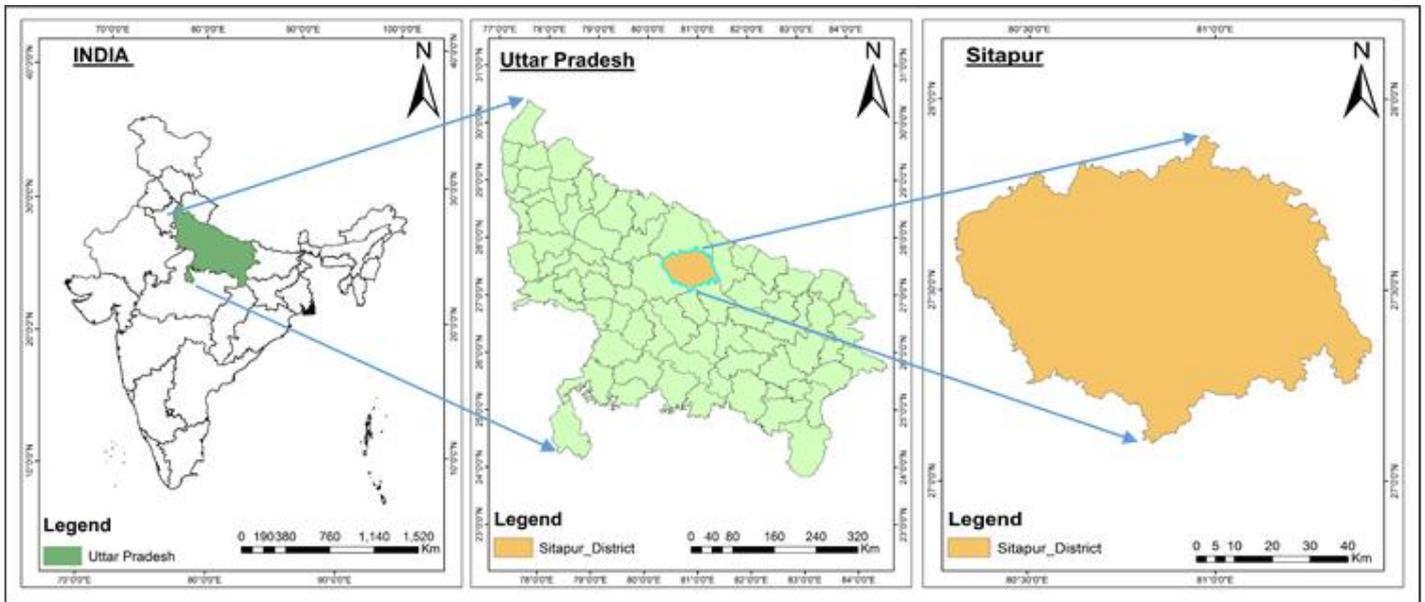


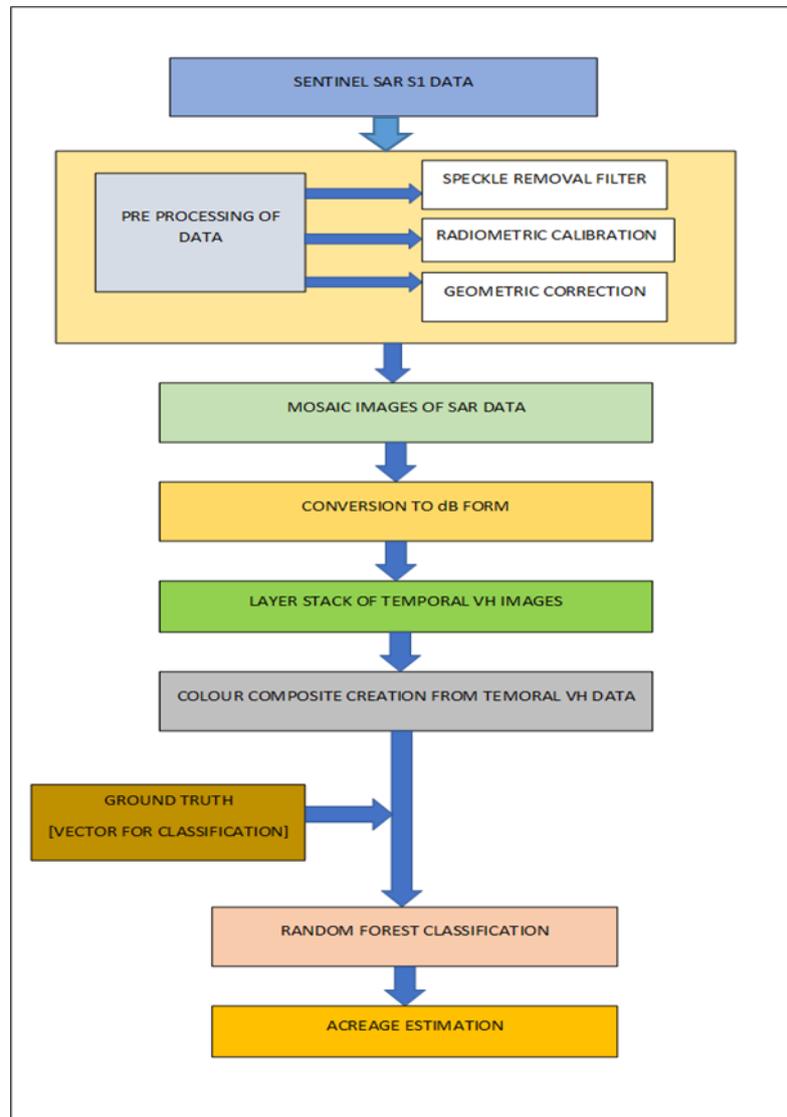
FIGURE -1: STUDY AREA MAP OF SITAPUR DISTRICT

### 3. DATA USED

DATA	ACQUISITION DATE	MODE	TYPE	POLARIZATION	TRACK	ORBIT
SENTINEL-1A	11-APRIL, 2021	IW	GRD	VH	56	37403
SENTINEL-1A	17-MAY,2021	IW	GRD	VH	56	37403
SENTINEL-1A	22- JUNE,2021	IW	GRD	VH	56	37403
SENTINEL-1A	16- JULY,2021	IW	GRD	VH	56	37403
SENTINEL-1A	21-AUGUST,2021	IW	GRD	VH	56	37403
SENTINEL-1A	14-SEPTEBER,2021	IW	GRD	VH	56	37403

TABLE-1: DATE WISE SENTINEL DATA USED FOR THE STUDY

#### 4. METHODOLOGY

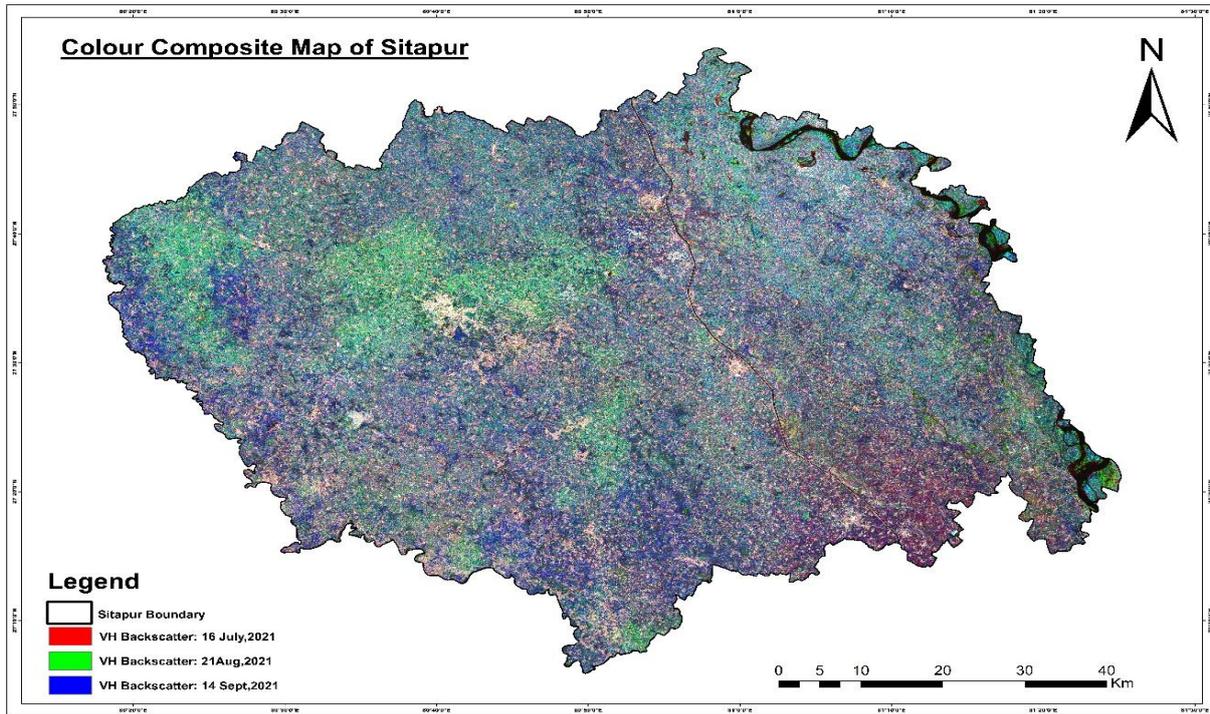


**FIGURE -2: FLOW DIAGRAM OF METHODOLOGY USED**

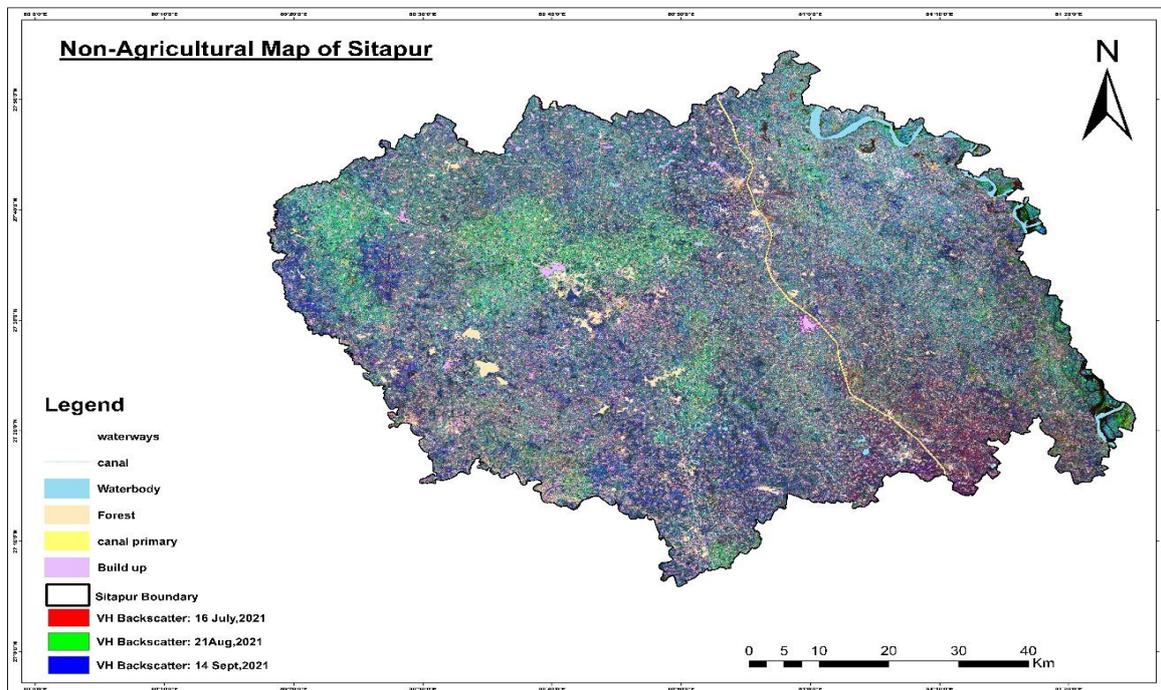
Acreage estimation of Sugarcane Crop Using Sentinel SAR data in Sitapur District has been calculated using following steps. Initially, Sentinel 1A images of 11 April, 17 May, 22 June, 16 July, 21 August, and 14 September were downloaded from ESA Website .pre-processing of SAR data has performed using SNAP tool for removal of speckle and radiometric and geometric correction. We have used VH Intensity data of SAR for the sugarcane study.

After Pre Processing, mosaicking of the SAR DATA consisting two files for same area has been achieved. Following this, a subset was generated to generate the area of interest (Sitapur) using the district boundary. After that, these data converted to dB form using SNAP Toolbox for each month, later got layer stacked to make it Colour Composite form.

As, we have to calculate the acreage estimation masking of non-agriculture land has been done along with ground truth of different crops has used. RANDOM FOREST classification has been done with the help of ground truth data to calculate the area under Sugarcane cultivation by assigning ground truth and non-agriculture mask in the form of vector to classification of image by classifier trained of vectors.

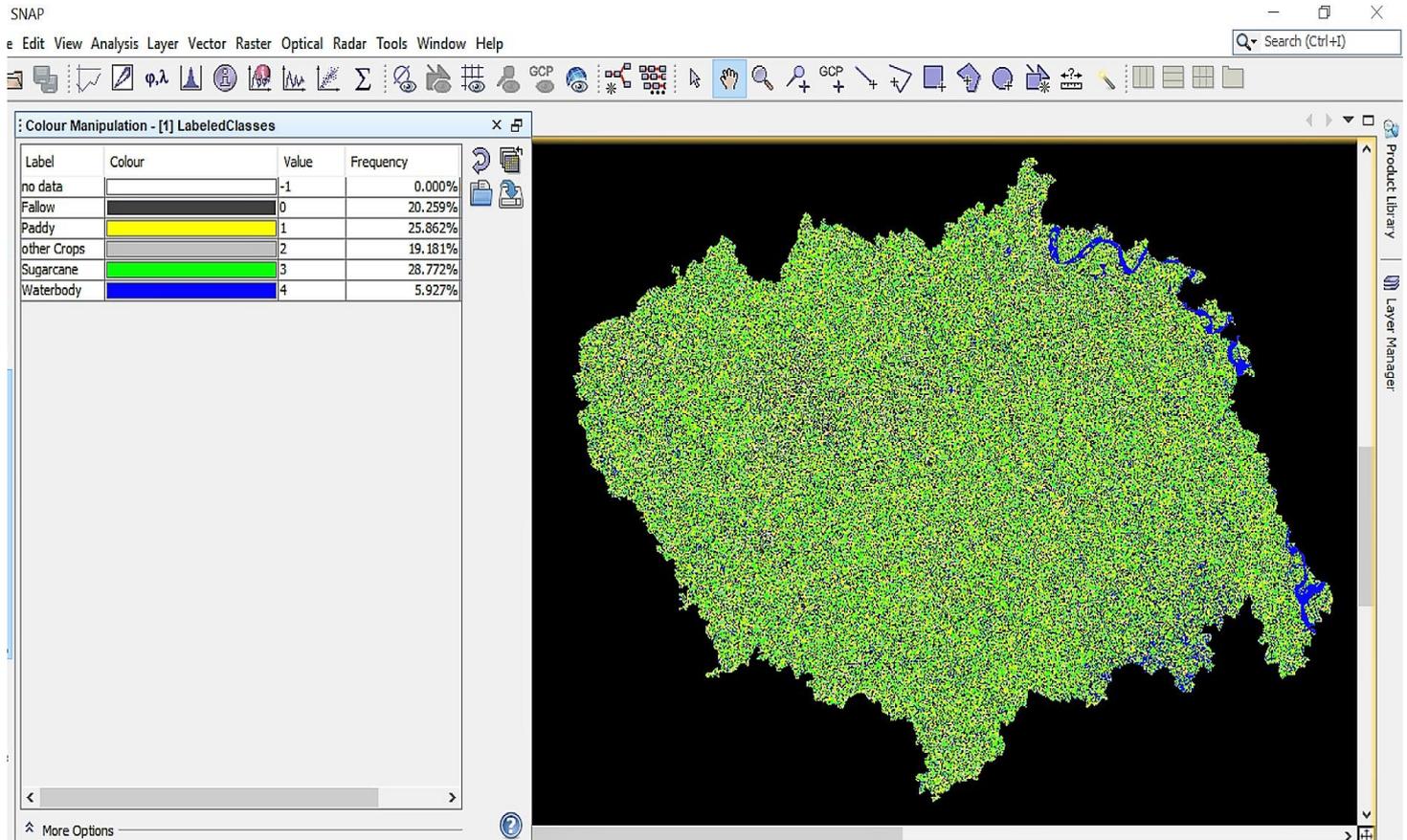


**FIGURE -3: SITAPUR DISTRICT, UTTAR PRADESH (STUDY AREA) COLOUR COMPOSITE MAP OF 03-DATES OF VH BACKSCATTER DATA**



**FIGURE -5: SITAPUR DISTRICT, UTTAR PRADESH (STUDY AREA) WITH NON-AGRICULTURE MASK SUPERIMPOSED ON COLOUR COMPOSITE OF 03- DATES OF VH BACKSCATTER DATA**

## 5. RESULTS



Sugarcane crop is identified on the basis of image classifier trained of vectors using Random forest classifier method where green color shows the area is under sugarcane cultivation. To assign a same value for sugarcane crop labeling of classes has been performed. Area in the image has been shown by percentage of frequency. The acquired ground truth data was utilized to test accuracy.

**% of Sugarcane in sitapur =28.772**

**Area of sitapur= 5, 73,619 hectare**

**Area calculated under sugarcane cultivation=1, 65,041.65hectare=1.65 lakh hectare (approx.).**

## CONCLUSIONS

The present study explored the possibility of temporal SAR Sentinel-1A VH backscatter for Sugarcane crop classification in Sitapur district, Uttar Pradesh. Paddy and other crop has shown overlap with sugarcane owing to similar phenology which has lowered the classification accuracy. Random forest classifier was exploited to map the sugarcane fields with accuracy of 86.60 along with overall accuracy of 87.12 percent. These Results demonstrate the possibility for using temporal Sentinel-1A VH and Random forest classification to Sugarcane crop mapping framework at regional level.

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