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PRE-HARVEST WHEAT ACREAGE/PRODUCTION ESTIMATION OF DOIWALA, SAHASPUR, RAIPUR & VIKASNAGAR BLOCKS AND NYAYAPANCHAYATS OF RAIPUR & VIKASNAGAR BLOCKS OF DEHRADUN DISTRICT USING REMOTE SENSING & GIS TECHNIQUE AND GROUND BASED INFORMATION

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ABSTRACT

Agricultural is one of the oldest economic practice of human civilization is indeed undergoing a makeover. Country's development largely depends upon the development of Agriculture. The agricultural production information is very important for planning and allocation of resources to different sectors of agriculture. The information on crop acreage estimation is backbone of Agricultural statistical system, if area has a strong inter-annual variability while yield remains relatively stable. Reliable and timely information on crop area is of great importance to planners and policy makers for efficient and timely agricultural development and making important decisions with respect to procurement, storage, public distribution, export, import and other related issues. Wheat is one of the most important staple food grains of human race. Wheat is an economically important Rabi crop for the Uttarakhand state, which is grown on around 26% of total available agriculture area in the state. Out of the total Wheat crop area of the Uttarakhand state about 5.98% wheat area is in Dehradun district. By seeing the advancement in the space technology and the demand of todays is to estimate acreage/production at block and nyayapanchayat level, one case study has been done at USAC. The main objective of the

study is to? estimate pre-harvest wheat acreage/production. Doiwala, Sahaspur, Raipur & Vikasnagar blocks of Dehradun district are our study area to estimate wheat acreage/Production. Methodology comprises Generation of master image, Image-to-image registration, Generation of Normalized Difference Vegetation Index images, Classification of images using hierarchical decision rules and Generation of district-wise histogram of wheat crop by complete enumeration and for yield estimation different models have been used and best model have been selected. Soil map (Soil Texture, Soil Drainage, and Soil Depth), Slope map, Aspect map, Max. & Min. Temperature, Rainfall maps have been used for the study area to find productivity. Production has been estimated by multiplying estimated yield with acreage of crop. This Nyayapanchayat level estimated data has been sent to state agriculture dept. and result showed good results.

KEYWORDS: *Acreage, Production, LISS-III, NDVI, Geo-referencing, Hierarchical Decision rules*

INTRODUCTION

Wheat is an economically important Rabi crop for the Uttarakhand state, which is grown on around 26% of total available agriculture area in the state. There is a variation in productivity of wheat crop in hilly and tarai region. The agricultural productivity is less in hilly region as comparison of tarai region due to terrace cultivation, traditional system of agriculture, small land holdings, variation in physiography, top soil erosion, lack of proper irrigation system etc.

A timely forecast of any crop helps the government in farming policies regarding its storage, distribution, export-import and procurement of price. Various methods ranging from conventional to Remote Sensing methods are used for crop production forecasting. Crop production forecasts consist of two components acreage and yield which are forecast separately.

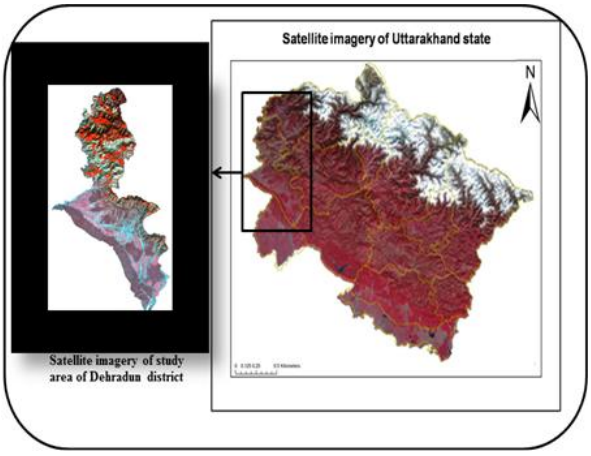
Remote sensing technology has potential in estimating crop acreage at district, regional and national level. Many crop acreage estimation studies have been carried out using remotely sensed data.

OBJECTIVE AND STUDY AREA

The main objective of the study is to:

- To Estimate pre-harvest wheat acreage/ production at Block/ Nyayapanchayat level.

Doiwala, Sahaspur, Raipur & Vikasnagar blocks of Dehradun district are our study area to estimate wheat acreage/Production on the request of Agriculture department.



***F**igure 1: Satellite imagery of Study Area*

DATA USED

Satellite data

IRS-P6-Resourcesat-2: LISS-III data & LISS-IV

Collateral data

- ♣ Ground truth sheet
- ♣ Temperature
- ♣ Rainfall

- ♣ Soil map
- ♣ Cadastral maps of Nyayapanchayats of blocks

METHODOLOGY

Methodology:-

Methodology consists of the following major steps:

- Generation of master image
- Image-to-image registration
- Generation of Normalized Difference Vegetation Index images
- Classification of images using hierarchical decision rules
- Generation of district-wise histogram of wheat crop by complete enumeration

Generation of geo-referenced base image:-

Remote sensing data was geometrically corrected so as to assign correct location in terms of co-ordinates to each pixel in the image. This is usually done by image-to-image registration.

Digital Data Loading:-

The digital data from Computer Compatible tapes (CCTs) or the Computer Discs (CDs) was downloaded in the computer. The four-band digital data was displayed on the display terminal and then False Colour Composite (FCC) was generated for identification of various features.

Image-to-image registration:

IRS P6 LISS-III digital data was registered with geo-referenced master images using image-to-image registrations. Mathematical Polynomial two order model was used for Geo-referencing. Root Mean Square (RMS) errors for image-to-image geo-referencing were within 0.5 pixels. These geo-reference images were used for extracting the study districts using the boundary mask approach. Raw boundary of Nyayapanchats of different blocks of Dehradun district has been rectified from satellite data of different blocks of Dehradun district.

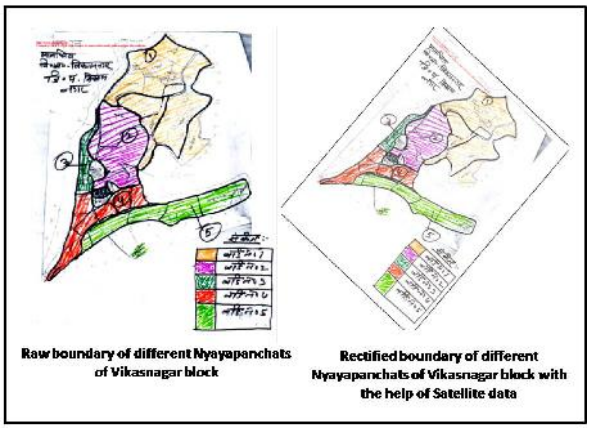


Figure 2: Georeferenced map of Nyayapanchayats of Vikasnagar block of Dehradun district

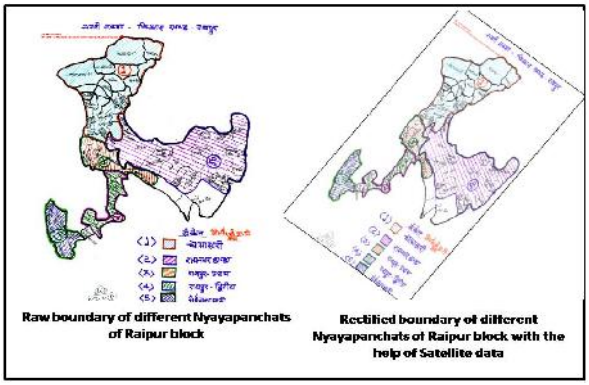


Figure3: Georeferenced map of Nyayapanchayats of Raipur block of Dehradun district

Generation of Block/Nyayapanchayat Boundary Mask:-

The approach adopted for Block/ Nyayapanchayat wheat acreage estimation is to overlay block/ Nyayapanchayat boundary by transforming it to image coordinates and analyze pixels inside the boundary for this-block-boundary traced from the SOI topographical maps were digitized. This boundary mask images were superimposed on the geo-referenced image and the area inside the mask was extracted for further analysis.

Generation of Normalized Difference Vegetation Index (NDVI) images:-

The images were converted to normalized difference vegetation index (NDVI) where NDVI is calculated as:

NDVI=NIR-R/NIR+R

Where, NDVI range scaled between 0 to 200.

Classification of images using hierarchical decision rules:-

Maximum likelihood classification requires generation of training sites for each class. This is very difficult so here classification based on hierarchical decision rule based classification is an estimation procedure where step-by-step other features are initially masked out to obtain feature of interest. First data loss due to zero fills and cloud cover and non-agriculture classes like water bodies, urban areas, wasteland, cloud shadows etc. are eliminated. It has followed by masking out of vegetated areas like forest and plantation etc. Finally the crop of interest is classified by masking out competing crops present in that area in that time period.

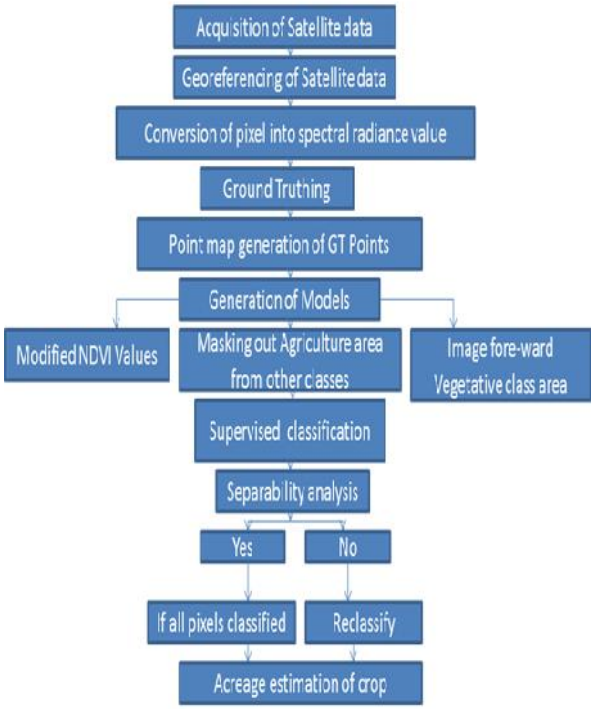


Figure4-Flow chart of Methodology for Acreage estimation

- **Yield estimation** -For yield estimation, different models have been used and best model have been selected. Soil map (Soil Texture, Soil Drainage, and Soil Depth), Slope map, Aspect map, Max. & Min. Temperature, Rainfall maps have been used for the study area to find productivity. An algorithm has been developed for Crop simulation.

- **Production estimation** -Production has been estimated on the basis of the following formula which give relationship between production, acreage and productivity:

Production of crop =Estimated yield*Acreage of crop

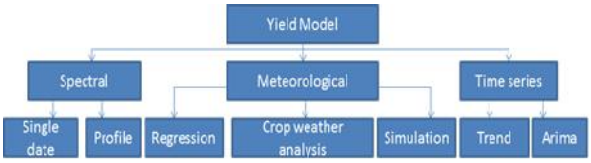


Figure5 -Flow chart of Models for Yield Estimation

RESULT AND DISCUSSION

Table1: Wheat Acreage/Production estimation of Doiwala block of Dehradun district

	Acreage estimation (ha)	Production estimation (m-t)
Doiwala block	**9745.3 ha**	**22500.6m-t**

Table2: Wheat Acreage/Production estimation of Raipur block of Dehradun district

	Acreage estimation (ha)	Production estimation (m-t)
Raipur block	**3326.59 ha**	**8013.76 m-t**

Table3: Wheat Acreage/Production estimation of Nyayapanchayats of Raipur block of Dehradun district

Raipur block	Area(ha)	Production (m-t)
Nyayapanchayat 1(Chamasari)	163.62	394.16
Nyayapanchayat 2 (Ramnagar Danda)	1966.67	4737.708
Nyayapanchayat 3 (Raipur 1st)	586.485	1412.84
Nyayapanchayat 4 (Raipur 2nd)	372.465	897.27
Nyayapanchayat 5 (Mehuwala mafi)	237.35	571.78
Total for Raipur block	**3326.59**	**8013.758**

Table4: Wheat Acreage/Production estimation of Sahaspur block of Dehradun district

	Acreage estimation (ha)	Production estimation (m-t)
Sahaspur block	**5861.91 ha**	**14056.86 m-t**

Table5: Wheat Acreage/Production estimation of Vikasnagar block of Dehradun district

	Acreage estimation (ha)	Production estimation (m-t)
Vikasnagar block	**6708.94 ha**	**15135.36m-t**

Table6: Wheat Acreage/Production estimation of different Nyayapanchayats of Vikasnagar block of Dehradun district

Vikasnagar block	Area(ha)	Production (m-t)
Nyayapanchayat 1	1765.44	3982.83
Nyayapanchayat 2	1941.78	4380.65
Nyayapanchayat 3	315.89	712.65
Nyayapanchayat 4	1545.91	3487.57
Nyayapanchayat 5	1139.92	2571.66
Total for Raipur block	**6708.94**	**15135.36**

CONCLUSION

Through remote sensing, GIS and land based observation, the acreage and production estimation at Nyaypanchayat level can be estimated. This data has been handover to state Agriculture dept. for their further use, this data is of great importance to planners and policy makers for efficient and timely agricultural development and making important decisions with respect to procurement, storage, public distribution, export, import and other related issues.

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