CROP DAMAGE ASSESSMENT IN FLOOD INUNDATED AREA OF MORIGAON DISTRICT OF ASSAM

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ABSTRACT:

Cropping System Analysis is essential for studying the sustainability of Agriculture. Remote sensing technology provide continuous and synoptic observations of crop area over large extent and substantial contribution in monitoring, evaluating and forecasting of crop and its damage assessment both in cloud and cloud-free environment. Geo-stationary satellites like Synthetic Aperture Radar (SAR) can penetrate through clouds hence it help in assessment of crop even in hazy atmospheric circumstances like fog, smog, light rain, mist etc. The present study reviews cropping pattern and crop rotation of of Morigaon District of Assam. Landsat OLI-8 multi-spectral data , sentinel 2 multi-spectral and sentinel- 1 SAR data was collected during crop year 2015, 2016 and 2017. The microwave SAR data was used for the classification of crop area for Kharif season due to unavailability of optical cloud free data and also helps in estimation of flood water propagation and its extent and its significant loss to agriculture crop. The result of the pilot study shows that integration of SAR data and GIS environment can be exploited in an efficient way to assess the crop damage area due to flood. Block-wise flood inundation statistics have been derived. This study can be extended to other states/ districts as data collected by satellite can be standardized, the data are reliably objective.

1. INTRODUCTION

Cropping pattern has become closely associated with technology and farming technique. With the advancement of space innovation technology it has became easier to evaluate the agricultural land, the low lying areas prone to flood, and also the specific period of the year the crops are vulnerable to natural calamities. Topography plays a major role, Morigaon district of Assam lies towards south of Brahmaputra, the river flows downstream with much force especially during rainfall destroying agricultural fields, human assets and wetlands. Every year south-west monsoon hit the land of Assam in the first week of June and continues till September, receiving about 1800mm of annual rainfall during monsoon season. It is observed that during 2017 heavy rain and severe flood hit the normal life of people in this region, which resulted in heavy crop damage during the kharif season. Morigaon District is predominantly dependent on agriculture and more than 70% of the population depends on agriculture and allied activities. The average area production yield of morigaon district is 4826 hectare, producing 8.9 yield per hectare, i.e. 42900 tonnes per year (DoI India). In our study we attempt to outline the cropping pattern of Morigaon district of Assam of three consecutive crop year with specification toward crop area damage assessment during 2017 Kharif crops. Optical Remote sensed data fails to capture surface events during huge cloud cover, rains and haze. This is overcome with the use of Microwave SAR data (Costa, M., 2004). A threshold method was applied to extract the inundated area from the sar images (Binod 2017). This study illustrates the use of Remote sensing as a very reliable and expeditious technique for monitoring, assessment and analysis the propagation of flood water in agricultural area using SAR data along with GIS by different image processing techniques. The major aim of the research is to get an overall view of flood incident with accurate extent of the affected area and to predict

the possible development and consequently delineate the agricultural fallow areas, and crop intensity maps deriving cropping indices.

2. STUDY AREA

Morigaon district of Assam extents from 26° 15' 36" North Latitude to 92° 15' 46.8" East Longitude stretching across fertile alluvial plains, forest and grass/ grazing lands, wetlands, water bodies and wetlands. The district has one subdivision and is comprised of five revenue circles as shown in figure: The soil covers are clay, clay loam, sandy loam and sandy.



Figure 1. Base Map of Morigaon Distrct, Assam showing Agriculture LULC

3. MATERIALS AND METHODOLOGY



Figure 2. Methodology Flow chart

3.1 Satellite Data Used

- Landsat OLI-8 (2015-18), Sentinel-2 (2015-18) multispectral and microwave SAR (Sentinal 1-A) (2017- Kharif seasons)

3.2 Collateral Data Used

- NRC-Land Use Land Cover (LULC) 50K project, NRSC, ISRO
- District and block shape files

3.3 Software Used

- ERDAS Imagine 2015 and
- ArcMap 10.3
- SNAP

3.4 Data Preparation

3.4.1 Multispectral Data Pre-processing

Cropping pattern of Kharif and Rabi season has been evaluate from Landsat-8 (30 metre resolution) and sentinel-2 (10 metre resolution) for three consecutive crop year i.e. 2015, 2016 and 2017. Before finding the final output the images were preprocessed and enhanced for better visualization. Satellite imagery suffers the impacts of climate, particularly the presence of clouds. A Manual threshold that has been evaluated for cloud masking as clouds generally reflect strongly in certain bands (such as the Cirrus and Coastal Blue bands) where as they are also cold and therefore low returns have in the thermal band. Cropping pattern derivation through Multi-spectral need NDVI calculation. A knowledge based threshold technique is applied to derive the season-wise crops from the NDVI values and LULC for indentifying the agricultural areas (J. Goswami. 2017)

3.4.2 Microwave SAR Data Pre-processing

Flood map for 2017 Kharif has been derived from SAR (sentinel-1A) for the month of June to October 2017. The processing of SAR data involves Radiometric calibration in order to depict backscattering true to pixel values, Speckle

Filtering, Multilooking to reduce noise and Terrain Correction (Long, S. 2014).

3.4.3 Flood Mapping

The major component of the study deals with the identification of the flood area propagation. To prepare the flood inundation maps, overlay operation has been done to demonstrate the crop affected area due to flood merged with the kharif crop area of 2017.

4. RESULTS AND DISCUSSION

4.1 Cropping Pattern Analysis

The cropping pattern of Morigaon district is more adapted to Kharif crops, since due to lack of technological advancement in farming technique farmer of Morigaon depend on monsoon rain water for irrigation purposes. It can be observe in the Fig.3 Rabi is usually sparsely cultivated through-out the district. However kharif cropping pattern has seen a major drop down of 10% than the previous year, in the year 2017. This is due to the severe flood that hit Morigaon during the monsoon of 2017.

Kharif Cropping Pattern



Figure 3 Season-wise Cropping pattern



Figure 4. Block-wise crop distribution of Kharif and Rabi crop (2015-16, 2016-17 & 2017-18)

Block-wise distribution of Kharif and Rabi crops for the year 2015-16, 2016-17 and 2017-18 in Fig.4 shows that crop area distribution under kharif and rabi is less in proceeding years. Rabi is generally grown less, however Khaif crop shows a

significant change in 2017. To access the reason behind this change flood maps were generated for this particular year.

4.2 Crop Damage Assessment

The Flood occurs generally in the low lying areas of the district during May to August every year. Huge deposition of the sediments takes place in the riverbed and as a result channel's carrying capacity is reduced and rain water flash out in the catchments areas. As a result large-scale erosion is encroching agriculture land. In 2017 kharif crop season, 19% of agricultural area was flood inundated. It is seen from the above images whenever there is absense of crop detected, flood water has been seen encrochment those areas. Fig.5 shows the total flood affected area of Morigaon District. Fig.6 shows the overlay operation of kharif crop area of 2017 along with the flood layer to demonstrate that the crop affected area was exclusively due to the flood.



Figure 5. Total Flood inundated area of Morigaon District





Block-wise statistics shows among the 5 revenue blocks Mayong was worst affected by flood in 2017. Mayong individually accounts 11% of total inundated area under agriculture. Followed by Morigaon revenue circle 3%. Other blocks of the district like Bhuragaon, Laharighath and Mikirbheta is also affected by flood but the flood water inundation is not much significant. Fig.7 Shows the block-wise flood area estimation of Morigaon district of Assam.



Figure 7. Block-wise Flood area estimation

5. CONCLUSION

Morigaon is a major agriculture land of of Assam. Cropping pattern in Morigaon is largely determined by the natural environment. Morigaon has abundant water resource due to its nearness to the river Brahmaputra and northern part of the district mostly falls under low-lying areas. Flood is a common issue for the people of Morigaon district of Assam. Every year severe flood affects the normal life of the people in this region in between June to September. The year 2017 is worst affected by flood and it has been evaluate in this study. Remote sensing and integration of GIS has played an important role in assessment of crop area and estimate flood inundation. Implementation of optical and SAR data together can expand the horizon of crop damage assessment in flood prone areas.

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