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Crop Discrimination Using Post Rainy Season Multispectral Data From LISS III And LISS IV In Two Coastal Districts Of Andhra Pradesh, India

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ABSTRACT:
Monitoring of agricultural areas has high importance in the context of global challenges such as population growth, increasing food demand and climate change. Ever increasing population demands more food supplies. Acreage estimation using traditional methods has its challenges and problems. Remote sensing based acreage estimation is proven to be more economical and accurate. Cloud patches cover the ground during rainy season reducing the visibility of land cover from an optical remote sensing platform. Post rainy season imagery have least cloud cover and can be used before harvest to estimate area under each crop with large extents, especially in the deltaic regions. Resourcesat-2 satellite imagery acquired by its two sensors LISS III (23.5m) and LISS IV (5.8m) were used to identify and map the rice and maize crops selected part of west Godavari and Guntur districts in Andhra Pradesh.

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I. INTRODUCTION:

Rice is grown in different agro-ecoregions with highly adapted varieties in each ecoregion feeding millions. 14 states grow rice as major crop in India during the kharif and rabi seasons. Kharif season rice accounts for more than 80%. It is grown in diverse soil and climatic conditions. In northeast region, which comprises of eight states. Assam grows rice in large area in Brahmaputra basin. Rice crop intensity is the highest in Mahanadi and Ganga basins. Rice is one of the pre-eminent crops in India. Mostly the paddy crop grows in warm and humid environments. Rice also grows in rainfed areas that receive very good rainfall. Rice is grown in well irrigated conditions. Where there are dams, reservoirs, canals and tanks along with groundwater sources such as bore wells and open wells. Rice is usually grown in heavier soils that have high water holding capacity.

Maize has many cultivators with different maturity periods and tolerance levels to environmental conditions. Maize can be grown on a wide variety of soils. But well drained, deep silt loamy soil with adequate organic matter is the most suitable. (Perera et al. 2014).

Access to timely and reliable data on crop distribution and its condition assumes importance for enabling decision makers to make informed decisions with respect to imports, exports and buffer stocks. Remote sensing technology provides temporal coverage and accurate information about these major crops.

II. METHODOLOGY:

2.1 Study area and Data:

The study area in west Godavari district measures 432km^2 located between 16^0 25' 49'' to $16^0$45' 49'' N and from 80^0 37' 36'' to $81^0$55' 60'' E. The study area in Guntur district of Andhra Pradesh, India is located at 16°13 ' 17.42 " N, 80°42 ' 35.57 " E covering an area of 835 km^2. Guntur district covering 11,391 km^2 is situated on the right bank of river Krishna. In this region, maize is the major crop during rabi. It is sown during last week of December or first week of January and harvested in last week of March or first week of April. Apart from maize, pulses such as green gram and black gram were also grown. However, these crops were harvested by the time the data was acquired.

The Resourcesat-2 satellite was launched on 20 April 2011 by Indian Space Research Organization (ISRO). It carries three sensors. LISS-III, IV and Advanced Wide Field Sensor (AWiFS) with resolution of 23.5, 5.8 and 56 m respectively. LISS-III sensor images the earth in four spectral bands, Green (0.52-0.59 µm), Red (0.62-0.68 µm), Near Infrared (0.77-0.86 µm) and Short wave Infrared (1.55-1.70 µm) (Dave et al. 2006; Pandya

et al. 2013). The LISS-IV sensor images the earth in three spectral bands, Green from 0.52-0.59 µm, Red from 0.62-0.68 µm and Near Infrared from 0.77-0.86 µm. April month of LISS-III data used to discriminate the maize and LISS-IV data used for rice crop discrimination.

2.2 Data processing:

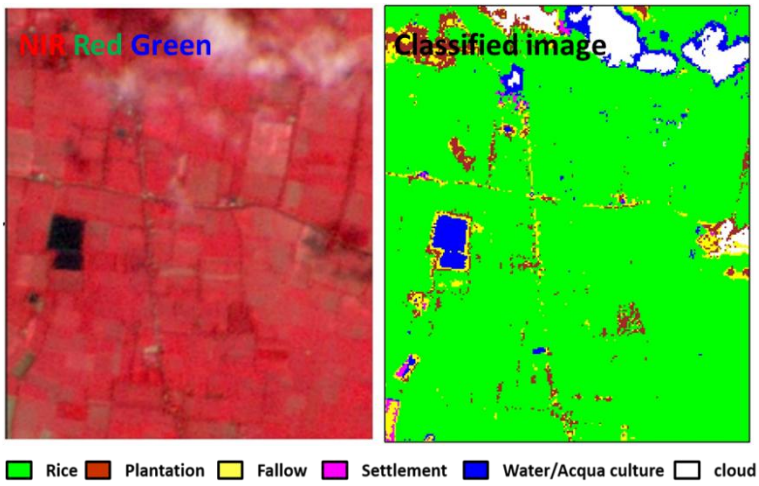
Satellite based multispectral imagery contains various quantitative information related to surface and atmosphere. The procedure of retrieving surface reflectance or removing atmospheric contamination from satellite measured radiance is called atmospheric correction. To extract the accurate information about the surface we need to correct atmospheric influence. In this study surface reflectance is retrieved using the constants in the metadata. This TOA correction was carried out by using model maker in ERDAS Imagine. After the correction, the data were subjected to classification to discriminate the crops.

III. RESULTS

Supervised maximum likelihood classifier was applied on the Resourcesat-2 LISS-IV and LISS-III data. Maximum likelihood classification is the most popular and widely used supervised classifier. The classifier assumes that the statistics for each class in each band follows normal distribution and calculate the probability accordingly. All the pixels are classified except for those below a specified threshold value. Each pixel is assigned to the class that has the highest probability.

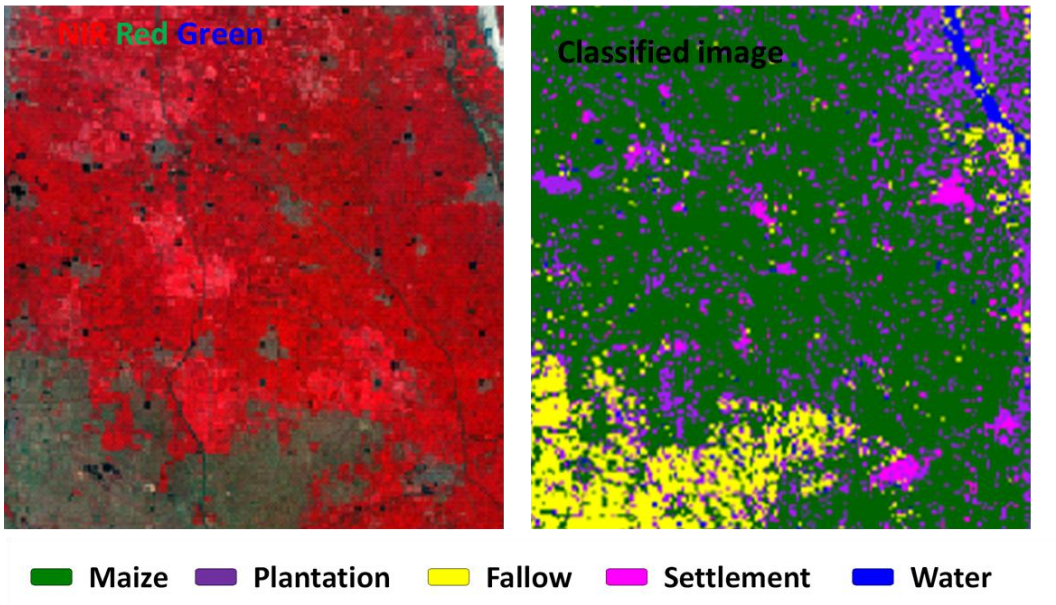
3.1 Rice:

The major land uses in the study area apart from rice are plantations, fallow, settlement and water body. The classification was performed LISS-IV data when the rice was in the reproductive stage and ideal for rice classification. Supervised classification methods are robust and effective methods and analyst must have high degree of familiarity of the area covered by satellite image. Supervised maximum likelihood classifier was applied on the Resourcesat-2 LISS-IV data. Maximum likelihood classification is the most popular and widely used supervised classifier. All the land cover classes showed good separability with NIR band combination. In NIR band, rice and plantation crops have shown high DN value than other land use and land cover classes (fallow, settlement water) because of high reflection in NIR than red and green (Tucker et al., 1986). In LISS-IV imagery a few pixels of the settlement class, were mixing up with fallow class. Low DN values were observed for water bodies in all bands due to absorption. The raw and classified image of LISS-IV were shown in the below figure.



3.2 Maize:

Maize crop dominates the area, followed by fallow, plantations and other land cover features. In LISS-III imagery maize crop is manifested in different shades of dark red colour due to wet fields and light red tone indicates maize at the harvest stage due to low moisture content in the field and dry vegetation. LISS-III data was also classified by using supervised maximum likelihood classifier. Maximum likelihood classifier was used for LISS-III data as it follows normal distribution. The misclassification of maize is observed due to harvest fields of maize. Scrub present in the field bunds is also clearly separable in classified of LISS-III. In Maize crop NIR, red play's major role in the classification. The raw and classified image of LISS-III was shown in the below figure.



IV. CONCLUSION:

Results clearly show the benefit of using Post rainy season imagery which has low cloud multispectral data for discrimination of rice and maize crop. The rice and maize crops are clearly sparable form the other land use classes like fallow, plantation, settlement and water. A single date before harvest is found to discriminate the crops from other land use.

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