Identification of Wetland Vegetation by Supervised Classification of Nal Sarovar Area using LISS-III Data

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Abstract--- This paper classifies wetland of Nal Sarovar by using LISS-III remote sensing data. Taking the Nal Sarovar as study area, LISS-III data of 2013 is used as data source and various classification processes like 1) Parallelepiped Classification, 2) Maximum Likelihood Classification are carried out in this study. The paper describes the utilization of accuracy assessment using kappa coefficients. This paper describes that maximum likelihood classification is more efficient than parallelepiped classification.

I. INTRODUCTION

Wetlands are valuable ecosystems that play important roles in our environment. It is human settlement and natural resources, and also one of the ecological landscapes full of biodiversity in the nature. Wetlands are defined as areas that are transitional between terrestrial and aquatic systems, where the water table is usually at or near the surface or the land is covered by shallow water. (Backer, 2006)

Most of the natural wetlands of India are connected with the river system of north and south. According to project report, wetlands are broadly classified in two major categories;

1) Inland wetland
2) Coastal wetland

In inland natural wetlands there are lakes, ponds waterlogged, swamps and marshes. While in manmade wetlands there are reservoirs, tanks, waterlogged, ash pond and cooling pond.

Wetlands have received considerable interest during recent years due to their ecological significance, biodiversity value, flood proofing ability and water purification. A wide variety of marshes, swamps, bogs, peats etc. can be used profitably for meeting many human requirements. Wetlands are sometimes described as "kidneys of landscapes" because they function as receiver of water and waste from both natural and human resources. Wetlands are one of the most important ecosystems in the world. It is very important to inventory and monitoring the wetland. (Bauer, 2002)

II. STUDY AREA

Nal sarovar is located in Gujarat state between $71^0 92^{'}$E & $72^0 08^{'}$E and $22^0 40^{'}$N& $22^0 55^{'}$N. It falls in two districts of Gujarat state Ahmadabad and Surendranagar. Area of 120.82 sq. Km of this wetland is being protected as bird sanctuary by the State Forest Department of Gujarat State since 1982. The natural and seasonal spread of this wetland is of irregular shape. It is shallow and in most parts muddy. Formerly an eustary, this depressed portion had come into existence by tectonic uplift, increased sedimentation.

In this study the wetlands are categorized under various classes and mapped using satellite remote sensing data from Indian Remote Sensing Satellite: IRS-P6 LISS-III sensor. The results are organized at 1:50,000 scales at district, state and topographic map. (Gandhinagar, 2008)

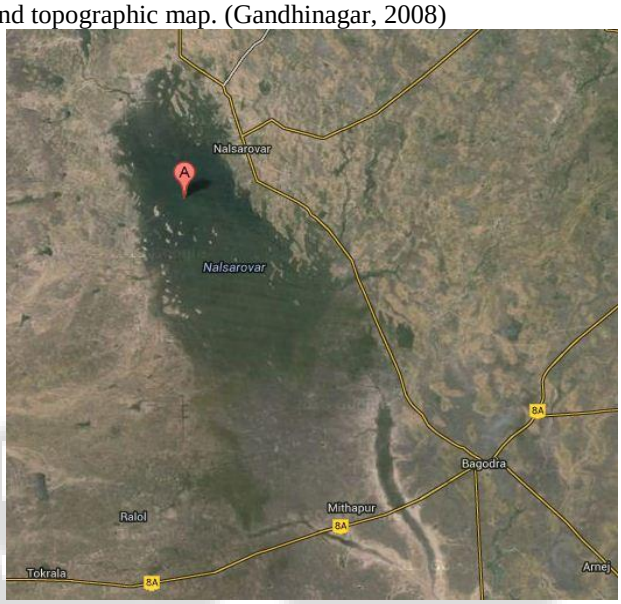

Figure 1: Satelite image of Nal Sarovar [Source: Google Map]

Fig.2 : Pre-monsoon image of Nal Sarovar

Fig. 3 : Post-monsoon image of Nal Sarovar

III. METHODOLOGY

Input parameters and output for supervised classification:

1) For different supervised classification we have to assign training signatures in terms of Region of Interest (ROIs) and the satellite image as source data**.**
2) The output of supervised classification is rendered in raster format having clusters of various classes.
3) By using QUANTAM GIS software we get vector format of our supervised classification.

We can give final layout and legend to the supervised classification image in QUANTAM GIS software.

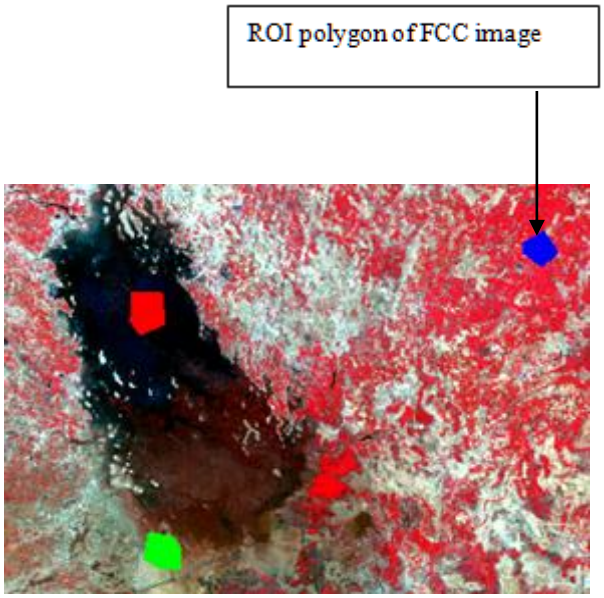

Fig. 4: ROI of FCC image (Source : BISAG)

A. Supervised classification:

1) Parallelopiped classification

In this classifier mean and standard deviations for each band and each class is calculated. The range for each class may be defined as mean 1 standard deviation for each spectral band. It forms a rectangular box in two dimensional. The number of box will equal to number of features. All the pixels covered in a box will classify to that class. And when there is overlap, that region will be labeled as unclassified. The boundary is modified to the stepped boundary.

Defining ROIs (fa):

Regions of interest (ROIs) are portions of images, either selected graphically or selected by other means such as thresholding. The regions can be irregularly-shaped and are typically used to extract statistics for classification, masking, and other operations. To perform ROI definition, I use the ROI Tool dialog. Defining Regions of Interest describes how to open the ROI Tool dialog, and how to turn off ROI definition. The sections that follow describe how to define ROIs**.** Authors have used same ROIs of pre-monsoon and post-monsoon image for both supervised classification methods**.**

In the present study polygon type ROI has been used.

2) Maximum likelihood classification:

The previous classification is non parametric, while MXL assumes that the DN values for each class has a Gaussian distribution. Each pixel from the lass mean is also linked with probability that pixel to be in that class. Pixel is classified to that class for which its probability will be maximum and above the threshold. If probability falls below the threshold than the pixel may be lebelled as unclassified. For any pixel if probability is equal for two features than additional conditions are applied. If the pixel value is closest to mean value of any class then it will have highest probability to belong that class. This probability decreases as pixel value moves away from the mean. So we may have equiprobability contour around the mean. In two dimension contour will take the shape of ellipse. The shape and the

IV. KAPPA COEFFICIENT

A. Using Ground Truth Image:

When using a ground truth image, we can also calculate error mask images for each class showing which pixels were incorrectly classified. To Kappa coefficient the ground truth image and ROIs are to be used and from that we can find out kappa coefficient.

V. RESULTS AND DISCUSSION

From the calculation of kappa coefficient we can say that the overall accuracy of maximum likelihood classifier is (91.46%) and kappa coefficient is (0.9004) for pre-monsoon image, (87.91%) overall accuracy and (0.8621) kappa coefficient for post-monsoon image. The overall accuracy of parallelepiped classification is (60.35%) and kappa coefficient is (0.5518) for pre-monsoon image and overall accuracy is (55.89%) and kappa coefficient is (0.5080) for post-monsoon image. Thus, from this study we can say that maximum likelihood classification is more accurate than parallelopiped classification.

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Authors are sincerely thankful to Shri T. P. Singh, director, Bhaskaracharya Institute for space Applications and Geo-Informatics (BISAG) for his encouragement and support in carrying out this task. orientation of ellipse is based on the scatter. Thus MXL classification takes into account the shape and distribution, it is more accurate than the previous two classifiers.

Generally, the kappa coefficient can be given by following equation:

$$\text{Kappa coefficient} = \frac{\text{Total pixels which are classified in that particular class}}{\text{Grand total of pixel classified by supervied classification}}$$

In present study the accuracy of each and every class which is classified by supervised classification can be find out by calculating kappa coefficient.

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