Evaluatoin of Landsat ETM Sensor To Separate Riparian Forest from River (Case Study: Maroon River – Khuzestan)

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ABSTRACT

In order to evaluate Landsat satellite imagery and remote sensing applications in separation of land from the river in riparian forest of Maroon Behbahan, a small window of multispectral images Landsat ETM+ was chosen. Selected area was 973 hectar approximately. Ground data picked randomly and was performed geometric matching using 30point and then the appropriate band was chosen. After selecting the training area was done use the classification Maximum likelihood, Minimum distance and Parallellepiped algorithm. Classified was taken three and two user classes. For Separability classes was used Transformed Divergence and Jeffreys-Matusita. For separation vegetation from other surface cover was used NDVI. The best method of classification was Maximum Likelihood. Overall accuracy was 96% and kappa coefficient was 0/93. The results showed the ETM+ sensor imagery of landast have to a relatively good ability to separate the river from the forest but it is better to use higher resolution images.

KEYWORD

Landsat, ETM+, Riparian forest, Maroon, Maximum Likelihood

INTRODUCTION

With rapid development of science and technology and their development in the field of Natural Resource Sciences and also with considering that satellite images have a special place in the modern world it seems necessary to test their different usages. The recovery action, identify, and diagnose the side effects and objects located in far distance which have done with use of images and means of identification is called remote sensing [1]. On the satellite images’ capability for mapping vegetation and forest lands and separation of lands around the rivers in the world and Iran, there are some studies however on mapping the woodlands surrounding Maroon River’s rainforeststhere are not enough studies. Given that this area is valuable in terms of environmental and natural habitats therefore the aim of this study was to evaluate the sensor in Riparian Forest of Maroon of Behbahan and separation of Khuzestan lands from the river. It should be noted that the width of the river is low and woodlands surrounding it are compact and intricate so use of satellite images to separate river from lands is a remarkable action. About Riparian forests and their environmental significance it must be said that Riparian forests as one of the critical components of the relationship between the environment of water and land have unique characteristics in terms of vegetation, fauna and biophysical characteristics. Natural forests that cover vast area of Khuzestan permanent rivers, despite their great importance, are faced with huge destruction. Since the stability of vegetation in these areas is critical in maintaining ecosystems, its restoration and management is essential for sustainable functioning of ecosystem [2].

About capability of satellite images many studies have been done in Iran and the world, for example, Farzad Mehr et al [3] in their study investigate the capability of multi temporal data of Landsat 7 in estimating canopy and vegetation production in the steppe region of Saveh’s Bakhshali Nemati. To do this, information were collected about canopy and production of different forms of vegetation belongs to 60 plots of 2 m². Results showed that use of these images has high accuracy but Perma et al [4] in their study on separation of forest’s types in Kermanshah’s Qalajeh forests to investigate capability of data of Landsat concluded that data of ETM+ has poor capability in production of 5 floors map type and 4 floors map type in Zagros forests. Rafieian et al [5] has done a vast study to investigate the potential of satellite imagery of Babol forests. In this survey the satellite images of 1380 were used and according to results the data gathered from Landsat 7 has much potential for mapping mountainous and forested parts. In another study, Goodarzi et al [6] have done a study to evaluate the use of digital data of Landsat TM in mapping...
land cover and classification of range condition of Nimrod Basin. This research has been done to find a quick and accurate way to classification of pasture lands and identification of different land covers with use of Landsat 7 images, TM sensor with revelation techniques (false color composite and principal index analyses) and image analysis (NDVI vegetation index and supervised classification) in GIS, types of land cover, including agricultural land, irrigated agricultural lands dry, rocky areas (rock mass) and different pasture classes (good, fair or poor) with an accuracy of 89.5 percent were distinguished. Also in a study by Ambinakoodig et al [7] has demonstrated that Landsat TM satellite imagery has an average capability for mapping vegetation ability and has moderate resolution.

**MATERIALS AND METHODS**

**THE STUDY AREA**

The Maroon River which originates from Kohgiloyeh and Boyerahmad province after passing through the Strait Tekab in Behbahan Plain. This river runs from East to West and splits Behbahan network into two regions [8]: North and South. Maroon forests along the river extended along this river which length of 41 to 44 degrees in width located between 32 and 35° C was selected as the study area. Study area is 973 hectares of Maroon woodlands around river in Behbahan city of Khuzestan province. Area covered with tamarisk trees and *Populus euphratica*. Tamarisk trees, *Populus euphratica*Oliv, *Lycium Shawii* and reedy shrub species in some areas covered in dense tangled around the river have created a habitat for many animals and the environment has created a zone.

**SATELLITE DATA**

In this research, were used of Landsat ETM + sensor data to pass number 164 and row 39 of 9 March 2004. So the research of multi-spectral bands 1, 2,3,4,5 and 7 were used for the spatial resolution of 30 meters.

**DATA PROVIDED LAND**

The ground truth map of random sampling was used. 30 points were taken using GPS.

**PRE-PROCESSING OF SATELLITE IMAGES**

In the process of using satellite images to perform preprocessing such as atmospheric correction, radiometric, geometric and corrects errors caused by the difference in height is necessary. In this study, geometric correction of images using topographic maps 1:25000 mapping agency, has become the method of polynomial and nearest neighbor re-sampling method was used. RMSE was 0/3 pixels. Given that the study area was relatively flat topography error correction was necessary due to the height difference [9]. Atmospheric correction of the data was performed using the Quick Method.

**IMAGE PROCESSING**

At this stage of training samples and the ground truth map image classification was attempted. Also in order to strengthen the reflectivity of vegetation and separation of vegetation from other surface cover was used NDVI. NDVI is from 1 to -1 and a higher numbers indicate more vegetation [10].

**CLASSIFICATION**

Ground control points for image classification were chosen as the reference vector image was selected the most appropriate band was selected for image classification. After careful selection of training samples, using class separability criterion turned and divergence between Matusita Jeffries was examined and then classified using both supervised and unsupervised done. In supervised classification, maximum likelihood, minimum distance to mean, do parallelepiped with the ground truth map accuracy was assessed. Both classes were used for the classification. Classified in three classes with two-class classification or category was chosen. In order to map the study area of 5 x 3 filter was used.

**SOFTWARE USED**

The research and application of image processing software ENVI4.5 and MAPSOURCE control points were used to create maps of ARCGIS10 training samples, can be used as ground truth.

**RESULT**

Based on studies the following results were obtained. It should be noted that along of river Maroon was calculated 33660 m. In Figures 2 to 7 are presented classified maps with different algorithms. Also In NDVI map, yellow areas show vegetation and this map is well separated from water than vegetation (Fig8).

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1. NormalizedDifference Vegetation Index
Fig2. Mapping with 2 classes of users by Minimum distance

Fig3. Mapping with 3 classes of users by Minimum distance

Fig4. Mapping with 2 classes of users by Maximum likelihood

Fig5. Mapping with 3 classes of users by Maximum likelihood

Fig6. Mapping with 2 classes of users by Parallelepiped

Fig7. Mapping with 3 classes of users by Parallelepiped
Table 2. Percent of area by maximum likelihood classification for Landsat ETM + map

<table>
<thead>
<tr>
<th>Category</th>
<th>Three-class</th>
<th>Two-class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Others</td>
<td>0/93</td>
<td>0/98</td>
</tr>
<tr>
<td>River</td>
<td>0/99</td>
<td>94</td>
</tr>
<tr>
<td>Forest</td>
<td>0/99</td>
<td>97</td>
</tr>
</tbody>
</table>

Table 2. Compare the overall accuracy and kappa coefficient for classification with different algorithms

<table>
<thead>
<tr>
<th>Algorithm</th>
<th>Minimum Distance</th>
<th>Parallelepiped</th>
<th>Minimum Distance</th>
<th>Parallelepiped</th>
<th>Maximum likelihood</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kappa coefficient</td>
<td>0/93</td>
<td>0/99</td>
<td>0/98</td>
<td>0/95</td>
<td>0/99</td>
</tr>
<tr>
<td>Overall accuracy (%)</td>
<td>96</td>
<td>70</td>
<td>65/1</td>
<td>0/90</td>
<td>78/8</td>
</tr>
</tbody>
</table>

**Discussion and Conclusions**

Based on the results obtained the best classification method of maximum likelihood [11, 12, 13, 14] because the variance of the maximum likelihood method. Class covariance is evaluated based on spectral reflectance classes [15], and each pixel in the class which is the maximum likelihood classification is attending the class. Since the classification was done with two different classes (category 3 classification and classification with 2 classes) were found to be more careful that whatever Classifieds classification is a map above. In the present study it can be inferred that the images ETM + Landsat function well for separating rivers Maroon lands nearby and woodlands and segregated land uses could be that this same study Kuhnell and colleagues [16], Kaplich [17], Goulevitch et al [18], Sivanpillai [19] and Ambinakudige et al [7] that these results are contrary to the results Günlü and colleagues[20]. But for a more fundamental review of higher resolution is needed because in some places could well determine the boundary between river and woodlands.

Johansen and Phinn [21] were as Landsat images are suitable to the whole map of the region but For more detailed maps can be used better spatial resolution images.

**References**


