Journal of
Geography & Natural Disasters
ISSN: 2167-0587

DOI: 10.4172/2167-0587.1000198

Research Article Open Access

Evaluation of IRS1D-LISS-III and Landsat 8-OLI Images for Mapping in Maroon Riparian Forest, Iran

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Abstract

In order to compare the mapping by IRS1D-LISSIII and Landsat 8-OLI data in *Riparian forest* of *Maroon Behbahan* of Iran, the small window of panchromatic and multispectral images of IRS1D-LISSIII, and Landsat 8-OLI satellites data have been selected at Maroon riparian forest. Quality of data and radiometric error has been checked. Using 25 ground control points, geometric correction, whose accuracy was less than 5.0 pixels, has been implemented. Classification of images has been performed by supervised method using Maximum Likelihood and SVM algorithms for seven classes on the original bands. Moreover, Jeffreys-Matusita Method has been employed in order to test the separability of classes. Considering to the results, it can be concluded that IRS1D-LISS-III and Landsat 8-OLI data have suitable ability for mapping Maroon riparian forest as well as classification of forest to separate land use. Overall accuracy of classification obtained by OLI images and using SVM algorithm on original bands was 92/95. Furthermore, kappa coefficient was 0/85 percent which was the best result. In general, it should be notified that according to the presented study, OLI sensor can be considered as a more accurate method than LISS Ш in order to map Maroon riparian forests.

Keywords: Classification; IRS1D-LISSIII; Landsat 8-OLI; Maroon Riparian

Introduction

Riparian zones possess an unusually diverse array of species and environmental processes. They play essential roles in water and landscape planning in restoration of aquatic systems, and in catalyzing institutional and societal cooperation for these efforts [1].

These forests are more important because of abundant biomass production (forest products), slow decomposition and impact on natural cycles [2].

Using satellite data and remote sensing techniques to decrease time consumption reduce field operations and expenses are getting more popular in natural resource mapping [3,4]. Satellite data improved monitoring resources and forest mapping with acceptable accuracy in most cases.

Satellite data can play a key role in management for land cover maps and forest resources. Fatahi et al. [5] compared classification methods using satellite images ETM+ and IRS for mapping landuse. Based on the results overall accuracy of Maximum likelihood was 89/15, and Results vegetation index was not satisfactory. Shtaei et al. were evaluated capabilities and integrated multispectral images Landsat 7 and IRS-1D satellites for mapping forests area in Golestan province. Finally, it was found that the IRS satellite images for appropriate spatial and spectral resolution, to produce and evaluate mapping of the forest were more appropriate. Also Parma [6] evaluated satellite images of ETM+ and LISSIII for mapping type forest and showed that LISSIII images were better images of ETM+.

Ghosh et al. [7] were studied forest cover and of land use mapping of Barak Valley of Assam in India, using IRS LISS-II images, and they said that the images for mapping land-use management plans are appropriate. Furby and Wu [8] after evaluated IRS P6 LISS-III and A WiFS Image data for forest cover mapping, stated that IRS P6 LISS-III images have enough resolution for mapping and it could be suitable alternative for Landsat images. According to Environmental importance of Maroon riparian forest.

So does research in relation to vegetation cover mapping and capabilities of satellite images for suitable management in this area is the high Priority. Based on the observations the dense tree and shrub cover this area that field operation is difficult. The study mainly focused on the evaluation of IRS1D-LISS-III and Landsat 8-OLI images for Mapping in Riparian Forest in Behbahan. The study also tried to evaluate the potential of the IRS-1D, LISS-III data for mapping riparian forest of Maroon river in Behbahan.

Material and Methods

Study area

The present research work was carried out in the Riparian forest of Behbahan in Iran. The study area is located between latitude 32° to 35° N and longitude 41° to 44° E, which covers about 16998 ha of land area (Figure 1). The climate in the study area is classified as semi

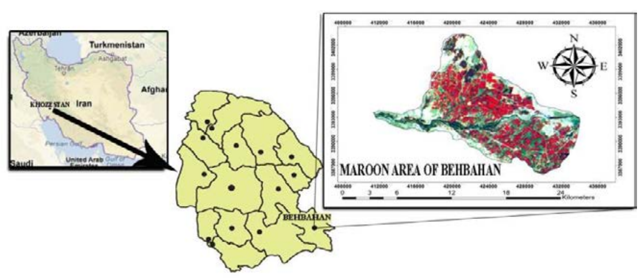

Figure 1: The location of study area in Khozestan province of Iran.

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Received March 25, 2017; **Accepted** April 28, 2017; **Published** May 02, 2017

Citation: Firoozynejad M, Torahi AA (2017) Evaluation of IRS1D-LISS-III and Landsat 8-OLI Images for Mapping in Maroon Riparian Forest, Iran. J Geogr Nat Disast 7: 198. doi: 10.4172/2167-0587.1000198

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dry and dries. Minerals such as limestone, marl, Chile, gypsum and conglomerates are found in the area [9]. The area is dominated by mixed tree and dense Tamarisk (Tamarixarceuthoides) and Populus euphratica Oliv (Populus euphratica) and shrub species in some areas (Lycium shawii), that creates an area of beautiful natural environment and ecosystems along the river of Maroon.

Methodology

Data in this study are composed of IRS-1D satellite data to path 68 and row 49 from 11th October 2005 (from Iranian Space Agency), Landsat8-OLI data to path 164 and row 39 from 12th June 2013 and digital topographic maps at the scale of 1:25000 were used to generate land cover map. Spatial resolution of LISSIII bands are 23/5 meter and a panchromatic band is 5/8 meter and spatial resolution of OLI bands are 30 meter and panchromatic band is 15 meter [10,11]. The Software used is ENVI 4.7, Arc GIS 10, Map source, EXCEL and SPSS.

Pre-processing of satellite images

In the process of using satellite images, pre-processing such as atmospheric correction, radiometric, geometric and correct the errors caused by the difference in height are necessary. In this study Geometric correction performed on these images with an accuracy of less than 0.5 pixels and Atmospheric correction of the data was performed using the Quick Method. For this was used polynomial analyzed and topographic map 1:25000. Since the study area has relatively flat topography; the error correction due to the height difference is unnecessary [12]. In this study, 25 ground control points pick up by Global Positioning System (GPS) Map76csX model as check points for classification accuracies and for Using geometric correction.

Classification

Spectral classification of images includes selection of training samples, selecting the best band and operations of classification. To obtain training samples, after check and identification of images, the training data was selected. For class separation used Jeffreys-Matusita distance (JM). The JM distance increasing class separation like transformed divergence. This method improves classification accuracies. Characteristic of JM method allow for easier comparison of class separability between images [13,14]. Data classification was done using Maximum Likelihood and SVM Algorithm. The study area is classified 7 classes (forest, agriculture, fallow, pasturage, settlements, river and road). To improve classification applied mode filters (3 × 3, 3 × 5 and 5 × 7). Four standards of overall accuracy, kappa coefficient, producer accuracy and user accuracy were employed to evaluate the classification [15].

Results and Discussion

Processing

The results of the classification map using maximum likelihood and support vector machine (SVM) algorithms with seven Classes are given in Tables 1 and 2. The highest overall accuracy to classify was obtained 92/95 by SVM method on originals bands of OLI. The forest area was calculated 2516 hectares by SVM method and 1940 hectares by maximum likelihood on the images of OLI sensor. Results of percent area of land use have been in Table 3. Also mapping of this area by both algorithms is shown in Figures 2-5.

Discussion and Conclusions

Land cover/land use maps can be used in the detection of climate change because that vegetation cover affects climate and weather conditions. This observation showed that the study area is often covered with Tamarisk trees and *Populus euphratica Oliv* with narrow width and scattered dense tree cover. Since the area being neighbor to agricultural land, therefore this neighborhood creates problem for classification.

Based on Tables 1 and 2 the highest accuracy of forest classification is for maximum likelihood method in the original bands of LISSIII,

	ML		SVM	
	Producer accuracy	**User accuracy**	**Producer accuracy**	**User accuracy**
Forest	97/75	100	96/55	98/59
Agriculture	97/29	99/71	96/72	99/85
Fallow	92/02	77/73	87/45	88/57
Pasturage	85/96	94/98	94/97	92/55
Settlements	100	100	82/14	100
River	98/21	97/78	93/75	98/59
Road	85/71	64/29	33/33	87/50
Overall accuracy	88/50		90/77	
Kappa coefficient	0/84		0/87	

Table 1: The results of classification by using ML and SVM algorithms in originals bands LissIII.

	ML		SVM	
	Producer accuracy	**User accuracy**	**Producer accuracy**	**User accuracy**
Agriculture	99/15	100	99/49	99/32
Fallow	80	68/57	80	100
Pasturage	81/16	96/55	95/51	88/58
Settlements	50/01	26/59	17989	25781
River	94/25	97/62	97/70	97/70
Road	50	62/34	56/38	73/26
Overall accuracy	88/50		90/77	
Kappa coefficient	0/84		0/87	

Table 2: The results of classification by using ML and SVM algorithms in originals bands OLI.

		Class name				
	Algorithms	**Forest**	**Agriculture**	**Fallow**	**Pasturage**	**Settlements**
Percent of land use area	ML	32082	47088	46/83	28/32	0/70
	SVM	15/40	23316	41/28	32/50	0/54

Table 3: Per cent of land use area by using ML and SVM.

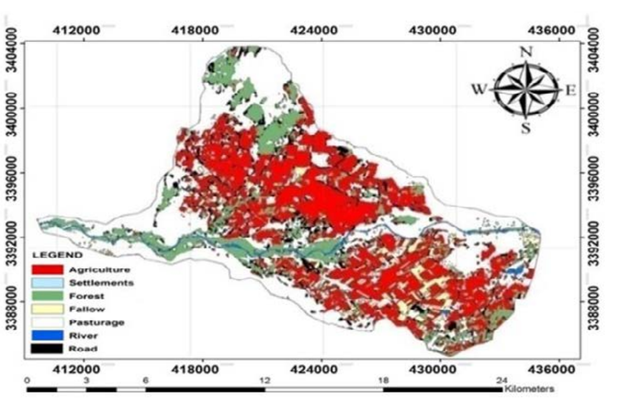

Figure 2: Land use mapping with seven classes by ML algorithm in original bands of LISS-III.

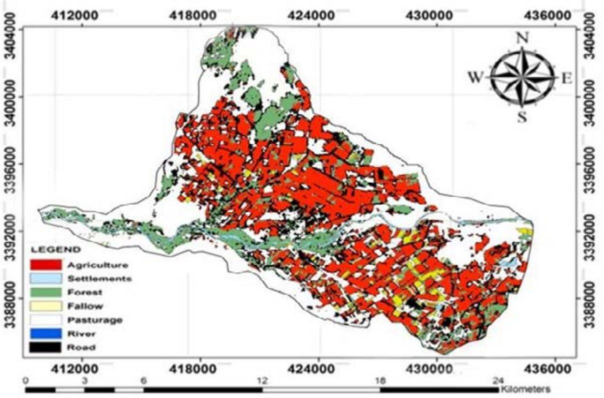

Figure 3: Land use mapping with seven classes by SVM algorithm in original bands of LISS-III.

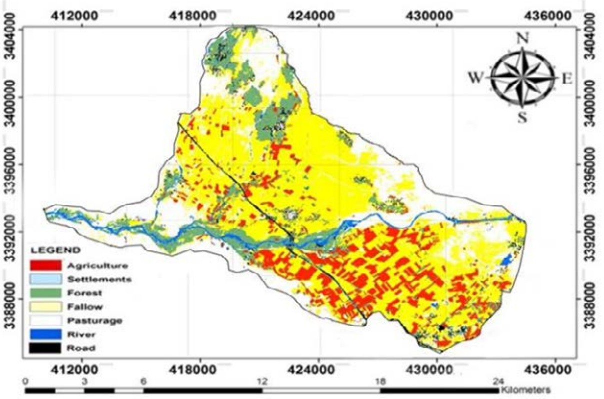

Figure 4: Land use mapping with seven classes by ML algorithm in original bands of OLI.

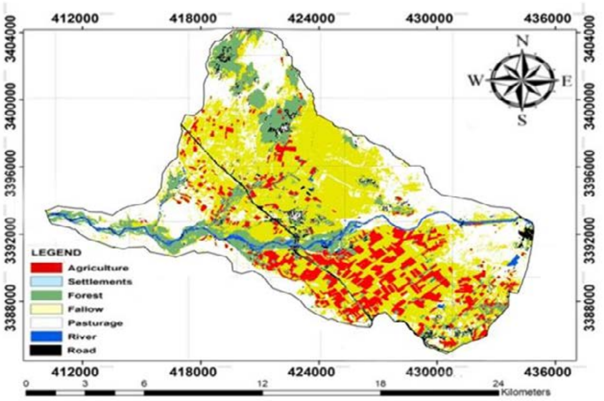

Figure 5: Land use mapping with seven classes by SVM algorithm in original bands of OLI.

Which indicates that 98/02% of the pixels of the forest are correct classification in ground truth map and remaining percentage is shown incorrectly classification.

The highest accuracy of forest classification is for maximum likelihood method in the original bands of OLI. In general, producer and user accuracy, by using two method of classification in original bands of OLI showed better results than LISSIII.

Least of producer accuracy is obtained for SVM method in original bands of LissIII. This can be due to, scattering and density of stands riparian forest that so Interference spectral of soil with ground cover and so separability was incorrect. As same as abdolahi and shataei [16] studies, stand scattered of Forest be effective the spectral interference of forest and non-forest and this will reduce the overall accuracy and Kappa coefficient.

Based on the results evaluate classification accuracy was determined that using support vector machine (SVM) method is better than maximum likelihood (ML) for classification of landuse/landcover.

This results is similar to studies of Godarzi et al. [17], Arekhy and Adibnejad [18], Hoseini and Ghasemiyan [19] and Melagni and Bruzzone(2004). Also determined that the result of classification OLI images for original bands (ML=90/30, SVM=92/95) was better than classify by LissIII images (ML=88/50, SVM=90/77), that was the evidence for better ability images of OLI for distinguishes riparian forest of Maroon in this area. It should be noted that according to obtained high accuracy by using images of LissIII, this images are a good ability for forest mapping and separation users. Also Ali mohamadi and Sadeghian [20], Shayesteh et al, Parma, Shirazi et al., Ghosh et al, Furby and wu and Mahdavi [21] recognized images of LissIII were suitable for mapping of land use or land cover but Pirbavaghar [22-24] describes average capability of this sensor.

Finally, based on the overall accuracy of the map and the results can be stated the OLI images of landsat 8 good ability for whole map of land use or land cover in riparian forest of Maroon that it would be higher spectral resolution than images of LissIII in original bands. Also, based on the results of classification with original bands of Landsat 8 could be a suitable replacement for ETM+.

Hopefully, this study for evaluation of land use/land cover map with Landsat 8 and IRS-1D are helpful for management and planning in the riparian forest of Maroon Behbahan in Khuzestan.

Acknowledgements

The authors are thankful to the Iranian Space Agency for satellite images and all those who helped us in the field work and all friends for suggestions, comments, and helps in various stages of this research and manuscript writing.

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