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Evaluation Land Cover Map Using by LISSIII Image in North of Iran

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ABSTRACT

Defining current surfaces of the forests as well as defining their destruction rate is among most fundamental information's on planning for natural resources management in an region which by using remote sensing science it is possible to achieve this data rapidly in acceptable precision. Present study aims to evaluate LISSIII data capability to provide forest range map in Guilan province. For this purpose, LISSIII image related to 2004 was analyzed. For this purpose 200 sample plots with 340×340 m dimension in the form of a random regular network with 1500×1000 m dimension were planned and harvested. This way a forest range map was provided in sample plots place. To perform modulator classification, a map with highest precision compared to land reality map was selected and its structure was transformed from raster structure to vector structure. This map was interpreted, revised and edited after placing on different color combinations such as images combined to panchromatic band and some additional information's. Resultant map has total precision of 95.1% and kappa coefficient of 0.89. This point represents high capacity of IRS in preparing forest digital map for these regions.
KEY WORDS: satellite images , Land cover map , north of Iran.

INTRODUCTION

Forest vegetation plays a major role in hydrologic cycles, temperature systems available worldwide (Defreis etal.,1999; Franklin,2001). Prerequisite of sustainable management of these valuable resources is quantitative, updated and high accurate data(Boyd etal.,2000). Nowadays, using remote sensing and satellite data is a technique to achieve these kinds of information's (Henderson-Seelers , 1999; Franklin,2001). Satellite data plays an important role in studies related to forest areas of developed and developing countries due to having properties such as wide vegetation. Understanding all kinds of land surface coverage and human activities on different parts of the land, in other word , method of land use , are among basic information for different planning and are of special importance . Maps displaying such a activities on different land surface are called land use maps (Lunetta ,1999). Various techniques are available for extracting land use maps, among remote sensing technique has an especial importance due to its particular properties including wide view , consistency , using difference parts of electromagnetic energy spectrum to record phenomenon properties , short reversion time , the possibility to use software and hardware , low cost , rapid survey as well as providing the ability to watch the region in the past . After geometric and radiometric corrections, percentage of important land use surface in the study area was extracted. Surface, reproducibility, continuous, lower cost and ability to access regions difficult to pass (Bonan ,1999; Terrill,1994) in present study , with due attention to particular condition of forest vegetation in north of Iran region , it is tried to evaluate ability of IRS related to satellite to prepare forest vegetation range map of this region.

MATERIALS AND METHODS

Study area : The research has performed in selected plots of Guilan Province, in the North of Iran (Fig. 1). This region is located in UTM Coordinate system in zones 39.

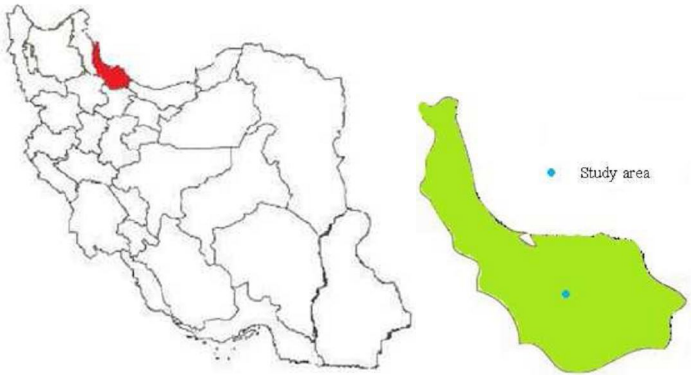

Figure 1. Location of Guilan province in Iran's map and total view of the province.

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Materials :

In order to make forest map, satellite image of year 2004from IRS-LISSIII surveyor were used. Image of studied region is as complete frames. These images were taken by fast format and as orbit-oriented with orbital parameters (Figure 2).

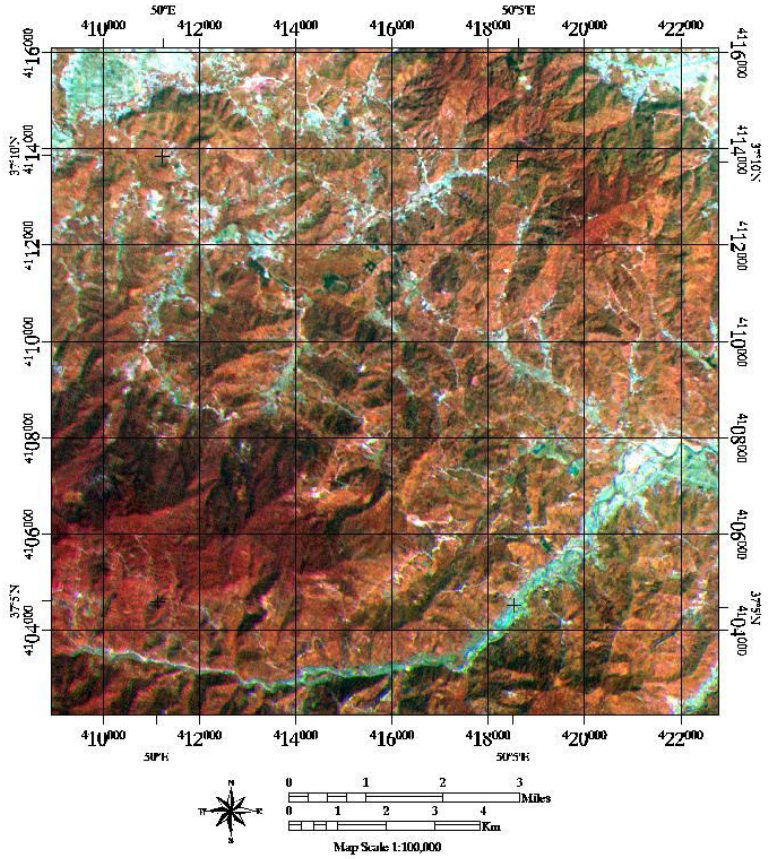

Figure 2. Image of ETM^+ satellite in Guilan province.

Methods:

Preparing ground troth map: In present study, for more assurance of results , land reality map was prepared in half of area surface and as sampling in a 1.5% surface using 1:25000 maps and GPS. For this purpose, 200 square shaped sample plots with 340×340 m diameter were designed as a random regular network with 1500×1000 m diameter in study area. This net work was designed digitally and it was used for land operation after placing on digital color images of the area (14). Then upon surveying total surface of sample plots , forest and non-forest areas borders were taken as a linear target as sequential recording of the points by using GPS. Coordinates of obtained points were converted to a vector map by using ARCGIS Then these boundaries were adjusted to sample plots boundaries and converted to surface surveying.

Reviewing satellite data quality : understanding geometric and radiometric status of utilized data is very essential .To study geometric errors and abnormality , images were displayed on the screen with high magnification and repeated scan lines were observed in all spectrum bands. Then it was tried to adjust these errors some what by using suitable geometric methods and further sampling. It is worth mentioning that in these images , error of detector deficiency didn't been exposed and errors such as dislocation of sixteen series of scan lines were ignored due to their insignificance.

Image processing :

Images were corrected geometrically by using or orthorectification method because the area was mountainous and area image was located in the margin of two image frames. For this purpose, firstly, orbital parameters of images were extracted and 60 land control points were selected on numeral topographic maps from study area. Then a mathematic model was provided according to land control points and orbital parameters. In the next step numeral DEM height mode of area was prepared using numeral topographic maps and was corrected geometrically with mentioned mathematic model by using PCI Geomattica.

Color composition: this function was used in this study to select land control points to perform geometric correction as well as combinational classification.

Spectrum ratio: These vegetation indexes were participated in classification process with other spectrum bands.
Tassled: Tassled cap conversion was performed on data to better extract the information from images. Brightness and greenness among other parameters were used which contain maximum in formations.
Principle components analysis (PCA) : Band 4 image (near infrared) has low statistical correlation to other bands. Thus principal components analysis was performed selectively. So that visible bands (1, 2, and 3) were participated in one group PCA process. First components of each group due to containment of maxim us information in them, were incorporated in image classification beside other bands.
Data combination: In present study HLS color space conversion and a method based on spectrum response were used to combine pan band to other spectrum bands. In addition to being used in numeral classification method (supervised).
Image classifications:

This kind of classification was performed in a supervised manner. Study area was consisted of various objects such as forest lands , agricultural lands , orchards and man-made areas which reflection id represented as a very diverse numeral values in satellite image . Thus, while present study aims to separate forest from other objects but it not possible to place them in a single class as a non- forest class due to diversity of these objects reflection. Therefore in addition to forest class other available objects also have been considered as thematic classes, so that finally they will be combined in classified image of non- forest classes and a forest- non- forest map.

After selection of training samples from all classes, spectrum value distribution graph of training samples in all spectrum bands were reviewed to evaluate and adjust the samples. Diver quality converted index and Batacharia distance index were used to qualitative evaluation of class separation .Then all mentioned bands were participated in classification process in various band collections several times so that best band collection being defined to separate forest regions .

Defining precision rate

Precision evaluation of the maps provided by satellite images classification requires pixel to pixel comparing of these images to land reality map . Then it is necessary to define the location of sample plots in maps resulted from classification operation and pixel to pixel comparison . being performed only in internal part of sample plots . Thus , sections located out of sample plots must be deleted in evaluation process . In present study precession evaluation was performed based on total precision and kappa coefficients parameters .

RESULTS

In qualitative evaluation images, geometric error, sixteen series displacement error in scan line as well as repeated scan lines error were observed. These lines were distributed in each band irregularly in the image and any especial rule or discipline was not observed in their repetition in image lines. In addition, any repeated scan line in image width was not extended and linear and there were fractures along them (in the level of one pixel upward or down ward). This factor as well as this fact that positions of these lined were not identical in various bands and there was no logic relation between them caused that their deletion or correction became impossible. In this line, it was tried to adjust these errors somewhat by using suitable methods of geometric correction and multiple sampling as interpolation. Additionally qualitative and quantitative evaluation of images in respect of radiometric errors indicated striping error which removing this error was disregarded due to its in significance.

Results of numeral classification of the image by using maximum probability classifier and by participating various band series indicated that in best conditions, total precision of 95.1 % and kappa coefficient of 0.89 will be obtained. Land cover map showed forest, agriculture, residential and shrubbery in study area (Figure3)

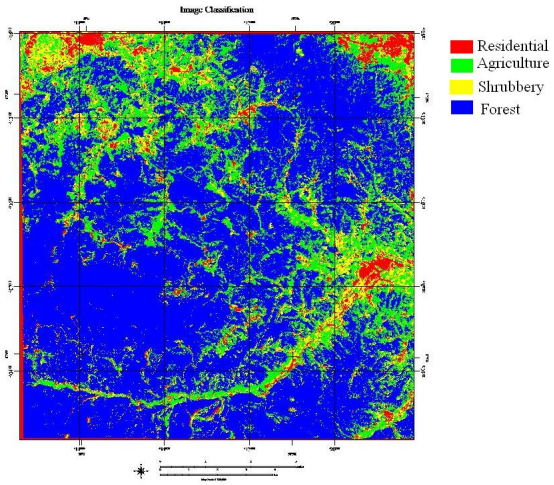

Figure3.Land cover map in study area.

DISCUSSION AND CONCLUSION

According to the results of this study, it can be sated that IRS surveyor's image has required ability to produce precise forest map, which similar studies confirm this result (Darvishsefat,1994, Houghton,1999).

According to the results and based on previous studied on mapping of type and density of the forest , it can be state that in preparing land cover maps by using satellite images , selection of band series has lower importance compared to maps with more detailed thematic classes . If suitable training samples were selected most band series will provided high acceptable precision form classification. This will be the case when mentioned band series are selected with completed understanding on spectrum propertied, spectrum bands and spectrum characteristics of objects in different bands. Finally it can be stated that in preparing forest map by using suitable images such as LISSIII in which most band series especially major, unprocessed bands achieve high precision from classification, there is no urgent need to use panchromatic band. It represents that efficiency of spectrum bands combined to panchromatic band is displayed better in classification with more thematic classes such as typing map or forest density map. Prerequisite of correct management is an exact planning and prerequisite of exact planning is correct and timely information. Thus, it is suggests that precise, new satellite information on the area being taken in near time interval and being provided to researchers and planners.

-one of most important methods well-p know worldwide to conserve and supervise natural resources is using monitoring tool. Since in natural resources monitoring generally and in forest monitoring especially, information extraction is performed every 10 years precisely , it is suggested that in medium-term planning , comprehensive extraction of forest information being performed as land surveying .

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