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Evaluation of Forest Surface Change Using by LISSIII Images in North of Iran

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ABSTRACT

Present study was performed to detect in land cover in forests of guilan conserved area and to describe factors influencing on this changes by using remote sensing. On this basis , Satellite images of 2000 and 2006 in addition to other required data such as topography ,roads and residential centers were transferred to ENVI. Radiometric correction, geometric correction, image classification and finally forest land use changes detection were performed. Additionally, height values and slops of the area were obtained by creating DEM. Results indicated that comparison between available and pervious forest land cover in the study area indicates that guilan forests area has decreased during 2000 to 2006 . This decreased has been estimated 520 hectares: that is in an six years period , 11 % of guilan forests area has decreased . Many factors affect on forest cover change in guilan , among them are : residential centers , altitudinal levels slope rate and slope direction.

Key words: forests, remote sensing, land cover change, change detection.

1. INTRODUCTION

Undoubtedly , conserved regions , national parks and generally ecosystems of the biosphere are valuable natural heritages of my territory or country which represent a range of intact ecosystems , a huge diversity of plants and animals species , an unique aspect of landscapes ,terrains and unlimited cultural monuments , and are of other economic , educational , research and recreational values in a not so much wide range . Despite common thought on the existential testimony of such regions which they are considered as dull and useless capital and even sometimes it is considered for some particular uses (Bonan,1997) .

Remote sensing techniques and scientists have a suitable tool to answer these problems . Remote sensing can provide rapid and cost-effective data . Additionally , analysis abilities of GIS can be used to analyses kind , location and amount of destruction . Firstly studies performed on study of forest changes by using spectrum data and GIS and secondly using these methods in all over the country specifically in study area in subsequent years(Boyd etal.,2003) . One of first studies used on utilizing spectrum data method and using GIS on detection of forest changes , is Rangsikanbhum with title study of change detection in eastern India forests using remote sensing technique. In this sturdy , he studies changes of eastern India during 1982 to 1993 . Results indicates that forest range has decreased about 101 m^2 during study period (Rangsikanbhum , 1997:3). Studies on the study area were performed by environmental conservation organization mostly descriptively . But a study based on using spectrum data as well as using remote sensing .

According to mentioned background , in present study , changes in studied conserved forests have been detected by using information resulted from comparing satellite images of IRS-LISSIII 2000 and IRS-LISSIII 2006. Then , factors effective in these changes were detected using analysis and results have been represented as thematic maps .

2. METHODS AND MATERIALS

Study area

2.1 Study Area

The research has performed in selected plots of Guilan Province, in the North of Iran (Fig.1).

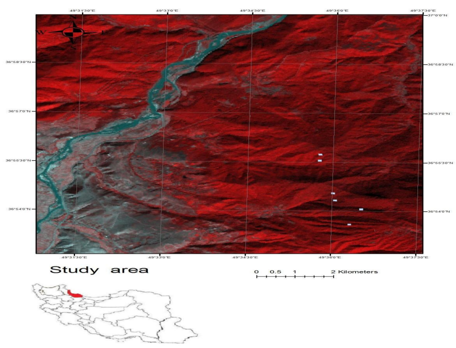

Fig.1 Location of Guilan province in Iran and location of study area

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In present study, study area was detected and positioned by topographic maps of 1 : 25000 and aerial images of 1:20000 as well as remote sensing data including IRS-LISSIII 2000 and IRS-LISSIII 2000images . There are different methods to detect forest changes. One of change detection methods is using satellite images to compare results of image classification. Using satellite image classification has the advantage that it shows the place location as well as kind and quality of changes (Franklin ,2001; Henderson,1999) .

By incorporating data resulting from satellite images to environmental factors in GIS medium , it is possible to detect changes and factors effecting on these changes .

By these description, methodology of present study is based on 2 major principles :

- change detection using remote sensing
- Atmospheric correction for images
- Coordination of images of study area
- Satellite images classification
- change detection

Atmospheric correction

Atmospheric correction is essential in remote sensing . When the goal is to compare multiple time images , elimination of negative effects will be feel greatly (Defreis etal.,1999) . In this study chavez method including decrease in dark pixels value was used to atmospheric correction of images and dark pixels value were decreased in the image so that classification process become highly precise .

Geometric correction of images

In this step , geometric correction was performed on the images and TM satellite images related to LISSIII image (2000)were referred using image to image method . For this purpose land control points were collected with suitable distribution from surface of 2 images so that mathematic model used to finds unknown coefficients in the equation have lower error. First order function was used to transform coordinate of corrected image to uncorrected image. And nearest neighbor technique was used to further sampling of pixel values of uncorrected image . Finally LISSIII image with 0.45 RMSe was referred .

Satellite image classification

Land use classes were defined as 3 groups including use classes of dense forest , cultivation land and Land without vegetation to classify satellite images and training samples were selected on area surface. Image characteristics like statistics of spectrum intensity and patterns of each class were extracted. In next step , land use classed were transferred to study area by using images properties and classes separation was extracted as shown in tables 1 and 2 .

After defining the rate of classes' separation, images were classified in a supervised manner by using maximum probability classification (MLC) technique. In this manner , land use maps related to LISSIII image-2000 and LISSIII-2006 were provided . In the next step , upon doing field operation and random sampling from study area , statistic parameters including error matrices , user care , commission and omission error were extracted (Table3-7)

Table 1 separation rate for classes of land use map extracted from LISSIII-2000 image

Title 1	Title 2	Separation rate
Land without vegetation	forest	1995
	cultivation	1,991
Cultivation	Land without vegetation	1886
	Forest	1887
Forest	Land without vegetation	1990
	cultivation	1992

Table 2 separation rate for classes of land use map extracted from LISSIII-2006

Title 1	Title 2	Separation rate
Land without vegetation	forest	1985
	cultivation	1,981
Cultivation	Land without vegetation	1896
	Forest	1897
Forest	Land without vegetation	1970
	cultivation	1972

RESULTS

Image characteristics like statistics of spectrum intensity and patterns of each class were extracted. In next step , land use classed were transferred to study area by using images properties and classes separation was extracted as shown in tables 1 and 2. Statistic parameters including error matrices, user care, and commission and omission error were extracted (Table3-7).

Table 3 Classification error matrices of LISSIII 2000 image.

Commission error (%)	total	Forest	Cultivation	Land without vegetation	class
0	88	0	0	88	Land without vegetation
0	220	0	220	0	Cultivation
0	371	370	0	1	Forest
-	679	370	220	89	total
-	-	0	0	0	Commission error (%)

Table 4 : classification error matrices for LISSIII 2006 image.

Commission error (%)	total	Forest	Cultivation	Land without vegetation	class
0	98	0	0	98	Land without vegetation
0	220	0	240	0	Cultivation
0	395	390	0	5	Forest
-	733	390	240	103	total
-	-	0	0	0	Commission error (%)

Table 5 : statistic characteristics of producer and user precision for classification of LISSIII-2000image.

class	Producer precision (%)	User precision (%)
Cultivation	100	100
Forest	98	98.45
Land without vegetation	99.34	99.56

Table 6 : statistic characteristics of producer and user precision for classification of LISSIII-2006 image.

class	Producer precision (%)	User precision (%)
Cultivation	100	100
Forest	99.43	99.21
Land without vegetation	99.33	99.76

Table 7 : study on classification precision for land use maps extracted from TM and spot satellite image.

Land cover map extracted from image	Kappa coefficient	Classification precision
LISSIII-2000	0.9876	98.22
LISSIII-2006	0.9711	98.33

Preparing change map

After preparing land use class was separated from other land use classes based or research goal . Then changes map were prepared in ENVI 4.7 . In the next step, by transferring land use maps and change map , forest decrease extent was calculated as shown in table 8 . After extracting land use map of each image, guilan forests area was estimated in every land use maps which is summarized in table 8 .Figure 2 an d Figure 3 shows land cover map of study area and changes forest type from 2000 to 2006.

Table 8 : Results of Guilan forests area during an 6 years time period.

Year	Area in hectare
2000	4720
2006	4213
Decrease in area	507

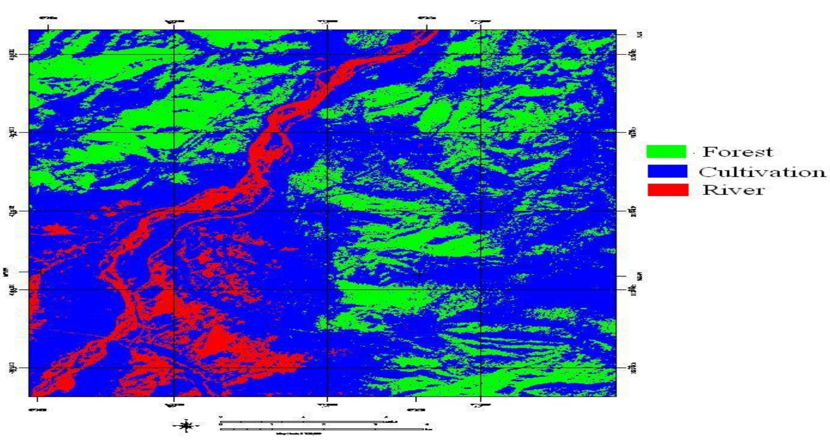

Fig2.Land cover map of study area from LISSIII-2000image

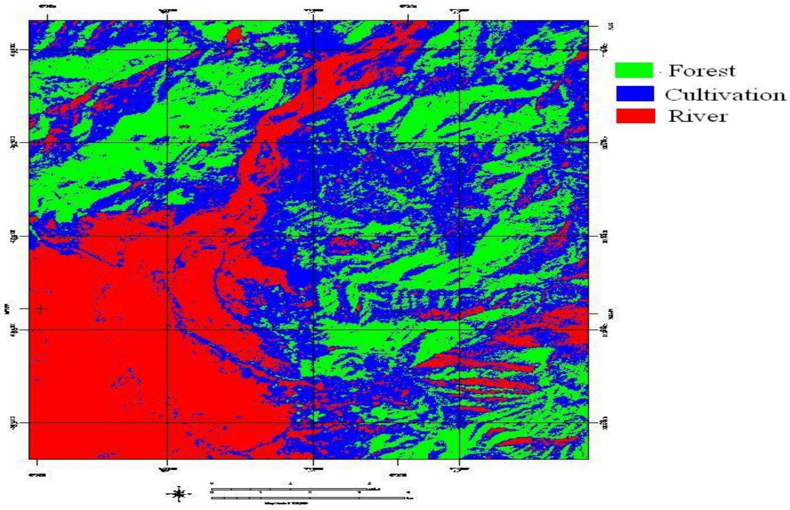

Fig.3 cover map of study area from LISSIII-2006image

DISCUSSION

Comparison between available and pervious forest land use in the study area indicates that guilan forests area has decreased during 2000 to 2006 . This decreased has been estimated 520 hectares: that is in an six years period , 11 % of guilan forests area has decreased . Many factors affect on forest cover change in guilan , among them are : residential centers , altitudinal levels slope rate and slope direction .

Guilan forests conserved area is consisted of 5 village (residential centers) which play an important role use change . Most of these changes are due to using trees wood to construct homes as well as using forest land for agriculture(Panikkar ,1982). Since most of village and residential centers are located in low altitudes, changes of this region are mostly in low altitude levels. Thus in higher altitudes, there is lower forest cover changes. As mentioned above , this is due to the difficult access of villagers to higher altitudes .Slop rate effect also is effective significantly in forest cover use change and has a direct relation to it .Residences are most important factors on guilan forests destruction due to close relationship to human activities such as grazing , agriculture , using tree's wood as fuel .Expansion of village residences specifically in mountainous parts of the forest id other factor in destruction . Various residences in forest span based in various factors such as population growth rate as well as tourism would destruct forest ecosystem and land use change . High birth rate and using heavy and semi-heavy mechanical machines and tolls to construct connecting roads and agricultural affairs as well as increased number of domestic animals compared to range land capacity are factors relevant to residential centers effective on increasingly destruction of forest cover. To avoid forests destruction upon considering dynamic characteristics of environment, it is necessary to pay great attention to avoid destruction and damages due to excessive development of residences and excessive use of environment during implementing development plans .

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