Biological Forum – An International Journal **6**(2): 19-23(2014)

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Forest Lands Cover Monitoring using the Data Satellite

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(Received 31May, 2014, Accepted 02 July, 2014)

ABSTRACT: Thus, satellite images with capability of massive vision and being repetitive are used at present as an efficient tool to identify and to control the vegetation. In this study, using supervised classification, land samples are taken by GPS and classified by ENVI 4.6 software. Manual classification despite being greatly precise is time intensive and is very expensive. Thus maximum likelihood was used as an adequate technique. Results of numerical classification of images using this technique with participating various band sets indicated that in best situation, total accuracy of classification of the image related to 2004 is 0.7598, respectively and their kappa coefficient is 0.7473, respectively. As well, results indicated that among the influencing factors on the trend of land use change in the forests of study area, the most important reason of these changes are residential centers, construction of new outdoor recreational structures, road construction and other tourism uses. These factors must be considered in the future plans of the area.

Key words: Forest cover, Gisoom forest park, supervised classification, ETM+.

INTRODUCTION

Providing the initial thematic information is the prerequisite for any planning in the forest sustainable management. For this purpose, forest cover mapping is highly considered as the basic information to provide forestry plane. Since these maps are produced using various techniques from field operations up to using aerial images, great time and huget and rigid work conditions are among the drawbacks to prepare such maps. Thus it is necessary to use more easy and up to date techniques for this purpose. Remote sensing science may be a suitable solution to remove this problem. Among the tools efficient for environmental studies and land sciences is utilizing the information systems technologies most important of which are remote sensing. Geographic information system (GIS) and Global position system (GPS) which provided a huge evolution in the management of land sources information. According to the importance of natural resources and forests, it is required to recognize the sources inside the country and to collect the comprehensive information related to these resources, so that planning in Marco level is performed according to the available potential and resources in the area.

Since the prerequisite for systematic planning and natural resources sustainable management is availability of precise, up to date data.

A study titled: "Study on the possibility to map the beech species using EMT+ sensor's data", performed the classification of satellite images with original and artificial bands derived by scaling, conversion of major components and combination by performing suitable processing and reconstruction maximum similarity classification was performed. Analyzing the major components was performed based on the bands with high correlation and on the basis of correlation calculation in the desired range. Finally, the map derived from this classification was achieved with 51% total accuracy. Yuan (2005) analyzed the changes and classification of land cover in Minnesota region utilizing the multispectral images of landsat, and studied the trend of land use changes around the urban areas. In this study which approximately 7700 km2 area, landsat images relating to 1986, 1991, 1998, and 2002 were used. Maximum likelihood algorithm in the satellite images classification was including 7 major bands and 3 bands resulting from teseldcap. Satellite images were classified to 7 classes including: forest, agriculture, pasture, urban areas, water, marsh and stony places and then they were studied.

A result of this study indicates a 70000 hectares increase of urban areas during 16 years which was including 75% forest and 13.6% lands converted from other uses.

Bonyad (2005) in a study on the classification of multiband satellite images for inventory and mapping the land cover to decrease the lack of correlation between satellite images utilized the major components analysis technique. Total accuracy in this classification was evaluated as 80.63%. This conclusion is considered suitable to classify the land cover in the study area using major elements analysis.

II. MATERIALS AND METHODS

Study area: Forest park of Gisoom covers an area of 1058h1. Length of this area is about 4300m^2 and its with is up to 2500m^2. This is located as a forest strip remained from Talesh forest area in the North western Guilan provine 42 Km^2 far from major road of Anzaly port to Astara.

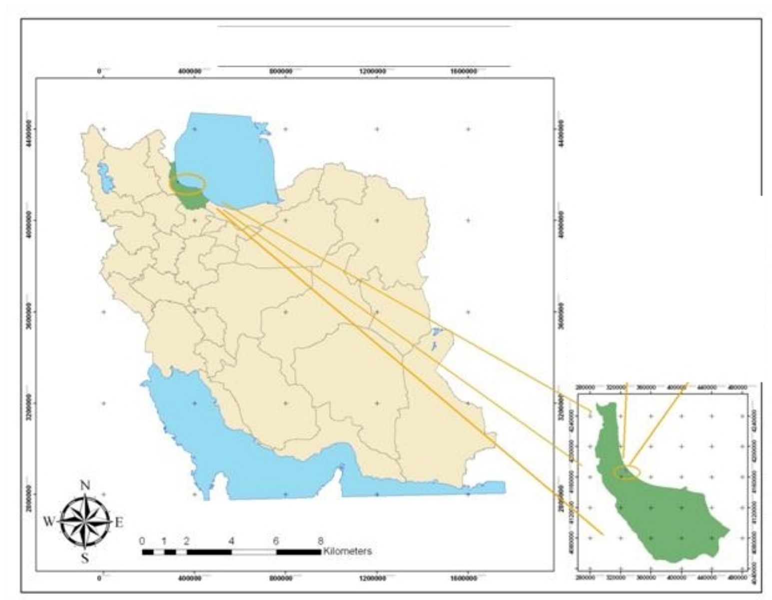

Fig. 1. View of study area.

Eastern part with about 887 h areas is assigned to the forest park (Fig. 1). Western part of Gisoom forest with approximately 171h area has been devotes for forest reserve. Image used in present study is the ETM+ images of satellites 2007. ETM+ sensor was launched by landsat 7 and was placed in the desired orbit. It has 8 bands. location resolution ability of all bands expect for 6 and 8 is 30×30 m and resolution ability of band 6 (thermal band) was 60 × 60 and for band 8 which is a panchromatic band is 15 × 15 m. in the operation of geometric correction of images utilized was obtained along the X and Y axis as 0.96 and 0.83, respectively. Also RMSE error for images of 2007 was achieved along the axis x and y as 0.58 and 0.72, respectively. This was acceptable. In both stages, polynominal transformation and nearest neighbor techniques were used for repeated sampling. This technique is the most common technique for repeated sampling. Among the most important merits of this technique is its rapid performance, and transmission of major numeric figures and lack of production of new numeric figures (Mehrabany, 2000). As well to perform atmospheric corrections, since the values recorded as pixel values in the remote sensed images differ from real values of reflection and it is required to deduct these values from real values of spectral reflection, thus water coverage value (taking the fact that water coverage value must be zero) is deduced from a. The image bands as atmospheric effect. In remote sensing data, initial calculation of some statistic indices is necessary and useful.

Processing: Image classification: In other words variance matrix and mean vector which in turn define the variance and correlation of spectral values are used. In general, in the technique of using maximum likelihood, elliptical surfaces will identical likelihood lines or curves are projected which are displayed in the picture.

Studied elliptical surfaces define the dependency status of a pixel to a specific spectral group, that is, variance and correlation statistic factors are used. For example, pixel a in the figure are belonged to the group class (0) according to the higher likelihood and correlation intensity.

Selection of classes: In this step, classification classes were selected using the available maps of study area and consulting the related experts.

Accuracy of classification maps was evaluated in 2007 using mixed variance- covariance matrix (Stehman 2004), after classification and derivation of forest land use layers from ETM+ images. In this study, total accuracy and kappa coefficient was used to evaluate the provided layers. In fact, half of land terrain data derived from various area in their field operation or from visual interpretation using high resolution images and available maps were used in the classification training phase. The other half of these data was used in supervision and classification precision evaluation phase. The reason to use this technique of land terrain utilization was to prevent optimistic results of evaluation.

Diameter of this matrix consisting the number of pixels correctly classified and the elements outside of the matrix in the rows displays the pixels not being correctly classified which during the classification incorrectly removed from the major class and were allocated to other classes. These errors are also called errors of omission or exclusion. Accuracy of classification of each class is achieved through dividing the number of correctly classified pixels (in diameter) on the number of control pixels (sum of the row) of each class which also is called producer's accuracy. Elements outside the matrix diameter in the rows display the land terrain pixels. This reliability is called user's accuracy (Table 1).

Table 1: Total precision in the land use in 2007.

Producer's Accuracy (%)	User Accuracy (%)	Classes
0.71	0.68	Pinus Forest
0.74	0.75	Road
0.87	0.63	Forest Mix
0.74	0.89	Building
0.72	0.70	Carpinus forest
0.80	0.75	Parrotia forest
0.70	0.81	AlnusForest

RESULTS AND DISCUSSION

Results of numerical classification of images by using maximum likelihood classifier and by participating various band sets indicated that in best conditions, total accuracy of image classification for 2007 is achieved as 0.7247, respectively and kappa coefficient is 0.7473 respectively (Table 2, Table 3). By refereeing and comparing to the references such as, Dellepiane and smith (1999), Lefsky and Cohen (2003), Stehman (2004) and Sedighy (2001) where total accuracy and kappa coefficients larger than 0.7 is mentioned as very good and smaller than 0.4 is considered as poor, results obtained through land use classification using satellite images had a good accuracy related to the produced information in respect of every landuse, total accuracy and kappa statistics.

Comparing the current and past land use of forests in the study area indicates that the forests dimension in the area had a decreasing trend during 2007, which will be illustrated separately in various species. Slope rate didn't influence on the forest cover use change since in the study area, slope is maximally 10% and is not effective in occurrence of earthquake and decrease in the forest area.

Several forest cottages in the park area based on various factors such as population growth rate and also colonization and tourism rate have disturbed the forest ecosystem and landaus change. For example, expansion of recreational camps, parking lots, race tracks and development of connective roads which were accompanied to utilization of heavy machines caused that the trend of forest cover change expanded during the study period. This had a great influence on destruction of other ecosystems relating to the forest and increase of soil erosion which is consistent to the results of Razaey (2005).

Table 2: Kappa coefficient and total precision of ETM+ picture in 2007.

Kappa coefficient (%)	Total precision
0.747	0.759

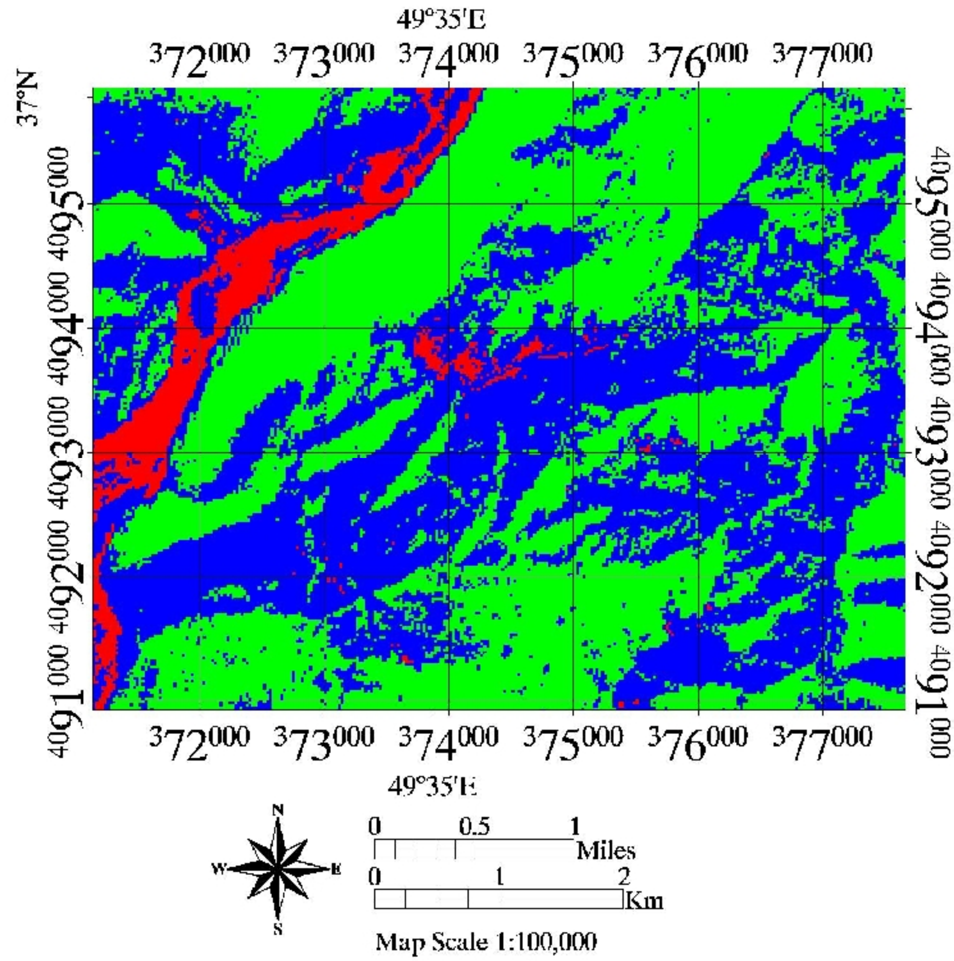

Fig. 2. Final classification map, 2007.

Table 3. Distribution of landuse levels for years 2007.

Images of 2007 Area (hectares)	**Land class**
31.2	Pinus Forest
110.5	Carpinus Forest
450.2	Alnus Forest
202.8	Parrotia Forest
162.5	Road Forest
80.2	Mix Forest
20.4	Building Forest
1058	Total

As dimensions of the road and constructions (parking lot, cottage, race track, etc) classes have increased. Increased dimension of these land uses was accompanied to decreased dimension of other land uses. Destruction and land use change may occur due to the factors such as draught, fire, flooding, volcanism and anthropologic activities such as animal pasturing, expansion of urban areas, agricultural lands and how to manage the natural resources. Finally, after comparing the prepared map and the land use map of the area, it can be concluded that outputs of years 2007 have a higher accuracy.

ACKNOWLEDGEMENT

I would like to express my gratitude toward of Islamic Azad University –Lahijan Branch for their kind co-operation and encouragement and finance support which help me in completion of this project.

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