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Exponential Micro Scale of Forest's Map by Satellite Data of Sensor OLI, Case Study: Forests of Golestan Province, Iran

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ABSTRACT

Identify and diagnosis of homogenous units and separating them and eventually planning separately for each unit are considered the most principled way to manage units of forests and creating these trustable maps of forest's types, plays important role in making optimum decisions for managing forest ecosystems in wide areas. Field method of circulation forest and Parcel explore to determine type of forest require to spend cost and much time. In recent years, providing these maps by using digital classification of remote sensing's data has been noticed. The important tip to create these units is scale of map. To manage more accurate, it needs larger scale and more accurate maps. Purpose of this research is comparing observed classification of methods to recognize and determine type of forest by using data of Land Cover of Modis satellite with 1 kilometer resolution and on images of OLI sensor of LANDSAT satellite with 30 kilometers resolution by using vegetation indicators and also timely PCA and to create larger scale, better and more accurate resolution maps of homogenous units of forest. Eventually by using of verification, the best method was obtained to classify forest in Golestan province's forest located on north-east of country.

Keywords: Observed Classification; Homogenous Units; Forest Management; EVI2 Indicator; Scale

1. Introduction

Forests as one of the most important renewable sources, play vital role in continuity of life and protection and stability of ecosystems. This issue is so important especially in Iran that is in category of drought and low water countries and suffer from extra limitation of vegetation and requirement atmospheric conditions for happening fire is prepared. Forest ecosystems which have been formed to present through the long time, have important role in saving balance in the land (Makhdoum Farkhondeh *et al*. 2007).What has importance about all the forests of Iran and especially in forests of Khazar which are the only commercial forest of Iran, is preventing of qualitative and quantitative destructing process in forests which has been started and it continues.Reducing of these forests is a serious warn that an appropriate decision should be made for it (Marvi Mohajer, 2005). Today fire of forest is beyond the natural disaster and makes all countries nervous about its effects. Fires are noticeable subjects which cause to fire of millions hectareof forests around the world every year. Each year approximately 4 million hectare of forests around the world are damages in average (Özbayoğlu and Bozer, 2012). Fire of forests and grasslands is one of the main subjects and nervous not only as environment point of view but also as economic, social and security point of view, all around the world (Merino-de-Miguel *et al*., 2010). Fire of forests imports noticeable amount of greenhouse gas, smoke and dust to atmosphere which cause to increase CO_2 (Levine, 1991).

According to reduction process of forests of country and importance of these forests from protecting water and soil sources and also investigation and creation of managing plans for revive or managing for prevention of natural events such as fire, creating some maps from homogenous areas seems necessary. (Magdon *et al*. 2014) providing map of relatively homogenous areas from forest types, is one of the main ways of managing forests (Etemad *et al* 2013). Protection and patronage of natural sources especially forest that has important and vital role in continuing life and environment, need planning like any other order (Zabiri 2000). Producing maps of forest types by using land data, requires much time and cost, especially in wide surfaces, mountainous areas with difficult access. First and most important way to manage forest is gaining correct and on time information about forest and this principle can be available by remote sensing science with high velocity and accuracy and low cost to identify environment and extract their usage for deciding to plan (Daghestani 2009, Alavipanah 2013, Feizizadeh and Hajmirrahimi 2008). Therefore, using of remote sensing data is considered as an appropriate alternative based on structural condition of forests on the earth (Daghestani 2009, Alavipanah 2013, Lotfi *et al*. 2010) and among this, developing methods of classification and their high ability, increases importance of usage. There are different methods of classification to resolute thematic phenomena and accurate extract of information from satellite, in remote sensing (Feizizadeh and Helali 2009) which don't have same results by using of usage method type and type of case study area (Tso & Mather, 2001). Purpose of this research is comparing of observed classification methods to diagnose and determine type of forest by using resulted data of Land Cover of MODIS satellite and also OLI sensor of LANDSAT satellite by using of vegetation indicators and also timely PCA. Eventually by using verification, best method for typing forest in forest areas of Golestan province located on north-east of country is obtained.

2. Material and methods

2.1 Area of case study

Area of case study is Golestan province located on south-east of Caspian Sea. Area of this province is 20387 km^2 and is involved approximately 1.3% of country. This province is located between 36 degree and 30 minutes to 38 degree and 8 minutes of north latitude and 53 degree and 51 minutes and 56 degree and 22 minutes of east longitude. Golestan province is limited by Turkmenistan republic in north, by North Khorasan province in east, by Semnan province in south and south-east and by Mazandaran province and Gorgan gulf and Caspian Sea in west. Figure (1) illustrates situation of case study area in order in Iran and Golestan Province.

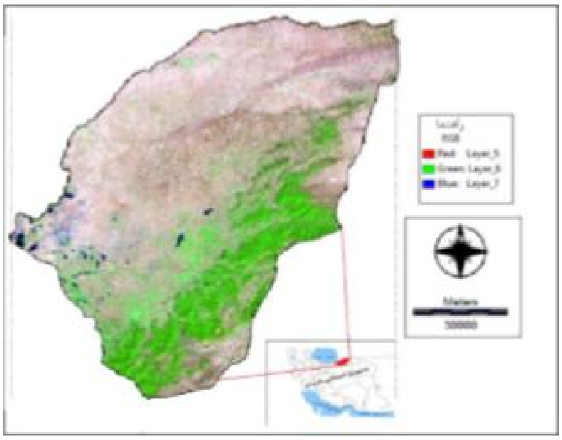


Figure 1; situation of area of study by order in Iran and Golestan province**.**

2.2 Data and Modus operandi

One of the most important abilities of satellite images in investigating of natural sources is determination of vegetation's type to manage forest arenas better. In distance measuring, interpretation and diagnosis of different complications are based on spectral behaviors (alayon,Yuan,Luenetta& Evidege,1998). Then, accurate knowing of these complications seems necessary. Plants, because of containing chlorophyll and other substances in their leaves, show features behaves in different bands which help us to distinguish them from other factors (Roberts, Rogan& Frankin). Even these features can have used for needle leaf and broad leaf plants. Why each type of plant has exclusive spectral features? In addition, different pants have different timely features which can be helpful to recognize them from each other. In this study, data of remote sensing contains satellite images related to MOD12Q1 product, MODIS sensor that is part of land surface cover's products and the resolution is 500 in it and also images of OLI sensor of LANDSAT satellite were provided for 4 season in year 2015 in the form of time series and it has 30 meters' resolution power. These images have appropriate conditions such as lack of covering by clouds in images. Images were requested from Geology Organization of United States and then were downloaded from related website and missions of preprocessing were applied on images and images were mixed together and one-time series image was provided. Then NDVI, LAI, EVI2 and OSAVI indicators were applied on images. In next step, time series image and time PCA with images of vegetation indicators were extracted from base pixel classified (observed) images of MODISby educational sites and it's done by the best band resolution based on the most divergence in recognizing phenomena. Then resulted images of classification, were verified based on MODIS's product.

Basis	Date	Shams date	Sensor	Satellite
WGS84			MCD12Q1	MODIS
WGS84	26_MAY_2015	Spring	OLI	LANDSAT
WGS84	22_JULY_2015	Summer	OLI	LANDSAT
WGS84	10_OCT_2015	Fall	OLI	LANDSAT
WGS84	29_DEC_2015	Winter	OLI	LANDSAT

Table 1.LANDSAT satellite were provided for 4 season in 2015 in

2.3 Preprocessing of satellite image

Step of data processing is one of the most important steps in images processing. Because all of next calculates will be done based on produced images in this step. In this step, radiometric corrects were done for existed images which for absolute calibration of atmospheric data, experienced line calibration was used by using of light and dark points of beach and also asphalted roads.

2.4 Process and classify of satellite images

In doing observed classification, first stepis determining type and number of stores. Observed classification is based on exact knowing of existed phenomenon in area. This knowledge is used as educational samples in area.

2.5 Constructing educational sites

Educational sites are first and most important step in classifying images to separate image units (HANG&NI 2008). Educational sites mean a group of neighbor pixels inside of a zone that similarities like number and tissue value is the most important their common criterion. (Feizizadeh 2007) subject images in remote sensing are homogenous which are determined by educational sites. L3 products of MODIS satellite that has ability of knowing exist components separately in nature and it separates forest areas as distribute tissues of needle leaf, broad leaf and mixture and uses as basis image for creating these educational sites.

2.6 Revealing images by plants indicators

To improve and reveal images, a series of plant indicators were applied on all intended images and after standardization of images, direction of equal output, all outputs were classified by using of extracted educational sites of products of MODIS and then verification was done on images.

This research, WV-VI, OSAVI, EVI2&LAI plant indicators in figure (2) and time series of season 4 in figure (3) and also timely PCA were used.

Equation	**Type of Indicator**	**Symbol**	**Name of Indicator**
OSAVI= (RNIR-RRED)/(RNIR+RRED+0.16)	Basis Distance	OSAVI	Adjusted Plant Indicator of Improved Soil
LAI= $(L_{A2}+L_{A1})/2 * (1/G_A)$		LAI	Indicator of eave surface

EVI=2.5*(NIR-RED)/(NIR+RED-7.5*BLUE+1)		EVI2	Indicator of leave surface with reflection of blue band
(CB-NIR2)+(CB+NIR2)		WV-VI	WOLD VIEW WATER INDEX

Table 2. Names of Indicator with equations

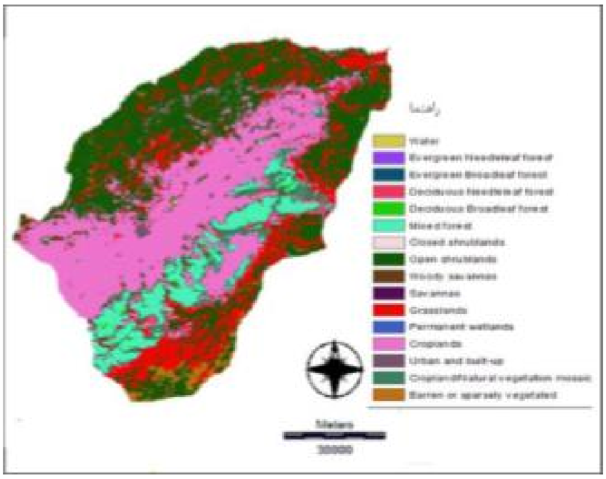


Figure 1; MODIS MCD12Q image.

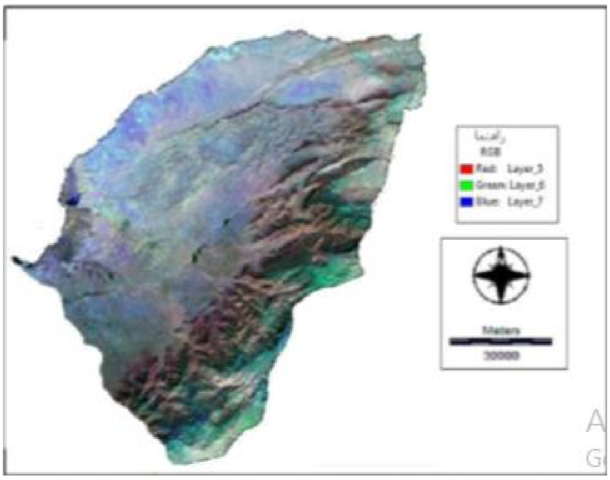


Figure 2; Time series image**.**

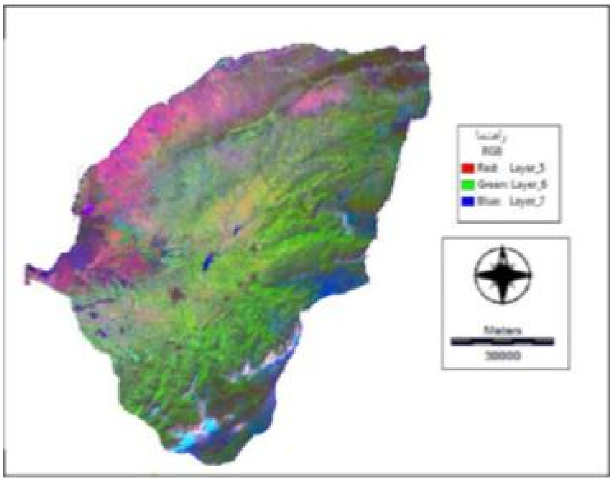


Figure 3; Timely PCA**.**

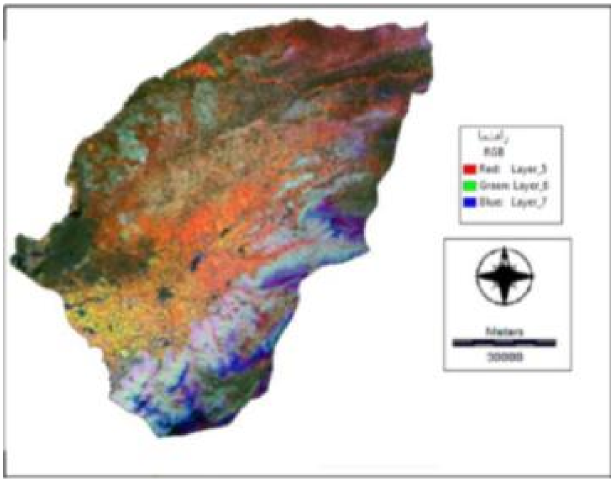


Figure 4; Vegetation Indicator EVI2**.**

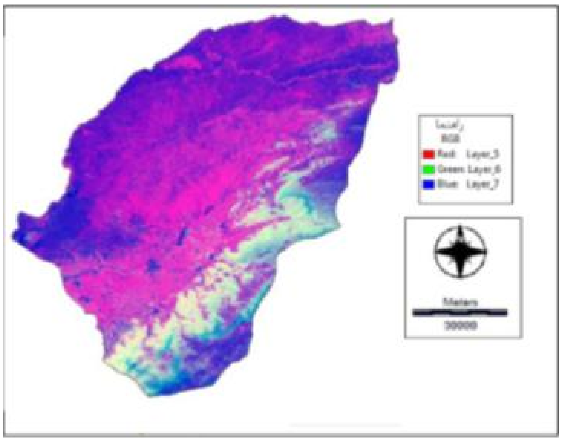


Figure 5; Vegetation Indictor OSAVI**.**

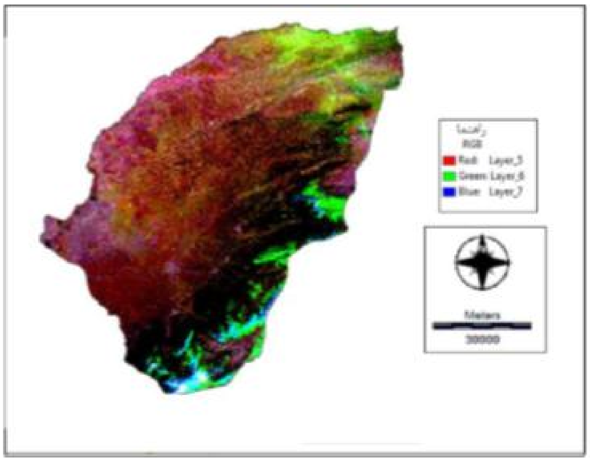


Figure 7; Vegetation Indicator LAI.

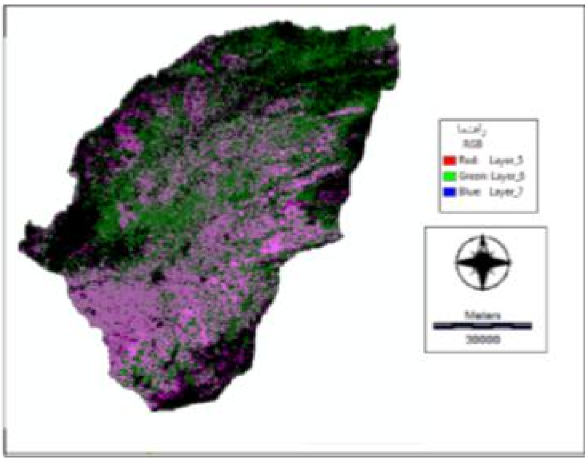


Figure 6; Vegetation Indicator WV_VI.

This research is trying to separate manage homogenous units in canvas creators of forest in three parts of broad leaf, needle leaf and mixture forest by using of observed classifying method by using of time series images of LANDSAT based on extracted educational sites from level 3 product of MODIS land cover. To compare results of the most important methods of verification such as total correctness and Kappa coefficient of classification were extracted. Final results show this truth that among the using indicators in classifying, EVI2 indicator has highest level of accuracy and Kappa coefficient, is able to resolute and identify homogenous units in canvas creators of forest.

2.7 Images resulted from classifying

After classifying and eliminate floors from discussion

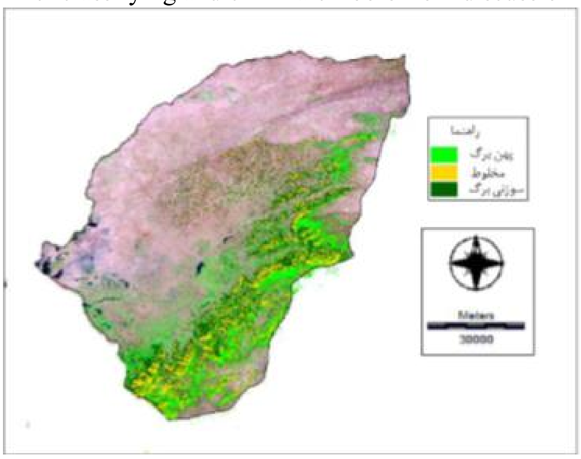


Figure 9 (B); Image Category Time PCA.

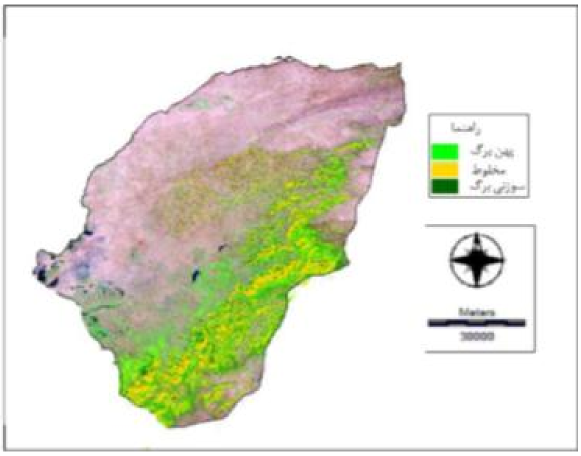


Figure 8 (A); Time Series Image Category.

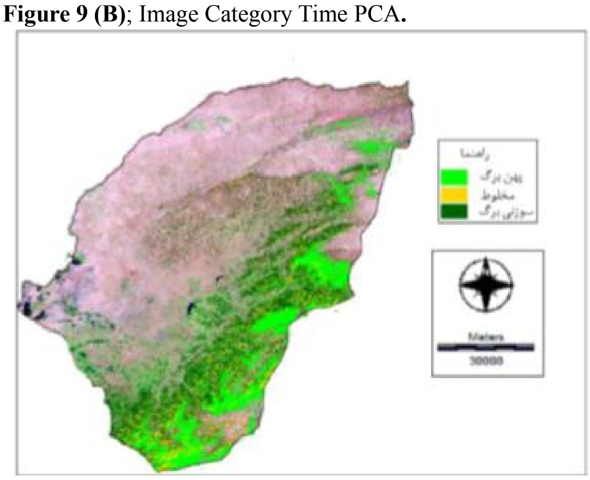


Figure 11 (D); Category of WV_VI Indicator.

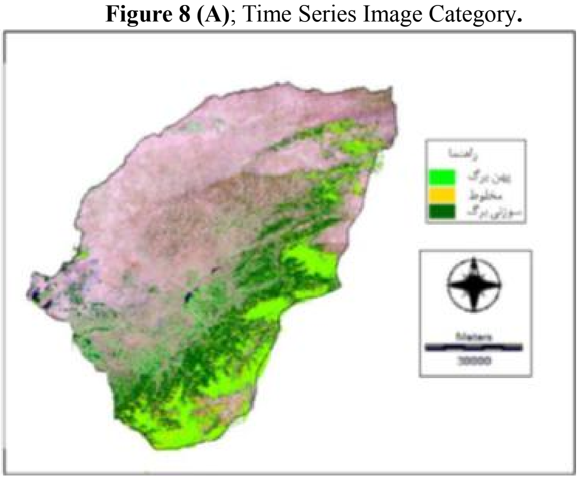
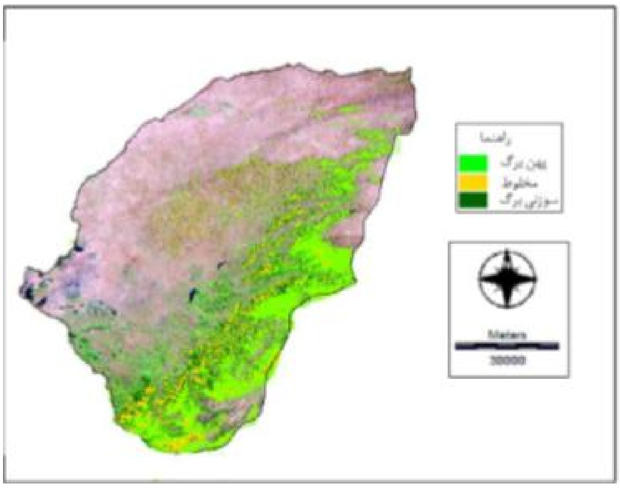
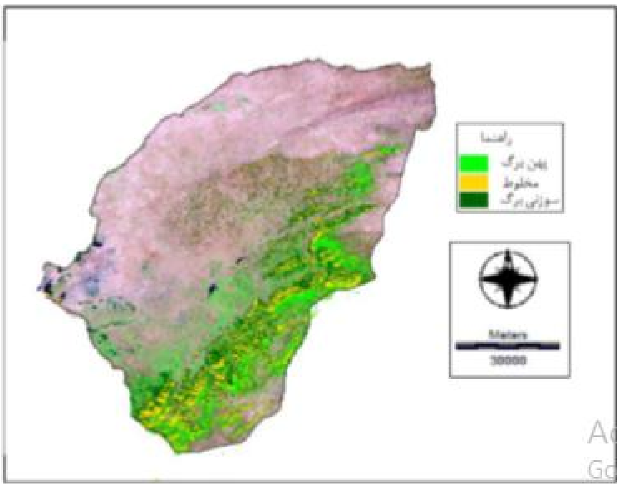


Figure 10 (C); Category of EVI2 Indicator.



F: Category of LAI Indicator



E: Category of OSVOC Indicator

Verifying of Classified Images:

Total accuracy	Kappa coefficient	Type of created image to classify
76.27	0.6948	Time series images of LANDSAT
65.52	0.5492	Timely PCA
84.75	0.8045	EVI2
85.00	0.8178	LAI
77.05	0.7119	WV_VI
50.22	0.4002	OSVI

Table 3. Resulted images is presented based on subject correctness of done verification

3. Discussion and concluding

Since that remote sensing science has a lot of abilities like wide and seamlessly view, high speed, low costing and low timing of getting data. Then in management and planning field, its usage has been emphasized.

In this research it's tried to resolute management homogenous units in canvas creators of forests by using of LANDSAT satellite image with 30 meters' resolution by using of observed classification method based on resulted images of MODIS sensor with 500 meters' resolution. To compare the most important conclusions of verification methods such as total verify and classification Kappa coefficient were extracted. Final results show the fact that among the applied indicators on images of LANDSAT to resolute type of forest masses of EVI2 indicator with the 84.75 percent most total accurate, show better conclusions.

Homogenous units which are created based on classification of satellite images, in fact are separated maps to managing forests and knowing of forest type in area explain its ecologic and economic value of area. Knowledge about type of forest masses helps to manage crisis such as fire and create potential maps of fire.

4. Suggestion of research

Using of spectral cloud images HYPERION and images with high power of resolution like QUICKBIRD as it can be seen in researches related to forest's classification, higher power local resolution images should be used because of spectral interference in different types.

- Effect of different methods of atmospheric corrective in category: using of other methods of atmospheric corrective in the way that it can raise the power of separating phenomena for more accurate resolute.

- Using of threshold method: by determining appropriate threshold there is possible of increasing separability of phenomena total verification and Kappa coefficient in each forest type.

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