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Study of Bio ecological and land cover change of Northern Lands of Khuzestan by Remote Sensing

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Abstract

Remote sensing is a useful technology as a superior to other methods thanks to features like vast and integrated view of the area, repeatability, accessibility and high precision of information, and saving in time. Vegetation index is extensively used nowadays in different continental, regional, and areal scales. Due to excessive use of natural resources, area of landscapes has been changing day to day and updating of the maps is a costly and time-consuming task. Thus, many of the well-developed countries take benefit of satellite data at different levels. The analysed factors included 1- preparation of vegetation and land use maps of North Khuzestan; 2- assessment of biological potential in agriculture development of the studied area using WLC and weighted overlay technique.

Based on the acquired results and performed computations, it was demonstrated the variations in the pasture and agriculture soil during the years from 2003 to 2014 were 19 percent and a significant reduction is observed in this part of land use. The changes between the years 2014 to 2016 were equal to approximately 11 percent according to the computations. This value is remarkably high and indicates intensity of changes during the recent years.

Keywords: Remote Sensing, Land sat Images, Vegetation, Agriculture Development

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1. Introduction

Keeping in mind Iran's population growth rate, destruction of natural resources, water and agriculture land deficiency as well as environmental pollutions, it shall be accepted that we are facing the crises associated with natural environments, the respective crises have unprecedentedly pervaded human activities, mass and energy exchange, and dependent natural subsets at the present age (Yousefi et al 2011). Repeated occurrence of floods in Iran, destruction of a vast expanse of forests (severe deforestation), desertification, and abandonment of farmlands due to immigration of villagers to the cities have imposed highly critical conditions to the ecological environments. And, it is not unlikely to lead to loss of all assets of fertile agricultural lands in less than half-century.

It is evident that Iran's natural environments have limited ecological capability for human use. In certain environments, nature is ready for development incurring least damages, whereas in others, unsustainable development has resulted in environmental destruction, implying that the ecological potential of any natural environment shall be evaluated before implementing the development plans therein (SANAEI et al 2006).

Remote sensing is one of the greatly beneficial methods for acquisition of information concerning vegetation. Providing a vast view of the area, data repeatability and integration are among the characteristics of the respective technology, causing the researchers to utilize this technique for their studies (Dube and Mutanga 2015).

Yang stated that access to updated and new statistics and information and awareness of the trend of variations is one of the key factors in planning, decision-making, and managerial tools in any organization, which will be enabled via deployment of detection process of land use variations (Yang et al 2015).
Perera studied land uses in Sri Lanka using GIS and determined land suitability for cultivation of agricultural crops. They divided their area of study into four units based on parameters of slope, soil type, land capability, and irrigation mechanism. They subsequently evaluated land suitability for each unit using analysis of the maps and relevant information in GIS environment (Perera et al 2001).

Satellite images are capable of assessing cultivation area of major crops and their health. Also, yield of products in different areas can be predicted and their marketing can be planned in different areas depending on the demand level (Singh et al 1999). When the plants are attacked by pests, their reflections differ at different wavelengths (Schowengerdt 1997). Water deficiency in leaf causes changes in absorption and reflection of electromagnetic waves. In other words, reflection of a leaf with water-saturated membrane is different from that a leaf suffering from water deficiency at varying wavelengths (Jeong and Howat 2015).

Today, via transmission of images from movement of clouds, position of high-pressure systems, and so on, meteorological satellites can help us get aware of presence of precipitation in the area approximately or with an acceptable probability. Hence, the farmers can plan the cultivation time with further assurance based on the weather forecast.

Also, the moisture content of soil can be analyzed using RADAR images (Peña and Brenning 2015).

Anderson reviewed GIS and deployment of systematic approach toward environmental planning. Objectives of the respective plan included determination of relationship between diversity, production, stability and existing pressures as well as models of water and soil ecosystems, and ultimately, utilization of the results of this type of attitude in larger areas and at different scales.

In planting stage, satellite images, and in particular, RADAR images may help the farmers for better preparation of the land (Jiménez et al 2014).

Water erosion caused by floods and torrential rains lead to destruction of agriculture lands. And, this destruction is completely visible in satellite images. Appropriate planning can be made by identifying the eroded areas and causes of erosion can be determined and plans can be proposed to mitigate or alleviate erosion (Yu et al 2014).

In recent years, in Iran, the assessment of the bio-ecological potential of development as a necessity in planning the use of land use has been raised. This is happening in economic, social and cultural programs. Khuzestan has vast and fertile lands and It is necessary to use ecological techniques to evaluate ecological power using new techniques such as remote sensing and geographic information systems. After recognizing the principles of optimal use, the findings are considered in future plans. The purpose of this plan is to estimate the change in agricultural land between 2003 and 2016 in a part of Khuzestan. Hypotheses are When it comes to the last few years, a change has been made and Agricultural lands have fallen.

Geographical location and Tectonics of Khuzestan

Khuzestan is located in the southwest of the country, Contract Between geographic length 32 0 50/ - 300 50/ Oriental and Latitude geography 470 50/ - 480 50/ North. The northern part is high and mountain with Moderate summer and cold winter but The southern part is mountainous and like plain. The weather is in this part of the semi desert.

2. Area of study: North of Khuzestan –Iran-

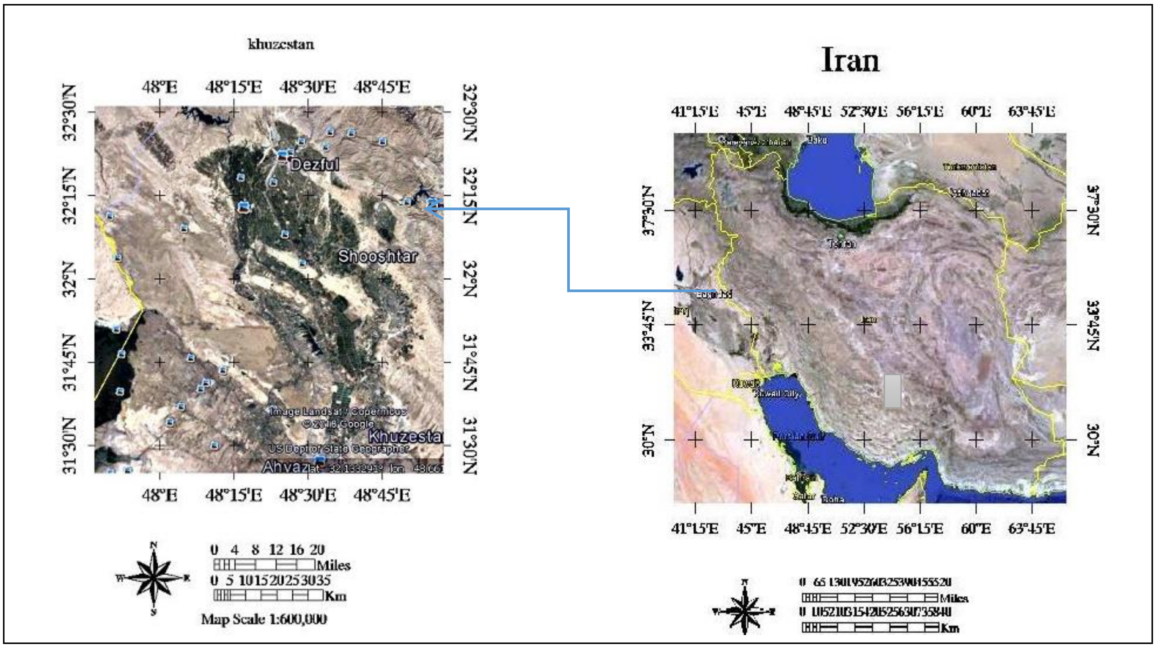


Figure1. Area study

2.1 Geological features

From morphological point of view three morphological structures dominate the province of Khuzestan. The first part is the structures that led to the formation of folded mountains in the northeast of the province. Second, the structure of the hills that surrounds areas of Dezful, Ramhormoz and Ahvaz.

Alluvial plains and floodplains located in the south of Ahwaz to the Persian Gulf coast that alluvial and flood deposits have been deposited there.

The composition of the geological formations lithology, the density and erosion of rocks and the origin of the sediment affect the mentioned morphology (terrane) of tectonic phenomena.

The structural position of Khuzestan province is located in semimetal tectonic state of Zagros that has a special sedimentary history and structure. The mountainous part of Khuzestan is an example of folded mountainous masses that in terms of rocky and tectonic features and following the general process of Zagros geological structure, which extends in the northwest - southeast, is called folded Zagros. But in the southwestern front of this mountain, especially around the Masjed Soleyman, southwest of Ramhormoz, Rags fid Mountain and in the southern anticline of Ahwaz, there are drifting to the southwest that due to tectonic processes in the Zagros sedimentation basin, there have been a lot of thrills in sediments, which is why it is called folded-drifted Zagros. The northern margin of the

Khuzestan plain is part of an indicator tectonic structure which is called Dezful downfall. This downfall is a kind of pre-arc basin formed in the southwest of the mountain front of the northeast of Khuzestan province. One of the geological characteristics of this downfall, is the high thickness of the sedimentary layers between 16 and 18 meters, which made it as one of the oil-rich regions of the province and Iran by forming good reservoir rocks.

The geological formations of the Khuzestan area is a part of folded-drifted Zagros which are formed in different sedimentary and tectonic conditions, Therefore, due to the time and conditions of sedimentation and tectonic location, various facial differences have been formed. Based on three factors of lithology, Tec tonicity and age, the geological formations of the province can be divided into following two tectonostratigraphic units:

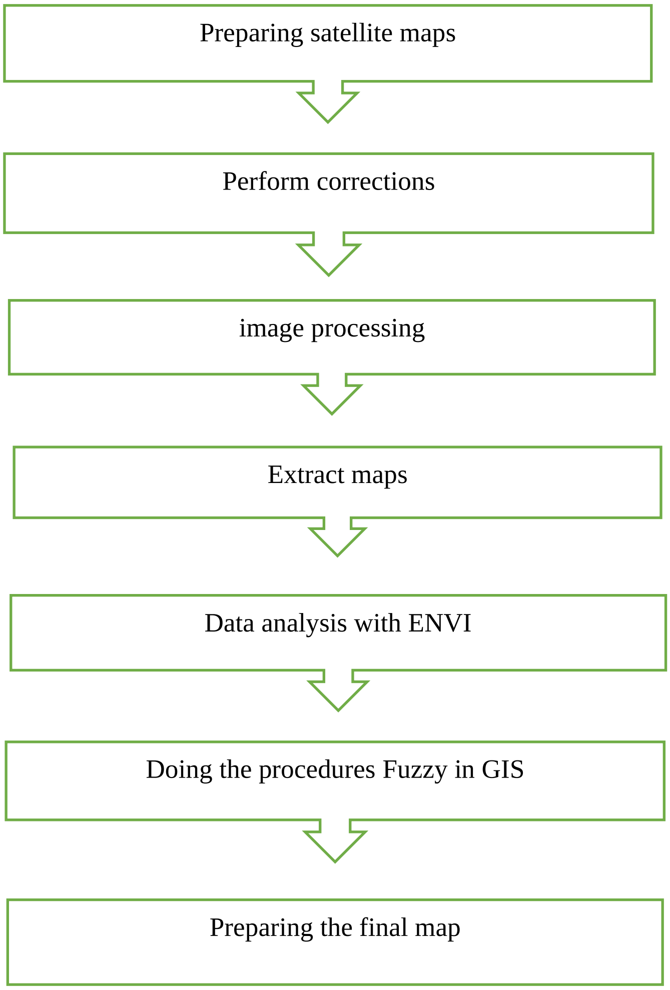
Based on geological-structural divisions of Iran, Khuzestan province is located in the structural zones of Khuzestan Plain, folded Zagros and Zagros highlands.

Khuzestan Plain is part of the vast Mesopotamia Plain, which is part of the Arabic Platform. Khuzestan plain is simple in construction and it has just a very mild bending in the north-south axis, which adheres to the general axial folding of the Arabic platform, and first, second and third era constructions exist in that. Determination of the boundary between Khuzestan plain with the folded Zagros region is not completely clear in terms of superficial changes; because the Neogene lagoon sediments, which thicken to the west, have covered both zones in the same way.

The Zagros Crushed Zone unit with width of 150 to 250 kilometers is located in the southwest of Iran, and its general trend is from northwest to southeast, and Paleozoic, Mesozoic and Cenozoic sediments are aligned on each other with the same slope and these structural units evolved over three stages.

3. Materials and Methods

Basic statistics and statistics and information include topography, soil properties, water resources, and climatic parameters based on which the other maps are prepared. In the present research, after performing the correction and processing of LANDSAT satellite images, the land use map of the area was extracted and the information were analyzed in GIS environment using Envi and ArcGIS software packages. Land capability assessment maps were then prepared by means of fuzzy and weighted overlay techniques. At the last stage, the maps were integrated based on land use priorities and the land use capability map was prepared. Envi and ArcGIS software packages and multiple-criteria analysis and fuzzy methods were used to analyze the data of the prepared map.



4. Results and Discussion

Destruction of these lands will have many environmental and economic consequences. The environmental values of the pastures are several times its economic value, which is forage. In this way, it is safe to say that by destroying or changing the use of a rangeland, though small, a living part of nature is lost. One of the problems encountered in these areas is unnecessary exploitation and overcapacity (De Alban et al 2018), which leads to a decline in the quality and quantity of these resources. Changing the use of rangelands in addition to grazing over capacity, which has always been a serious threat to rangelands, mass transfer and alteration of their use is one of the major problems that threatens the existence of rangeland ecosystems and in recent years this has happened in the region The study has been conducted. And lands with vegetation have been altered to other lands (Ahmadi and Vahid 2018). Due to population growth over the period, farmers were forced to plow plenty of pasture land and change their use.

Investigating the studies of other colleagues and researchers in recent years in the same areas indicates tangible changes in the land so that farmers and rangelands are hardly able to cope with their agronomic needs.

This research was carried out with respect to the importance of the study area using satellite imagery. Landsat images were used in this study. Following preparation of images and applying the required preprocessing operations, supervised classification was carried out by means of maximum likelihood estimation technique (Pirnazar et al 2018). For this purpose, four major classes namely vegetation, urban areas, soil, and water were considered. The classification results were then estimated for all three years i.e. 2003 and 2014 and 2016. (Figure 2.3.4)

The results of changes in use for each of four geographical features in two periods of 2003 to 2014, as well as 2014 to 2016, are presented as percentages as well as the level of changes. According to the results and calculations, the amount of changes in the vegetation cover between years 2003 and 2014 was 19 percent, and there is a significant reduction in this part of the use. The same proportion is 11% just in two years of 2014 until 2016, which is significant comparing with the 11-years period between 2003 and 2014. (Figure 3.4)

Also, the changes between 2003 and 2014 in residential sectors are -43%, considering that the changes between 2014 and 2016 (in only two years) are -15%.

Changes in soil maps are much more impressive than other areas. Just over two years of 2014 and 2016, we see about 2 percent of the change but from 2003 to 2014, this change was only -4% in 11 years. (Figure 3.4)

In terms of regional water change, it was -11% between 2003 and 2014, but in period of 2014 to 2016 it was about -67% that is a very contemplative number.

Consequently, and considering the above factors in the bio-ecological subject, it can be verified that changes over the two years' period of 2014-2016 are very important and demographic changes and dominant faunas in the region are subject to severe fluctuations, and water shortages and high rates of underground utilization will result in irreparable damages in the future.

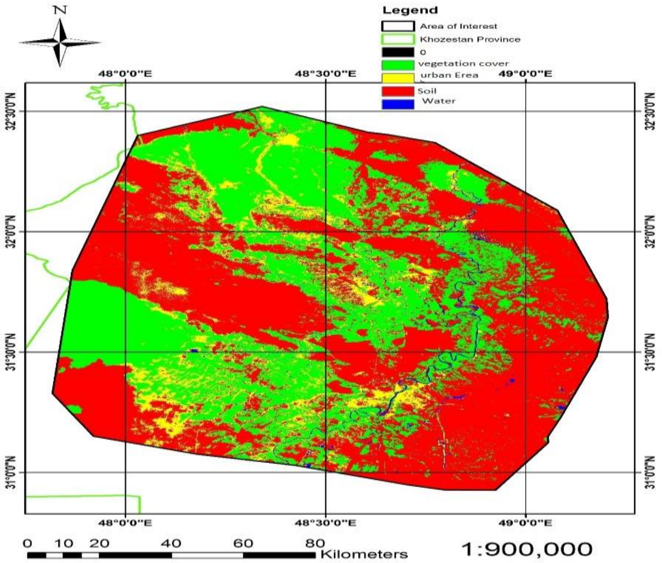


Figure2: Classification results of topographies for data of the year **2003**

Overall Accuracy = (122808/127479) 96.3359%

Kappa Coefficient = 0.9367

Ground Truth (Pixels)					
Class	veg	City	Soil	water	Total
Unclassified	0	0	0	0	0
veg[Green]4	4753	56	27	2	47616
City[Yellow4	5	8632	4053	2	12732
Soil[Red]68	30	456	64499	0	64985
water[Blue]	0	0	0	2146	2146
Total	47606	9144	68579	2150	127479

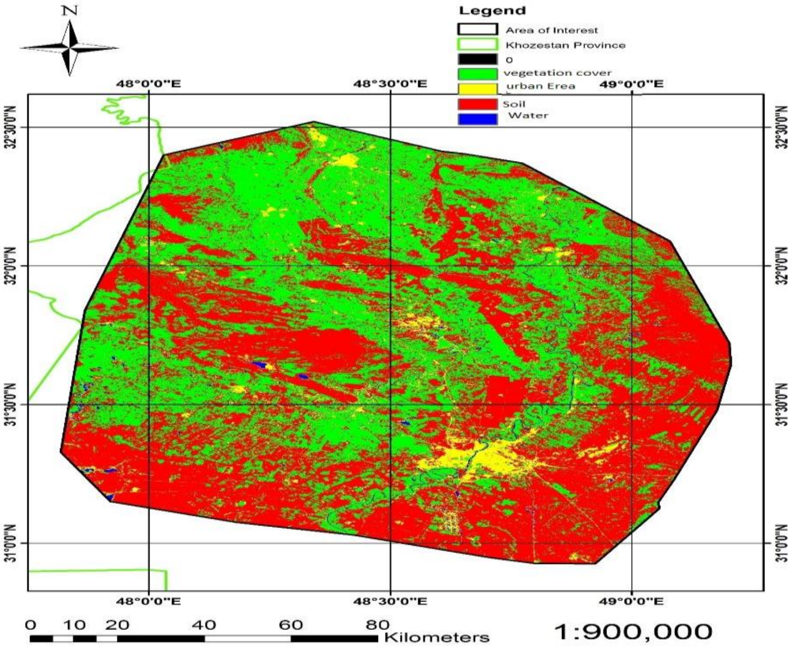


Figure 3: Classification results of topographies for data of the year 2014

Overall Accuracy = (104761/105691) 99.1201%

Kappa Coefficient = 0.9803

Ground Truth (Pixels)					
Class	veg	city	soil	water	Total
Unclassified	0	0	0	0	0
veg[Green]1	13790	60	525	7	14382
city[Yellow]	2	11972	170	8	12152
soil[Red]76	44	114	75887	0	76045
water[Blue]	0	0	0	3112	3112
Total	13836	12146	76582	3127	105691

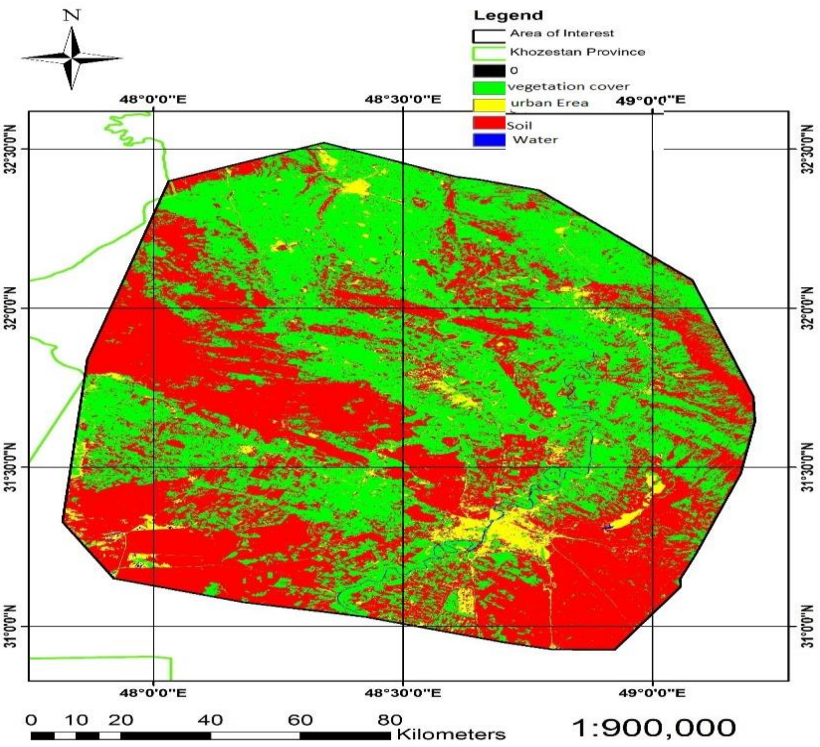


Figure 4: Classification results of topographies for data of the year 2016

Overall Accuracy = (294586/297814) 98.9161%

Kappa Coefficient = 0.9775

Ground Truth (Pixels)					
Class	Veg	city	soil	water	Total
Unclassified	0	0	0	0	0
veg [Green] 1	103238	24	1284	0	104546
city [Yellow]	277	5777	368	2	6424
soil [Red] 18	1241	31	185379	0	186651
water [Blue]	1	0	0	192	193
Total	104757	5832	187031	194	297814

Figure above illustrates classification results of land uses for four types of topographies during the interval from 2003 to 2014 and also from 2014 to 216 as percentage as well as variation level.

Table 1: Topography changes during the interval from 2003 to 2014 in terms of percentage and area

	Vegetation	**residential areas**	**soil**	**water**
Vegetation	66.615	32.929	17.365	21.562
residential areas	5.145	17.821	3.029	18.512
soil	27.762	47.649	79.341	27.417
water	0.478	1.601	0.265	32.509
total	100	100	100	100
Percentage change level	19.556	-43.297	-2.033	-11.577
	Vegetation	residential areas	soil	water
Vegetation	4076.0892	668.8143	2531.8278	38.7243
residential areas	314.8038	361.9701	441.675	33.2469
soil	1698.7275	967.8096	11567.8395	49.239
water	29.2563	32.5143	38.6487	58.3839
total	6118.8768	2031.1083	14579.991	179.5941
Percentage change level	1196.5788	-879.4125	-296.3754	-20.7909

Table 2: Topography changes during the interval from 2014to 2016 in terms of percentage and area

	Vegetation	**residential areas**	**soil**	**water**
Vegetation	75.268	28.982	16.35	7.553

residential areas	1.9	43.145	1.764	53.785
soil	22.807	27.285	81.841	15.232
water	0.025	0.588	0.045	23.431
total	100	100	100	100
Percentage change level	11.918	-15.487	-4.109	-67.129
	Vegetation	residential areas	soil	water
Vegetation	5506.1892	333.7821	2335.3542	11.9943
residential areas	139.0212	496.8936	252.0072	85.4118
soil	1668.4254	314.2449	11689.857	24.1884
water	1.8198	6.7752	6.3972	37.2087
total	7315.4556	1151.6958	14283.6156	158.8032
Percentage change level	871.8642	-178.362	-586.8999	-106.6023

5. Conclusion

Based on the results and calculations it was shown that the changes in the vegetation cover are positive but not very large changes, because satellite images and their analysis show this. But the point to be considered is a lot of changes in the water zone of this region, which is very impressive and shows a significant decrease. The over usage of groundwater and the reduction of surface water and the reduction of precipitation in the years between 2014 and 2016 are indicative of this issue.

Due to the increase in agricultural vegetation and the reduction of water in the area, this increase seems to be in line with the higher usage of groundwater and the expansion of agricultural land and rangelands is the reason of these waters usage.

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