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The Survey and the Comparison of Maximum Likelihood, Mahalanobis Distance and Minimum Distance Methods in Preparing Land use Map in the Western Part of Isfahan Province

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***Abstract*—**In this research three methods of Maximum Likelihood, Mahalanobis Distance and Minimum Distance were analyzed in the Western part of Isfahan province in the Iran country. For this purpose, the IRS satellite images and various land preparation uses in region including rangelands, irrigation farming, dry farming, gardens and urban areas were separated and identified. In these methods, matrix error and Kappa index were calculated and accuracy of each method, based on percentages: 53.13, 56.64 and 48.44, were obtained respectively. Considering the low accuracy of these methods to separate land uses due to spread of the land uses, it's suggested the visual interpretation of the map, to preparing the land use map in this region. The map prepared by visual interpretation is in high accuracy if it will be accompany with the visit of the region.

***Keywords*—**Aghche Region, land use map, Maximum Likelihood, Mahalanobis Distance and Minimum Distance.

I. Introduction

THE investigation of spatial distribution of land use and their changes for management planning and monitoring processes in regional, local, and national scales is necessary. This information in addition to make land use aspects understanding better, it also plays an important role in formulating policies and programs needed for development . Nowadays there are different methods and data to make clear the changes of a region over time. The use of satellite data because of their specific features, such as: broad vision, integrity, using different parts of the electromagnetic energy spectrum to enter the specification of phenomena, the short return period, the possibility of using the hardware and software, cheep, quick cheek and prepare the regional monitoring in past and present is specially referred in the world. As the ability of satellite data, is preparing the land use and the land cover in the past and present, so the remote sensing and geographical information system can be used together [4].

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II. Materials and Methods

A. Study area

The area which is studied is in the Western part of Isfahan province with an area of 1970 hectares, located in the suburb of Feraydan in Isfahan province. It's located in 50°02′13″ to 50°05′56″ northern latitude and 33°03′34″ to 33°07′25″ eastern longitude, 3788 meters above, and 2288 meters below the sea level .The average annual precipitation is 85.417 mm and the average annual temperature is 5. 9° C. the climate of the region according to Domartan method is semi-dry and Amberje method is semi-wet cold.

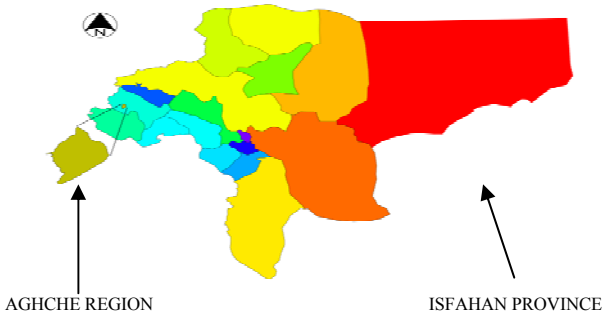

Fig. 1 position of the region to Isfahan province

B. Methods

For this research the scanner LISS III satellite belonging to the IRS is studied. Therefore, the satellite data were prepared in August 2008. To produce the land use map. As presented before, in visit of area, five types of land use were selected. To prepare the land use map from LISS III scanner, first the control classified method in preparing land use map was selected [2][6].So the data obtained in the visit of the area (partial mapping of each land use) was used. The data in ERDAS IMAGINE software was used as AOI (Area of

Interest) and the land use map by theme and in three methods of classification-Maximum Likelihood, Mahalanobis Distance and Minimum Distance- was prepared. Due to lack of urban area development and to avoid classification error, the urban areas were not considered in this classification. Finally, results from each method were reviewed separately and then the amount of each method and map accuracy and were evaluated. To determine the accuracy of the map, in fact, it will be clear that the map from Classification extent compatible with the realities of the earth. Value and usability of each prepared map depends on the degree of its accuracy. Very common and standard method for determining the accuracy of classified maps is the use of

III. RESULTS

A. Preparing the land use map by use of Maximum Likelihood method

This method is one of the best methods of remote sensing classified data [1].By using this method 4 different land use in region were separated, the results are shown in Figure 2.The Results of overall accuracy and Kappa Maximum Likelihood method are 53.13% and 0.2780, respectively.

TABLE I
RESULTS OF ERROR MATRIX BY MAXIMUM LIKELIHOOD METHOD

			Reference Data					
conditional Kappa	User's Accuracy	total	Dry Farming	Garden	Rangeland	Irrigation Farming		
0.3133	%54.13	109	2	0	48	59	Irrigation Farming	classified data done by user
0.3071	%65.63	96	26	0	63	7	Rangelands	
0.1568	%16.67	18	0	3	3	12	Garden	
0.2135	%33.33	33	11	0	15	7	Dry Farming	
		256	39	3	129	58		total
			%28.2		%48.8			Producer's
			1	%100	4	%69.41		Accuracy

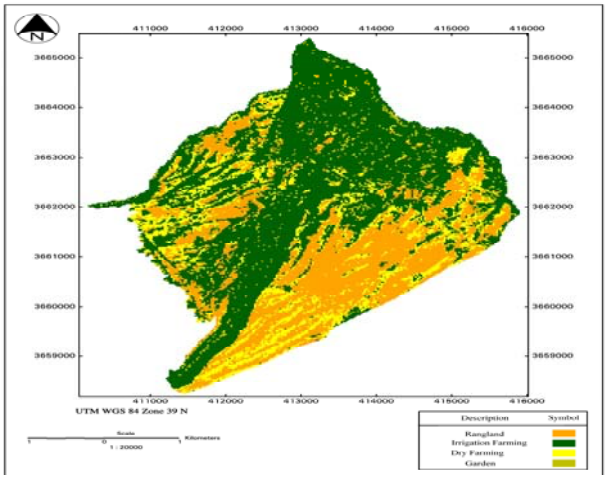

Fig. 2 land use Map prepared by Maximum Likelihood method

B. Preparing the land use map by use of Minimum Distance method

The Results of overall accuracy and Kappa Minimum Distance method are 48.44% and 0.2284, respectively.

TABLE II
RESULTS OF ERROR MATRIX BY MINIMUM DISTANCE METHOD

			Reference Data					
conditional Kappa	User's Accuracy	total	Dry Farming	Garden	Rangeland	Irrigation Farming		
0.4321	%62.07	58	0	1	21	36	Irrigation Farming	classified data done by user
0.3406	%67.29	107	25	0	72	10	Rangelands	
0.1231	%13.33	15	0	2	0	13	Garden	
0.0373	%18.42	76	14	0	36	26	Dry Farming	
		256	39	3	126	85		total
			%35.90	%66.67	%55.81	%42.35		Producer's

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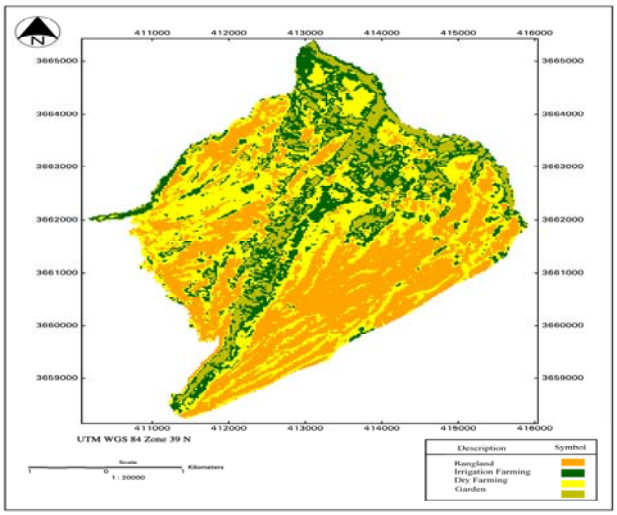

Fig. 3 land use Map prepared by Minimum Distance method

C. Preparing the land use map by use of Mahalanobis Distance method

The Results of overall accuracy and Kappa Mahalanobis Distance method are 56.64% and 0.3021, respectively.

TABLE III
RESULTS OF ERROR MATRIX BY MAHALANOBIS DISTANCE METHOD

conditional Kappa	User's Accuracy	total	Reference Data: Dry Farming	Garden	Rangeland	Irrigation Farming		classified data done by user
0.3099	%53.90	141	5	3	57	76	Irrigation Farming	
0.3138	%65.96	94	26	0	62	6	Rangelands	
-0.0119	%0	3	1	0	1	1	Garden	
0.2791	%38.89	18	7	0	9	2	Dry Farming	
		256	39	3	129	85		total
			%89.41	%48.06	%0	%17.95		Producer's Accuracy

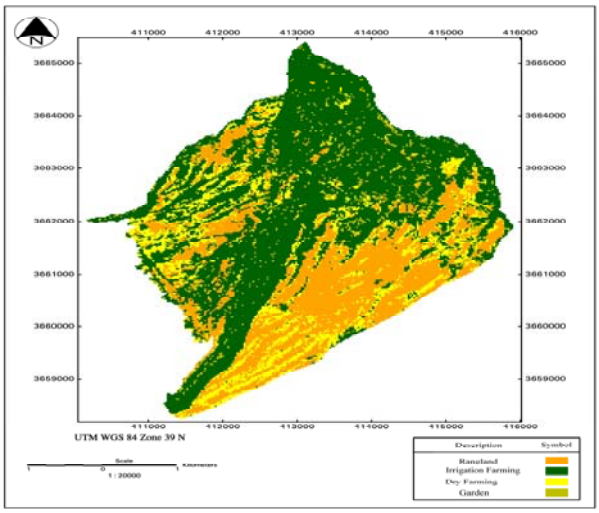

Fig. 4 land use Map prepared by Mahalanobis Distance method

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IV. Discussion and Conclusion

In this research to evaluate the accuracy of: statistical parameters such as error matrix, overall accuracy and classified coefficient Kappa for each map were extracted [4].To obtain accuracy of any of these methods first by ERDAS IMAGINE software randomly with ACCURACY ASSESSMENT command, 256 points in the region (except urban) was determined and the characteristics of this points were noted. Then each of these points was studied by GPS and the type of land use of every point was noted. Finally, by ERDAS IMAGINE software and ACCURACY ASSESSMENT command, error matrix and Kappa for each three methods for preparing land use map were used[5].Considering the low accuracy of these methods to separate land uses due to spread of the land uses, it's suggested the visual interpretation of the map, to preparing the land use map in this region. The map prepared by visual interpretation is in high accuracy if it will be accompany with the visit of the region [3].

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Ali Gholami was born in Tehran city in Iran on 19 February 1976. He was graduated with bachelor degree in agriculture engineering-soil science in 2000 and in master of science in soil science in 2005 from Islamic Azad university (in Iran in Isfahan province). He was accepted as ph.D student in Faculty of Agriculture and Natural Resources, Department of soil science, Islamic Azad university, science and research Branch in Tehran in 2006 and academic member of Islamic Azad university, Khuzestan Science and Research Branch in Ahwaz city of Khuzestan province) in 2007 and now he is studying his thesis in field of land use changes and its influence on soil physical, chemical and mineralogy characteristics.

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