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Research Article

THE USE OF BOLEAN LOGIC IN RS AND GIS TO DETERMINING THE FUNCTION AND SUITABILITY OF LANDS (TANGE BOSTANAK BASIN)

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ABSTRACT
Knowing the natural potential of an ecological and dynamic system seems necessary in the proper and comprehensive management. The use of new and updated methods and models for the assessment of real potentials of any usage is inevitable. In determining the harmony of a piece of land, the existence of variety, the degree and the scale of limitations indicate the different levels of the suitability of land. The present study has made use of the potentiality of RS and GIS by the use of BOWLEAN logic in an attempt to assess and classify the land harmony and the preparation of land application. Following this, the production and the combination of different information layers obtained through the new models and techniques including erosion, runoff, and land usage, vegetation, slope, DEM, soil depth, precipitation data extraction and the calculation of rainfall gradient, and preparing isohyetal map of the Lost Paradise watershed basin are the procedure which has been standardized by the BOLEAN logic and the combination of the components the proper and improper areas and areas with limitations were identified. The results showed that %81 of the basin plane had land harmony and %19 had harmony limitation for the present usage. %59.28 form the basin plane had the S4rdt condition which shows little harmony with topographic limitations (stone exterior) soil depth and slope. %10.82 of the basin plane had S4tep conditions which showed little harmony with high flood potential, erosion topography, soil depth and slope. % 13, 06 of the basin plane had S1 conditions which are completely suitable and have no limitation and %13.19 of the basin plane had S2d conditions which are considered as suitable with the limitation of the soil depth. In addition the general authenticity and Capa for P6 measuring tools of IRS satellites in 2005 were calculated 0.84 and 0.83 respectively.

Key Words: *BOLEAN Logic, Land Harmony, GIS, Lost Paradise, RS*

INTRODUCTION
The increasing growth of population has increased the strain on natural habitats and unsystematic manipulation and change of utilization has caused the destruction of ecosystems (Lu and Weng, 2007). The application of new techniques such as geographical information data base or the distant assessment which accelerate the identification and control and management of renewable natural resources seem urgent (Kazemi, 2011). Mohan (2005) believes that one of the common applications of geographical information data base if locating the suitable areas for specific utilization. In addition the use of RS and the alteration of spectral reflection of forest vegetation to non-forest vegetation are among the features that indicate the type of utilization and the degree of alteration in vegetation (Ghorbani *et al.,* 2006b). The growth of population all over the world, especially in developing countries and the urgency of supplying food for them have caused the irrational unsuitable utilization based on the potential and balanced use of water and soil resources. Blending of effective factors on different sectors of watershed, different dimensions and the people involved in the watershed area and also the models and data in different scales are the different dimensions of evaluation and management of the watershed basin (Sadodin *et al.,* 2010). A remarkable portion of forest areas of the high altitude in watershed basins have changed into agricultural lands which have caused the soil erosion and consequently the decrease in fertility of them

(Ustine, 2004). The increase of flooding, the fall of water quality and the change of economical and social infrastructure of different areas of watershed basin are the other negative results of excessive use of water and soil resources (Bayramin, 2003; Ghorbani, 2006a). The increasing growth of population has increased the strain on natural habitats and unsystematic use and change of utility have caused the destruction of ecosystems (Sadodin *et al.*, 2010; Jakman, 2005). The aim of the present study is the classification of watershed basin based on the natural potential and capacities of it for the improved utilization and the use based on the ecologic capacity of it. The qualitative classification of the harmony of land and determining the degree of harmony are based on the qualitative effective grading performed on the harmony. The study of land for different uses separately was done with no regard to their harmony with other usages and away from geographical distribution, the expanse and location of them since a piece of land with the same harmony but different degrees may be suitable for different usages. The study of space and environmental capacities is the first step toward stable development and land logistics. On the other hand, geographical information system has got a desirable capacity and potential for modeling and identifying the proper areas. The geographical information system's capacity allows us to make connections between different variables and use them for the analysis of the harmony of lands and locating them (Bayramin, 2003). Bowline logic is one of the common models for connecting information layers. Bowline mathematics logic (twin) was first introduced by George Bowl. There are two classified layers in this logic, one with correct value and the other one with false value. In the analysis based on Bowline logic different operators such as NOT, OR, AND, XOR are used. Of course it is possible to use the conditional combination of this software. Concerning the fact that the best and the most ideal conditions can be selected in Bowline method, the obtained results are more reliable and the certainty percentage is high and its definiteness is distinct. Some of the elements such as prioritizing for different factors, the internal changes of each variable, the concept description error and layer error cannot be operated in this method, which can be considered as a defect of it (Ghayomiyan, 2007). Including the studies done by Bowline logic are the works of Ghayoumiyan *et al.,* 2007) in locating the area for artificial feeding in the Govbandi region in the South of Iran. For the artificial feeding of standardized layers multiplied algebraically based on Bowline logic And Mohan and Shankar (2005) in India for locating a place for artificial feeding.

MATERIALS AND METHODS

The Basin Introduction

The examined basin for this study was the Lost Paradise watershed basin at nearly 80 kilometers Northwest of the city7 of Shiraz in the Fras province Southwest of Iran in the Geographical location of 52'o3'43" to 52'13'36" Eastern and 30'16'33" to 30'25'18" northern.

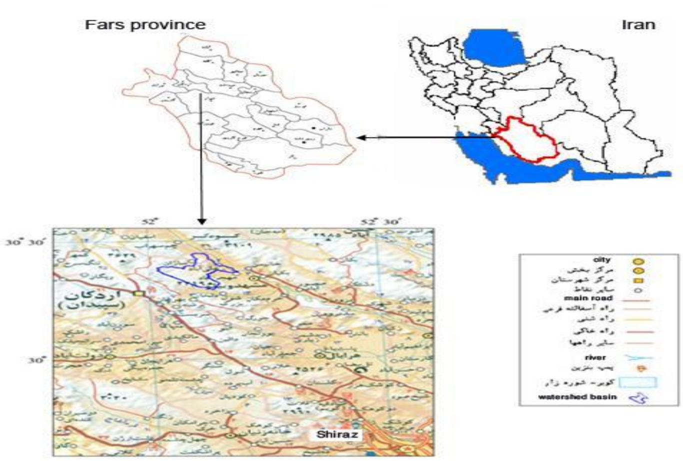

Figure 1: The location of the area under study and the access ways to it

The basin has a maximum height of 2729 meters and the annual precipitation of 609 millimeters and the average temperature of 13 degrees centigrade whose water enters the Bakhtegan Lake after entering the Kour River. Figure (1) shows the location of the basin and its access roads. As the first step of the study, the KML Layer of the boundary of the basin was made and it was loaded to GOOGLE EARTH software. To test the precision and exactness of making borderline the capacity of AreGis software was used. Then DEM map was prepared by the use of TPSS algorithm. The slope map was prepared by the use of DEM from topographic layers, waterways, elevated points and the basin boundary. The satellite images of IRS P6, 2005 were used to make land utilization maps. Digital maps of 1:25000 (Hydrographic and road networks) by the state Surveying Organization were used to correct geometric errors. Geometric correction is the foundation of using satellite images. The Affin equation is more appropriate for site correction because of its measurement of four main elements of location and the scale of sites, their extension and turning (Mather, 2005). The minimum land control points for site correction was calculated based on the multi sentence functions rate of Wolberg method (1990) (equation 1).
K=(N+1)(N+2)/2 Which means:
K is the minimum required points and N is multi sentence functions rate
Land control points and also the Affin equation which is a linear function were used for Geometric correction of P6 images with 14 points respectively.The Root Mean Square Error (RMSE) was 0/106 for the mentioned images respectively. For the radiometric correction, the Histogram Equalization algorithm was used based on the equation 2 and the radiometric error was also corrected. As the atmosphere has the maximum effect on the wave lengths shorter than 0/5 m and the minimum effect on longer wave lengths and the atmospheric dispersion lowers the contrast of images (Lu and Weng, 2007) histogram Equalization was used to eradicate the problem.

Equation (2) $$Y = \frac{X - X\min}{X\max - X\min} * 255$$

In which Y=output number of light degrees, X=Input number of light degrees, Xmin=minimum light degrees, Xmax= maximum light degrees.
Satellite image wave lengths have negative or positive correlation. The existence of correlation between image bands indicates the existence of common data, i.e. the more correlation exists between the bands, the more common data can be found (Huang, 2002; Mather, 2005; Ghorbani, 2006b). Using statistical features of training area, is the most common method of selecting the best bands from among the obtained bands (Lefsky, 2003) for this purpose the optimum index factor (OIF) (Chavez *et al.*, 1982) was used (equation 3). The band combination which contained the highest optimum index factor (OIF) was used as the best combination in this method.

Equation (3) $$OIF = \frac{\sum_{j=1}^{3} SDi}{\sum_{j=1}^{3} |CCj|}$$

In which $\sum_{j=1}^{3} SDi$= total standard deviation of the three bands, $\sum_{j=1}^{3} |CCj|$= total absolute value of correlation coefficient between two bands of three band
After the selection of the best band combination tutorial samples were prepared. In the selection of the samples, it was attempted to perform the sampling from all analogous regions so that the spectrum value of the image pixels could be compared with tutorial samples and the pixels could be placed in separable categories. It is worthy of mention that in the sampling process, the vegetation data map with NDVI index and its change into vegetation percentage was used to make a definite sampling from different vegetation

cover of land including the middle ranges or forests with the subdivision of weak range. Concerning the available data of the region and also preparing the tutorial samples by the use of Global Position System (GPS) and the use of controlled classification using the maximum probability method, the working map for the intended 2006 was prepared.

Using the random matrix of the g variance and covariance (Kazemi, 2011) the authenticity of the prepared layers was evaluated by processing satellite images.

The overall assessment of the correctness of the proposed Dellapiane and Smith method (1999) was calculated (Ghorbani, 2007) (equation 4).

Equation (4): $OA=1/N (\sum P_{ii})$

In which: OA=overall correctness, N= the number of tested pixels, $(\sum P_{ii})$ = total pixels classified correctly

For the assessment of Kappa coefficient, the proposed Fody method (1992) was used. (Equation 5)

Equation (5): $K=(OA-1/q)/(1-1/q)$

In which: K = Ka[ppa coefficient, Q = pixels not classified correctly.

Finally, the amount of classified sections was assessed based on the Jensen method (2005) on data levels %1 and %5 and following the equation (6).

Equation (6): $S=P–(Z(PQ/N)^{0.5}+(50/N)$

In which: R=the percentage of data levels, P= the percentage of correctly classified samples

Q= the percentage on wrongly classified samples that were assessed by the relation Q=(100-P)

N= number of samples

Z = The modified amounts of r based on the table z which were assessed by the relation Z=(100-r)/100

S= the definiteness certainty

Data analysis was done on two levels of 1 and %5 and the amount of z to the mentioned data was assessed based on the data conversion table r and z respectively 2/05 and 1/645

Then choosing the best band combination (Chavez, 1982), the separation of soil types on the mentioned image and saturation calculation with double cylinder (Kazemi, 2011). The analogous points throughout the basin hydrologic soil class maps were prepared. In the next step, having made a two way table of land utility and hydrologic soil classes, the informative data layer curve number was prepared in GIS field and by the use of this map, the soil informative data layer keeping coefficient by the relation $S = \frac{25400}{CN}$ - 254 (in which CN is the number of curves)was prepared. Also after obtaining precipitation data of the last 24 hours of the surrounding and inside the basin stations and the regression relation with definiteness percentage of 0/94 between the stations and the 24 hours precipitation based on the relation P=0/208H+ 21/2 (in which H is the height of the station by meters) was obtained and the use of numeric model map helped to prepare the height of the based by the TPSS method and was placed in the precipitation gradient relation to make co-rainfall areas of the basin. Having prepared the above mentioned data layers and modeling the formula SCS based of the relation $Q= \frac{(P-0.2S)}{(P+0.8S)}$ (in which P is the 24 hours rainfall by millimeters and S is the soil keeping coefficient) the running water layer of the basin was also obtained. Then using the ICONA model, the examined area was partitioned for the erosion risk. The ICONA has been presented by the Nature Protection Committee of Spain for Mediterranean and semi Mediterranean climates and microclimates. The following chart shows the different stages of this model (Bayramin, 2003). Chart 1 shows different stages of ICONA model.

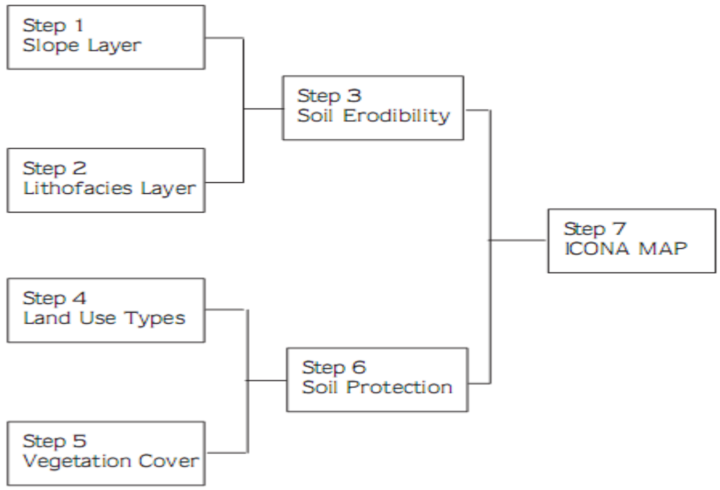

Chart 1: Stage of ICONA Erosion model

All of the stages of this model were done in GIS field. As it was mentioned, the map of vegetation percentage was prepared by NDVI index and satellite image. Also the flooding potential map was made by the capacity of GIS. This layer has geological and sensitivity of components in itself. It is worthy of mention that the map of soil depth was prepared by the use of satellite image and soil type identification and field sampling were prepared by the Geographical data base software (the used layers in Bolean logic include: slope and topography, vegetation, running water, erosion, flooding capacity, and the soil depth which' of course, have other maps inside them and the effect of them show themselves indirectly in standardizing). It is worthy of mention that weight giving operations in the geographical data base was done in this way. After opening the data table related to the intended layer, a new field labeled NUMBER was added and then using the Query and Calculator icons, the intended numbers were input and then these standardized layers were joined together based on the Bowline Logic. Based on the research objective, the most sensitive operator, AND. Which obtains the common sets based on the set hypothesis, was used (the proper values S and the improper values N were mentioned conventionally in the layers bank). Usually the classification of land harmony is done in four levels including: ranking, class with degree, subclass and unit and the present study will deal with the level of sub class of land harmony. In more comprehensive studies performed in larger scales and shorter spectrum the unit level is also included (Ghayomian, 2010). The S symbol exists in four classes as follows: S1(Highly suitable) this class included the lands with no limitation in utility, S2 (Relatively suitable) this class included the lands with little limitation in utility ,S3 (Moderately suitable) this class included the lands with moderate limitation in utility and S4 (with low suitability) this class included the lands with a lot of limitation in utility and using them is not economically feasible and spending assests on them has little justification. The N symbol in two classes indicates the following: N1 (currently not suitable) the limitation on these lands is very high to the extent that it is not possible to use them in the present conditions; however, with the advancement of technology and the studies being done continuously on the use of different types of land, it is possible that in the future the limitations be eradicated and the use of these types of lands become economically feasible. N2 (permanently not suitable) in this class or degree the harmony between quantity and the type of land limitation is in such a way that there is no possibility to use and utilize of land for any main purpose (agricultural). As in case of rock and stony surfaces, the type of main limitations in the land, which causes the classification and determining the degree of harmony of land, is in itself indicative of sub classes or sub-degrees of harmony. The sub-classes include one or some qualities of land the limitations resulted from them cause the fall of harmony in land. This is usually shown by conventional symbols which, in the present study, are shown by lower case letters to indicate the type of limitations and are written in front of the harmony degrees. For instance, to show the water erosion the letter (e) is used. The harmony formula S4e of lands or the low degree of harmony for the intended utilization is very high because of the existence of limitation in water erosion. As for topographic limitation, the letter (t) is used and for low depth of soil the letter (d) and for water erosion the letter (e) and for the limitation in flooding the letter (P) are used. In determining the land harmony of the basin under study, the components and units of land were selected as the study unit and the map and the features, limitations and harmony degrees of any of the components for each one of the main utilities were studied separately; as a result of which, each of the land unit components in the basin have the somewhat the same harmony. To determine the harmony in land unit components, the features of each component was synchronized based on the conditions and the type of expectation for each utility and considering the type and the amount of limitations in them, harmony or non harmony with each of the main utilities were determined. Using the weather report record of the region(region precipitation was 609/3 and the potential perspiration and sweating was 1389/1) and identifying the dry farming areas by the use of distant assessment tools, the capacity of these regions from the ecological point of view was studied. This showed that regarding the rainfall degree and unsuitable soil condition, the high or nearly high slope, in perspiration and sweating at the time of flowering and seeding and the low penetration of water in the soil caused the scarcity of moisture for the plant and the need for complementary watering and consequently dry farming will lose its usefulness and quality because of high altitude and lack of access to springs and running water.

RESULTS AND DISCUSSION

Geometric correction is one of the first steps in using satellite images and is considered the preliminary step in pre-processing images. The selection of method for geometric correction depends on the altitude of the region – the minimum required points and the minimum intended precision (Mather, 2005). Using Afain equation is more efficient because of having the four main indicators of location and the point scale, their stretching and twisting. As the atmosphere on the wavelengths shorter than 0/5 µm has the most effect and the higher wavelengths have the least effect and also atmospheric dispersion lowers the contrast in the images (Lu and Weng, 2007) equal rectangles were used to eradicate the problem because it is possible to distinguish the data dispersion spectrum of any phenomenon, the study of the variety of phenomena, the increase of contrast and the similarity and coverage of the data spectrum in the bands by equal rectangles (Mather, 2005). Since the stretch in the equal rectangles is of the linear type, the pixels have been place by new numeric arrangement (255-0), therefore, the contrast and variance between used Peaks and Tails of the image spectrum increased. So preparing the pixel dispersion in separate groups became possible by the use of algorithm. To make variance in the region, the diagram peak was increased and the tail was reduced. The wavelength of satellite images has positive or negative correlation. The existence of correlation among the image bands is an indication of common data. It means that, the more correlation exists among the bands, the more common data exists (Hang *et al.,* 2002; Ghorbani *et al.,* 2006b). However, the purpose of the present study was to find band with high co- variance. In other words, the more the difference between the spectrum reflection among the bands, the more possibility of differentiating between the faults and phenomena with a high precision (Kazemi, 2011; Stehman, 2004). The results of desired indicator factor in the T.m measuring with wavelengths of 0/90 µm -0/76, 0/69 µm -0/63 and 0/6 µm -0/52 and the P measuring factor with wavelengths of 0/89 µm - 0/78 -0/68 µm -0/61 and 0/59 µm - 0/50 with the best band for band combination respectively were chosen. Concerning data classification, it was attempted to compare the spectral values of image pixels with edifying samples using computer software so that such pixels are placed in separable classes. The cases were studied. Numerical classification is based upon spectral differences of different phenomena on various spectral bands. However, it does not mean that each phenomenon is not separable on each specific band. For this purpose, most of the researchers, (Ojigi, 2006; Moundia and Aniya, 2005) have used experimental classification. The maximum probable similarity algorithm has been the most common classification method in most studies (Lu and Weng, 2007). The main feature of this method is based on statistical mean and standard deviation parameters in a multi dimensional space of bands and after calculating the belonging probability of each pixel to different classes, the pixel is allocated to a class with the most probability. Since the basis for using this type of algorithm is the normal condition of the image, therefore, the selection of experimental samples, to lower the standard deviation to the class mean and also increasing the class mean from each other, it was tried to select the samples from analogous regions with smaller areas, in large numbers, with desirable dispersion and identical shapes in each class to help to a better separation of operational classes. Examining the accuracy of the degree of correspondence resulted from the classification with ground reality. In the total accuracy which evaluating criterion of the classification and is obtained by the random matrix proposed by Dallapiane and Smith (1999) added to the image from total classified correct pixels of all classes added to the image pixels and consequently the criterion can be used for the general accuracy of the produced layer. The Kappa coefficient is also another criterion for the map accuracy. The coefficient indicates the concord of the resulted from the classification with ground reality and fluctuates between zero and one. The number one indicates the hundred percent concords in classified layers with ground reality. Using these two methods, the accuracy of the operational layers prepared from the mentioned appraisers was calculated 0/87, 0/85, 0/84, and 0/83 respectively.

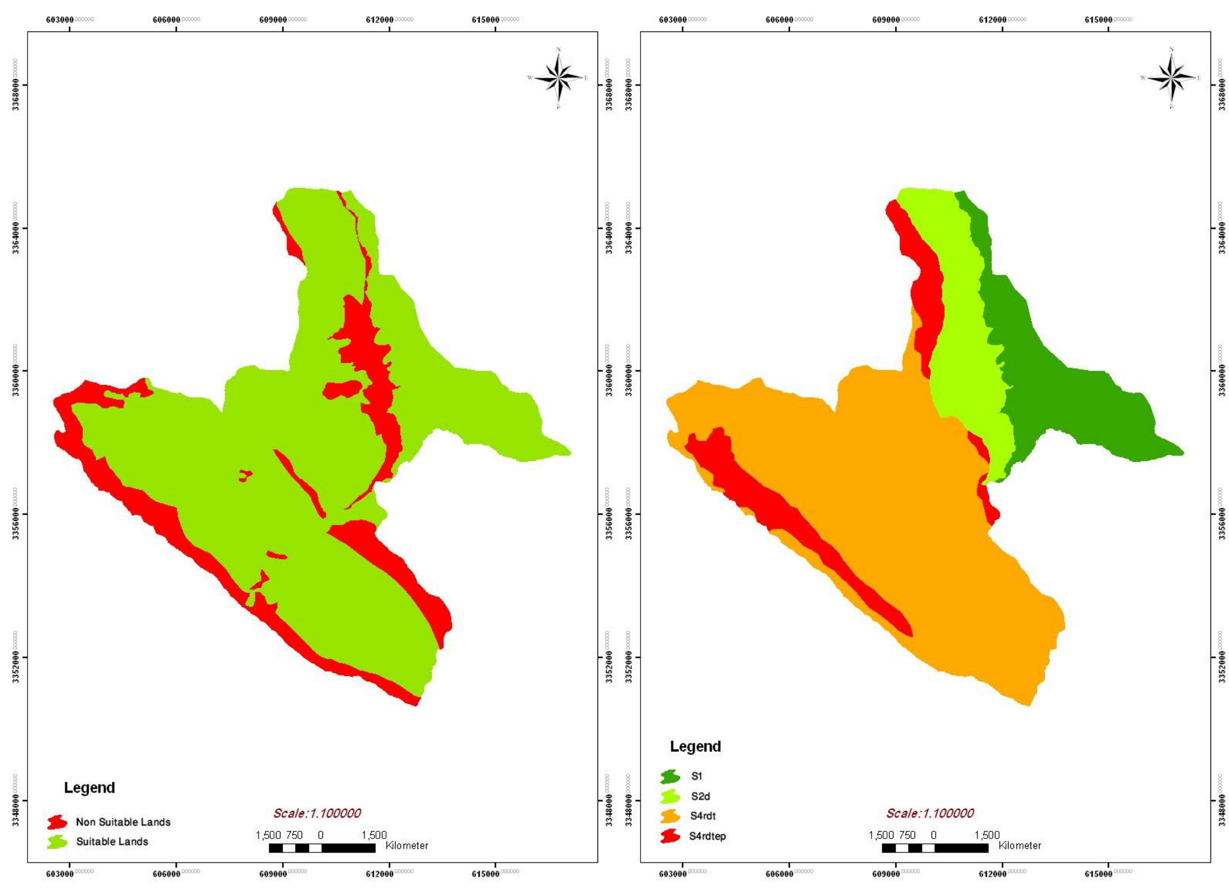

Figure 2 & 3: The maps of land Harmony and Land suitability of Lost Paradise Basin

One of the bases of basin region general management is taking the harmony of land into consideration and using proper models to achieve this goal in ecological sorting of agricultural lands. In the present study, SCS and ICONA models were used for the physical factors NDVI vegetation indicator was used for the ecological examination and for the highest percentage suitability and unsuitability criterion in the layers in Bolean Logic, for the mean the Zagrous forests were considered. The result of the blending layers which is the obtained areas and the limitations in land harmony is %59/28 from the basin area with the (S4rdt) condition which indicates low harmony with topographic limitations (stone appearance) soil depth and slope. %10/82 of the basin area has (S4dtep) conditions which indicate low harmony with the limitation of high flooding potential, erosion, topography, soil depth and slope. %13/06 of the basin area has (S1) condition which is competently suitable and has no limitation and %13/91 of the basin area has an (S2d) condition which is considered as suitable however, with the limitation of soil depth. The Figure 2 and 3 show the results.

In addition, the map of operation basin land harmony with its limitations and potentials showed that %81 of the basin area with the present operation is not suitable and %19 of the basin has too much operation capacity and adjustment or changing of the operation with the one in harmony with natural capacity should be taken into consideration. Including among these operations is dry farming located in the basin heights and in the slope of the heights which is more than harmony and out of the natural capacity of the basin.

The results also showed that the %/05 barren lands of the basin had increased to %0/21 and the dry farming lands had increased from %./5 to %1/65 of the basin that if we include the forests with dry farming underwood %/002 of the basin area has increased to %./51 and it indicates the growth of barren lands and dry farming lands. In contrast, the forest areas especially the ones with pasture underwood an average of %40/7 of the basin area has reduced to %12/33 which is equal to %.27/74 of the total basin area equal to 2267/38 hectares of the basin area. Also the average forested pastures (independent) of the basin area has reached to %3/61 from %4/06 which shows a negative growth equal to %4/45 of the basin area that corresponds to 36/38 hectares of basin. In contrast to this drop of pasture area with moderate vegetation has changed to pastures with weak vegetation and also the forest with moderate pasture underwood has changed to forest with weak pasture underwood.

To the extent that the expanse of weak pastures has changed from %/39 to %/75 of the basin area and forests with the pasture underwood have changed into forests with moderate pasture underwood.

In other words, in 1988, most of the basin area was covered with forests with pasture underwood while at the present time forests with weak pasture underwood cover most of the basin area. In general, the areas with moderate vegetation have decreased. The highest decrease of the basin area is related to the forests with moderate pasture underwood and the highest increase of the area is related to the forests with weak pasture underwood which is, in fact, a kind of alteration (in table 2 and figure 1 these changes and their growth have been mentioned). And also, concerning the accuracy of the developed maps, the overall accuracy (OA) and the Kappa accuracy of the water farming class, the overall accuracy was %92 and the Kappa accuracy was 0/91 in the 1988 which means the highest amount and the barren lands with overall accuracy of 0/72 and Kappa accuracy of 0/71 showed the lowest amount in the year 1988. Furthermore, in the year 2005, the water farming class with the overall accuracy of %92 and the Kappa accuracy of 0/92 had the highest amount and for forest class with the dry farming underwood had the lowest amount with the overall accuracy of 0/72 and the Kappa accuracy of 0/71 in the year 2005. Noting the figure 4 which was made by distant assessment techniques and satellite images and comparing it with figure 4 it can be said that the dry farming lands with the area of %1/56 out of the whole area of the basin showed an excess of the potential capacity of concord in the basin. The forest with dry farming underwood with an area of 0/51 percent out of the whole operation area was more than the potential o the basin and also the pastures with moderate tree cover with an area of %3/61 out of the whole area of the basin which was moderate forest and had changed into tree pasture as a result of demolition and excessive operation of the basin and needed protection and management to be restored to climax conditions.

Table 1: The operational map of Lost Paradise Basin

Table of statistical assessment of minimum percent of confidence in the processed classes

Minimum assurance percent (IRS) 2005		**Land use**
%5 statistical level	**%1 statistical level**	
83/4	82/28	Barren lands
85/2	84/18	Stone exogenous
58/6	56/38	Forest with dry farming underwood
85/1	84/4	Dry farming
80/8	79/7	orchard
87/06	86/57	Forest with moderate pasture underwood
81/23	80/66	Forest with weak pasture underwood
73/55	71/81	Residential area
76/22	75/37	Moderate pasture with trees
77/8	76/74	Weak pasture with trees
91/02	90/7	Water farming

In addition, some parts of the water farming areas located near the main waterway of the basin are more than concord and gully erosion, especially near the river can be seen in these areas and need to be corrected.

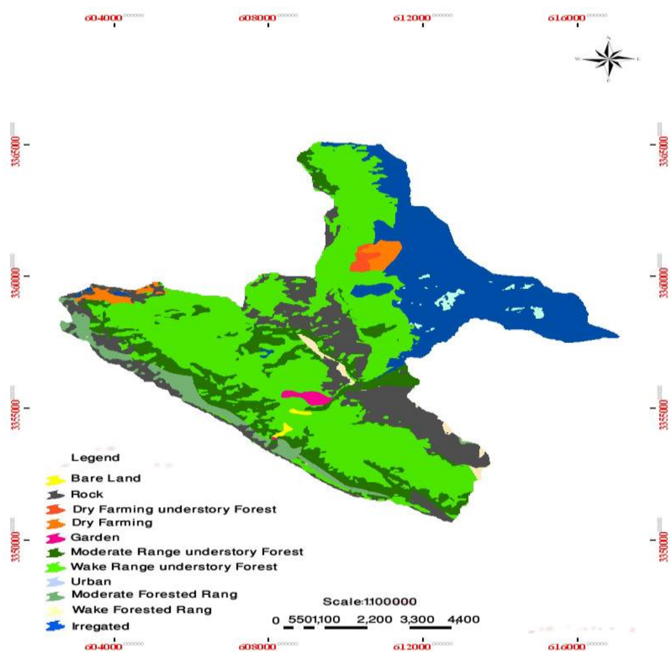

Figure 4: Current land use that created by RS technique

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The barren lands with an area of %0/5 out of the whole area of the basin are also the other regions of the basin with excessive concord and require management and correction. Water farming operation with an area of %21/24 out of the whole qarea of the basin had the heist land concord. Also, considering the biological conditions and including the growth period that is 174 days and the recommendation of FAO, the first decade after the beginning of growth period (the minimum rainfall of 30 millimeters) planting should be done. Concerning the performed calculations, the period of soil moisture for dry farming is short and insufficient; therefore, dry farming is not economical in the normal years and needs to be supplemented with watering. Therefore, based on the physical, climate and biological conditions this type of operation is not suitable. However, in S1 region, in which the index type of farming is rice, water farming is suitable.

Conclusion

The present study has used co-variance instead of high correlation between bands and their variance since high correlation of bands has caused the merging of data and the pixel values and at the time of eye vision, the objects and reliefs cannot be separated. However using the co-variance statistical index for bands makes the objects and reliefs to be seen more vividly and distinguishing between them and their separation will be much easier and more accurate. Therefore, it is suggested to study the reliefs and various phenomena the best index of band combination be used so the difference in spectrum reflection of bands make the separation of reliefs and phenomena with high accuracy become possible. The use of the potentiality of distant assessment and the combination of the data in the geographical data base and the preparation of new models in this field makes the analysis and refinement of an area for correct management possible. Concerning the existing maps and comparing them with each other and the resulted consequences, it can be said that the results show a good assurance level since in Bowline logic the issue of certainty and uncertainty is important and the ideal conditions are chosen in this method. Therefore by using geographical database, in addition to offering different studies with different objectives, the preparation and combination of data layers are done with necessary speed and precision. On the other hand, the need for up-to date data for the studies and programming, have made the use of distant assessment technique inevitable.

REFERENCES

Bayramin IO, Dengiz O Baskan and Parlak M (2003). Soil erosion assessment with ICONA model: Case study, Beypazari area, *Turkish Journal of Agriculture and Forestry* **27** 105-116.

Chavez PS, Berlin GL and Sowers LB (1982). Statistical methods for selecting Landsat MSS ratio. *Journal of Applied Photogrammetric Engineering* **8**(1) 23-30.

Dellepiane SG and Smith PC (1999). Quality assessment of image classification algorithms for, land cover mapping: A review and a proposal for a cost based approach. *International Journal of Remote Sensing* 20(8) 1461- 1486.

Foody GM (1992). On the compensation for chance agreement in Image classification accuracy assessment. *Photogrammeteric Engineering and Remote Sensing* **58** 1459-1460.

Ghayoumian J, Mohseni Saravi M, Feiznia S, Nouri B and Malekian A (2007). Application of GIS techniques to determine areas most suitable for artificial groundwater recharge in a coastal aquifer in southern Iran, *Journal of Asian Earth Science* **30** 346-374.

Ghorbani A (2007). Terrestrial Survey and Remotely-sensed Methods for Detecting the Biological Soil Crust Components of Rangeland Condition, The School of Natural and Built Environment, University of South Australia, Australia, A PhD Thesis.

Ghorbani A, Bruce D, Tiver F and Brien C (2006a). Biological soil crusts classification using ground-level spectra. In Proceeding of the 27th Asian Remote Sensing Conference, Ulaanbaatar, Mongolia.

Ghorbani A, Bruce D and Tiver F (2006b). Stratification: a problem in rangeland monitoring. In:

Proceeding of the 1st International Conference on Object-based Image Analysis (OBIA), Salzburg, Austria.

Huang C, Wylie B, Yang L, Homer C and Zylstra G (2002). Derivation of a Tasseled cap transformation based on Landsat 7 at satellite reflectance. *International Journal of Remote Sensing* **23** 1741- 1748.

Jakman A, Letcher RA, Rojanasoonthon S and Cuddy SM (2005). Integration knowledge for river basin management, progress in Thailand, *ACIAR Monograph* 118 13-28.

Jensen JR (2005). Introductory Digital Image Processing: A Remote Sensing Perspective. Englewood Cliffs, NJ: Prentice –Hall.

Kazemi M (2011). Impression of Landuse change on Flood risk potential. MSc Thesis. School of Natural Resources, Hormozgan University 148 (In Persian).

Lefsky MA and Cohen WB (2003). Selection of remotely sensed data. In: M.A. Wulder and S.E. Franklin (Eds), Remote Sensing of Forest Environments: Concepts and case studies 13–46, Kluwer Academic Publishers, Boston, USA.

Lu D and Weng Q (2007). A survey of image classification methods and techniques for improving classification performance. *International Journal of Remote Sensing* 28(5) 823–870.

Mather PM (2005). Computer processing of remotely–sensed images 3rd Ed, John Wiley & Sons, Ltd. 319.

Mohan G and Ravi Shankar MN (2005). A GIS based hydro geomorphic approach for identification of site-special – Techniques in the Deccan Volcanic province, *Journal of Earth System Science* **114**(5) 505-514.

Mundia CN and Anyia M (2005). Analysis of land use/cover changes and urban expansion of Nairobi city using remote sensing and GIS. *International Journal of Remote Sensing* **26** 2831-2849.

Ojigi LM (2006). Analysis of spatial variations of Abuja land use and land cover from image classification algorithms. In: Proceedings of the ISPRS Commission VII Mid-term Symposium" Remote Sensing: From Pixels to Processes*".* Enschede, Netherlands.

Sadodin A, Sheikhi V, Mosa Zadeh R and Halili MGh (2010). Analysis of vegetation-based bmanegment scenarios using MCDM in Ramin watershed, golestan, Iran, *International Journal of plant production* **4**(1) 51-62.

Stehman SV (2004). A critical evaluation of the normalized error matrix in map accuracy assessment. *Photogrammetric Engineering and Remote Sensing* **70** 743–751.

Ustine SL (2004). Remote Sensing for Natural Resource Management and Environmental Monitoring. 3rd Ed, **4** 522, John Wiley & Sons, Inc., Hoboken, New Jersey.

Wolberg G (1990). Digital image warping. Los Alamitos, CA: IEEE Computer Society Press 318.