The Spatial Analysis Of The Terrain Impact On Agricultural Land Use By Using Gis And Rs Techniques: A Case Study Of Soran District-Erbil-Iraq

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Hakan OĞUZ
Department of Environmental Engineering, Kahramanmaras Suzhou University, Turkey

Tarq K. Hassan
Department of Geography, Salahaddin University-Erbil-Iraqi Kurdistan
tarq.hassan@su.edu.krd

Farhad O. Omar
Erbil Polytechnic University- Iraqi Kurdistan
farhad.omar@epu.edu.iq

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Abstract

In this study, Soran District was selected as study area due to the fact that terrain elevation ranges between 361m and 3406m with many land use/land covers (LULC) types. The main objective of this study was to determine the impact of terrain over agricultural land use using GIS and RS techniques. Landsat 8 satellite imagery and DEM compose the main data for this study. Slope and elevation maps were derived from DEM using ArcGIS software and classified into six categories according to Zuidam Classification System. ERDAS Imagine software was also used to classify Landsat 8 satellite imagery in order to derive the LULC types of the study area. Slope, elevation, and LULC maps were overlaid on top of each other to determine the spatial relationship between slope, elevation and agricultural land use, pasture and forest. The final results indicate that there is a negative relationship between agricultural land use and slope. The steeper slope that area has, the less likely that agricultural land use will occur. 70% of the agricultural land use has slope of 0-18 degrees. On the other hand, there is a strong relationship between slope and forest. The more sloped the area is, the more likely to be the forest. It was determined that 80% of the forest in the study area has slope of 18-24 degrees. It was also found that 72% of the pasture has slope of 12-24 degrees. It was also found that 84% of the study area's elevation was over 900m. Elevation has also negative relationship with agricultural land use. This is the main reason that only 7% of the study area is used as agricultural land use. Results also indicate that 30% and 14% of the study area are pasture and forest.

Keywords: Terrain, Slope, Elevation, Agriculture land use, Pasture

1. Introduction

Terrain consists of the physiography, lithology, morphometry, soil geography and to some extends land cover (Meijerink, 1988). The abiotic attributes (relief, geological or geomorphological processes, lithology, soil, etc) and hydrological condition complemented by vegetation/land-cover types characterises the terrain, (Van Zuidam, 1985). Terrain analysis for land suitability is a process through which fractal nature of terrains along with various biophysical processes are quantified or attributed into thematic layers. These thematic layers containing information of local land system are then synthesized through an overlay function in Geographical Information System (GIS) which helps in delineating different suitability classes of terrain. The resultant terrain units presented in the form of map and report are meaningful to a local user (Ceballos-Silva and Lopez-Blanco 2003a). Quantification of terrain for land suitability necessitates compilation of data on requirements of land use / land cover, determination of biophysical potentials and identification of more or less homogeneous land mapping units (Kilic et al., 2005). Land use land cover is two components that are relating together, then for a while have been studied independently. Land cover like the physical shape of the land, it‟s mainly apart of natural scientists while land use as the people establishment of land, also mostly the focus of human scientists (Turner II and Meyer, 1994). Land use is

presented to human works and the different uses which are carried on land. Land cover is identifying "Natural Vegetation, Water bodies, Rock/Soil, artificial cover and other noticed on the land" (Kumar, 2011). Often confused and not clearly replaced with land cover and the „land use" idea has developed above new decades to be mainly viewed like the socioeconomic task of land. While land uses land cover by satellite imagery have been one of the goals of the assessment of the new technologies with methodologies from the start of the remote sensing period. Several existing information systems are combination land cover and land use where natural or semi-natural pasture and natural vegetation are described in kinds of land cover and urban or settlement farm land and agricultural areas in tapes of land use.

This study will help the interested researchers, planners and investors in the agricultural field study to understand the characteristics of terrain and impact on the use of agricultural land in the Soran District.

2. Study Area

The study area is located in the north and northeast of Erbil Erbil Governorate, however located in the north and northeast of the Iraq. Moreover, in Province of Erbil it has administrative borders with four of the province districts Choman district, Rawandiz district, Shaqlawa district, Mergasor district, and to eliminate administrative border with the Governorate of Sulaimaniya from the south-west and the south-Eastern borders are part of the natural border of the Governorate of Erbil because of The River Great Zab who is the administrative border between the provinces of Erbil and Duhok. The northern border state of Turkey and Northern borders the eastern state of Iran. The geographical location of the Soran bridge link between Iran and the Turkey with the Republic of Iraq.

The study area is located between latitudes (37 .10´-(36˚.30´) N, and longitudes (44˚.50´-(44˚.10´) E. Location is one of the important factors in the effect on agriculture in any agricultural area because the location factor has an impact on the amount of rainfall, quality of the soil and then the quality of the plants that can be grown, The study area, within its current borders occupies a large area of Erbil governorate show Table (1) and Figure (1).It is including large area of 2116.38 km2, or equivalent %14.62of the total amount of the province space 14471 km2. The study areas have four sub district Sidakan, Diana, city center Soran and Khalifan.

Table (1) Area of Administrative Unit's Sub Districts of Soran with Population

Sub district	**Population**	**Area km2**
Soran	60755	5.91
Khalifan	37072	417.51
Diana	64156	162.72
Sidakan	16244	1530.24
total	178227	2116.38

Source: from the work of a researcher depending on Arc GIS 10.3.and KRG of Iraq, Ministry of Planning, foundation of statics Kurdistan region, the population of Soren (2015)

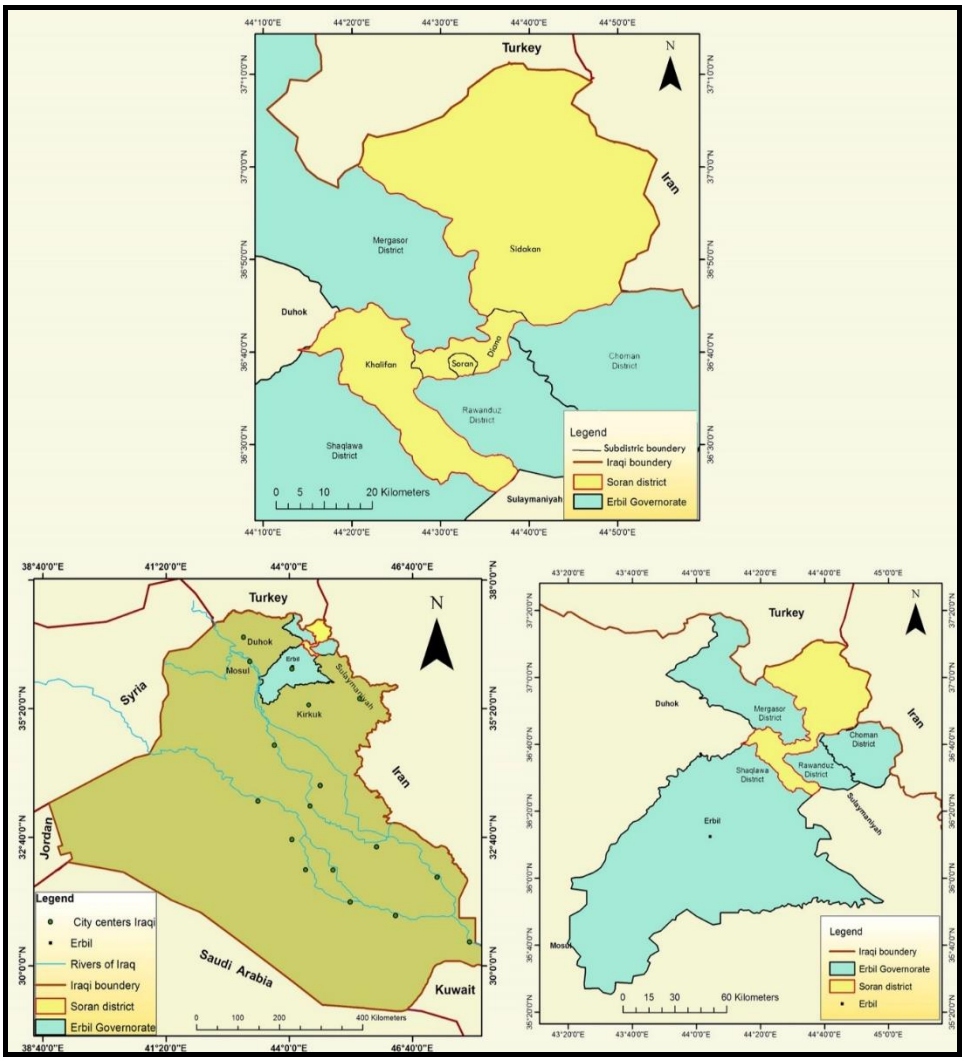

Figure (1) Location of Soran District in Erbil Governorate.

3.The Physical Factors in the Study Area

3.1. Land Surface

The shapes of land Surface affected to land use land cover and agricultural production to the plains, the lower areas most suitable for cultivation and settlement, at the same time in the highland areas this does not mean a lack of production in the highland areas due to the presence of some agriculture crops, pasture and forest on the high area (Barazi and AL-Mashhadani, 1980). The elevation of Soran district has 361 - 3466 m with difference land use types show the Figure (2). narrow and deep, then the use of agricultural land and agricultural production that their areas are complex and can be used in the planting of trees, forest and natural pastures. And between the high mountains have valleys such as (Sidakan Valley and Valley Barazgr) and small plains mountain such as (Sidakan plain and Barazgr plain) used for agricultural production (Al-Hadad, 2000).

Moreover, simple mountains sprains amounting in the center and south of Soran district, and its contain all the kinds of shapes Terrain Mountains, plains and valleys. While the Simple Sprains Mountains enough to point to the existence of some areas over the elevation where about 361 -2000 m. while Have the most important plains in this region is plain‟s Diana and this plain is the most important human settlement centers, however plain‟s Alana is located on Alana‟s valley and it is one of the most important sites for the use of agricultural land and production of agricultural crops and forest, the importance of this plain is in a river

of Alana that help agricultural crops, moreover plain‟s Biaw is one of the smallest plain in the study area and use for agricultural crops (Kahraman, 2004).

It has great diversity of natural land surface in the study area. However, it is a complex and series high mountains That their hight ranges between 600-3466 m, as well this area is located in the northern parts of study area that is contain Sidekan sub district. The space between the chains and valleys that is

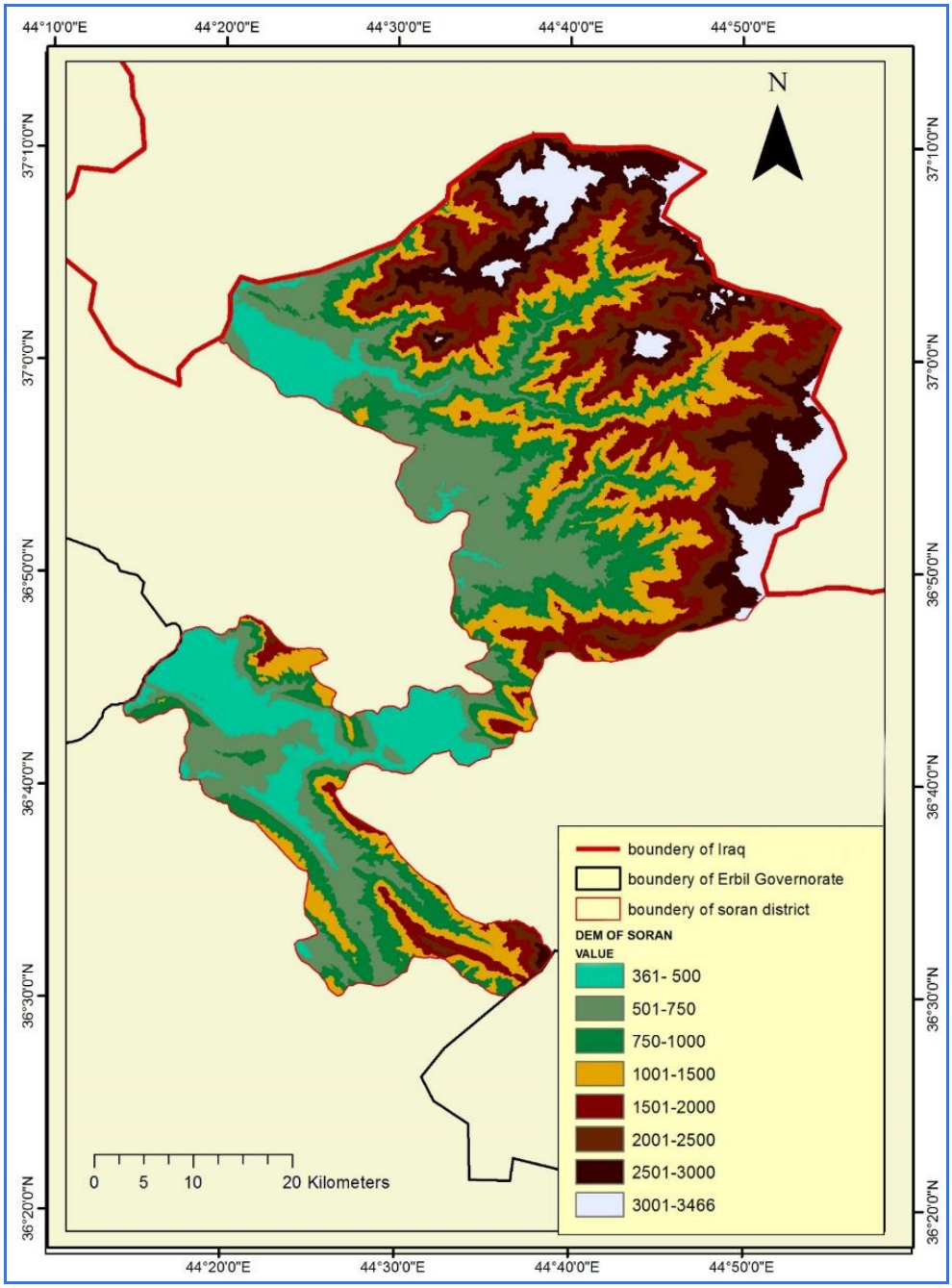

Figure (2) Land Surface of Soran District Worked by Researcher Depending on DEM.

3.2. Climate

The climate is the largest natural factor on the land use land cover and agricultural land use, specifically agricultural crops and crop varieties which identifies areas that can be grown and given crops (Al. Bana, 1990). As that the major factor in the climate and soil formation of

different types and degree of fertility, and that the most important climate affecting agricultural production of rainfall elements, temperature, relative humidity and wind.

The climate of the Soran district is included of warm dry in summers and cools wetly in winters. Usually precipitation starts in October in autumn and ends in May in spring. This district is characterized by rich rains more than 600 mm for each year. Show Table (2). Precipitations in study area are changing from station to another station depending on the geographical location, elevation and climatic conditions of district. The most quantity of rainfalls in winter is 123.9, 107.5 and 118.5 mm for the Sidakan, Soran, and Khalifan stations respectively. However, in summer the lowest quantity rainfalls is 0.4 mm for Soran station, changing amount of precipitation has affected on agricultural land use and crops that is a factor for decreasing agriculture in the summer.

Table (2) Average Rainfall and Elevation from Stations of Soran District

Stations	**Elevation**	**Average rainfall in summer (mm)**	**Average rainfall in autumn (mm)**	**Average rainfall in winter (mm)**	**Average rainfall in spring (mm)**
Sidakan	983 m	0.7	44.7	123.9	84
Soran	680 m	0.4	34.4	107.5	72.2
Khalifan	704 m	0.5	40	118.5	72.1

The seasonal temperature has a big difference between winters and summer in the study area, present the Table (3). It decreases from study area in winter 10.53 Co while the temperature increases in summer 38 Co in Soran station. It also effects the evaporation and limits crop production. However, in another way impact on humidity, relative generally their average annual 63.1%. However, the relative humidity is due to the low temperatures, lack of rainfall and evaporation. For the characteristics of wind speed in the study area, the data as shown in the Table (3), with the highest recorded speed of 2.12 m/s in spring to Soran station, while the minimum wind speed in summer 1.59 m/s.

Table (3) Average Temperature, Relative Humidity, and Wind of Soran Station

Average speed of Wind Seasonal m/s	**Average humidity relative Seasonal %**	**Average temperatures of the seasonal (Co)**	**Seasons**
1.88 m/s	50.0 %	38 Co	Summer
1.75 m/s	61.4 %	26.43 Co	Autumn
1.59 m/s	74.9 %	10.53 Co	Winter
2.12 m/s	66.1 %	22.13 Co	Spring

Source: the work of a researcher depending on the KRG of Iraq, Ministry of Agriculture and Water Resources, General Directorate for the cultivation of Erbil, climatic data for agricultural station and rainfall for the period (2002-2015).

4.Data Sources:

The primary data used in this study are two Landsat images obtained from the USGS Earth Explorer website and Geo-referenced to UTM zone 38, WGS 84. Both images are from Landsat-8 and the images were retrieved in August. The images were chosen as being sufficient for detecting spatial analysis of the terrain impact on the agriculture land use. In addition, secondary data and materials used in this study are illustrated in Tables (4) and (5) however used in the study area to make mapping and specifically types of agriculture land use or land cover types.

Table (4) Input Data Used and Satellite Image Descriptions

LANDSAT/ 8	**LANDSAT/ 8**	**Satellite**
2016-08-10	2016-08-10	Date
07:26:39	07:26:40	Time
LC81690352015236LGN00	LC81690342015236LGN00	LANDSAT SCENE ID
169	723	WRS Path
35	34	Row
UTM Zone 38	UTM Zone 38	Map Projection
WGS 84	WGS 84	Datum

Source: The work by a researcher depending on https://earthexplorer.usgs.gov/

Table (5) Secondary Data Used in This Study

Date	**Descriptions**
Map of Iraq with the province of Erbil and major cities	This is a file format Arc GIS system. That it contains information the borders of Iraq, Erbil Governorate and governorate center.
Map of study area	Soran district boundaries, this is a file format Arc GIS system, which borders Iraq and Governorate Erbil.
DEM	researcher has been adopted digital elevation model accuracy (30 m) and from the (USGS) Earth Explorer. Web.
The Weather stations data	This is an Excel file in agricultural and climatologically stations, which contain the climate elements recorded from 2002 to 2015. These standards are: precipitation, temperature, humidity and wind. In Soran stations, Khalifan and Sidakan.
Library sources	Library subject, Global Studies and scientific research references that have to do with this.

5. Software Used

ERDAS IMAGINE version 14 and ArcGIS 10.3 were used to analyze the images, evaluate the results, converted raster to vector and mapping. The Google Earth is also utilized as an added source for more information about Iraqi boundary and land cover types in the study site. Microsoft Excel was used for statistical and regression analysis purposes, and for producing charts and graphs.

6. Supervised Classification

Supervised classification is one of the methods to retrieve land use land cover from satellite imageries. This method is working to account and resolve preparing data needed to the spectral signatures for land use land cover classes that are divided into seven different classes: urban, forest, pasture, agriculture crops, barren land, rocks and water as shown in Table (6). Using spectral signature, this image was classified using all pixels. Also, this method is very important because that is utilizing accuracy and retrieves the complete classification in Soran district. The study area of land use land cover has been found by utilizing supervised maximum likelihood classification algorithm for this study; because the supervised classification is general using and important method than other methods that complete on a mixture of background information and private information of the Soran district.

Table (6) Description of Land Use -Land Cover Classes

Class name	Description
Urban	Location that have been Humanity settlement, building or location of commercial, industrial and transportation.
Agriculture crops	vegetables, orchard and fruits
Pasture	Grasses, some trees and drought grasses
Forest	Nature forest, Alpine shrubs and including shrubs.
Empty land	Land Drought, no vegetation, no agricultures in this land and bad land
Rocks	rocky mountain, stone, cliffs and badlands diffuse high-elevation vegetation
Water	Surface water, rivers

7. Slope

The Slope is one of the main parts in landform classification that has been useful in many researches. The slope is generated from a terrain ratio, which represents the ratio of elevation between two points by the horizontal straight distance divided to vertical distance (De Winnaar, 2007). In this study depending on classification Zuidam that is one of the most importance methods that are used for slope degree. It has been using colors to differentiate slope degrees of each area from the others. Table (7) shows the colors with a rating Zuidam (Van Zuidam, 1979). The selection of surface features terrain type as well as easy to determine the slope degree for six categories anywhere in the study, according to the classification of phenomena.

Table (7) The Slope Classification

Shapes	Slope degree	Colors
Ground flat	0-2	Dark green
Land a few slopes	2-7	Light green
Land slanted	7-12	Yellow
The land slope is medium	12-18	Orange
The land is sloping	18-24	Light brown
The land is intense steep	24 and above	Dark brown

8. Elevation

The elevation is an important factor in the study of LULC and agricultural land use, particularly in the different terrain the study area, as elevation difference from the sea level and effects clearly on the growth of plants and the distribution of their collections president and the agriculture land use. A digital elevation model is a main resource for analyzing and making an elevation map. As well as the elevation was reclassified by the correcting digital elevation model into 6 classes Table (8) The classes represented Plain of mountain, Basins Mountain, The mountain slopes, Alluvial fans, The Mountains and the high mountains (Hasan 2013; Chabala et al., 2013). The reclassification was based on field observation made during the beginning field visit.

Table (8) The Classification of Elevation

Class	Elevation range(m)	Description
1	361-700	Plain of mountain
2	700-900	Basins mountain
3	900-1150	The mountain slopes
4	1150-1500	Alluvial fans
5	1500-2000	The mountains
6	2000-3466	The high mountains

9. RESULTS AND DISCUSION

9.1. Land Use Land Cover Results

The outcomes of the supervised classification, based on the mosaicked Landsat image 2016, were illustrated in the form of table, figure and map. The supervised classification statistics for all land use land cover can be found in Table (9), which shows the spatial patterns of land cover type in square kilometers, coverage percentage of individual class areas and Figure (3) displays the percentage cover of each individual class area statistics of 2016. Digital maps of remotely sensed images and supervised classification for all LULC for 2016 are shown in Figure (3) respectively.

It is observed that in 2016 the largest area was covered by pasture which made up around 30.618% of the total area. However, the second area was barren land during this period with 29.109%. In contrast, forest during the year under investigation, as we can see, from 14.564%, The Rocks were located around 16.559%. Also, the other areas that were used by agriculture crops which from 7.167%. And the Urban water contained area which made around 1.258%. The last class area was covered by water body which is 0.725%.

Table (9) Land Use Land Covers results

No	Classification	Area (km2)	Percent%
1	Urban	26.634	1.258
2	Forest	308.217	14.564
3	Pasture	647.088	30.618
4	Agriculture crops	151.837	7.167
5	Empty land	616.018	29.109
6	Rocks	351.077	16.559
7	Water	15.359	0.725
Total	----------	2116.23	100.00

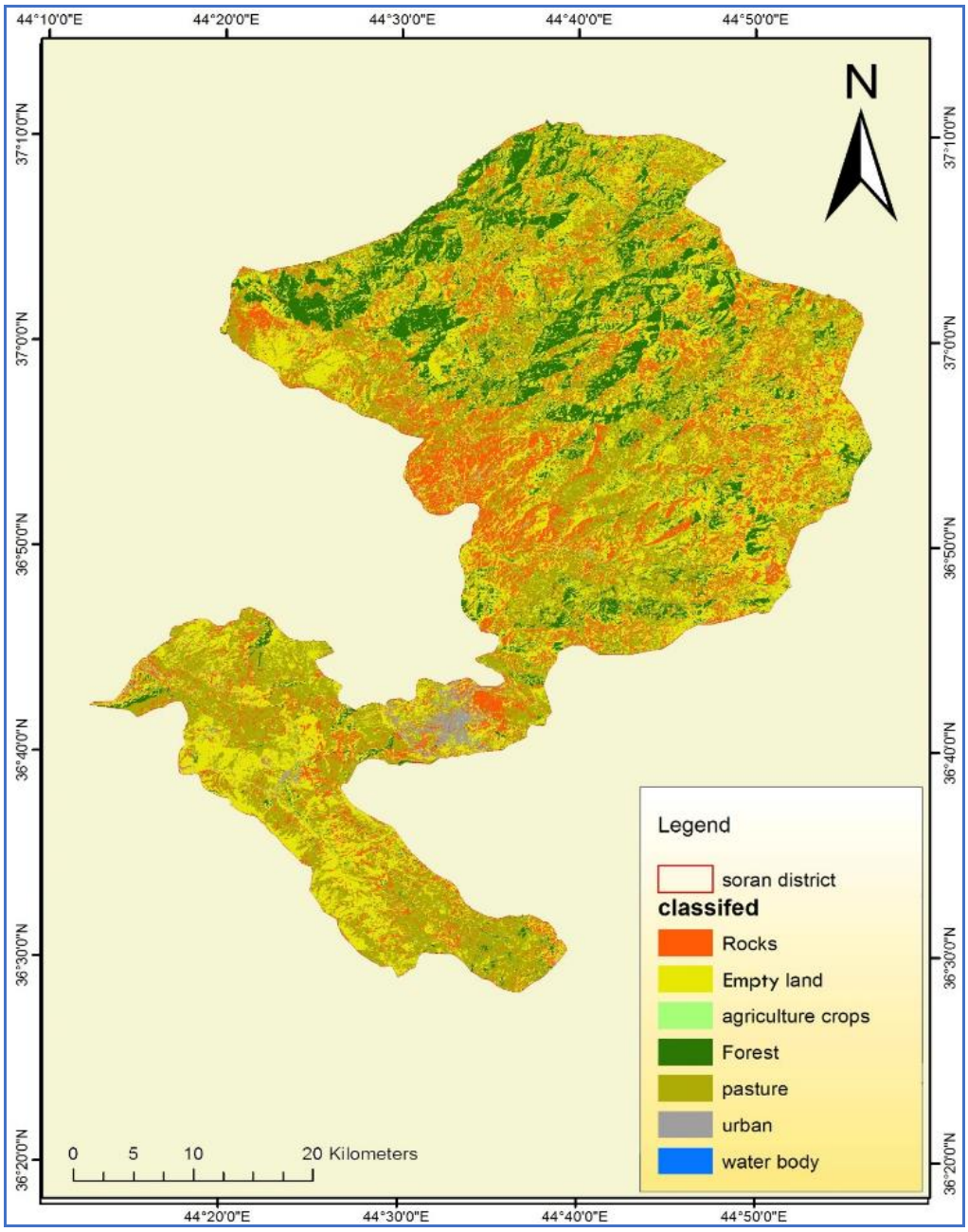

Figure (3) Supervised Classification Map Based on Landsat 8 (2016).

9.2. Accuracy Assessment Results

Accuracy assessment is a necessary step after each classification process. In this case, the most usually used method - the error matrix technique was used. After measuring 210 random points and following all classification stages, an accuracy assessment was obtained. Table (10) shows the results of this assessment. As we can see the overall accuracy of the classified image in 2016 is about 94.50% with a kappa 0.92.

Table (10) The Summary of Error Matrix Accuracy Assessment for The Supervised

data	**Urban**	**Agriculture crops**	**Pasture**	**Forest**	**Barren land**	**Rocks**	**Water**	**Line total**	**Producers accuracy**	**Users accuracy**
Urban	2	0	0	0	0	0	0	2	100.00%	66.67%
Agriculture crops	0	31	0	0	0	1	1	33	93.94%	88.57%
Pasture	0	0	56	3	2	0	0	61	91.80%	94.92%
Forest	0	0	0	88	1	2	0	91	91.70%	96.70%
Empty land	1	0	0	0	7	0	0	8	87.50%	100.00%
Rocks	0	1	0	1	2	8	0	12	100.00%	100.00%
Water	0	0	0	0	0	0	3	3	100.00%	100.00%
Total row	3	32	56	92	12	11	4	210		

Overall Classification accuracy = 94.50
Overall Kappa statistics = 0.92

The Slope Results

The researcher was used digital elevation model to analyzing slope and produce slope map according to the classification of slope degree. Each class values takes steep and reflect amount of change happening to rise between each cell with the next cell. When applying classification Zuidam on the study area, appearing the difference slope degrees as shown in Table (11) and Figure (4), it shows through the table that the largest surface area occupied by the group that land their slope degree is 24 and above which amounted to 789.241 km2 and by 37.294% of the total area of the basin, also the second ranked is including 410.902 km2, and by 19.416% in that land their slope degree 12-18. While the third level category amounting by area 397.332 km2 and by 18.775% it‟s that land their slope degree 18-24.

Table (11) The Slope Classification Result, Depended on Zuidam Classification

Category of slope	**Slope degree**	**Area (km2)**	**Percent %**
1	0-2	18.142	0.857
2	2-7	197.335	9.324
3	7-12	303.278	14.331
4	12-18	410.902	19.416
5	18-24	397.332	18.775
6	24 and above	789.241	37.294
Total	----------	2116.23	100.00

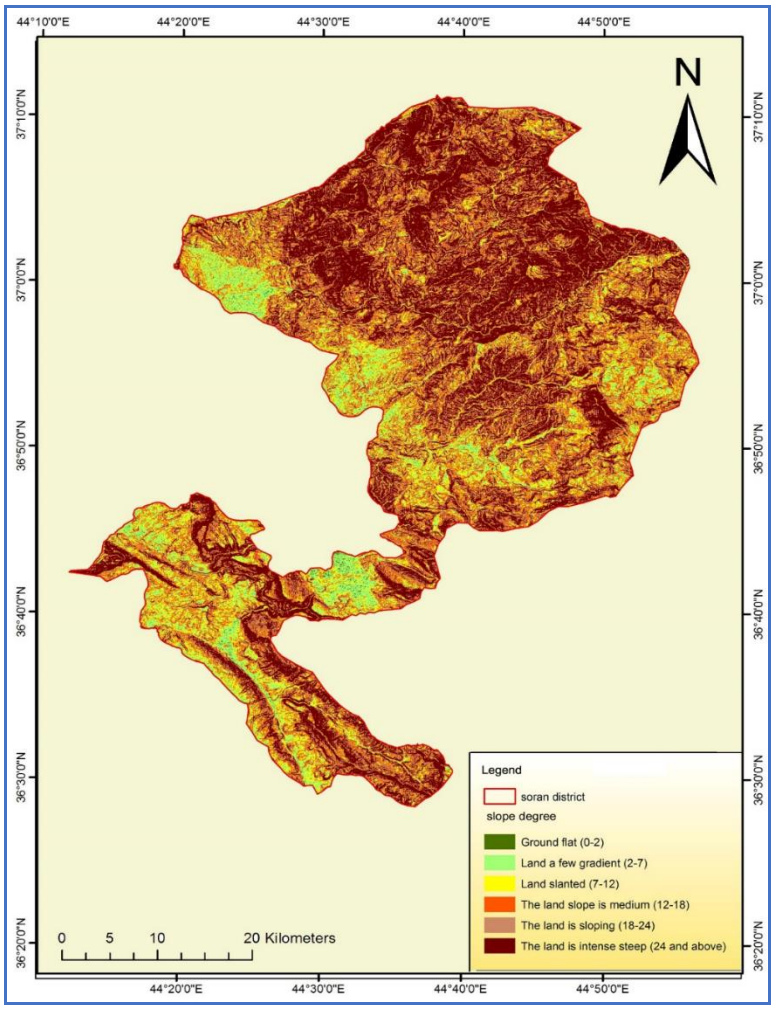

Figure (4) The Slope Classification Result, Depended on Zuidam Classification.

9.3. The Relationship Between Slope Degrees and Agriculture Crops

It has been conducting the intersection topology of the data matching the file containing the map slope degrees with a file of representing a layer of Agriculture crops within the map classified and the result was to get on the map, new data, and looking at the Table (12) with Figures (5) we note the following:

Table (12) The Relationship between Slope Degrees and Agriculture Crops

Slope degree classes	Area of slope degree km2	Area of slope degree %	Area of Agriculture crops km2	Area of Agriculture crops %	Total of Agriculture crops in Soran District
0-2	18.142	0.857	2.887	1.901	0.136
2-7	197.335	9.324	30.76	20.258	1.453
7-12	303.278	14.331	38.738	25.515	1.83
12-18	410.902	19.416	34.238	22.549	1.617
18-24	397.332	18.775	21.999	14.488	1.039
24 and above	789.241	37.294	23.215	15.289	1.096
Total	2116.23	100	151.837	100	7.171

-There is a strong relationship between the slope degrees and agriculture crops, since the area included by the agriculture crops vary by slope degree.

- The highest percentage of the presence of Agriculture crops were among the slope category 7-12 and by 25.512% of the total area the use of Agriculture crops, also slope category 12-18 and by 22.549% area of agriculture crops.

- The slope has been occupied the areas were classified, that was a part of a class slope 2-7, which represented as 20.258% of the total area of agriculture crops.

- The lowest percentage of the presence of spatial agriculture crops fall within the categories of slope 18-24, which the area by 14.488%, respectively, that was the total area of the use of agriculture crops.

Based on this relation, that the distribution of agriculture land use has into all slope degrees classes and for this reason we can say that the areas of high slope degrees used to fruit or can be invested to grow fruit because of their suitability for growth as well as to increase production first and protect the soil from erosion. The flat areas and the low-lying areas are suitable for the growth of all agricultural crops, and do not need the periodic agricultural operations of tillage and harvest, such as agricultural grain and agricultural mechanization

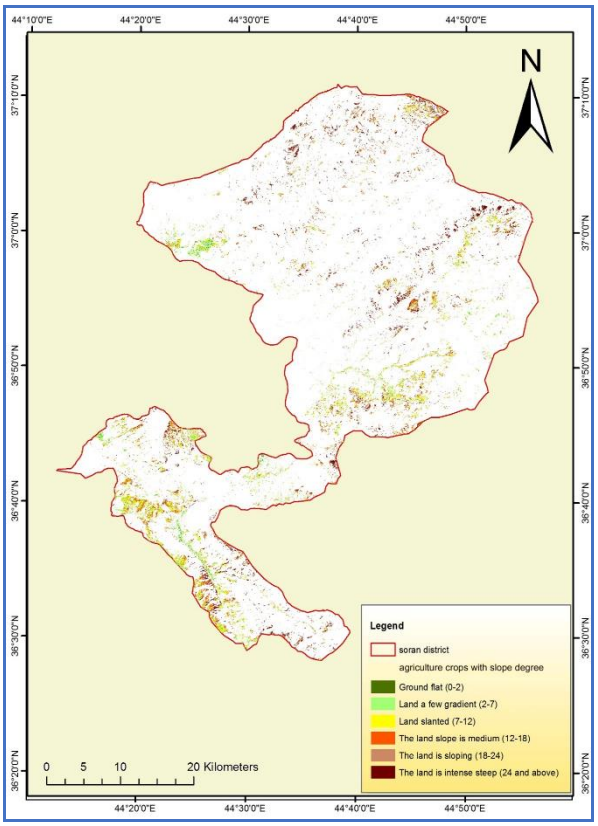

Figure (5) The Relationship Between Slope Degrees and Agriculture Crops

9.4. The Relationship Between Slope Degrees and Pasture

It has relation between slope degrees and pasture for finding this correlation it has been conducting the intersection topology of the data matching the file containing the map slope degrees with a file represents a layer pasture within the map classified and the result was to get on the map, and new data, and looking at the Table (13) with Figures and (6) notes what comes:

Table (13) The Relationship Between Slope Degrees and Pasture

Slope degree classes	Area of slope degree km2	Area of slope degree %	Area of pasture km2	The Relationship between slope degree and pasture %	Total of pasture in Soran District%
0-2	18.142	0.857	5.607	0.866	0.264
2-7	197.335	9.324	65.569	10.132	3.098
7-12	303.278	14.331	111.098	17.164	5.249
12-18	410.902	19.416	149.375	23.084	7.058
18-24	397.332	18.775	131.139	20.266	6.198
24 and above	789.241	37.294	184.3	28.481	8.708
Total	2116.23	100	647.088	100	30.58

Generally, in this study have a great relationship between pasture with slope, whenever the slope degrees are raising, the pasture is increasing.

- The highest percentage of the presence of spatial pasture appeared in the sixth slope degree category 24 and above of the areas as classified Zuidam, and by 28.481% of the total area of pasture in the study area. While the second ranked in the pasture area as category fourth slope degree 12-18, also by 23.084% of the total area of pasture in the study area.
- The fifth ranked of slope degree category 18-24 and classified areas to the third area of pasture by 20.266% of the total area of pasture in the study area.
- The lowest percentage of presence where the pasture fall within the categories of the first slope and the second 0-2 and 2-7, which are areas Ground flat and Land a few gradients by 10.132% and 0.866% of the total area of the use of pasture, respectively.

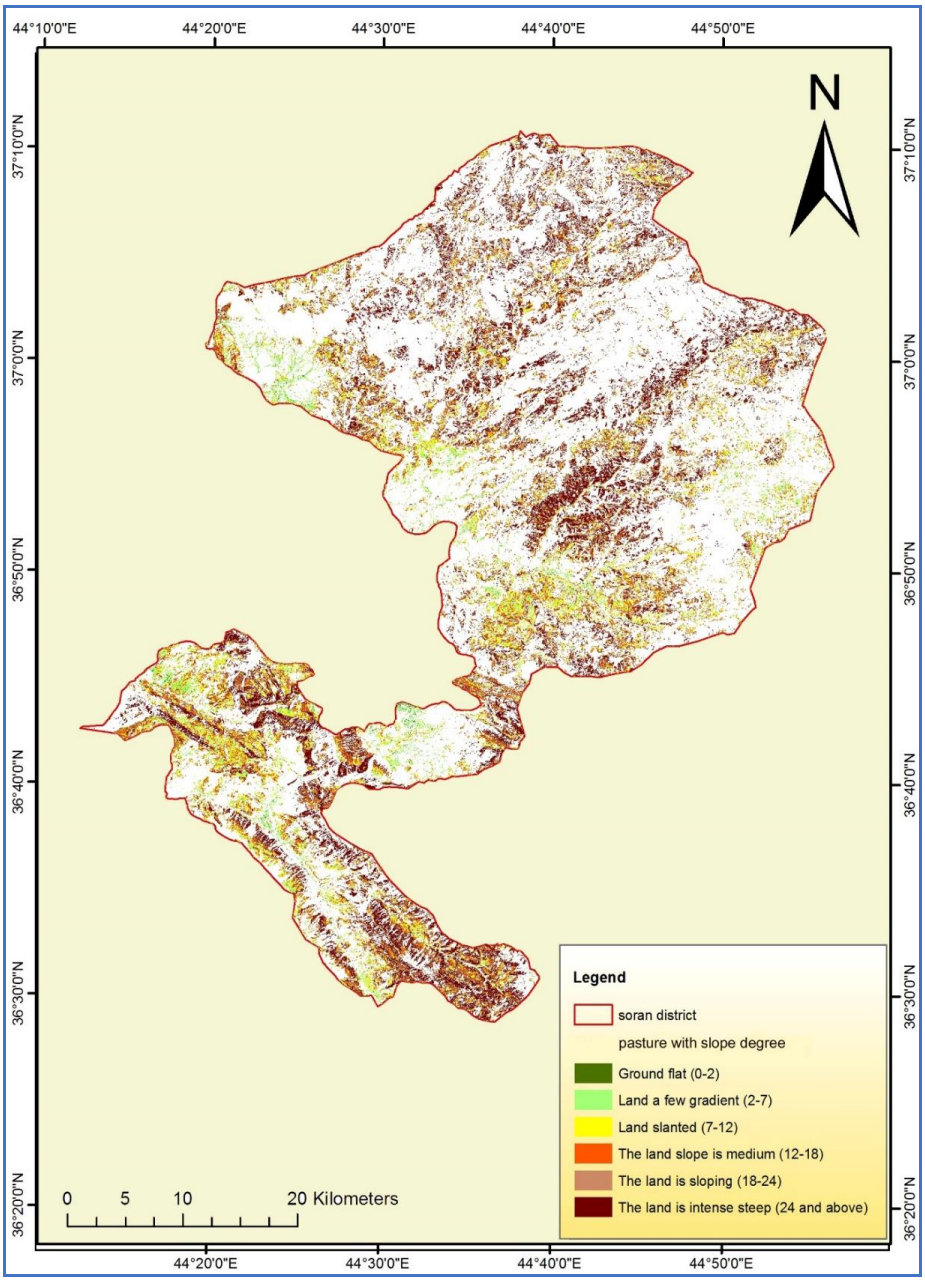

Figure (6) The Relationship Between Slope Degrees and Pasture.

9.5. The Relationship between Slope Degrees and Forest

In the operations of the intersection after calling the two layers of Forest with slope degrees, and accounted the area occupied by each slope of the territory of Forest category and are shown in the map and the table and it is clear that the area of Forest varies depending on degrees and categories of gradient and a map showing the area by regression groups, looking at the Table (14) and Figures and (7) observes the following:

Table (14) The Relationship Between Slope Degrees and Forest

Slope degree classes	Area of slope degree km2	Area of slope degree %	Area of forest km2	The Relationship between slope degrees and forest %	Total of forest in Soran District
0-2	18.142	0.857	0.71	0.230	0.033
2-7	197.335	9.324	7.597	2.464	0.358
7-12	303.278	14.331	15.833	5.136	0.748
12-18	410.902	19.416	33.215	10.776	1.569
18-24	397.332	18.775	49.155	15.948	2.322
24 and above	789.241	37.294	201.707	65.443	9.531
Total	2116.23	100	308.217	100	14.561

Normally in this study have important connection between forest and slope degrees, whenever the slope degrees are rising, at the same time the forest is increasing.
- Show more than 65% of the forest within sloping areas between 24 and above slope degrees, essentially leaving some areas which are barren land without using.

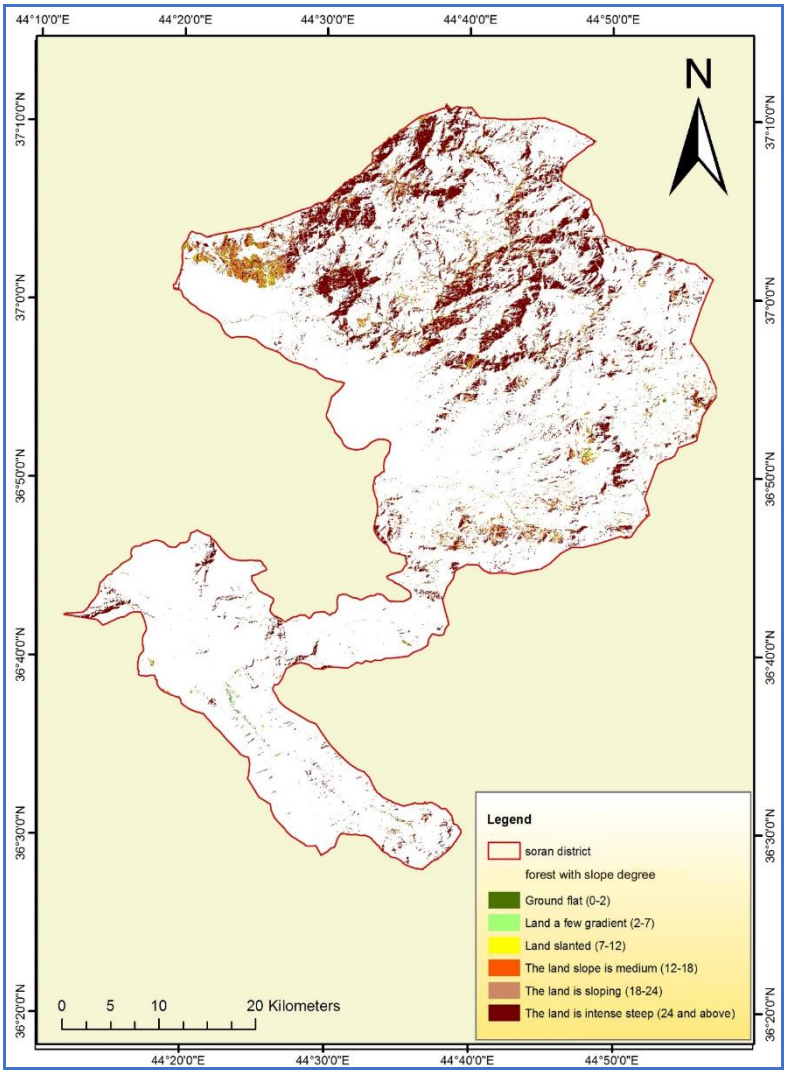

Figure (7) The Relationship Between Slope Degrees and Forest

10. The Elevation Results

The elevation is an important factor in the study area, also the elevation effects the rainfall level, as it receives hillside that in front of the wet winds greater amounts of precipitation, which receive other hillside, the higher mountains increased rainfall to upside the air will cooler at this moment (Ghanem.2013). Also that there is a relationship between the soil and the surface, where areas are the highest, the soil became less, because of that the plains can more ability for agriculture and absorb population, however for the purpose of the statement after elevation has been used of the program Arc map 10.3 and has been the introduction of Digital Elevation Model of the study area, As the study area was divided into six ranges elevation by merging polygons each height range and then accounted each band area of the total area of the study area, as shown in the Table (15) and Figure (8) .

Table (15) Elevation Classification Results

Class name	Elevation range(m)	Area (km2)	Percent (%)
Plains of mountain	361-700	134.880	6.373
Basins mountain	700-900	201.733	9.532
The mountain slopes	900-1150	331.856	15.681
Alluvial fans	1150-1500	451.680	21.343
The mountains	1500-2000	533.517	25.210
The high mountains	2000-3466	462.564	21.857
Total		2116.23	100.00

First range amounted to an area of 361-700m this range 134.880 km2 in the study area include the plains, as it is smaller ranges within the study area, as it accounted 6.373 of the total area in the study area. Planting summer vegetables okra, eggplant and tomato.... Etc. but in small sizes, and grow the natural herbs and plants such as grass and shrubs.

The second range 700-900m includes the basins mountain as an area 201.733 km2 form 9.532 of the study area space. Land within this range is divided into two parts, where

the trees are planted in a fruitful Mixed such as grapes and figs and nuts. While the third range 900 – 1150m, as it constitutes 15.681% of the study area space, the existence of natural forests and grass in some parts. Although, the fourth elevation range 1150-1500m, which has an area 451.680 km2 and constitutes 21.343% of the space area. The prevailing agricultural use within this range is the cultivation of grain in the narrow plain between the mountains and also orchard planting of trees, grapes and pomegranates and figs and apples. The advantage here orchards, small area, covering the highlands, which is not suitable for agricultural investment, nut, oak, and natural grass. Moreover, the fifth of elevation range 1500- 2000m including an area 533.517 km2, as it is the largest ranges within the study area where accounted for 25.210% of the total area of the study area. And features orchards small space here shows through field of the study area and the presence of natural forest and grass in some parts. Then the sixth elevation range 2000-3466m includes high mountainous areas in the study area and come in second place in terms of space, which has an area 462.564 km2 and constitutes 21.857% of the space area. Located in this range Lands rugged not suitable for agricultural use, mostly rocky areas showing through the field of the study area, and the presence of natural forest and grass in some parts.

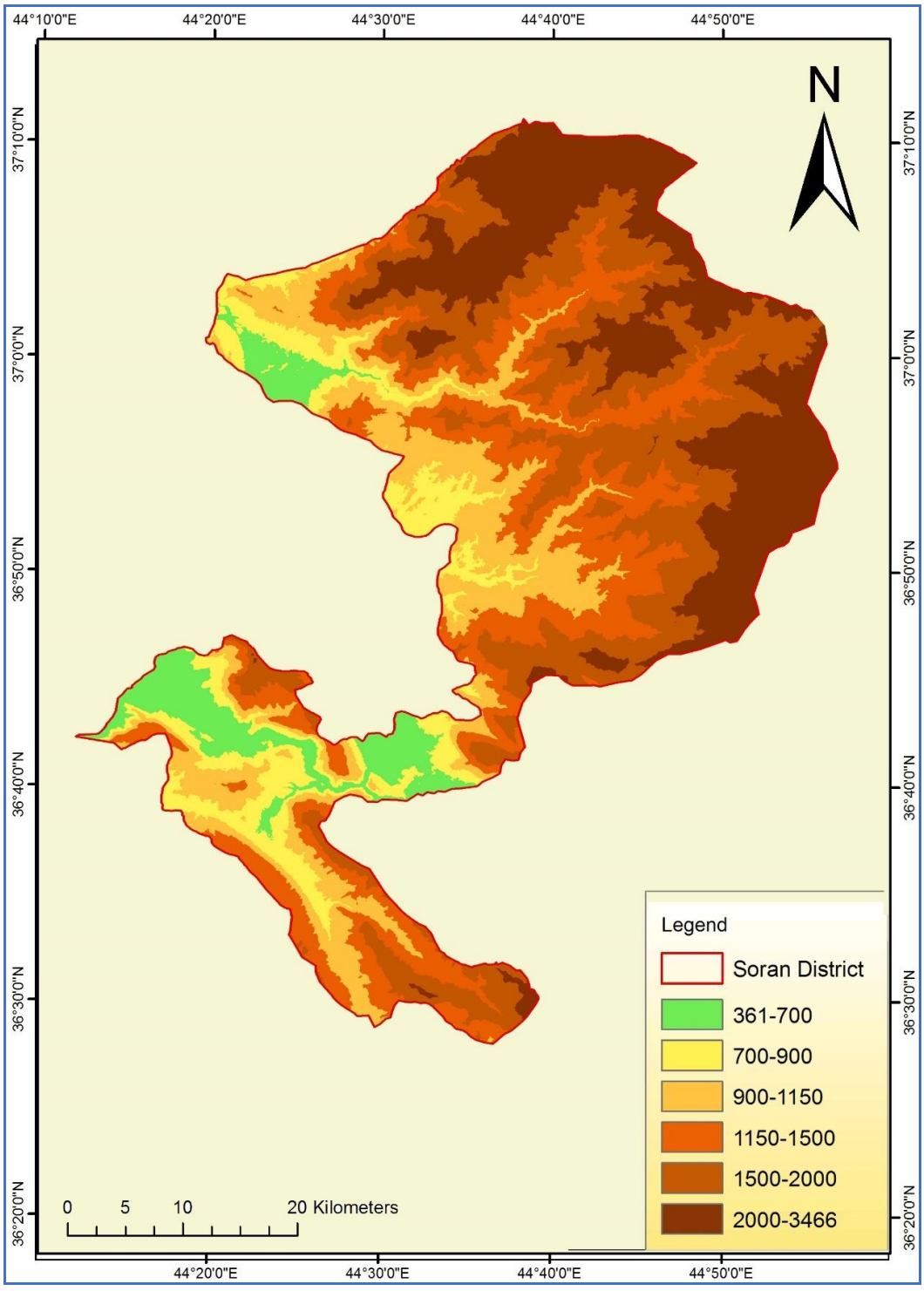

Figure (8) The Elevation classifications result.

11. CONCLUSIONS

The study conducted in one of the development area of Soran district in Iraq advocates that multi temporal satellite imagery plays a vital role in quantifying spatial and temporal phenomena which is otherwise not possible to attempt through conventional mapping. Also, this study had attempted to achieve different objectives as identified in the introduction section, all of which were achieved successfully. While remote sensing and Geographical information system were used to achieve the main aims of this research. Landsat -8 was used to classify different land use land covers for the study area in 2016. However, land use Land cover was classified into seven different classes such as urban, agriculture crops, pasture, forest, barren land, Rocks and water.

Remote sensing and GIS approaches now equipped with powerful tools for detecting and assessing land use land cover such as agriculture crops, pasture and forest, particularly for the locations, like this study field, where access is risky and complicated. Also, these programs have significant importance in examining the impacts of elevation on land use generally and agricultural land more specifically in the Soran district. Due to good results obtained by the researcher in a shorter period of time, it can be concluded that these programs mentioned can be very helpful in obtaining detailed information about a wider area in shorter time periods.

There is a strong relation between forests and slopes, the more sloped an area is, the more forests there are. 80% of forests are situated in areas with 18-24 and above slope degrees, whereas nearly the remaining 20% of forests are located in areas of 0-18 slope degrees. At the same time, there is inverse relation between the Agricultural crops and slope, the more slope an area is, the less it is to have agricultural crops. 70% of agricultural crops are situated in the 0-18 inclination degree, and nearly a 30% of are located in areas of 18-24 and above slope degree. Generally, the majority of 72% of pasture areas are located in the 12-24 slope degree.
elevation has obvious implications on the land usage generally, and for agricultural purposes more specifically.

The Elevation has significant impacts on the usage of agricultural land studied in this study, therefore the area exploited for agricultural use makes no more than 7% Also, 30% of that area is a pasture, and 14% a forest.
Generally, the examined area is blanketed with greenery and forest to a great extent. Thus, this has a significant impact on advancing the animal resources. Agricultural crops, pasture and forest of the study area occupy 51% of the study area.

The dominant weather for the studied area is of the Mediterranean Sea, has a severe cold and rainy winter seasons, and with dry and hot summer seasons also, significant difference in temperature degrees and rainfall intensity between seasons and years. The elevation has great impact on the weather of the studied area, in which it has short summers and the further we go to the north of the cooler the weather is in summer seasons, it becomes the colder, rainier and snowier the winter seasons. However, the elevation of the studied area is a factor in which it has a rich both water resources; surface and underground, in which they’re comprised of a number of river branches and springs

12. Suggestions

1. They also afford valuable information that can aid in decision making process on agriculture planning, management and conservation for land use land cover.
2. Establishing RS and GIS centers, along with designated university departments and courses providing GIS and RS courses to contribute in development plans for the country in different areas generally, and agricultural land usage specifically.
3. Considering restriction and collecting water through building barriers such as dams, especially the studied area has shown to be suitable for doing so due to its good deferent terrain and a good amount of water resources. This will help the area under study to develop in a number of aspects e.g. agricultural, tourism and energy. Also, contributes to increase in underground water.
4. Building the Natural Reserves or national parks to the north of the studied area, an area called (Sidakan sub district) due to its difficult terrain and having forests along other natural resources.
5. Increasing the land use through agriculture and seeding and planting vegetables and fruit product in the elevated areas e.g. mountain slopes.
6. Considering provision of advanced agricultural equipment and focusing on advanced methods and practices of doing agriculture, in order to improve and increase not only agricultural crops, but suitable agricultural area as well.
7. Conducting more researches in the areas of hydrology, geology, agriculture, soil, environment and other areas in order to develop the country.

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التحليل المكاني لتأثير التضاريس على استخدام الأراضي الزراعية باستخدام تقنيات GIS و RS: دراسة قضاء سوران - أربيل - العراق

هاكان أوز
قسم الهندسة البيئية ، جامعة كهرمان مرعش سوتشو أمام ، تركيا

طارق خضر حسن
قسم الجغرافيا جامعة صلاح الدين - اربيل - كردستان العراق
tarq.hassan@su.edu.krd

فرهاد عثمان عمر
جامعة بوليتكنيك أربيل ، كردستان العراق
farhad.omar@epu.edu.iq

ملخص

في هذه الدراسة ، تم اختيار قضاء سوران كمنطقة دراسة نظرًا لحقيقة أن ارتفاع التضاريس يتراوح بين 361 م و 3406 م مع وجود العديد من أنواع استخدامات الأراضي / الغطاء الأرضي (LULC). الهدف الرئيسي من هذه الدراسة هو تحديد تأثير التضاريس على استخدام الأراضي الزراعية باستخدام تقنيات نظم المعلومات الجغرافية و RS. تشكل صور القمر الصناعي لاندسات 8 و DEM البيانات الرئيسية لهذه الدراسة. تم اشتقاق خرائط المنحدرات والارتفاع من DEM باستخدام برنامج ArcGIS وتم تصنيفها إلى ست فئات وفقًا لنظام تصنيف Zuidam. تم استخدام برنامج ERDAS Imagine أيضًا لتصنيف صور القمر الصناعي Landsat 8 من أجل اشتقاق أنواع LULC لمنطقة الدراسة. تم وضع خرائط المنحدرات والارتفاع و LULC فوق بعضها البعض لتحديد العلاقة المكانية بين المنحدر والارتفاع واستخدام الأراضي الزراعية والمراعي والغابات. تشير النتائج النهائية إلى وجود علاقة سلبية بين استخدام الأراضي الزراعية والميل. كلما كان منحدر تلك المنطقة أكثر حدة ، قل احتمال استخدام الأراضي الزراعية. 70٪ من استخدامات الأراضي الزراعية لها انحدار من 0-18 درجة. من ناحية أخرى ، هناك علاقة قوية بين المنحدر والغابة. كلما كانت المنطقة أكثر انحدارًا ، زادت احتمالية أن تكون الغابة. تم تحديد انحدار 80٪ من الغابة في منطقة الدراسة يتراوح بين 18-24 درجة. كما وجد أن 72٪ من المراعي تنحدر من 12-24 درجة. كما وجد أن 84٪ من ارتفاع منطقة الدراسة كان يزيد عن 900 متر. للارتفاع أيضًا علاقة سلبية باستخدام الأراضي الزراعية. هذا هو السبب الرئيسي في أن 7٪ فقط من منطقة الدراسة تستخدم كأراضي زراعية. كما أشارت النتائج إلى أن 30٪ و 14٪ من مساحة الدراسة عبارة عن مراعي وغابات.

الكلمات المفتاحية: التضاريس ، المنحدر ، الارتفاع ، استخدام الأراضي الزراعية ، المراعي

شیکردنەوەی شوێنی کاریگەری بەرزی و نزمی لەسەر بەکارهێنانی زەوی کشتوکالی بە بەکارهێنانی تەکنیکی GIS و RS تۆژینەوەک لەسەر قەزای سۆران- هەولێر- عێراق

هاکان أوز
بەشی ئەندازیاری ژینگەیی , زانکۆی کهرمان مرعش سوتشو أمام ، ترکیا

طارق خضر حسن
بەشی جوگرافیا زانکۆی سەلاحەددین- هەولێر – کوردستانی عێراق
tarq.hassan@su.edu.krd

فرهاد عثمان عمر
زانکۆی پۆلتەکنیکی هەولێر – کوردستانی عێراق
farhad.omar@epu.edu.iq

پوختە

لەم لێکۆڵینەوەیەدا، قەزای سۆرانمان هەڵبژاردووە بۆ شوێنی لێکۆڵینەوەکردن بە هۆی بەرزی ئەوزەویانەی کە تایبەتمەندی جیاکەرەوەی هەیە (بەرزایی) کە لە نێوان ٣٦١م و ٣٤٠٦م لەگەڵ هەبوونی چەند جۆرێکی زۆر لە بەکارهێنانەکانی زەوی /بەرگی زەوی (LULU).ئامانجی سەرەکی لەم لێکۆڵینەویە دیاریکردنی کاریگەری بەرزایی لەسەر زەویە کشتووکاڵییەکانە بە بەکارهێنانی تەکنیکی سیستەمی زانیاریە جوگرافیەکان و RS وێنەئاسمانیەکان ، وێنەی مانگی دەستکردی لاندسات 8 و DEM داتا سەرەکیەکانی ئەم لێکۆڵینەوەیەن.

بە داتاشراوکردنی و پۆلێنکردنی نەخشەی نشێوەکان و بەرزاییەکان بە پێی(DEM) بەبەکارهێنانی پرۆگرامی Arc Gis پۆلێن کراون بۆ شەش بەش بە پێی پۆلێنی سیستەمی zuidam . وە پرۆگرامی Erdas Imagine بەکارهاتووە بۆ پۆلێنکردنی وێنەی مانگی دەستکردی لاند سات 8 بۆ پۆلێنکردنی جۆرەکانی LuLu بۆ شوێنی لێکۆڵینەوە. دانانی نەخشەی لێژی و بەرزی LULU کە لەسەر یەک دانراوان بۆ دیاریکردنی پەیوەندی شوێنی لە نێوان بەرزی و نزمی وەبەکارهێنانی زەوی کشتوکاڵی و پاوان و دارەستانەکان.

دەرئەنجامە کۆتاییەکان ئاماژەبەوە دەکەن کە پەیوەندیەکی نەرێنی هەیە لە نێوان بەکارهێنانی زەوی کشتوکاڵی و لێژی. دەشێ بڵێین بۆ بەکارهێنانی زەوی کشتوکاڵی دەبێت لەکاتێکدا ئەم هەرێمە لێژی زۆرە، ٧٠% بەکارهێنانی زەویە کشتوکاڵییەکان لاربوونەوەو لێژی هەیە بە پلەی 0-18. لەلایەکی تر پەیوەندیەکی بەهێزهەیە لە نێوان نزماییەکان و دارستانەکان .لەکاتێکدا ئەم هەرێمە لێژی زۆرە،بەڵام دارستانەکان دەشی زۆر ببن.لەدوای دیاریکردنی لێژی دەرکەوت ٨٠% دارستانەکان لە ناوچەی لێکۆڵینەوە لەنێوان ١٨-٢٤ پلەن . هەروەها لە ٨٤% ی بەرزی ناوچەی لێکۆڵینەوە بەرزتر لە ٩٠٠م. بەرزیەکانیش پەیوەندی نەرێنیان هەیە لەگەڵ زەویە کشتوکاڵییەکان. ئەوەش هۆکاری سەرەکی ئەوەیە ٧% ناوچەی لێکۆڵینەوە وەکو زەوی کشتوکاڵی بەکاربێت . هەروەها دەرئەنجامەکان ئاماژە بەوە دەکەن ٣٠ % وە ١٤% لە ڕووبەری ناوچەی لێکۆڵینەوە بریتیە لە لەوەڕگاو دارستان.

کلیلی وشەکان: زورگ ، بەرزی ، بەکارهێنانی زەوی کشتوکاڵی ،لەوەڕگا