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EVALUATION OF LAND DEGRADATION OF MYMONA PROJECT IN MISAN GOVERNMENT BY USING REMOTE SENSING

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Abstract

The Mymona Project was chosen within the Mesopotamian plain in Misan city, with an area of 657 km2, due to the variations of geomorphological and physiographical features as well as significant variations in soil conditions led to occurring multiple geological and pedological processes led to degrade the lands of this project. Thus, the site was chosen to achieve the objectives of this study, which included the determination of land degradation, used criteria and indicators according to the requirements and their relevant to for environmental conditions of the study area. Data of Sentinel_2 for 2018 were downloaded from United States Geological Survey(USGS), the coordinate of the site of study area was(46˚45' 0.0"- 47˚ 0' 0.0")East(31˚ 45' 0" - 31˚ 30 0") North. The necessary improvement had been made as Image processing, atmospheric correction, mosaic were conducted. Previous soil survey report, information and field data was collected and updated field data, soil sampling from pedons locations, were used. The result of study area appeared domination of high degraded in the most of land area and less degree of moderate degradation compare of slightly and non degraded which showed less area, also decrease of vegetation cover between high and moderate that lead to high degraded.

Key words : land Degradation, Mymona, Remote Sensing.Introduction

Introduction

Land degradation in arid, semi-arid areas as a basic result of adverse human conduct, this includes soil, water resources, crops and natural vegetation. Land degradation involves the reduction of resource potential by one or various combined processes acting on soil and cause reduction of the quality and diversity of natural vegetation or a considerable decrease in crop production, ether increase salinisation and sodification in soil. salinity is one of the main problems of soil degradation, it is an environmental hazard that causes losing the agricultural productivity (UNEP, 1992). The new research refers to ability of used the Remote Sensing "RS" and Geographic Information Systems "GIS" and Global Positioning Systems "GPS" which is used to specified degradation degree, thus, this techniques is very important because of minimize time and work field and increase the accuracy and also, this technical tool useful for giving continues data for land properties, even it could be alarm of danger and help to find solutions for it,so it become more important to use it in agriculture in deferent field (Younes & Abdel –Hady , 2006, Ibrahime (2008, Soil leads to be associated with high reflectance in the visible and near- infrared (NIR) spectra (Everitt *et al.*, 1988 and Karavanova *et al.*, 1995). soil reflectance is contributed by the heterogeneous combination of mineral, organic matter, particle size, and parent material. As well as, the presence of soil moisture tends to darken the soil and reduces the surface reflectance, moisture content leads to decrease the spectral response in the highest extent of red and near infrared bands (Epema 1990). So by using the Remote Sensing and Geographic Information Systems programme, it could be specify the land degradation and produced digital map that can easy deal with it, managements, analyse, save, update and it is possible to viewer in deferent way in short time (Ismail *et al.*, 2017).

In this study some indicator and criteria of Remote Sensing was used to evaluating land degradation of Mymona Project In Misan government. And Produce map of land degradation.

Material and Methods

Description of the Study Area

Location and area

Chosen Mymona Project In Misan government because of the variations of geomorphological and deferent use of agriculture land, the coordinated of the site of study area was (46° 45' 0.0"- 47° 0' 0.0") Eas t(31° 45' 0" - 31° 30 0") North , with an area of 657 km^2, Include marshes area 70 km^2.

Collocation and documentation

Data, information, report, soil map unit, soil survey that belong to study area which done before was collected to get benefit and used on this study, make update. Its done with scale 1:50000 as base map. Geographic coordinated was done to the topographic map and soil map. Building data of geographical information by doing shape file, convert data from topographic map to digital data by using tool in ArcGIS 10.3 program and located position of sample that taken to get benefit, compare and find some properties of study area. This data can loaded later to draw map and calculate of study area.

Image of study area

Data of Sentinel_2 for 2018 were downloaded from United States Geological Survey (USGS), that covered all area of study region, it contend two image take in the same date in April 2018. The compacted file contend 13 band distinguished territorial 10, 20, 60.

Analysed Image of study area

Doing Analysed by using ERDAS IMAGINE 14 program after made music to the band of image that loaded.

Coordinated the path of study area on the image and made Subsetting of study area.

Process and interpreter of image

Visual Interpretation this was the first step in interpreter process and use False Colour Composite for band blue green red (BGR) and for that use Colour, brightness, shape, size, position, pattern to do interpreter.

Used Digital Interpretation of image by use deferent series classification of math algorithm in ERDAS IMAGINE 14 programme.

Image Restoration

doing Geometric Correlation to the image to use it as base map in the Interpretation process.

Radiometric Correlation by doing Noise Removal because of interaction between element of image that make confuse in image loaded.

Image Enhancement

The goal of Image Enhancement is to get more suitable from original image by doing Spatial Enhancement, Enhancement Spectral.

Spatial Enhancement

Merge band is consider one of Spatial Enhancement goal to increase of image resolution so the Interpretation of image it could be increase. Doing merge to the band 2,3,4,8,11 by using Layer Stack in ERDAS IMAGINE 14 program which represent (BGR) and short wave infrared.

Enhancement Spectral

Band index like (NDVI) Normalized Deference Vegetation Index consider one of Enhancement Spectral that goal to estimate quantity and quality for vegetation cover by depended of low reflectance of red band and high reflectance of near infrared (NIR).

Band index that use for study degradation

Normalized Deference Vegetation Index (NDVI) :

This index use the formula develop by Rouse *et al.,* (1973).

NDVI=(NIR-Red) /(NIR+Red)

Bare Soil Index(BSI):

This index useful for study degradation because it show the rang of land that empty from vegetation cover use from Krishnendu *et al.,* (2014).

BSI = [(NIR+Green)-Red] /(NIR+Green+Red)

Soil Adjustment Vegetation Index(SAVI) :

This index use Soil Adjusted Factor(L) equal 0.5 in the formula below, develop by Huete((1988

SAVI= [(NIR-Red)*(1+L)/(NIR+ Red+L)]

Low vegetation density became the used of NDVI less effected which related to reflectance of bare soil, In this situation (Ismail, 2010) recommended to use this index in area that cover with low vegetation.

Normalized Deference Salinity Index (NDSI):

Use to evaluate soil salinity develop by Khan, *et al.,* (2005) and use from Amal and Lalit, (2013) to study soil degradation

NDSI = [(RED - NIR) /(RED + NIR)]

Normalized Deferent Water Index (NDWI) :

This index can use to get content of water cover as formula of McFeeters, (1996), this index use the band (Green and NIR) as in the formula below

NDWI=(Green- NIR) /(Green + NIR)

Bare Index(BI)

This index refer to the ponders prevent of interaction between soil reflection with plant reflection and water cover as in formula below (Zhang 2002)

$$BI=[(Red)^2+(NIR)^2]^{0.5}$$

Work in the GIS environment

Work in this environment conclude building data base, soil map unit, and output layer index for vegetation, water, bare soil, salinity. for that purpose we used ArcGIS 10.3 program, input data and save it, so this data can be used any time when the work need to get it building and connected data base with anther program, output this data and get view in form map, table, shape.

Expert classification of image

Dependent Expert classification on Expert analyser or Interpretation to select class by use Visual Interpretation of image and building geographic information system by use Arc GIS programme to find land use and land cover (LU/LC) and convert it from Vector to Raster. and building model for (LU/LC) in knowledge Engineer Classification, to use this tool and complete this operation it is need to use Knowledge classify tool in ERDAS Imagine 14 programme. This model content of element that connected from each one to anther of each class, this element is Hypotheses, Rules, Variables, the user can do operation and get the target with feeding information and data for each class from deferent resources like Vector data, Raster data and Tables. Also from information that got it from last study about the natural of the region. This classification have high level of accuracy compare with anther classification.

Results and Discussion

Criteria and index degradation dependent on Remote sensing

Normalized Deference Vegetation Index (NDVI)

Many natural surfaces are almost equally bright in red and near-infrared part of the spectrum with the notable exception of green vegetation. Red light is strongly absorbed by photosynthetic pigments (such as Chlorophyll) found in green leaves, while near infrared light either passes through or is reflected by leave tissues, regardless of their color. It means that the areas with bare soil having little or no green plant material are similar in reflectance for both red and near infrared wavelengths. The areas with much green vegetation show more brightness in the near-infrared and are very dark in the red part of the spectrum (Yousef *et al.*, 2006).

(Table 1) showed the deferent value of natural vegetation in year 2018 the result showed in Fig. (1) there was irregularly in spatial distribution of NDVI value, and it was between (0-0.56), we can find the higher percentage for land cover weak vegetation this percentage represent 86%.

While the bare soil (empty from vegetation cover) represent 2% this percentage represent value less then zero, irregularly distribution of land cover appear in study area, because of deferent distribution of vegetation between agriculture land and natural plant and growth plant in marshes in wide area. Maybe the reason of that come from effect of high salinity of soil and land degradation also decrease of percentage of agriculture land and large area of drought marshes after absent of water on it.

The range of NDVI less then zero (negative value of NDVI, represent area that cover by water or shallow near the surface of soil, also bare soil effected by salinity accumulation, for that reason this land didn't used for agriculture, while the class of weak vegetation (Low) was (0-0.19), while the positive value represent irregularly density of vegetation, so when value of NDVI increase near (1+) the density of vegetation increase and became very high.

The degradation of study area divided accordant to value of this index which represent vegetation cover and their density to four assumption class. The table above show High degradation covered all the study area, and this class related with decrease of NDVI value, which refer to the weak vegetation that covered most of study area, this case by effected of drought climate, limited rain and irregularly, and also the drought marshes that have shallow water and high salinity growth on it some plant that can deal with such sever environment.

Table 1: Range of degradation relationship with NDVI.

Land Deg.	Veg. Density	Area cover km^2	Veg. Cover Ratio	NDVI Range
Very High degradation	NO. Veg.	10	%2	< Zero
High degradation	Low Veg.	494	%86	0-0.19
Moderate degradation	Medium Veg.	67	%12	0.2-0.49
Slightly degradation	Dense Veg.	0	%0	0.5-0.56

Normalized Deference Salinity Index (NDSI)

The result of (NDSI) Refer in table 2 and Fig. 2 the percentage of salinity in study area. It showed the percentage that located in range higher then zero represent less reflectance and the content of salinity in the soil was less. Also it showed the percentage of salinity in soil in deferent

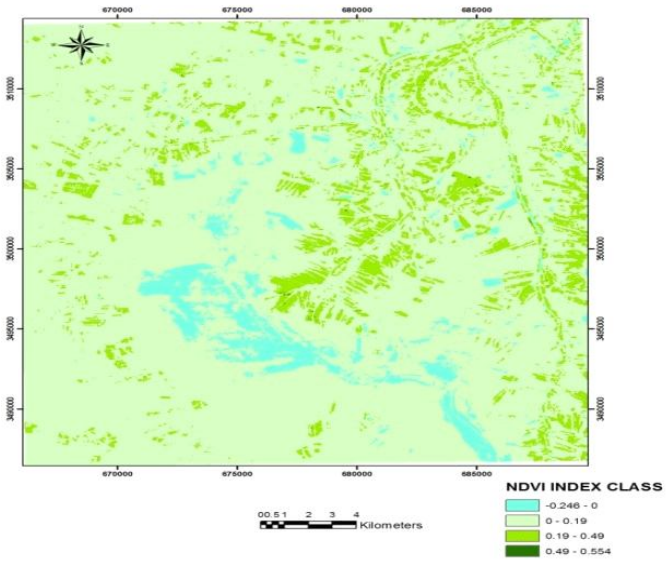

Fig. 1: NDVI class of study area.

degree was (96%) while the soil not effected was (4%) of study area, this refer the bad quality of water, some sample collected from water of marshes reached between (21, 5) dS m^{-1}. in anther side increase of salinity very high in the soil of study area cause decrees percentage

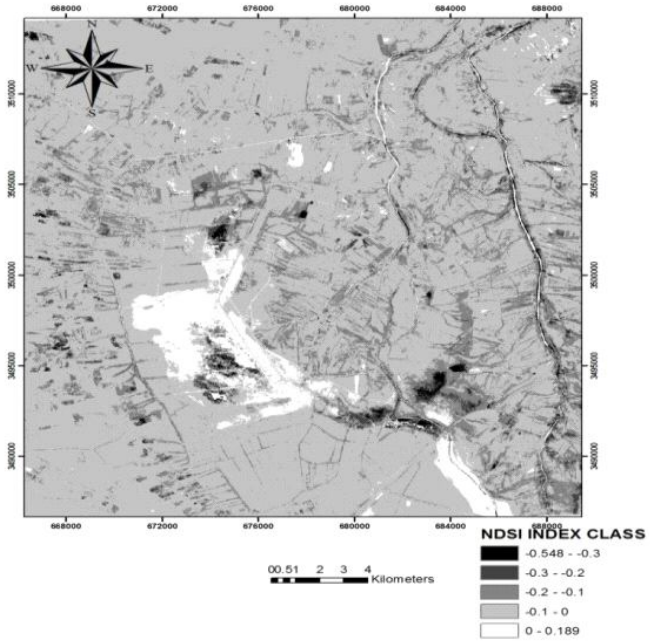

Fig. 2: The NDSI class in study area.

Table 2: NDSI Range in study area.

Salinity	Area km²	NDSI Range
No Salinity	21	Zero
Low	444	(-0.1) — (0.0)
Moderate	94	(-0.2) — (-0.1)
High	12	(-0.548) — (-0.2)

Table 3: Showed degradation land relater to NDSI in study area.

Land Deg.	Salinity. Cover Ratio	Area of Salinity/ km²
No deg.	4%	21
Low deg.	78%	444
Moderate deg.	16%	94
High deg.	2%	12

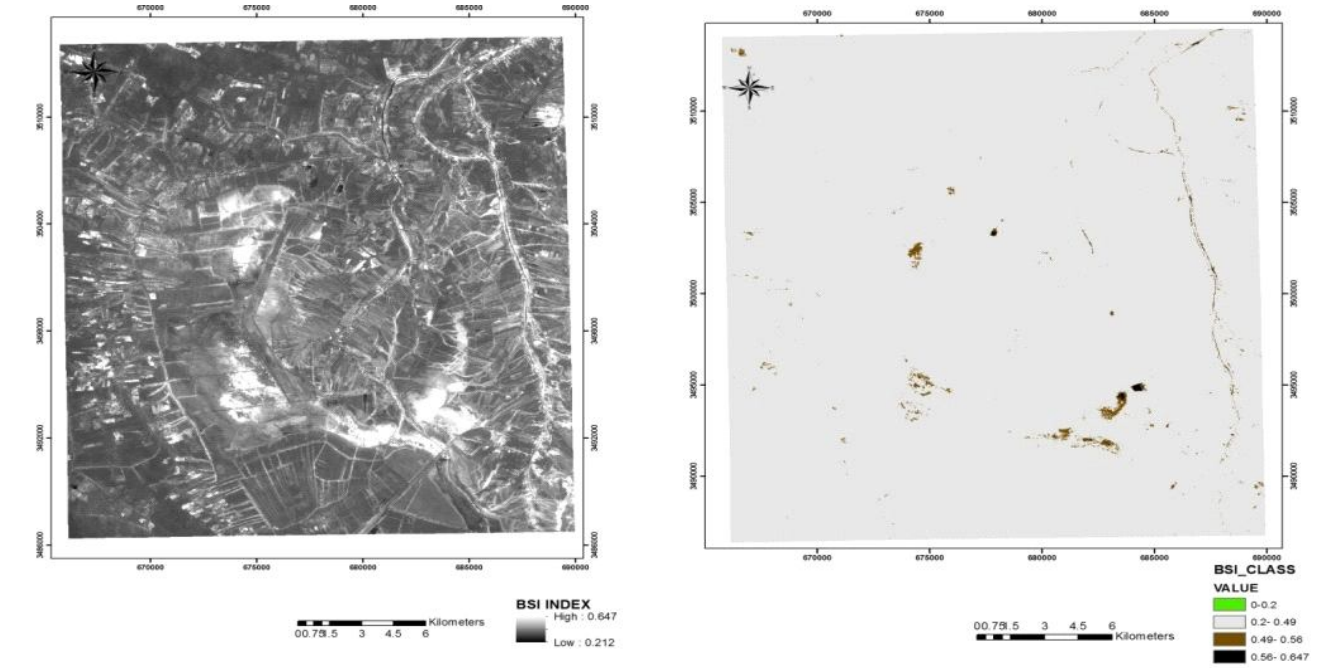

Fig. 3: BSI class of study area.

Table 4: BSI Range in study area.

Land Deg.	Area of class km^2	BSI Range
No deg.	0.47	0.56-647
Slight-moderate deg.	2	0.49-0.56
High deg.	568	0.211-0.49
Very High deg.	0	0.0-0.211

of agriculture land, increasing of salt content leads to increase the spectral reflectance of the soil, so reflectance value of spectrum band of visible band (Red) and eight band (NIR) depended to discover the saline land because of high reflectance. (Karavanova *et al.*, 1995).

Irregularly ground water level, bad drainage and high salinity content, mainly effected for appearing salinization in soil, and related negative for growth and develop vegetation cover and soil properties physical and chemical (Chhabra, 1996; Tsutsuki, 2003) which lead to degradation

Table 5: NDWI Range in study area.

Area km^2	Ratio	Range NDWI
43.8	7%	-0.47-0.0
613.2	93%	.00-0.27

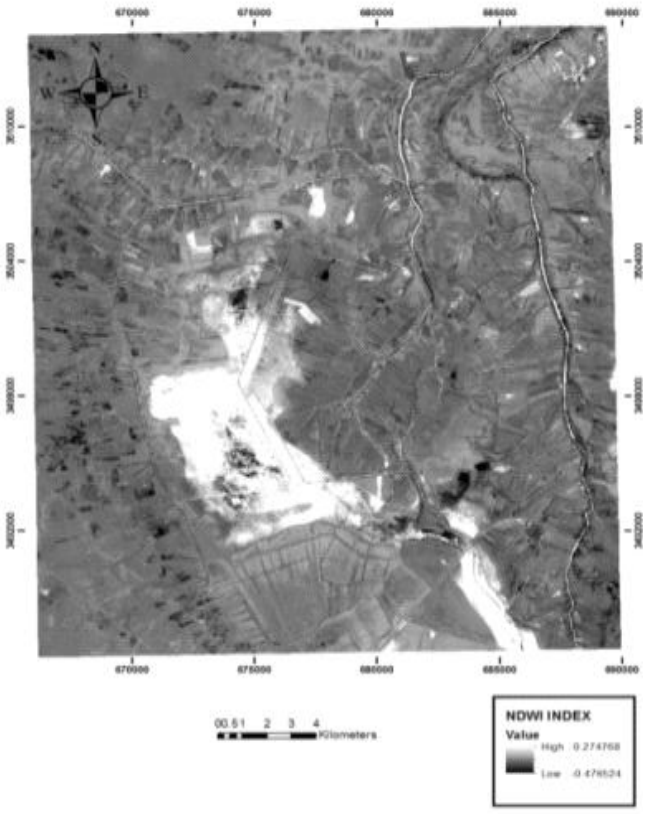

Fig. 4: NDWI class of study area.

in deferent degree, also the rule of human activity increase degradation in study area because of bad management of agriculture land. the increase of this index consider high problem to convert agriculture soil to bare soil because of salinity phenomena

Bare Soil Index BSI

BSI could used to recognized soil from absent of

Table 6: BI Range in study area.

Brightness degree	Area km^2	BI
Darkness	81	0.022-0.0077
Low	478	0.062-0.022
Moderate	96	0.12-0.062
High	2	0.17-0.12

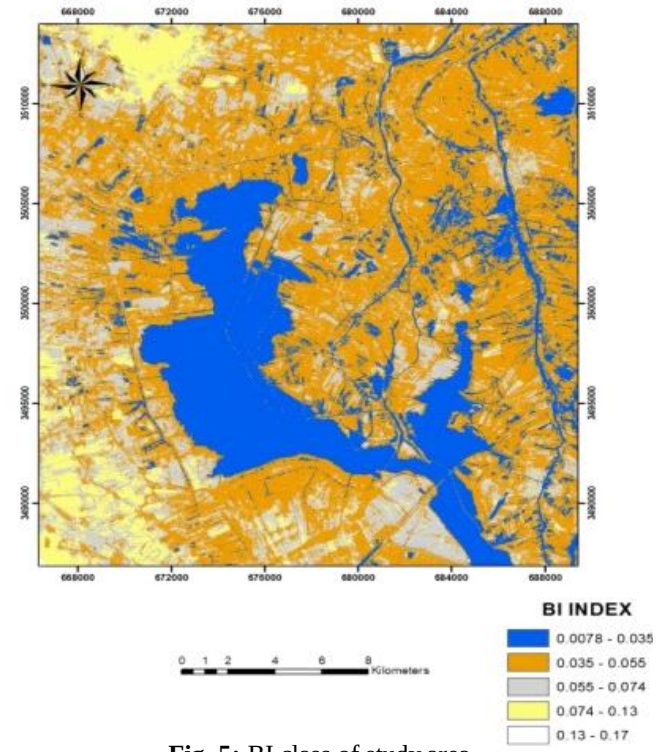

Fig. 5: BI class of study area.

vegetation cover, the table 4 and Fig. (3) showed the higher value of this index in soil which had higher percentage of salinity and absent of vegetation cover. The higher value of this index was 0.647 and less value 0.211, so this index related and take the same direction with NDSI.

The table 4 showed the most of study area was in High degradation class (semi bare soil) 568 km^2 the case of that related to increase percentage of salinity, also severe climate, low rain, increase of high temperature which effected on plant growth, that case decrease of vegetation cover and susceptibility to degradation increase. While the area not degraded represent area 0.47km^2 because of growth *Bulrush* and *Common reed* in area cover with water, also there were some agriculture

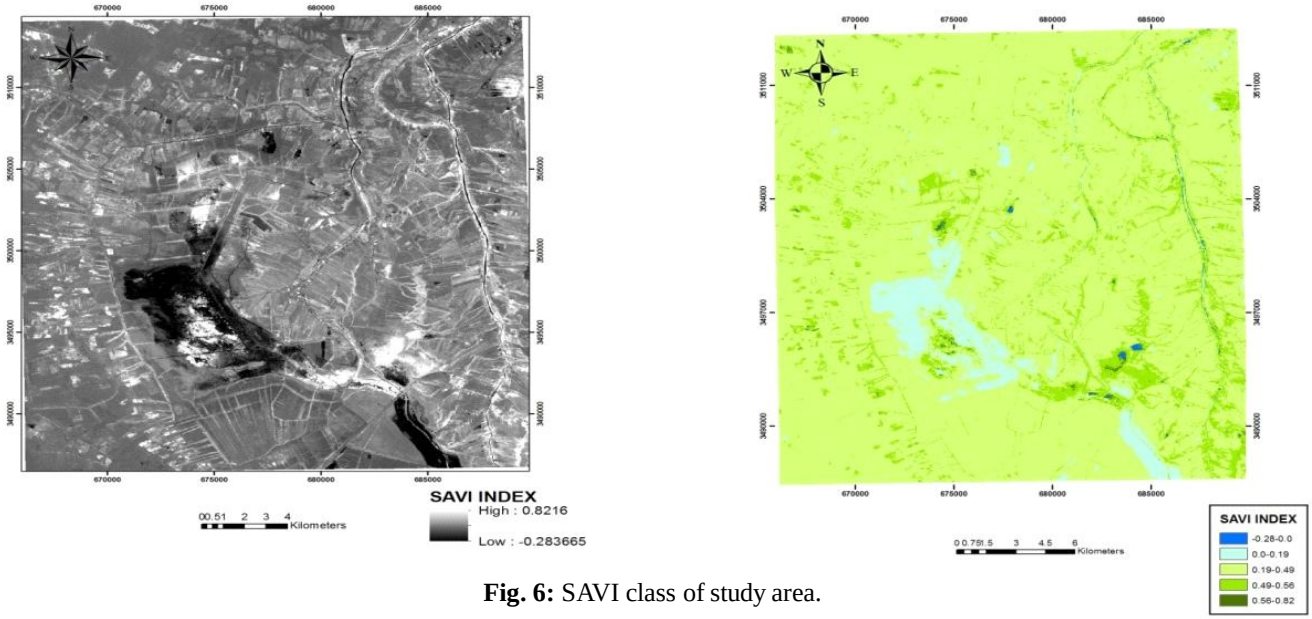

Fig. 6: SAVI class of study area.

land planted with crop and tree.

The class Slight – moderate degradation equal 2 km^2. The table 4 showed absent of class very High degradation because of growth some natural plant like *Tamarisk*, *Suwad*, *Prosopis*, *Prickly Alhagi* that could deal with sever environment such as high salinity, effected of shallow water in soil and bad climate.

Normalized Deferent Water Index (NDWI)

The result of (NDWI) in table 5 and Fig. (4) appeared different value between (0.27) and (-0.47).

Mainly used of this index is to selected, choses and isolated watershed from the rest of land cover class spatial the one had reflectance near from watershed and remove the interaction between them. general viewer of this index was the higher value that related to watershed compare to the rest of anther environment component. From this index can find the area that covered with water from the positive value (greater than zero) while the negative value (less from zero) represent dry land. This index showed different in watershed and dry land, the area of water equal 43.8 km^2 in study area, while the land equal 613.2km^2. Because of the limited water applied to watershed (marshes that had different level of water), also bad use of irrigation in agriculture land.

Table 7: Percentage of land degradation accordant to BI in study area.

Degradation	%	Area km^2	BI
Low	83.7%	478	0.067-0.027
Moderate	16%	96	0.12-0.067
High	0.3%	2	0.17-0.12

Table 8: SAVI range in study area.

Degree of Degradation	Percentage cover area	Area km^2	SAVI
Bare soil (extremely degradation)	0%	0.58	-0.28-0.0
(Very degradation)	4%	20.81	0.0-0.19
(Moderate degradation)	87%	496	0.19-0.49
Slightly degradation	9%	53.21	0.49-0.56
No degradation	0%	0.85	0.56-0.82

Brightness Index(BI)

The table 6 and Fig. (5) explain distribution value of (BI) in study area, and showed different value between (0.17-0.007) that reflect to different state of natural land cover in study area.

The table 6 showed different Brightness degree, the darkness area that represent water cover, marshes equal 81 km^2 of total study area this relate to decrees reflectance in water environment and wet area, therefore this area appear darkness in image, the area less Brightness equal 478 km^2, the area of class Moderate Brightness represent 96 km^2, while the class high Brightness equal 2 km^2, the result of study area refer to the most of land of study area effected with salinity. The degree of salinity effected different between low, Moderate, high.

The table 7 recognized the degree of land degradation in study area because of effected of salinity between low, Moderate, high may be this cause by retried of water in large area spatial marshes because of limited water suppler to this area and case salinity accumulation in surface of soil, this related with bad climate also effected bad management and irrigation.

Table 9: Distribution of LU/LC in study area.

Area km^2	LU/LC
3.82	Urban area
35.3	Water bodies
74.65	Natural vegetation
124.4	Irrigation land / crop
418.8	Bare land
0.45	Orchards

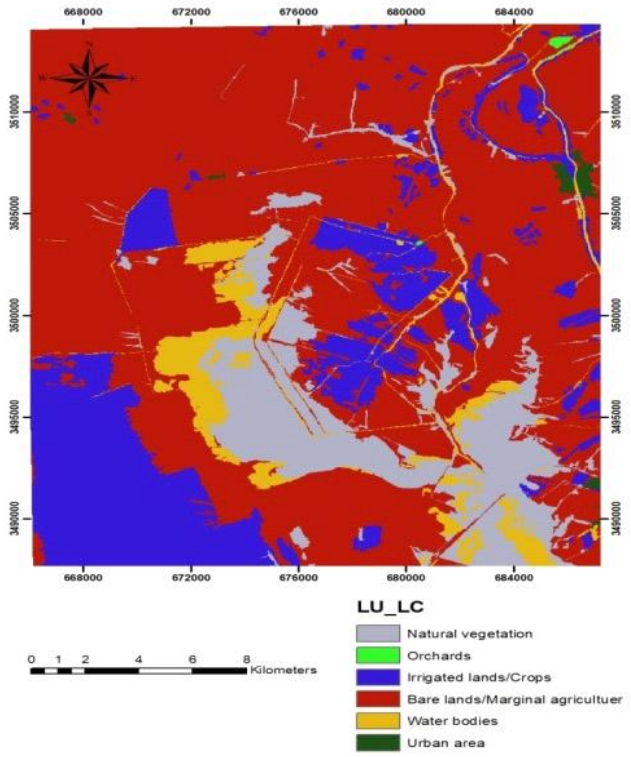

Fig. 7: LU/LC class of study area.

Soil Adjustment Vegetation Index(SAVI)

The result of (SAVI) in table 8 and Fig. (6) showed distribution of value of this index of study area the different of value between (-0.28) and (0.82) this reflected different state of kind of land cover in study area. The Fig. (6) showed land cover class that selected by using this index which represented watershed, uncover area like bare soil, building and agriculture land (low vegetation density, Dense vegetation).

The table 8 showed the percentage of extremely degradation and No degradation class equal zero this cause by growth of natural vegetation in difficult condition of climate and environment represented as high salinity, shallow of water, distribution in few area in spot like *Prosopis*, *Prickly Alhagi* , *Tamarisk*, *Suwad*, *Common reed*, *Bulrush* also falling few rain help some crass to growth that disappear in summer session.

All area of this index focus in Moderate degradation in range (0.19-0.49) equal 496 km^2, next Slightly degradation class at range (0.49-0.56) covered area 53 km^2, while the class Very degradation at range (0.0-0.19) equal 20 km^2. this relate to effect of agriculture land also natural plant spatial *Common reed*, *Bulrush* (in marshes) this area was coved with water then because of the limited supplied of water convert and became bare soil but shrinking with sallow of ground water.

Expert classification of image

The table 9 showed the type of land use, land cover LU/LC and there disruption in study area represented by Urban area, Bare land effected with salinity, vegetation land cover (irrigated area, Natural vegetation (included the plant that growth in water environment) also of water cover like (river and marshes).

The area of bare land was equal 418.8 km^2 represent 64 % from total of study area, the area of watershed equal 35 km^2 represent 5 %, the area of agriculture was 124.4 km^2 represent 18.9% of study area, natural vegetation equal 74.65 km^2 represent 11% while orchards area equal 0.45

Bare land and Urban area can evaluated them and described as very degradation land represent area 422.6 km^2 equal percentage 74% of study area while the agriculture land and Orchards can described as slightly to moderate degradation equal 124.85 km^2 represent 22% of study area, the degradation in agriculture land related to bad management and high salinity in ground water that participated of accumulation salinity in soil and degraded.

Conclusion

1. High degradation represent most of study area, and less degree moderate degradation compare with anther degradation class(slightly and non degraded), the slightly degradation in study area was decrease, while the area of non degraded was limited in study area.
2. Decrease of vegetation cover area between moderate and high degree while there were increase in class high degradation.

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