International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2015): 78.96 | Impact Factor (2015): 6.391

The use of Digital Elevation Models (DEM) and Geographic Information System (GIS) to Produce Some of Topographic Maps in Mesopotamian Plain, Baghdad- Iraq

Abdulghafour Ibrahim Hamad

Lecturer. Desertification combat. Dept. College of Agric/ Univ. of Baghdad-Iraq

Abstract: ***There are three types of the topographic maps are used to study apart of Mesopotamian plain, Iraq, contour lines, slop map and Aspect map under Geographic information system (GIS).the study area located in between latitudes 33° N and longitudes 33 E °, Digital Elevation Model (DEM) is used to produce these maps, The results of contour map referred to there are five classes for elevations were represented in contour lines, Elevations values were <=10, 11-20, 21-30m, 31-40, and 31-90. All the elevation in the study area begins to decrease as we move for the South, east and west. There are three types of slop, Low-type of slop covers a large part of the study area then medium-slop and Higher-slop. That means most the study area is flat. The Entisol soil order, sub soil order Fluvent and Torrifluvents great group covered the study area.***

Keyword: DEM, Contour lines, Slop map, Aspect map, GIS

1. Introduction

Digital Elevation Model (DEM) is produced by Photogrammetric techniques from stereo-photo pairs, stereo satellite images or interpolation of elevation data **(Hilmi 2014).** The DEM is a computer representation of the earth's surface and provides a base data set from which topographic parameters can be digitally generated. The routing of water over a surface is closely tied to surface form ***(Wood, 1996).*** The Digital Elevation Model is regular gridded matrix representation of the continuous variation of relief over space ***(Burrough1986)***. Elevation can be defined as "the height above the horizon", The term horizon refers to the sea level. The Term Digital Terrain Analysis (DTM) is attributed to two American Engineers namely Miller & Laflamme at the Massachusetts Institute of Technology during the late 1950s ***(Naser El Shelmy2005)***. DTM refers to the altitude of ground itself while DEM refers to the maximum altitude everywhere (Pratibha et al.2013). A contour line (also isoline, isopleth, or isarithm) of a function of two variables is a curve along which the function has a constant value ***(Courant etal.1996)***. The contour interval of a contour map is the difference in elevation between successive contour lines.

Aspect is measured counterclockwise in degrees from 0 (due north) to 360 (again due north, coming full circle). The value of each cell in an aspect grid indicates the direction in which the cell's slope faces. Flat slopes have no direction and are given a value of -1***(Esri 2009)*** fig.1.

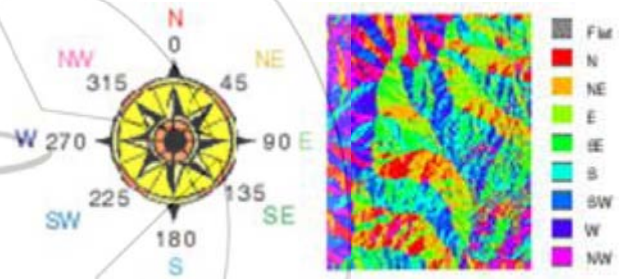

Figure 1: General Aspect map

Aspect is the compass direction that the slope is facing (National Wildfire Coordinating Group, Basic Land Navigation). Exploring the brightness values of the aspect layer shows that this analysis also has a very different range of values compared to the original DEM and our Slope layers. Using the layer properties you can see that the minimum and maximum range from around 0 – 360. The aspect units are expressed in terms of degrees of cardinal direction co-related to the direction a hillside is facing. This scale starts with 0 degrees as North, and continues in a counter-clockwise direction all the way to 360 degrees. Use the image below as a reference to the degree values of cardinal direction fig.2.

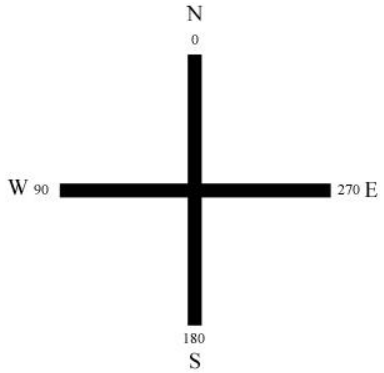

Figure 2: Aspect Key

Using the legend you can determine the appropriate aspect for each hillside in the area, allowing you to identify North (~ 0 or 360 degrees), South (~ 180 degrees), East (~270 degrees) or West (~90 degrees) facing hillsides. Values found in between these ranges assume a mixture of cardinal direction; ex. 225 degrees would represent a hillside with a South-East facing aspect (http://www.gistutor.com/).

2. Material and Methods

Description of the Study Area/ Location and area

The study area (Fig.3) called Baghdad located in between latitudes 33° N and longitudes 33 E °. Its part of Mesopotamian Plain, Iraqi. It is a geological depression filled with river sediments which covers the central and southern parts of Iraq. Mesopotamian Plain, Iraqi is a plain of the Tigris and Euphrates rivers. The northern part extending between Samarra and Delta consists of three distinct river terraces which are about 5 to 15 meters higher than the present river level. These old river terraces thus form high plains which are never flooded by the river. The lowest of these terraces is the most important for irrigated agriculture. It extends on both sides of Adhaim River. In central Iraq, the plains are nearly level. Large parts of it were flooded almost every year during spring and new soil material was deposited till 1956 when the first flood control project was completed. Deposition of material by the rivers is in a levee basin pattern giving a distinct meso relief in the nearly level landscape. In addition, the old irrigation canals have deposited irrigation silt to form narrow high strips along them (**Omer, 2011**).

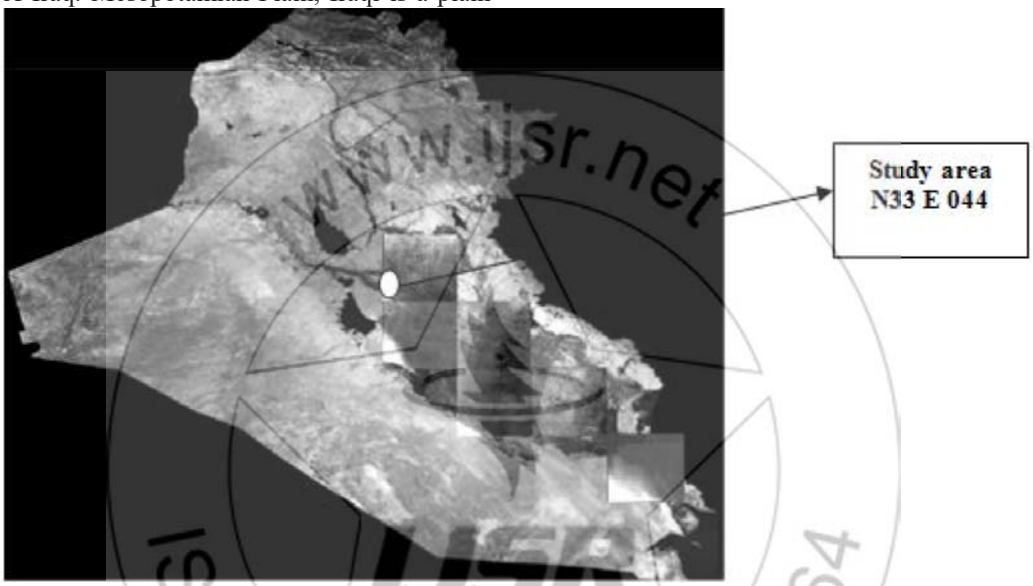

Figure 3: Digital Elevation Model (DEM) for Mesopotamian Plain Iraqi

Remote sensed dataset

The Digital Elevation Model (**DEM**) was used to investigate topographic maps of the Baghdad. Image processing and transformation for raster data set were applied under GIS program (Arc map v.9.3), Fig 2 by the following steps:

- The Digital Elevation Model (**DEM**) downloads for the Mesopotamian Plain Iraqi.
- Transforms the raster dataset from decimal degree to UTM projection in gis environment.
- Surface analysis was applied to produce the following maps.
- Contour maps, Slop maps, Aspect maps, Hill shade maps.

3. Results and Discussion

Contour map

The results of contour map referred to there are five classes for elevations (fig.2)

Were represented in contour lines, Elevations values were <=10, 11-20, 21-30m, 31-40, and 31-90 respectively fig.4

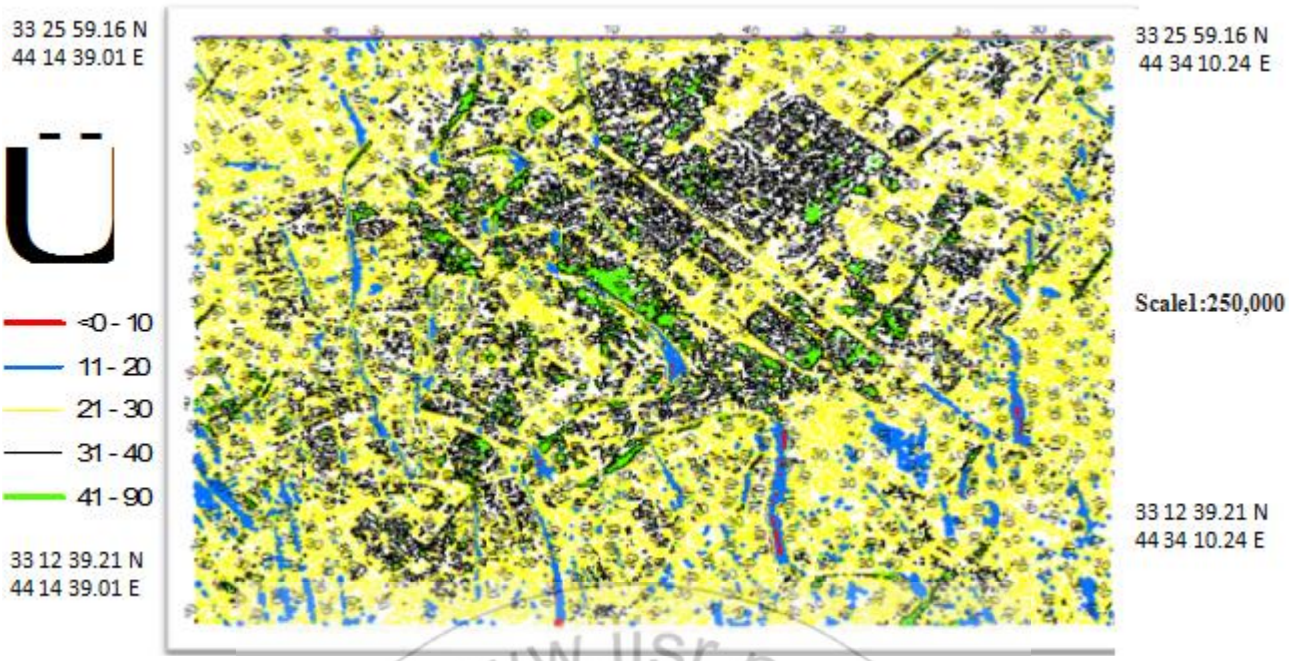

Figure 4: Digital Elevation Model (DEM) for Mesopotamian Plain Iraqi

Each of the elevations values from 21 -30 and 31- 40 covered most of the study area fig.5, 6.

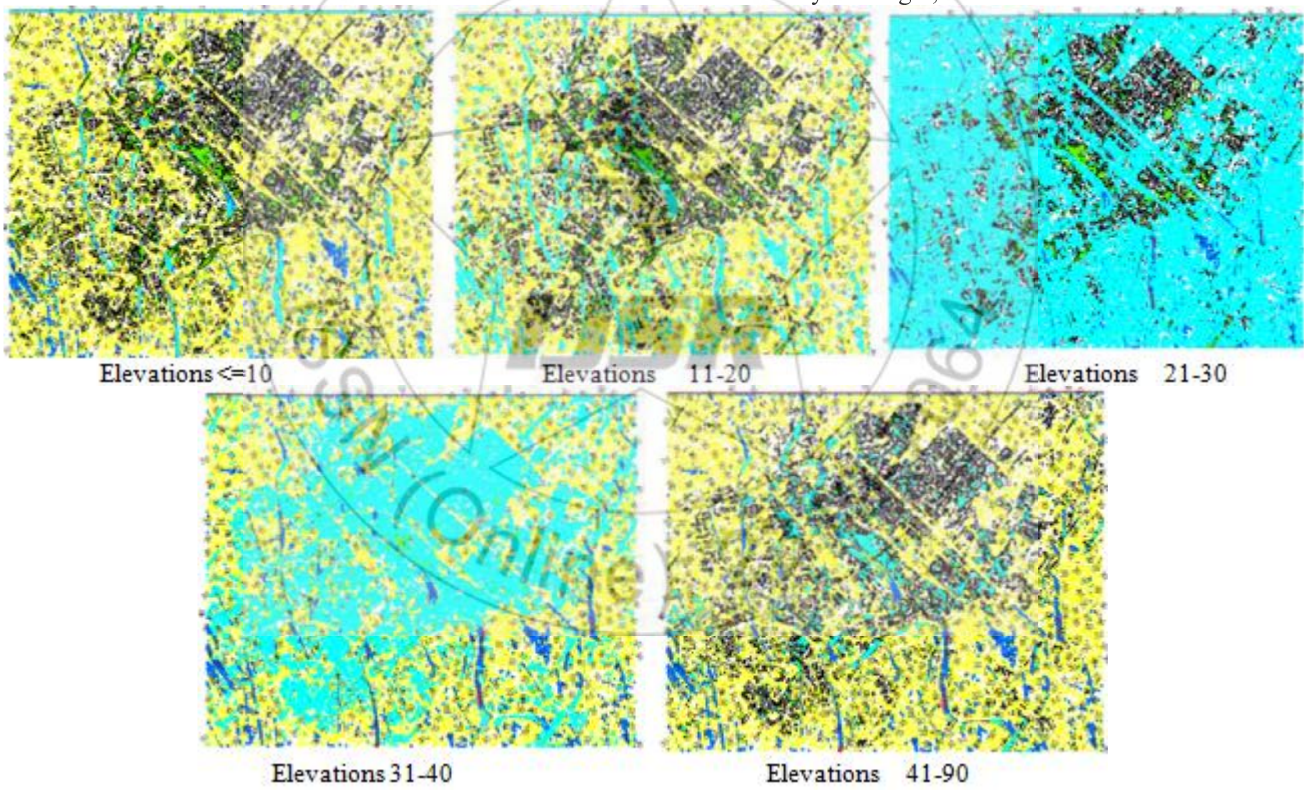

Figure 5: Digital Elevation Model (DEM) for Mesopotamian Plain Iraqi

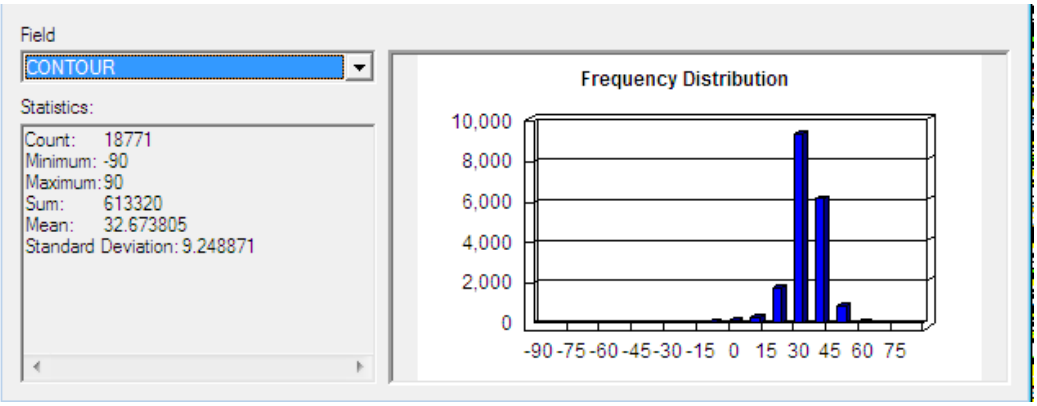

Figure 6: Frequency distribution for elevation

All the elevation in the study area begins to decrease as we move for the South, east and west fig.7, 8, 9 and10.

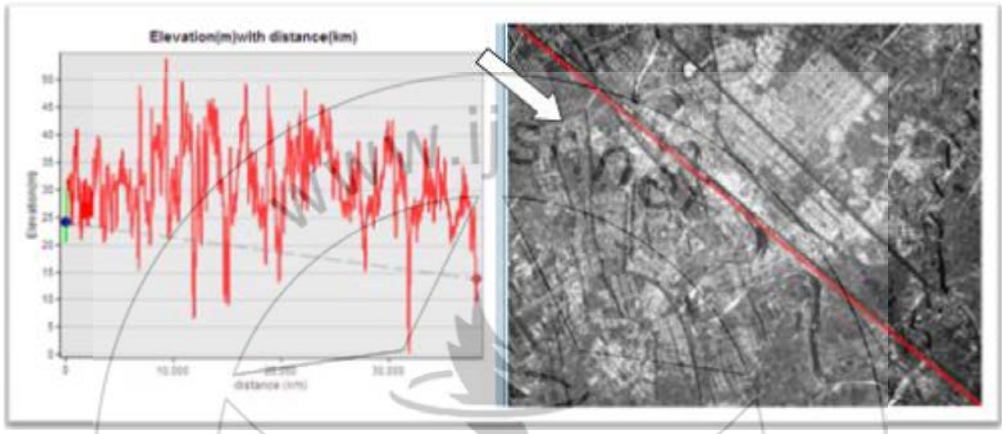

Figure 7: Digital Elevation Model (DEM) to the south east

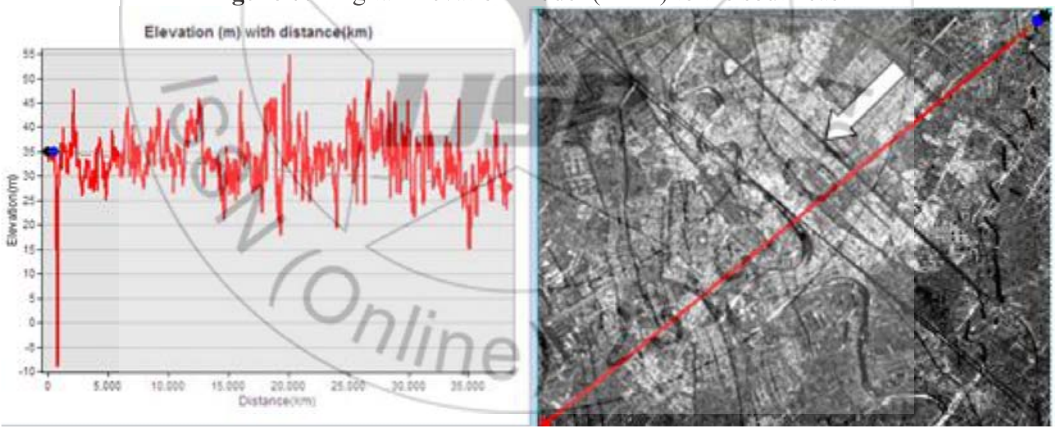

Figure 8: Digital Elevation Model (DEM) to the south west

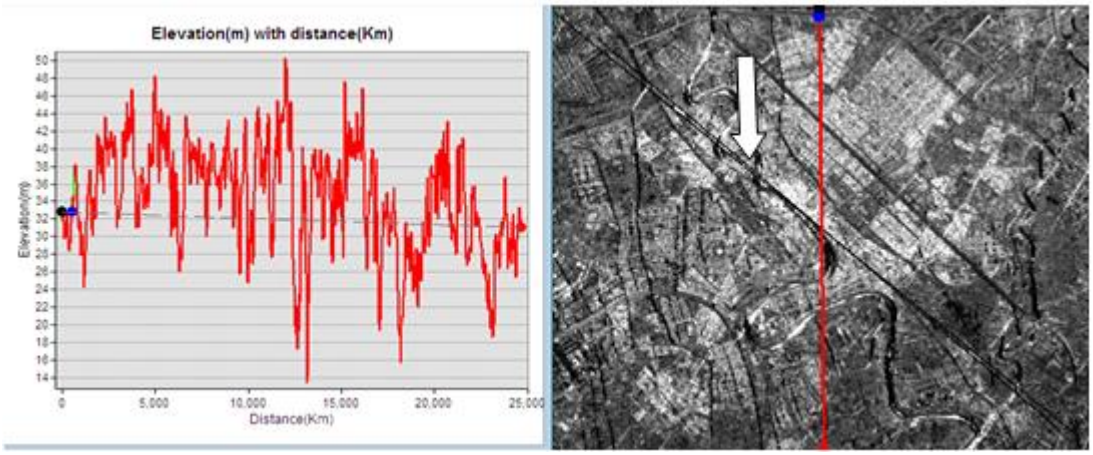

Figure 9: Digital Elevation Model (DEM) to the south

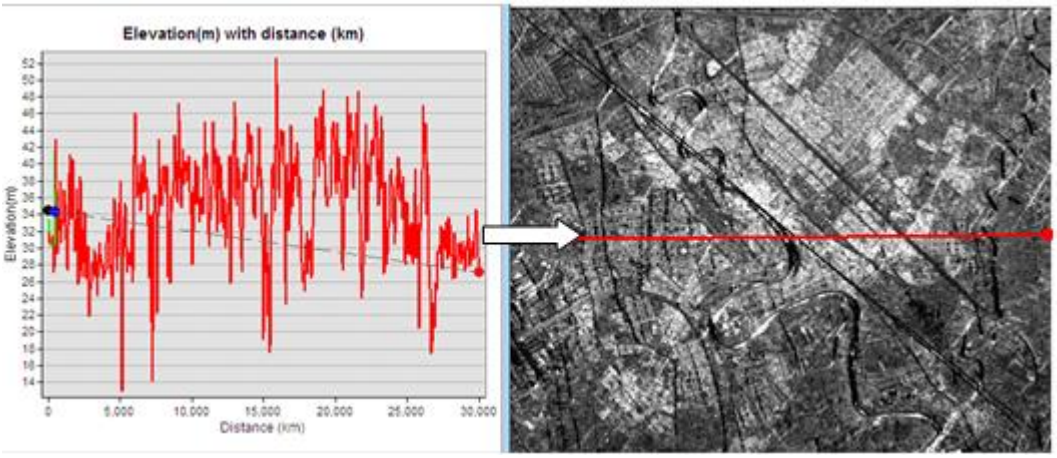

Figure 10: Digital Elevation Model (DEM) to the East

The greatest drop was when heading towards the southern and eastern and western part Compared to the northern part, the greatest low represents the southeast and east in the study area.

Slop map

There are three types of slop in the study area low, medium and high slop, values range for these types from 0-20, 20.01-30 and more than 30.01 respectively, Low-type covers a large part of the study area Followed by Type medium and then kind of Higher (Jason McGilloway 2011) fig.11, 12. That means that the study area is flat except for some places that make up a small percentage and mostly of water bodies such as the Tigris River.

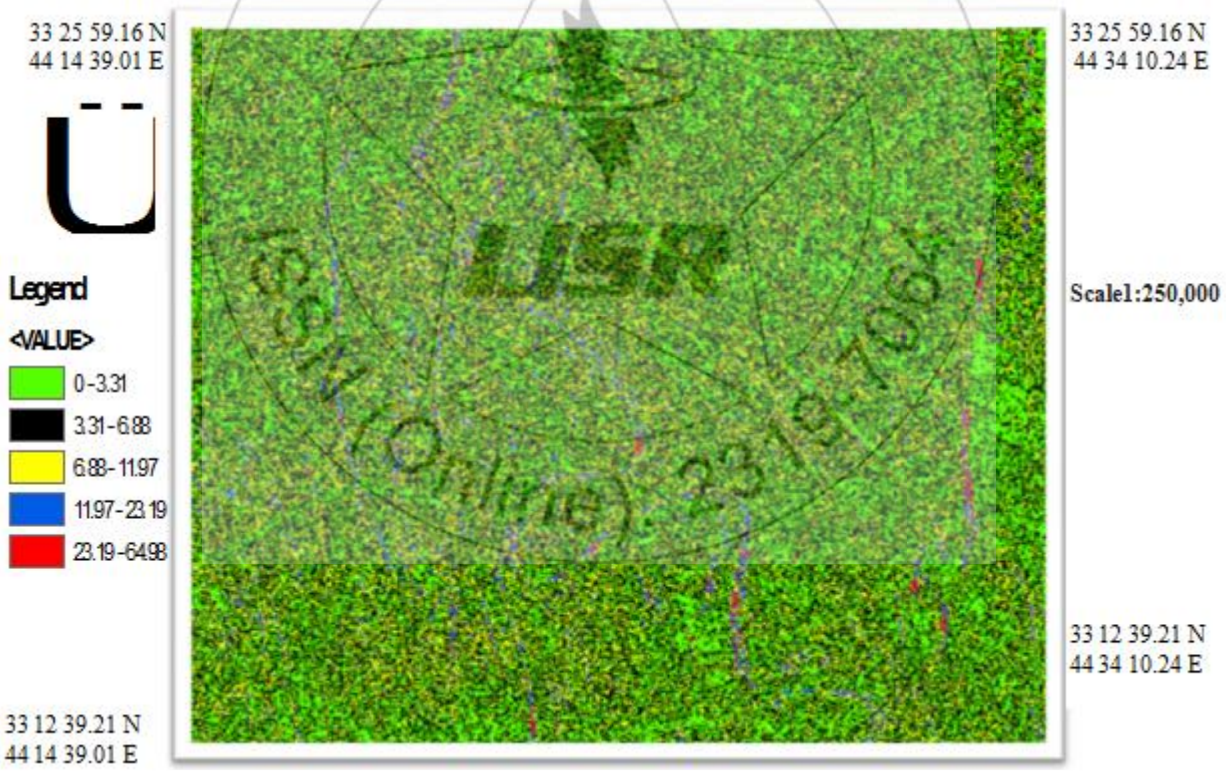

Figure 11: Slop map in study area

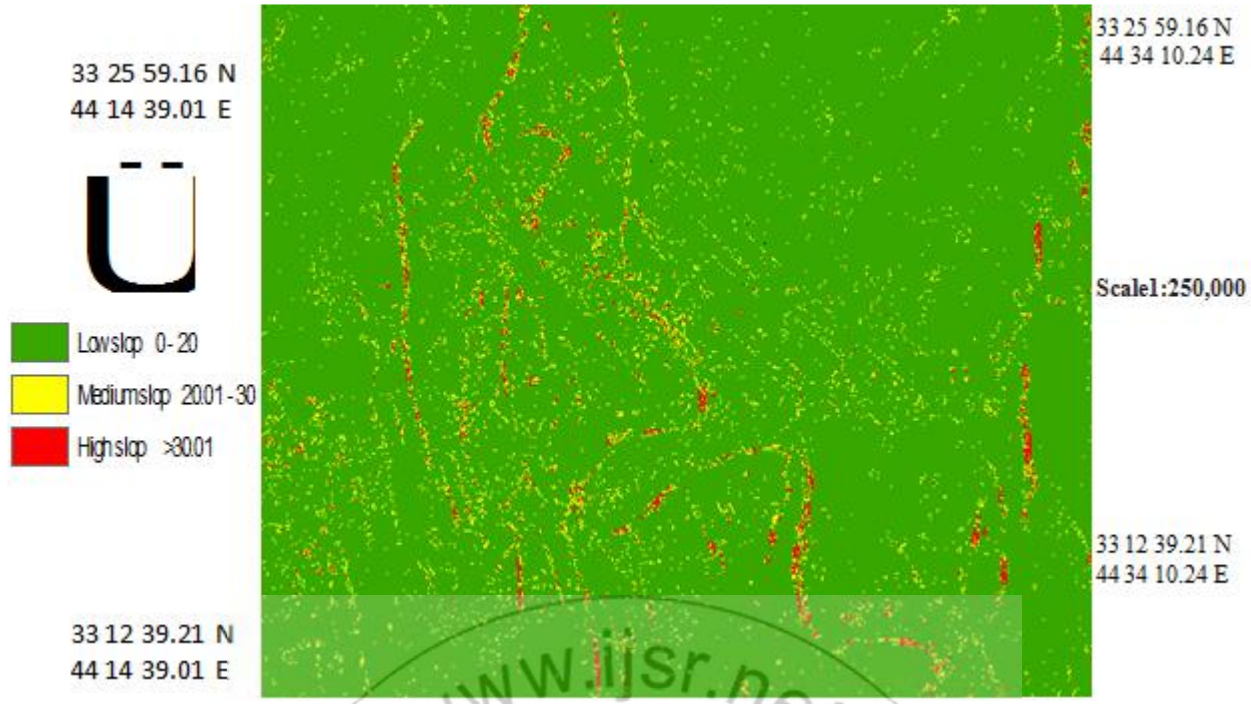

Figure 12: Types of slop

Aspect map

The results referred to the Lands of study area is moving clockwise at different angles towards the north(0-22.5), northeast(22.5-67.5), east(67.5-112.5), southeast(112.5-157.5), south(157.5-202.5), south west(202.5-247.5), west247.5-292.5), north west(292.5-337.5) and back again to the north(337.5-360). The gray color referred to the flat lands.

Figure 13: Aspect map for study area

Soil classification

The **Entisol** soil order, **Fluvent** sub soil order and **Torrifluvents** great group covered the study area **(Muhaimeed et.al 2014).**

4. Conclusion

Most of the study area elevations values from 21 -30 and 31-40 covered, the elevations values begin decrease when heading towards the southern and eastern and western part, but the greatest decrease represents the southeast and east in

the study area. There are three types of slop, Low-type of slop covers a large part of the study area then medium and Higher. That means that the study area is flat except for some places that make up a small percentage and mostly of water bodies such as the Tigris River. The Entisol soil order and sub soil order Fluvent covered the study area.

References

[1] **Burrough, P. and McDonnell, R. (1986)** .Principles of Geographic Information Systems, Oxford University Press, New York, NY, 333 pp.
[2] **Courant, Richard, Herbert Robbins, and Ian Stewart (1996).** What Is Mathematics?: An Elementary Approach to Ideas and Methods. New York: Oxford University Press, p. 344.
[3] **ESRI (2004).**Getting started with ArcGIS .United State of America.
[4] **Hilmi, H. S. M. M.Y. Mohamed, E. S. Ganawa(2014).** Impact of water harvesting dam on the Wadi's morphology using digital elevation model Study case: Wadi Al-kanger, Sudan. IJISET - International Journal of Innovative Science, Engineering & Technology, Vol. 1 Issue 9, November 2014ISSN 2348 – 7968.
[5] **Jason McGilloway (2011)**. Slope Aspect Mapping, Contour Generalizing & Indexing . Brewer's Applied Cartographic Design course, Pennsylvania State University.
[6] **Muhaimeed .A.S, saloom.A.J, Saleem.K.A,Whaib.K.A and Alshafey .W.M (2014)**. Spatial variability for soil order and sub soil order. International Journal of agriculture annovations and research (IJARS).
[7] **Naser El-Sheimy Caterina Valeo Ayman Habib, Digital Terrain Modelling Acquisation, Manpulation & Applications (Artech House, Incorporated, (2005).**
[8] **Omer, Tara Mohammed Anwar.(2011)**. Country Pasture/Forage Resource Profiles. http://www.fao.org/ag/agp/ AGPC/doc/ Counprof/Iraq/Iraq.html.
[9] **Pratibha P. Shingare , Mr. Sumit S. Kale (2013).** Review on Digital Elevation Model Department of Electronics & Telecomm., College of Engineering Pune, India) International Journal of Modern Engineering Research (IJMER) Vol. 3, Issue. 4, Jul - Aug. 2013 pp-2412-2418 ISSN: 2249-6645.
[10] **Wood, J., (1996),** The Geomorphological Characterization of Digital Elevation Models, Ph.D. Dissertation, Department of Geography, University of Leicester, Leicester, UK, 1996.(http://www.gistutor.com/).