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USE OF AERIAL IMAGES TAKEN BY DRONES FOR SURVEY OF SOILS OF AKARKOF AREA LOCATED NORTH WEST OF BAGHDAD IN IRAQ

Wallaa Aldeen Jameel hammad and Abdulhalim Ali Suliman
Soil and water sciences department, College of Agricultural Engineering Sciences ,
University of Baghdad, Iraq
E mail: waldeen324@gmail.com

ABSTRACT

For the purpose of developing and testing new remote sensors, unmanned aerial vehicles (UAV) or what is known as (Drones), have been selected and equipped with a BGR camera of up to 20 megapixels with a resolution 4K photography for conducting soil surveys. The Akarkof area, which is located northwest of Baghdad in the Abu Ghraib district, about 25 km North West from the city center of Baghdad, has an area of 650 hectares and is confined between the two latitude 33° 20´35and 33° 21´40 and the longitude 44° 12´33 and 44° 11´30, the elevation of the study area ranges from 23-29 meters above sea level. In addition to using software to process these images and create mosaics for them. The comparison of spatial accuracy was based on the spatial distinction and the pixel size between the aerial and the satellite images. The satellite images obtained an accuracy about 10 m meters, while the drone imaging gave a 4-centimeter accuracy in addition to their supervised and unsupervised classification and wave classification, which It is based on the visible spectrum only to classify farmland and soil surface. Seven soil pedions were identified for the largest and most frequent areas of the Series, where 10 Series differing in area and frequency were diagnosed**.** The isolation of the image units based on the eight characteristics in the interpretation of aerial images, namely color, shape, size, pattern, texture, shadows, link and location with the types of soil Series, and a final map of the study area was created in the traditional way and IDW. The results reflect and confirm the possibility of using drone images for soil management, mapping, and agricultural field development.
Keywords: Drones, Unmanned Aerial Vehicles, survey soils, RGB

Introduction

The continuous trend in the exploitation of large areas of land, whether agricultural or residential, as well as environmental and climatic changes and the resulting risks to human beings in nature, has an important effect in increasing his desire to document everything on earth in the form of data and maps, as well as the need to keep up with the continuous changes in the earth as well as the technological development taking place in the world, and what requires an integrated vision For all that happens with the latest methods and means, make the individual resort to aerial photography, and from it to take pictures in search of the work of maps and study the surface of the soil for purpose information to meet the needs of each specialty related to these appearances, hence the priorities of specialized aerial photography began to collect information about objects or phenomena and obtain them using devices and equipment from long distances without having direct physical contact with the object or target. (Lillesand,2000).

With the rapid progress in technology, it has become imperative to integrate technology in all sectors, and the use of unmanned aerial vehicles (UAVs) is no longer limited to military fields, as some companies are working to develop drones for the purpose of using them in many fields, such as taking aerial photos and distributing Parcel and postage (Anderson,2013).

The drone editions are comprehensive from regular aircraft or regular aircraft. These services have begun to put a queue in place to receive a set of services in remote areas on the Internet to include all parts of the world.

He explained (M. Ehtisham,2014) that through the definitions and differences in nomenclatures, this is not reflected in the overall meaning of unmanned aerial vehicles, while this difference is due to the diversity of research, studies and angles of view. Aircraft, but this term is widely used in the civilian side, while others argue that the term drone cancels out the value of the human element controlling the plane via the ground station and prefer to use the term Remotely piloted Aircraft System (RPAS) broader and more comprehensive and includes All remote flight requirements from: pilot, equipment and technology, including the drone.

It is another source for remote sensing, Remotely piloted Aircraft System (RPAS), but it is distinguished from satellites with many advantages, the most important of which is that it can photograph and obtain images and the sky is overcast, while this is not possible in the case of satellites, that the satellite visuals taken by satellites give an accuracy in meters While unmanned aerial vehicles (UAV) are given a centimeter resolution. (Bu *et al., 2017*), (Matese *et al*., 2015).

Announced (FAO,2016) The World Food and Agriculture Organization announced that it has entered into a partnership with Google to make remote sensing data more efficient and easier to access good data, which is the key to achieving sustainable development goals by 2030**.**

Agriculture is one of the first sectors to benefit from drones on a large scale, especially in precision agriculture, which involves the use of detailed data on soil types, crops, moisture and yields from increasing agricultural productivity, which enables farmers to respond in a targeted manner instead of traditional, useless methods Especially for large agricultural areas (Bill,2015).

It has become clear (Reg, 2010) that drones can scan crops using infrared cameras to detect the emergence of disease in crops through the changes that appear on them. These systems can also be used for growing crops and spraying pesticides. This agricultural technique is used in Japan to grow rice on a large scale.

He noted (Santana,2010) that there are many future uses of unmanned aircraft in agriculture where unmanned aircraft can be used as a guidance system to assist high-tech tractors in the field.

He concluded (Nigam et al,2011) that drones are the easiest way to collect information and provide the user with the required information. By using drones, health imaging of crops can be made using infrared and multi-spectral sensors, which makes farmers better track crop health, transpiration rates and radiation absorption rates. Sun and so on.

Many studies have stated that drones have already provided evidence of being a suitable model for mapping forests and agricultural crops, when the satellite images or visuals have poor spatial or temporal resolution, and the studies refer to the most important uses of drones in agricultural fields, namely: the discovery of groundwater Ground water Exploration and Land Use Planning, Definition of cultivated Areas, Crop Monitoring, Irrigated Areas, and Range Management Range (Nebiker *et al*.,2008); (Berni *et al*., 2009); (Laliberte *et al*,2011) and (Gini *et al*,2014).

In addition, it has been used (De Castro Neto,2013) to simulate and monitor crop growth.

(Katsaros,2017) proved its effectiveness in spraying agricultural crops with high accuracy and a big cost difference, limiting areas and areas of different crops, determining plant diseases during the growth period, and pest control processes that affect plants at appropriate times, and they suggested using them to identify pests and weeds in the field.

As a result of the lack of such studies in the world and the absence of similar studies in Iraq, so we decided to conduct this research in the field of soil survey, so this study aims at the following: -

1- Soil survey using aerial photos taken with a drone-mounted camera.
2- Test the efficiency of aerial photos captured by drones with satellite visuals.

Materials and Methods

Location and space

The study area is located northwest of Baghdad in the district of Abu Ghraib, which is about 25 km from the city center of Baghdad, and the area of the study area is 650 hectares and is confined between latitude 35´20 ° 33 and 40´21 ° 33 north and longitudes 30´11 ° 44 and 33´12 ° 44 East, and the height of the study area ranges between 23-29 meters above sea level ... as shown in Figure (1)

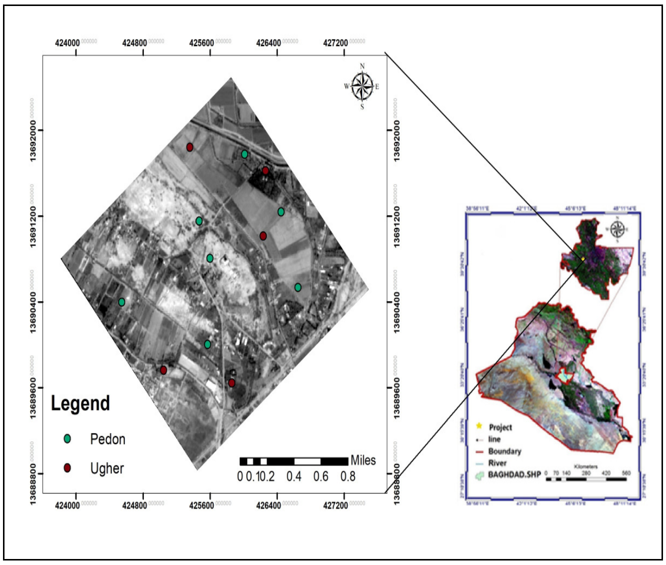


Fig. 1 : Shows the location of the study

Field work

The Mavic 2 Pro drone was chosen by DJI with four foldable propellers, as shown in Figure 2, equipped with a BGR camera of up to 20 megapixels and 4K imaging that contains a typical battery made of lithium fibers It has a flight time of 30 minutes per flight and has a small weight, making it easier to take off and fly without a runway or catapult.

Fig. 2 : Shows the aircraft and its

The design of the flight path consists of determining the number of elements such as determining the number of flying paths, determining the flight altitude and the flight angle, determining a flight time, and the longitudinal and lateral interference ratios of the antenna image. As shown in Figure (3).

The aircraft is controlled independently by an automated GPS-dependent pilot according to previously specified paths before flying, as shown in Figure (3). It ended, as more than 6 batteries were used in the study area due to the distance and the large area of the study area.

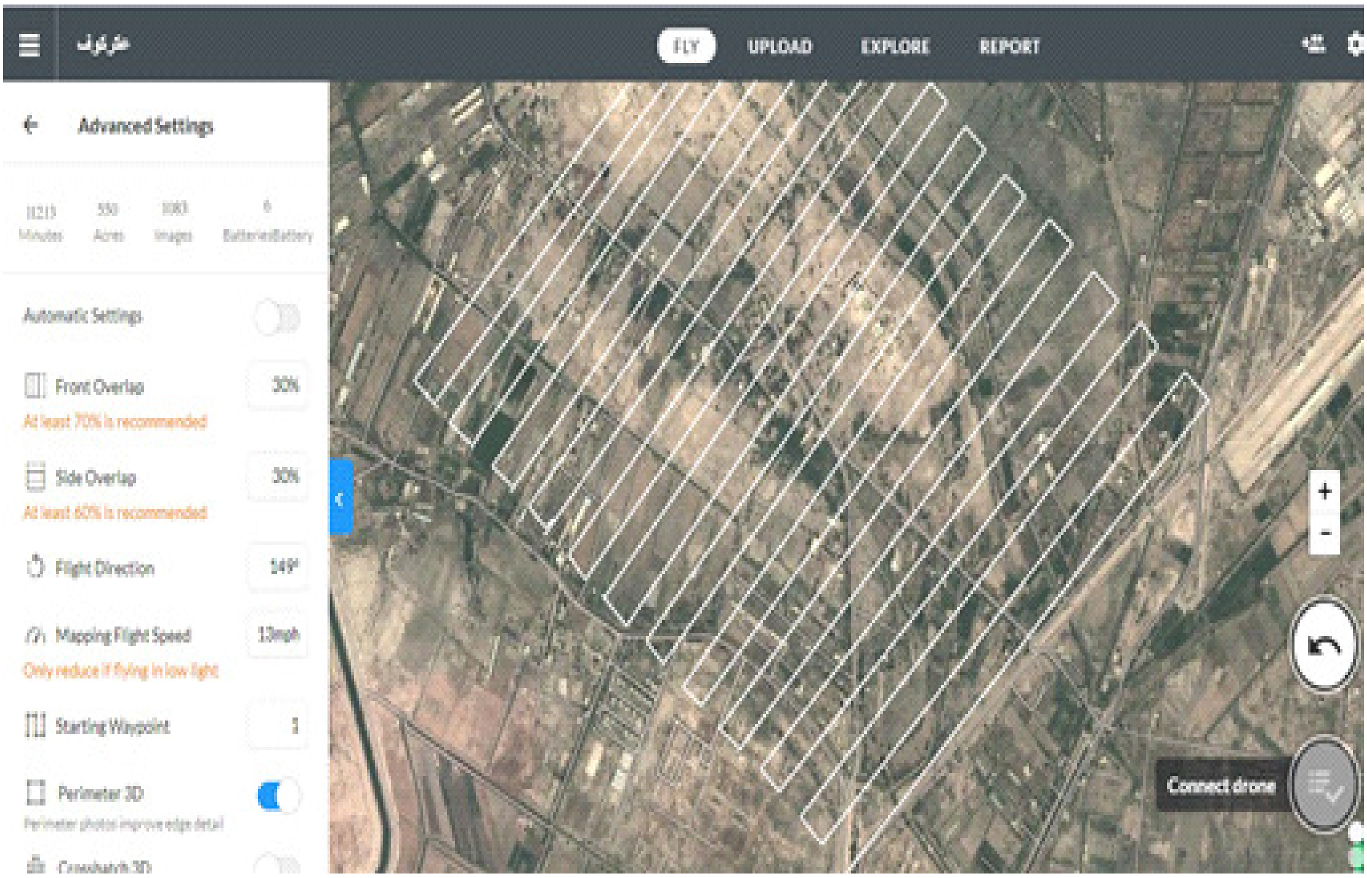


Fig. 3 : Shows the plane's movement paths

Image data were taken for an area of 650 hectares (2500 m × 2600 m) and with a photo sample size of 1144 frames with a 4k video survey to cover the area of the study area and with side and vertical overlap of 30% and vertically as in Figure (4), and after calculating the shots without interference on the basis of subtracting the value of side interference The vertical number was 552 without interference.

The shot was taken with spatial resolution of 140 m × 80 m on the ground and covered an area of 11200 square meters, equivalent to 4.5 dunums for one shot at a height of 100 meters

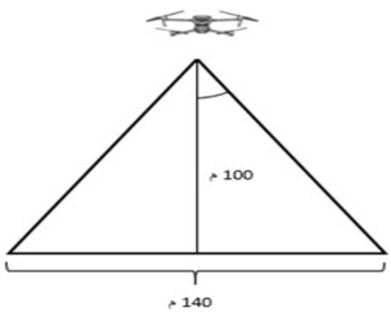


Fig. 4 : Shows the height and dimensions of one image

Office work

To perform a comparison between the satellite visual survey with the aerial imaging survey, a high spatial resolution was selected from the USGS (US Geological Survey) site of the Sentinel-2 satellite with the same date of taking the aerial images, then the coordinates of the study area were projected onto the satellite image and the deduction process was made.

The unsupervised digital classification of the aerial and satellite images for the year 2019 was conducted to determine the land coves in the study area.

Field work

Seven pedons of the most extensive and frequent soil series identified, detected and described morphologically, and the physical and chemical properties of the soil were measured.

The soil of the study area was classified in the form of soil series s, so the proposed classification was adopted by Al-Agidi (1976) to classify alluvia soil series. 10 series were diagnosed with varying area and frequency.

Results and Discussion

Aerial photo and mosaic production

Figure 5 shows the number of images taken from the paths sequentially and sequentially from the paths before the merging process, if the number of paths reached 20 paths and the number of images reached 1144 frames with a side and vertical overlap of 30% where one shot was taken with spatial resolution of 140 m x 80 m on the ground and covered an area of 11200 m 2 Equivalent to 4.5 dunums per shot at a height of 100 meters.

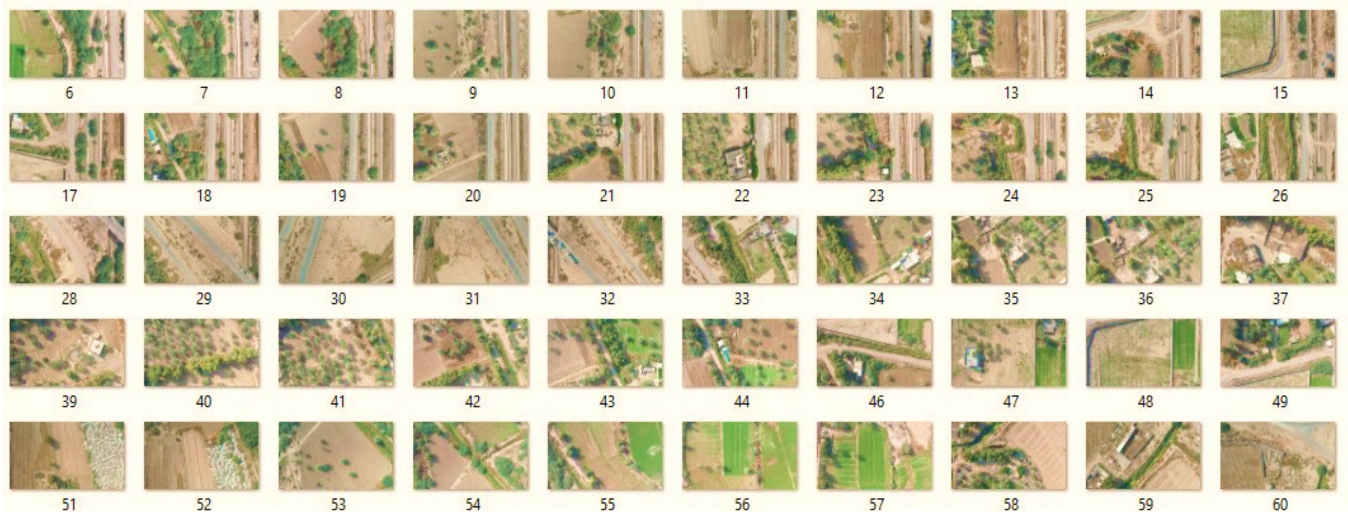


Fig. 5 : Number of images of the serial plane (Drones) before the merging process

The process of geocorrection of aerial images taken by a drone aircraft, then merging and combining the images into a single image called mosaic, was performed after performing all the necessary operations to reduce the differences between aerial images, the most important of which is the engineering difference, after the engineering correction of aerial images.

After performing the correction of the aerial image taken by a drone, it was combined in a mosaic, and then a large aerial image covering the study area was produced, as in Figure 6, through which the visual interpretation and digital classification process was performed.

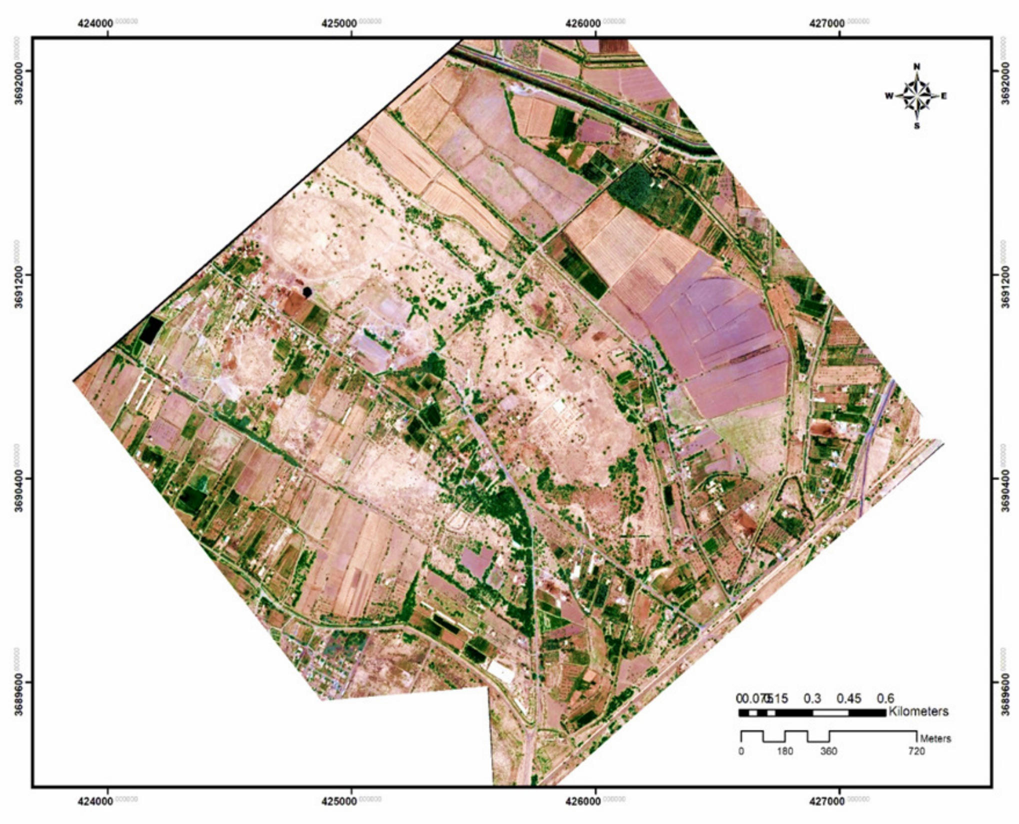


Fig. 6 : Shows the aerial image after the merging process (mosaic)

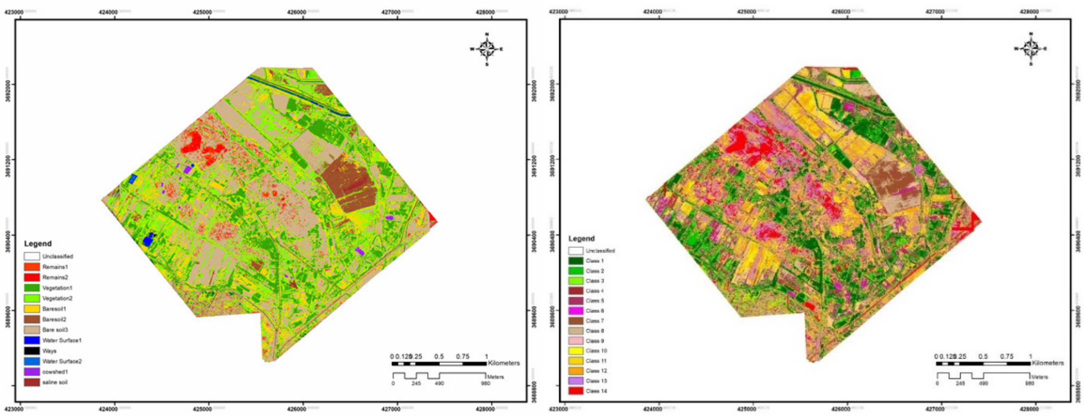
Digital image classification

The digital data were classified by placing the pixel image cells into groups known as spectral rows based on their patterns in order to identify what they represented from the Objects Ground through the different channels (Bands).

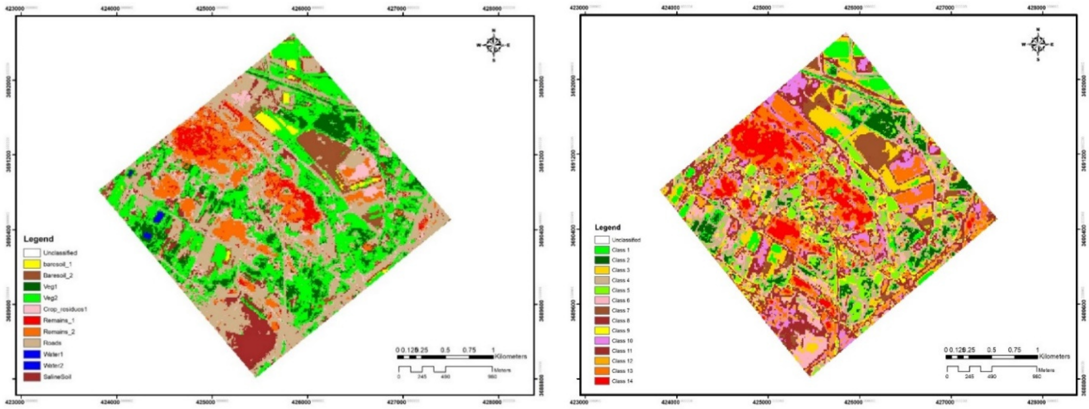
The digital classification of air and satellite data was used in this study, as the results of the study indicated in the use of digital classification, both supervised and unsupervised, and using the ERDAS IMAGINE 14.0 program, to the following:

Interpretation results of aerial photographs using the unsupervised classification method indicated the existence of 20 classes of soil and land use series and 15 classes for satellite visualization. The results of the unguided classification were balanced with the results of the field visits, as they were merged with each other due to slight differences with reality, so that the total of the items for the aerial image became 14 items and 11 items for the space visual as in Fig. A-7 and Fig. C-7.

supervised classification was implemented on the aerial image using 12 wavelengths by choosing typical and accurate training sites that covered the study area, as the distribution of the sites on all the image allows the training data to represent all the variables in the cover patterns present in the image, and then determine the spectral signature of each type of soil series And the rest of the land uses for the study area. The directed classification results indicated the existence of 11 types of soil chains and other land uses, as shown in Figures b-7 and d-7.



a. unsupervised classificationfor aerial imagery **b. supervised classification for aerial imagery**

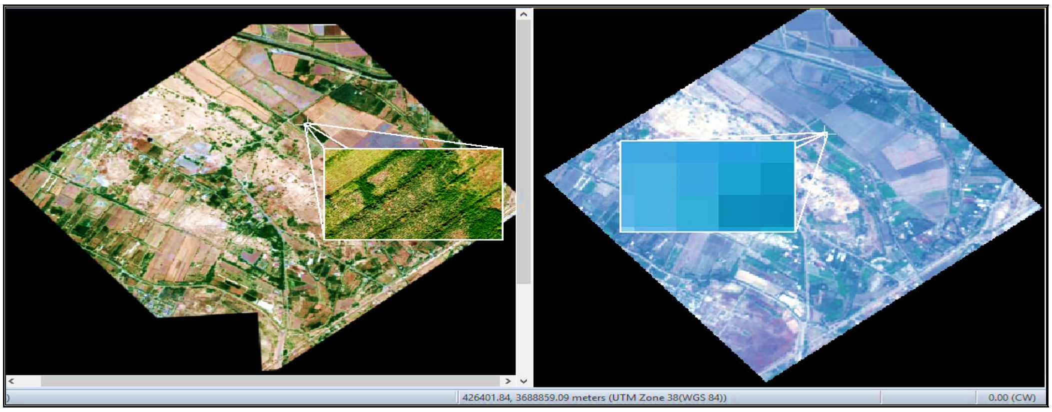


c. unsupervised classificationof the satellite visibility **d. supervised classification of the satellite visibility**

Fig. 7 : Classification of aerial and satellite imagery

Aerial photo and satellite spatial resolution comparison

The comparison with spatial resolution was based on spatial distinction and pixel size. Where Fig. 8 shows the difference in the spatial resolution of a part amplified by the ERADAS software between the aerial and satellite visual images before classification for the same location and the area with difference by spatial distinction.

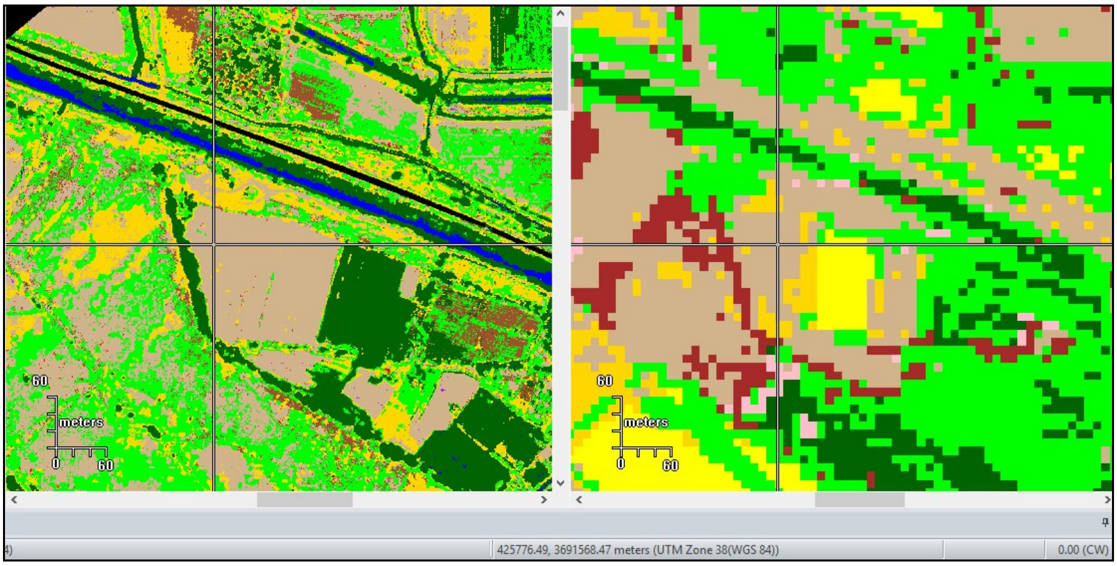


a - the aerial image b - the satellite image

Fig. 8 : Spatial resolution of an enlarged part between the satellite and aerial image

The reason for the high spatial resolution of the aerial image is due to the small size of the cell or the size of the pixels compared to the satellite image , where the cell size represents the smallest area on the earth that can be distinguished, so the smaller the cell size, the greater the spatial distinction, and Figure 9 shows the accuracy of the spatial distinction between the aerial and the satellite image of the same site after Classification process.

Figure 10 shows the pixel size values of the aerial and satellite imagery, where a limit of 4 cm 2 can be distinguished in the aerial image, 10 square meters in the satellite image, meaning that 1 pixel of the satellite image corresponds to 250 * 250 pixel in the aerial image taken by a drone at an altitude of 100 M.



a - the aerial image b - the satellite image

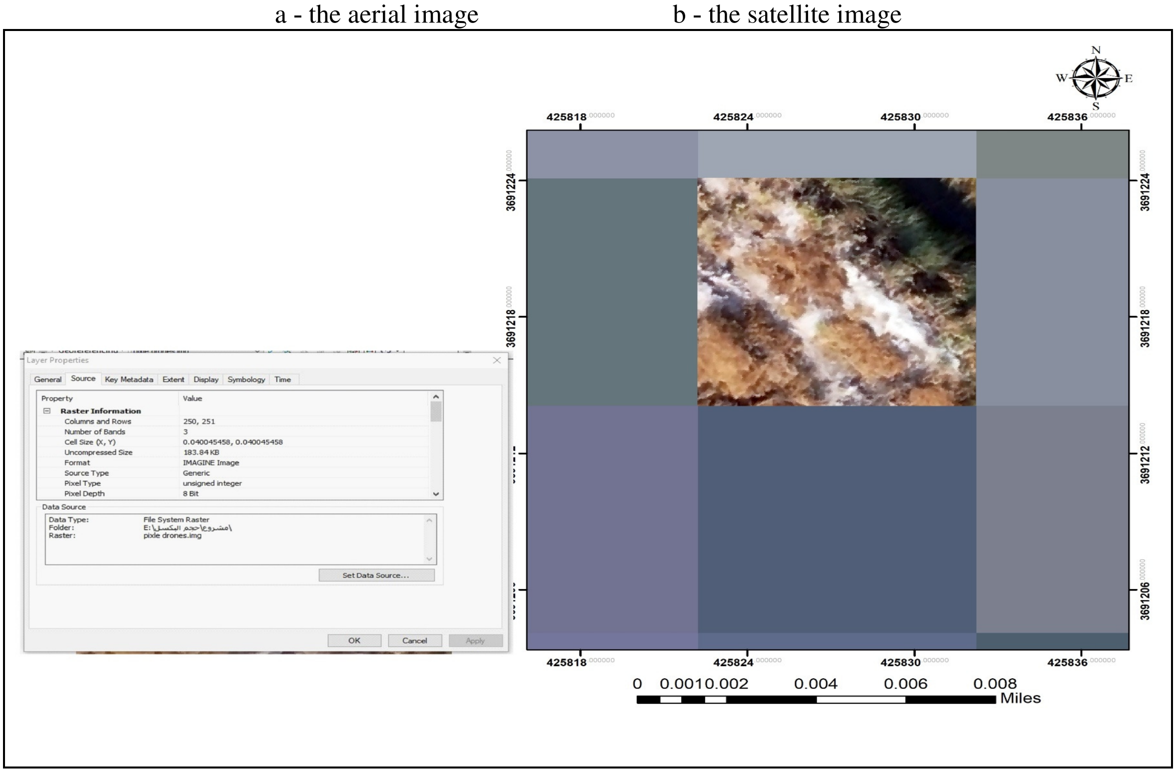


Fig. 9: An enlarged portion between the visible satellite rated wave rating and the air image rated wave rating

Pixel aerial photo	Visual pixel space
0.04*0.04 m	**10*10 m**
250*250 pixel	**1 pixel**

Fig. 10 : Pixel values for the aerial and satellite images

Through the results of the comparison, it is evident the high importance and benefit of using aerial photographs by unmanned aircraft in the field of surveying soils, assisting in their classification, mapping, managing agricultural fields, and the possibility of developing them in the agricultural field**.**

Map of soil Series

The results of the classification and interpretation of the aerial image indicate that there is a difference between the soil units at the series level the soil units are isolated depending on the eight characteristics in the interpretation of the aerial images, which are color, shape, size, pattern, texture, shadows, correlation and location with the types of soil series. Figure 12**.**

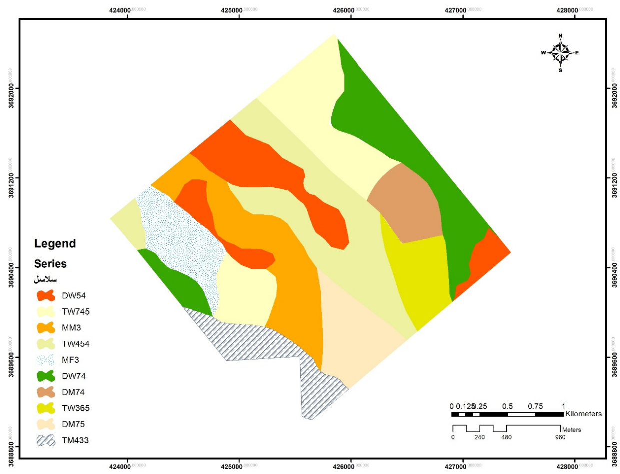


Fig. 11 : A map of soil Series for the study area in the traditional way

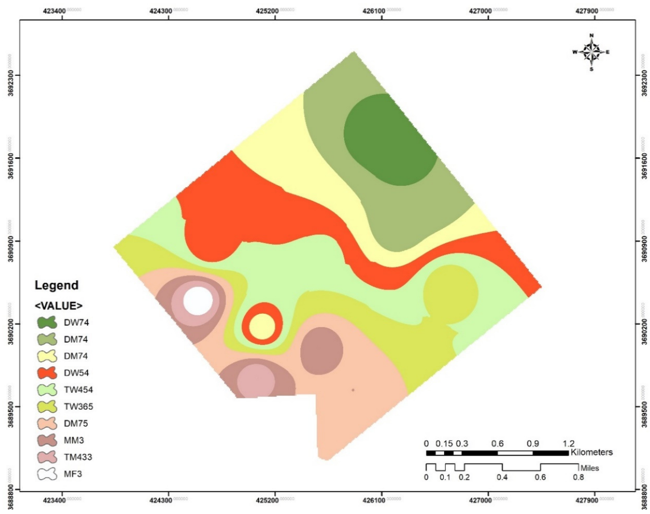


Fig. 11 : A map of soil Series for the study area in the IDW

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