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# Using shape extraction to enhance classification of Landsat satellite images to visualize vegetation

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ABSTRACT

Identifying vegetation from satellite images is very necessary for studies related to agricultural sector. Enhancing the quality and classification of satellite images is a challenge especially when study areas contain complex vegetation. The study aimed to enhance the image classification based on using extraction tool of the ArcGIS. In the present study, the classification of Landsat satellite images before and after extracting specific areas covering vegetation using the ArcGIS was compared. Two regions in Egypt, one with complex vegetation located at Siwa Oasis and the other one with simple vegetation located at Abu Simbel region, were used in this study. Then, several polygons were used to extract specific areas covering vegetation from the satellite images. Images were subsequently classified using Iso cluster unsupervised classification tool. The classification outcomes were compared between the original images before extraction with images after extraction. The results showed that extraction tool greatly enhanced the quality and classification of the image and it was possible to identify different types of vegetation.

## 1. Introduction

Satellite images can be used in many applications and vegetation from these images has special importance for agriculture. For example, changes in land cover have been studied utilizing satellite images and geographical information system (GIS) at El-Behera governorate in Egypt to understand effects on honey production (Abou-Shaara 2013). Also, floral resources for honey bee colonies can be mapped using GIS (Ausseil 2018) including potential sources for resin (Abou-Shaara and Eid 2019). The vegetation layer is important during GIS analysis for specific agricultural activities including beekeeping as an example (Abou-Shaara 2019). It is possible to specify the most suitable locations for apiaries based on many layers including vegetation and distance from plants (Estoque and Murayama 2010; Amiri et al. 2011; Amiri and Shariff 2012; Yari et al. 2016). It is also possible to determine honey production from honey bee colonies utilizing vegetation layer (Adgaba et al. 2017; Abou-Shaara 2019). Moreover, GIS has many applications including planning for different agricultural activities (Abou-Shaara et al. 2013; Ambarwulan et al. 2017).

The quality of the satellite images and correct classification are the main challenge during studies on land cover and vegetation. The method of multispectral classification is a conventional method and has been developed to visualize buildings (Zhang 1999). Other various techniques have been developed to classify and analyse satellite images especially in regard to vegetation including combing two data source to estimate forest variables (Holmström and Fransson 2003), using image fusion to detect fruits (Bulanon 2009), using post-classification enhancement after the classical maximum likelihood classifier (MLC) to Landsat images to improve the classification results (Manandhar 2009), and using spectral signature generalization to improve image classification accuracy (Laborte 2010). Searching for more methods to enhance image classification is very necessary to obtain clear

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vegetation maps. The map with clear vegetation can be precisely handled using GIS and other map analysis programs to extract required information. In this study, shape extraction was used to enhance classification of Landsat satellite images to visualize vegetation and was tested using locations with complex and simple vegetation.

## 2. Methods

### 2.1. Satellite images

Landsat 8 Operational Land Imager (OLI)/ Thermal Infrared Sensor (TIRS) Collection 1 (C1) Level 1 images (March 2018) with 30-meter resolution for two locations were used in this study. The first location had complex vegetation (Siwa Oasis, 29° 10' 53.76" N, 25° 30' 5.76" E). A Google earth image for this location is shown in Figure 1. The second location had simple vegetation (Abu Simbel region, 22° 24' 21.6" N, 31° 32' 41.64" E). A Google earth image for this location is shown in Figure 2.

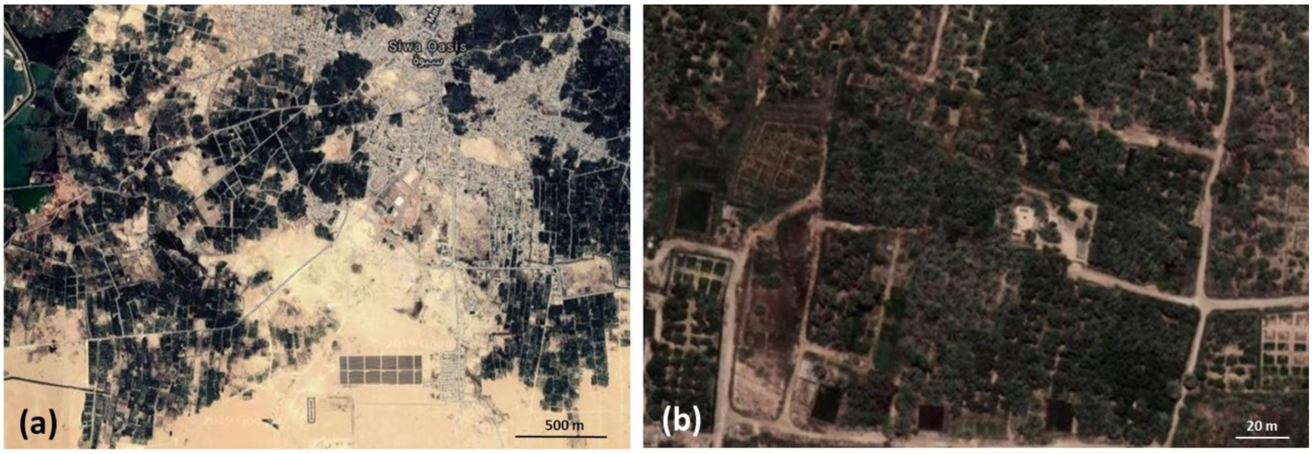


**Figure 1.** A Google earth image for a location at Siwa Oasis (a) with complex vegetation (b)

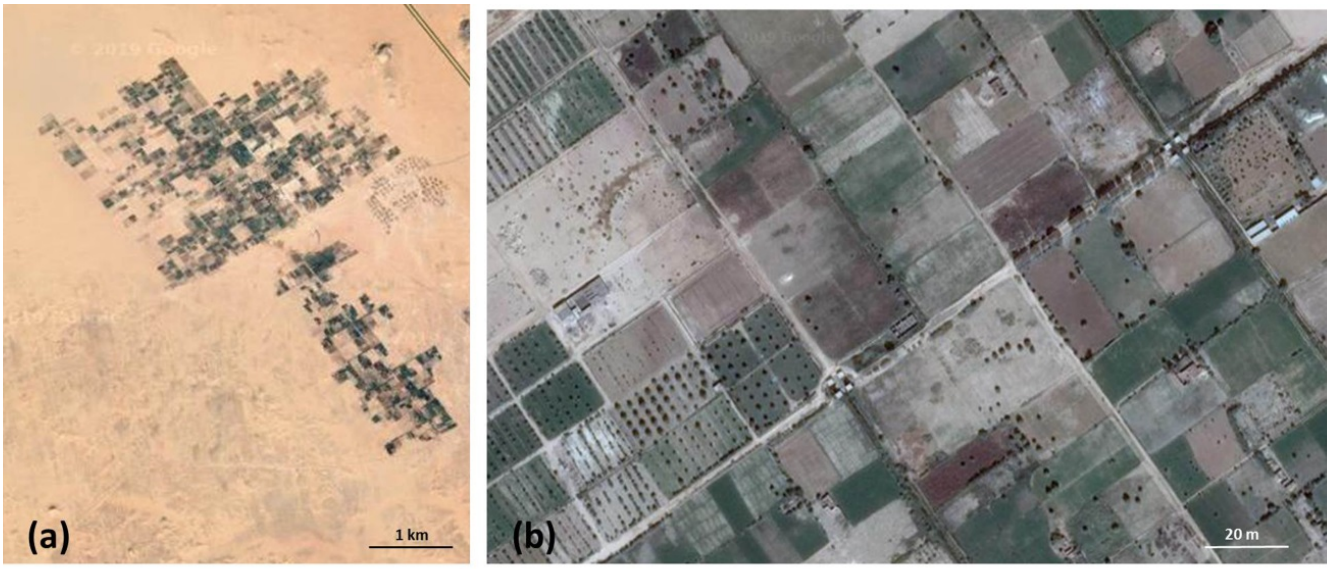


**Figure 2.** A Google earth image for a location at Abu Simbel region (a) with simple vegetation (b)

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### 2. 2. Band composition, extraction, and image classification

The ArcGIS 10 was used to perform the analysis utilizing the satellite images taken during spring 2018. The arrangement of bands as 4-3-2 was used to obtain the natural colours of the two locations. Then, polygons were drawn around specific areas covering vegetation and were extracted from the satellite image (Figure 3). The extraction was done using extraction tool of the ArcGIS. So, the steps of the analysis can be summarized as: 1) obtaining the satellite images for the study locations during Spring 2018, 2) map bands were arranged to visualize natural colours of the image to locate vegetation areas, 3) polygons were drawn around vegetation areas, 4) extraction tool of the ArcGIS was employed to extract vegetation from the satellite images, and 5) the images were classified using Iso cluster unsupervised classification tool into different classes according to land cover type (each class represents specific land cover type).

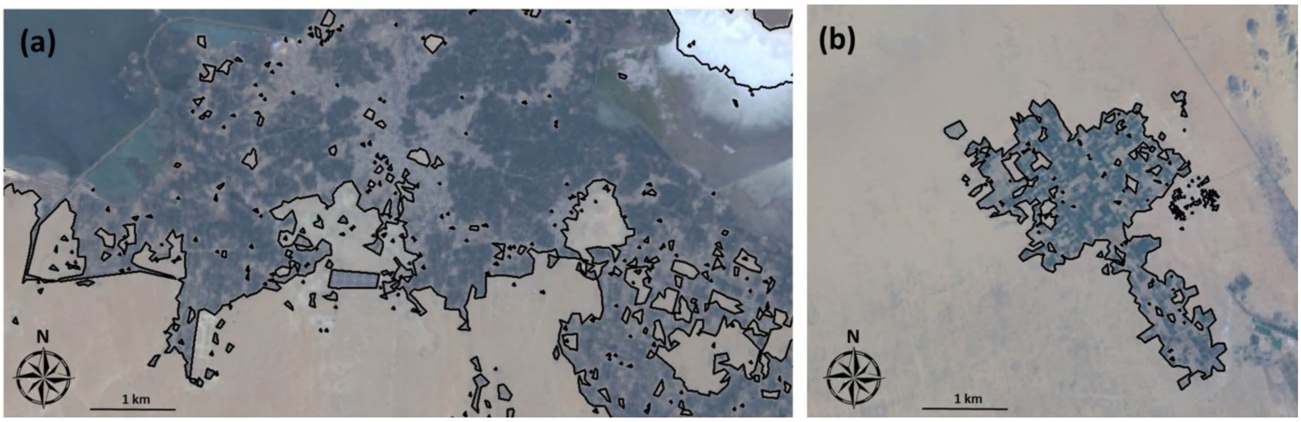


**Figure 3.** Shapes used to extract areas from the satellite images of locations at Siwa Oasis (a) and Abu Simbel region (b)

The vegetation areas in the original images were then compared with those in the new images after using extraction option. The original and the extracted images were also classified using Iso cluster unsupervised classification. Then, the classified images were compared to find out the effects of extraction on image classification results.

## 3. Results and Discussion

### 3.1. Complex vegetation

Extracting the specific locations covering vegetation from the satellite images followed by using band composition (4-3-2) greatly enhanced the visualization of the image in comparison with the image without extraction (Figure 4). It is apparent from the images that the colours of the extracted areas are clearer and darker than the original image without extraction.

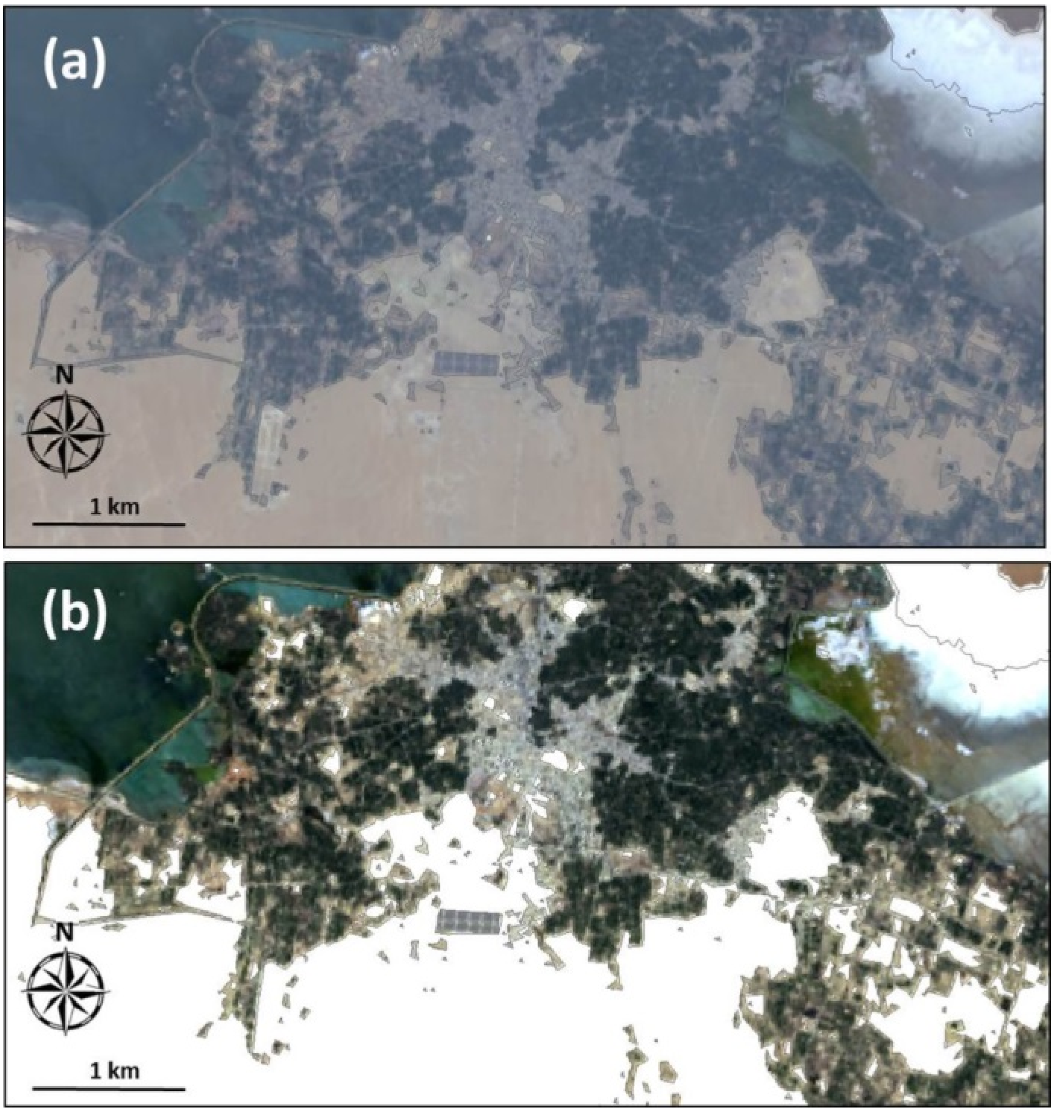


**Figure 4.** Natural colours of the satellite image for a location at Siwa Oasis before extraction (a) and after extracting specific areas covering vegetation (b).

The unsupervised classification presented in Figure 5 clearly shows that the extracted image has more correct details than the original one. Four classes (from 2 to 5) covered vegetation but in the original image without extraction some urban areas were wrongly classified as vegetation. The classification was correct and precise in the extracted image unlike the original one. It is possible to identify different plant types in the extracted image more so than the original one. This indicates that using extraction option can reduce errors during image classification.

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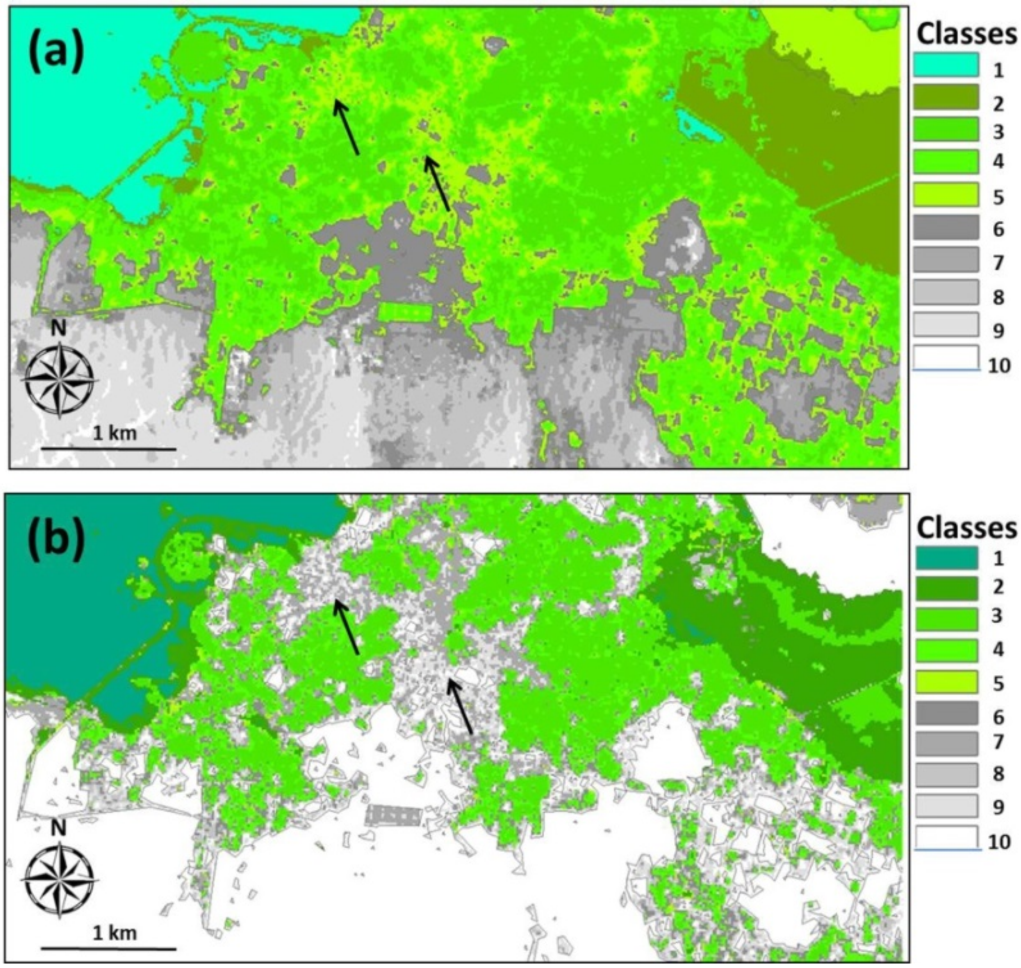


**Figure 5**. Iso unsupervised classification for the satellite image for a location at Siwa Oasis before extraction (a) and after extraction (b) using shapes. The black arrows denote to some urban areas. Classes from 1 to 10 reflect the identified land cover types.

### 3.2. Simple vegetation

Similarly to the location with complex vegetation, the extracted image for a location with simple vegetation was clearer than the original image (Figure 6). Also, the natural colours in the extracted image were darker than the original one without extraction. Two classes (2 and 3) were given to vegetation in the original image while three classes were given to vegetation in the extracted image (Figure 7).

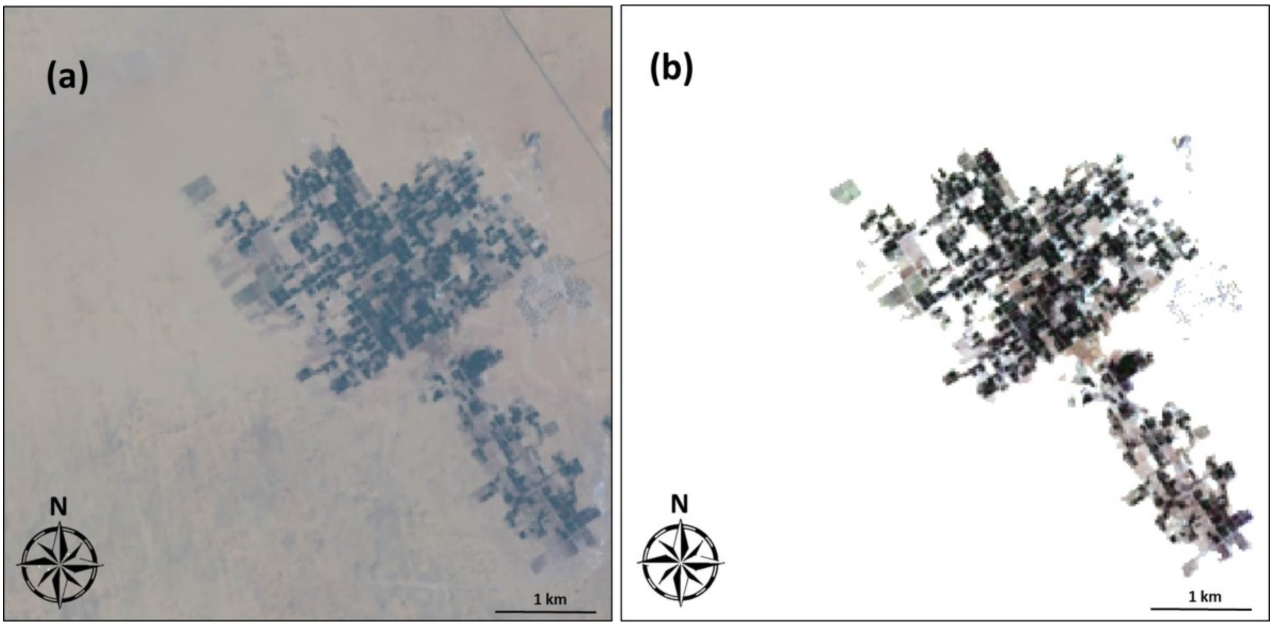


**Figure 6.** Natural colours of the satellite image for a location at Abu Simbel region before extraction (a) and after extraction (b) using shapes.

The classification was better and more precise in the extracted image than the original one, indicating the classification of vegetation according to plant type (e.g. trees, field crops, or grasses) in the extracted image (Figure 7). This confirms that classifying images after extracting specific areas give better results than classifying the original satellite images without extraction.

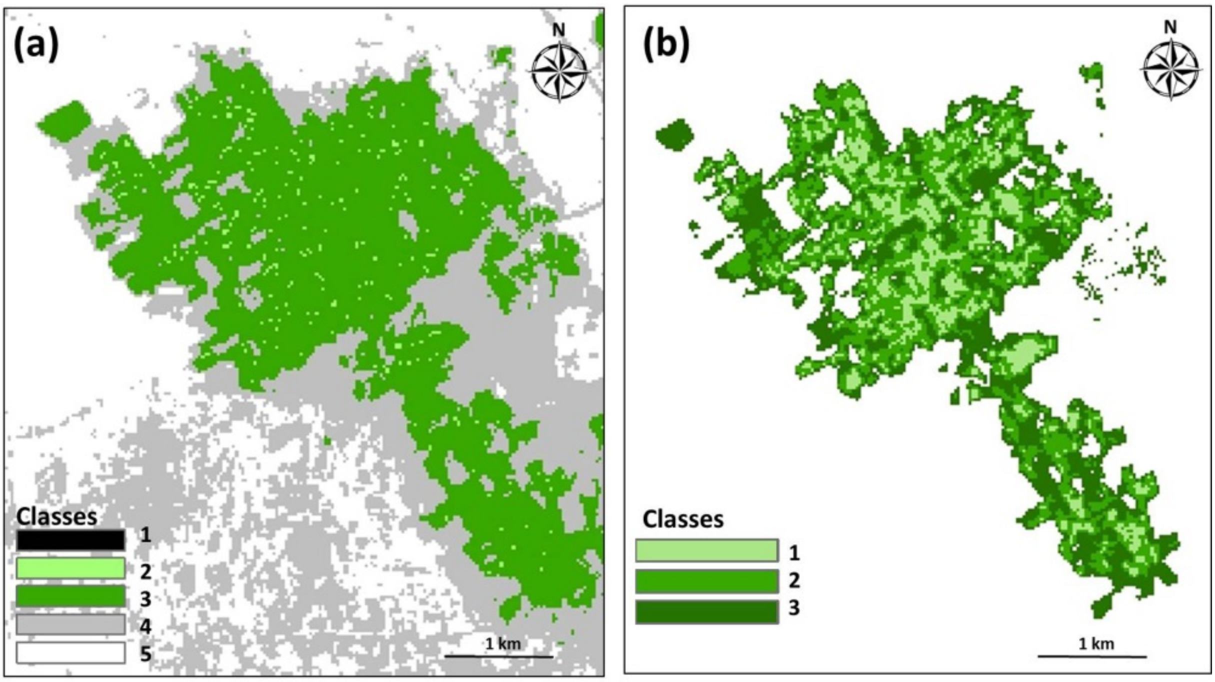


**Figure 7.** Iso unsupervised classification for the satellite image for a location at Abu Simbel region without extraction (a) and after extraction (b) using shapes. Classes from 1 to 5 or from 1 to 3 reflect the identified land cover types.

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## 4. Conclusion

This study proves that using extraction tool in the ArcGIS to separate areas with vegetation from the satellite image befor classification can greatly improve the image classification results instead of classifying the whole areas (vegetation and periphery). The ffeciency of this method was proved using two types of land cover: one with complex vegetation at Siwa Oasis and the second one with simple vegetation at Abu Simbel region. The classification results of the both locations were greatly enhanced after using extraction tool. Therefore, researchers are advised to extract specific areas with vegetation from the satellite images prior to the classification.

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