THE IMPACT OF WAR-INDUCED POPULATION MIGRATION ON LAND USE CHANGES IN THE GOVERNORATE OF SWEIDA, SYRIA

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The war in Syria began in 2011 and has continued until the present time but at a slower pace. The clashes between armed factions led to massive destruction of infrastructure, state facilities, and government departments, which resulted in a state of chaos, insecurity, and instability. Migration began, from unsafe areas to safe areas, including the city of Sweida, which was characterized by peace and security during the war years. A large number of people moved from other governorates to Sweida Governorate, which resulted in great pressure on economic sectors, especially the agricultural sector. This led to the need to cultivate a larger area of agricultural land to fill the agricultural gap. The research aims to show this increase in agricultural land cultivation after the beginning of the war in two years, i.e., from 2013 to 2021, by calculating the Normalized Difference Vegetation Index (NDVI) for each year and creating a line graph.

Keywords: land use; crop lands; NDVI; Sweida.

Introduction. The governorate of Sweida is located in southern Syria. It covers an area of 6550 square kilometers [1], and is considered the original homeland of the Druze community in Syria [2].

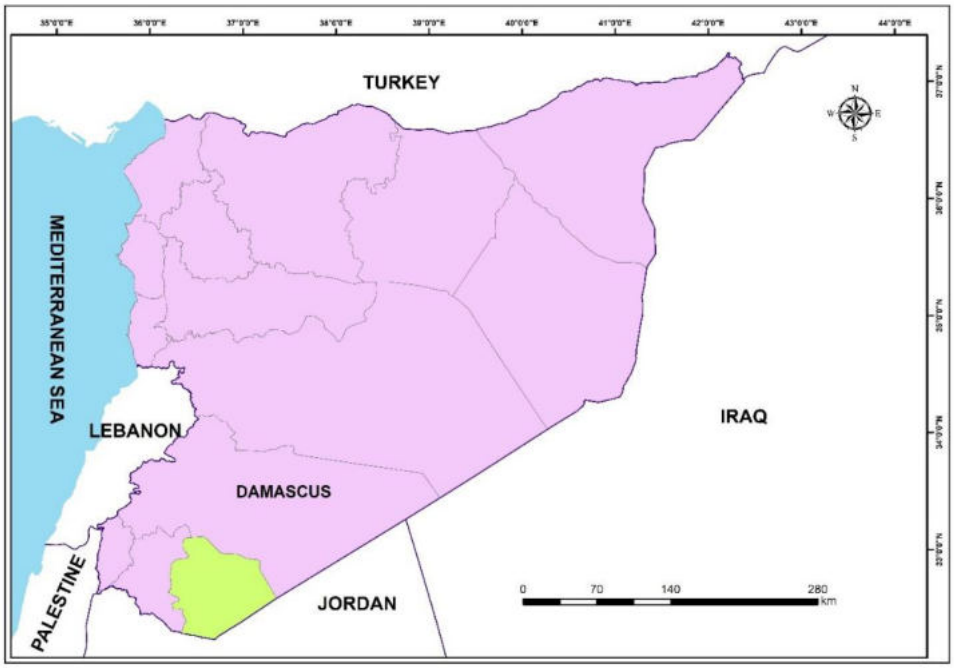

Fig. 1. Location of the governorate

The religious makeup of the province, which consists of approximately 91 % Druze, 6 % Sunni, and 2 % Christian, played a significant role during the years of war [1].

As this province adopted a neutral stance regarding the warring parties, the neutral position taken by the city's residents led to the prevalence of peace and tranquility within the city. This, in turn, resulted in a large influx of displaced people from other Syrian cities experiencing clashes between armed factions [1].

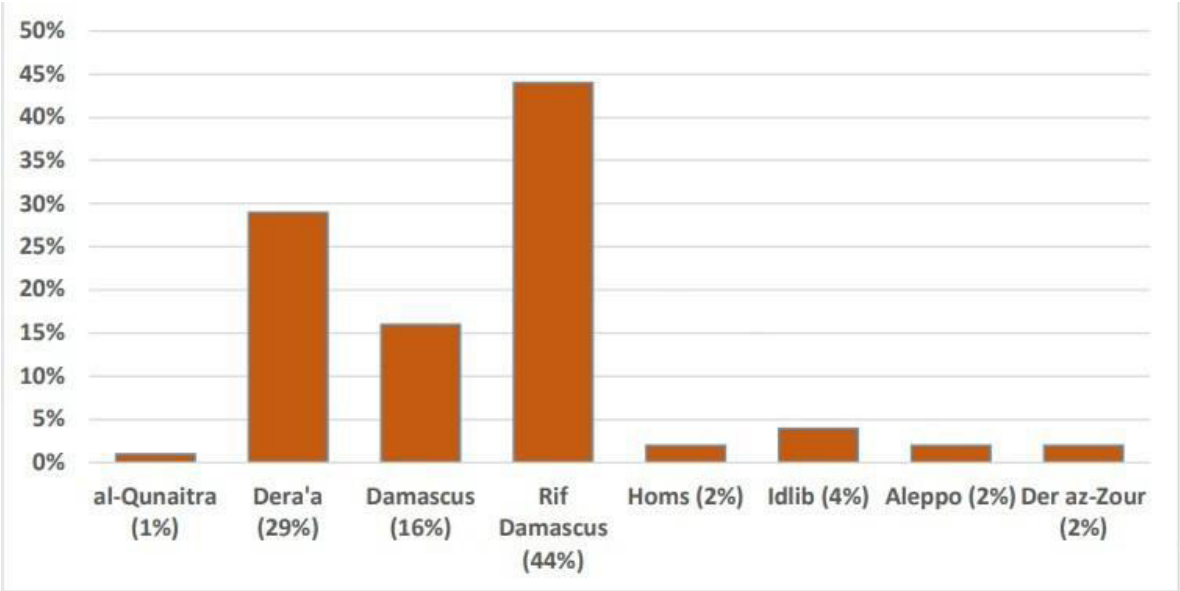

Fig. 2. Displacement Rates from Syrian Provinces to Sweida 15/07/2013

The purpose of the research – based on a long-term series of Landsat images, we determine the changes in vegetation cover in the city of Sweida, which increased significantly in 2013. We attribute this increase in vegetation cover to the influx of a large number of people into the city and an increase in agricultural activities.

The vegetation change index is one of the best indicators for detecting changes in vegetation over different time periods [3].

And it is calculated through the equation:

$$NDVI = (NIR - R) \div (NIR + R)$$

where NIR – near-infrared; R – Red radiation.

The methods used in the research. Starting from 1984 to 2021 satellite image of the city was downloaded from the EOS Land viewer website for the summer months, Summer was chosen because it is the season in which summer vegetables are cultivated, which are the main food source for the population and include tomatoes, potatoes, eggplant, cucumbers, etc. [4].

The Normalized Difference Vegetation Index (NDVI) was calculated for each year within this time frame. Subsequently, a land cover layer was downloaded from the ESA World Cover 2021 [5]. The specific purpose was to extract layer representing agricultural lands. Agricultural lands were isolated to mitigate the impact of other vegetation covers such as trees and grasses on the analysis.

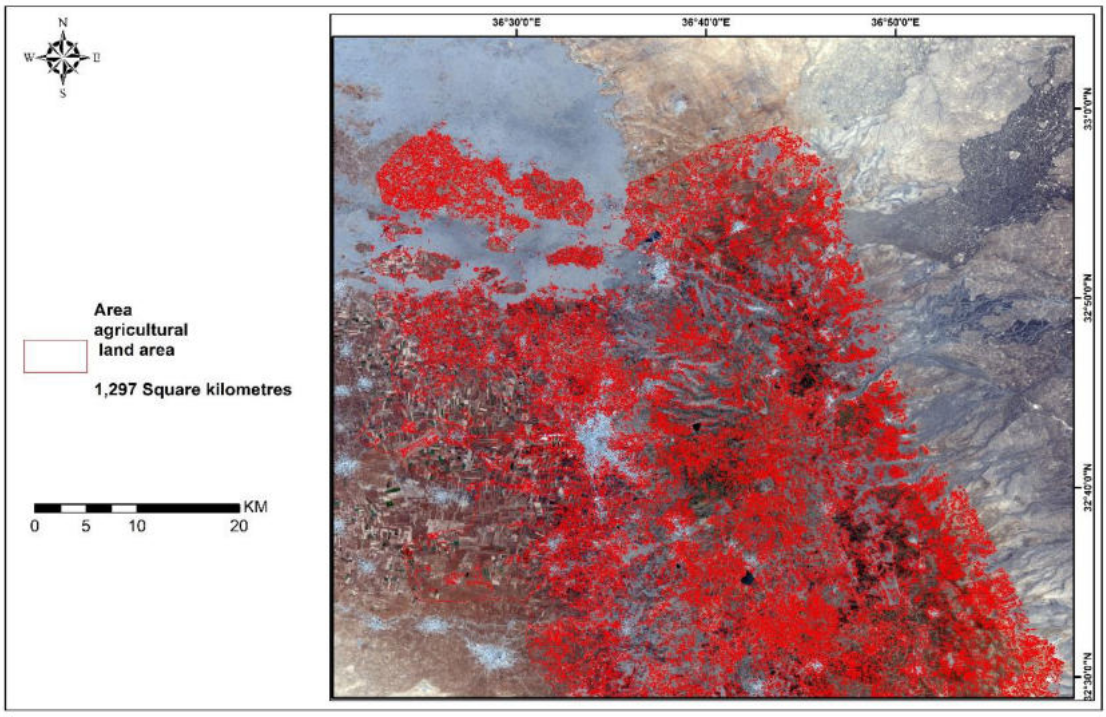

Fig. 3. Agricultural lands in governorate Sweida according to World cover 2021

37 satellite images from Landsat-5 and Landsat-8 were downloaded for the summer season. The earliest image was captured on 3 June, and the latest on 19 August, with some exceptions due to the unavailability of images during certain years or the presence of dense cloud cover. The June was chosen because, during the winter, agricultural lands are cultivated with crops such as wheat, barley, and lentils, primarily relying on rainfall. These crops are harvested in May [6]. After harvesting, summer vegetables are immediately planted, with farmers relying mainly on artesian wells for irrigation. Therefore, summer was selected to distinguish between grain crops and summer vegetables.

Using the Model Builder tool, the average NDVI was calculated for each image and added to a table using the Zonal Statistics as Table tool. Subsequently, the mean values were joined to a shapefile using the Join Field tool. Afterwards, these values were copied to an Excel spreadsheet and visualized as a graph.

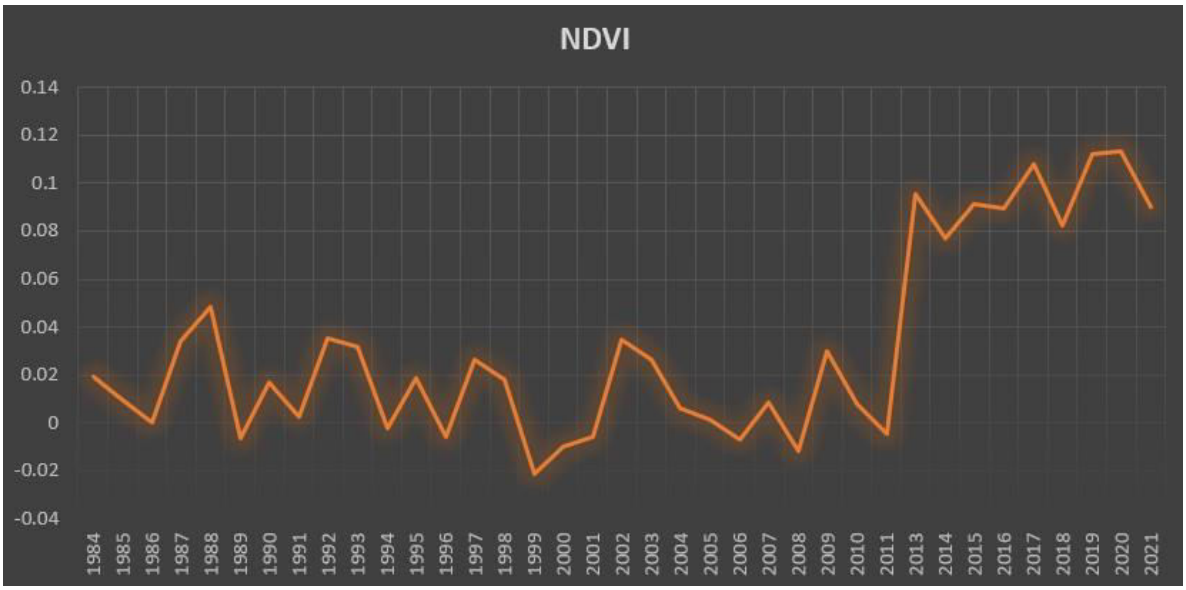

Fig. 4. Changes in Agricultural Crops, 1984 – 2021

Conclusions. We conclude from the graph a sudden rise in 2013, two years after the war, due to the displacement of people to the city and the increase in the area of agricultural land.

There are other factors that affect on land use, the most important of which is the climate, where the vegetation cover can be studied in a specific area and for a specific time period by comparing the vegetation cover with temperature or rainfall, where the percentage of vegetation cover is directly proportional to rainfall and inversely proportional to temperatures within reasonable limits.

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