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Spatial Change in an Egyptian Village

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Author's contribution

The sole author designed, analyzed and interpreted and prepared the manuscript.

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ABSTRACT

Aims: The objective of this paper was to detect spatial change in the village of Shoeshay in Menoufia governorate, Egypt. The study focused on change in the residential area through the period 2003 – 2015, and some other aspects of spatial change.

Study Design: The study is a case study to apply GIS and survey data to explore spatial change in the village.

Methodology: Different types of data were collected using different techniques. The old maps were obtained from the Survey Agency in Cairo. Soft copies of the village maps through the period 2003 to 2015 were obtained from Google Earth. The residential areas were delineated and measured using GIS Arc Map 10.2 tools. The overlay method was adopted to show the expansion of residential areas through the study period. Data concerning other aspects of spatial change were gathered through the author's observation and a survey carried out on owners of buildings and some knowledgeable persons of the village.

Results: Results showed a dramatic increase in the residential areas occurred as a result of encroachment on agricultural lands of the village. Over 82% of this increase has occurred during the last six years (2009 – 2015). Changes have occurred also in the shape of buildings, their identity, building materials and other types of spatial change.

Conclusion: Changes in the spatial distribution of the village may reflect improvements in housing

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conditions and standards of living of inhabitants. But these changes have occurred on the expense of agricultural lands and have a negative effect on land conservation and agricultural sustainability of the village. Great efforts are needed by the agricultural extension organization to make people aware of the importance of land conservation. Great efforts are also needed by the government to take and implement serious decisions to put an end to this critical problem.

Keywords: GIS; overlay method; role of extension; sustainability; types of spatial change.

1. INTRODUCTION

Agriculture is an important economic sector in Egypt. The majority of Egypt's population (57%) are living in rural areas and depend mainly on agriculture. The total cultivated agricultural land in Egypt is 8.2 million acre (5.7 million acre in the old agricultural areas and 2.5 million acre in the new reclaimed areas) [1]. A real pressure on agricultural lands in Egypt has been occurring as a result of population growth and urbanization. The conservation of agricultural lands is essential for achieving agricultural sustainability in Egypt. Therefore, great efforts should be devoted to make people aware of the importance of land conservation to attain agricultural sustainability, and to achieve agricultural development in the country.

Human interference and modifications on the physical environment are important issues facing modern society [2]. Such interference and modifications cause several kinds of environmental change over time besides natural environmental change occurring through natural ecological processes. Spatial change is a subset of environmental change occurring as a result of human interference.

Several kinds of spatial change occur. For example, expansion of buildings on agricultural lands, change in the shape of buildings, change in building material, change in the number of floors, and change in land utilization and the cropping pattern. Therefore, it is important to explore all kinds of change occurred in any community accurately to better understand relationships and interactions between humans and natural phenomenon, better manage and use resources and for the governmental decision-making at local, national, and regional levels [3,4].

Some kinds of spatial change may be regarded as improvements and have positive effects on environment. Some other kinds are against agricultural sustainability and cause harmful consequences on environment and agricultural production. Examples of these changes are: The construction or reconstruction of buildings using modern building materials accompanied with better shape and housing facilities can be considered as improvements of housing conditions in rural areas. But if these improvements were made on the expense of the area of agricultural lands, they will be against sustainability and cause harmful consequences on the environment. While transforming a barn or a pool to build a house, a school or a heath unit for a village will have positive effects on the environment, encroachment on agricultural land for construction of buildings is against sustainability and has harmful effects on environment. Studying these kinds of spatial and environmental changes is critical for planners and decision makers to set up and implement policies and take necessary actions to avoid any harmful consequences occurred as a result of any undesirable expected changes.

Spatial change in Shoeshay village was explored for the first time by the present author in a recent study [5]. The previous study focused on the central village only. But the present study explored spatial changes in the central village and all surrounding ezab. It also applied a different technique for studying this phenomenon. The study depended mainly on using Google Earth maps of the village and its surrounding ezab at different points of time through the period 2003 - 2015, measuring areas under buildings, and applying the overlay method using GIS Arc Map 10.2 tools.

Another research study was carried out by the present author also [6] on encroachment on agricultural lands in Egypt as a main cause of the expansion of residential areas on agricultural lands. The problem of encroachment on agricultural lands in Egypt was explored. A case study on Shoeshay village was conducted and Losses in agricultural lands of the village were estimated through the period 1989 to 2012. It was found that the absence of the implementation of laws and legislations, besides different social, psychological, and economic reasons, encouraged people to encroach on agricultural lands of the village [6].

Different methods and techniques for exploring spatial change have been described, summarized and reviewed by different researchers [3,7]. Among these methods and techniques are: GIS including integrated GIS and remote sensing method and GIS approach, visual analysis which includes visual interpretation, and survey data. A large number of research investigations have been carried out in different parts of the world using integrated remotely sensed data, GIS and survey data [4,8,9,10,11,12,13,14,15,16,17,18,19]. The most common and widely used method of examining spatial change is to overlay maps representing the spatial distribution of a variable of interest at two different time periods [8].

1.1 Objectives

The main objective of this study was to explore different aspects of spatial change occurred in Shoeshay village, Ashmoon district in the governorate of Menoufia, Egypt. The study focused on changes in the residential areas through the period 2003 to 2015. It also explored the changes in the identity of different places, shape and type of buildings, building material, number of floors, and some other types of spatial change.

2. THE STUDY AREA

This research was conducted on Shoeshay village, Ashmoon district, Menoufiah governorate, Egypt. The village of Shoeshay is located in the southern part of the Nile Delta, some 50 kms. North west of Cairo. It is situated in the district of Ashmoon, which is the southernmost district of the governorate of Menoufiah, and lies 10 kms north east of Ashmoon town (the administrative seat of the district), and about 40 kms south of Shibin Elkom (the capital of the governorate) (Fig. 1). The village is circular in shape. It has two main roadways paved leading to Ashmoon from the west and to Shibin Elkom from the north. Within the village, there is an inner circular road, from which small narrow streets lead off. The houses are built on either side of these streets. This is the Central Village. Attached and belonging to it, according to the administrative classification, are six hamlets (Kafr Atta and five other Ezab). The Kafr is 2 kms. West of the Central Village. One of the five Ezab is close to the village on the western side, and another one is close to Kafr Atta. The other three Ezab are 2 to 4 kms from it: one to the south west and the other two to the northwest.

The total population of the village was estimated to be around 15,000 in 2015 [20]. The total cultivated area of the village was 1331 acre and the total number of farmers was 1557 with an average size of land holding of 0.85 acre. Three quarters of farmers of the village hold less than one acre and only 1% of them hold five acres or more. The distribution of farmers according to holding size is given in Table 1. The study was conducted during the period January 2015 to February 2016.

Table 1. Distribution of farmers of the village of Shoeshay according to size of holding

Size of holding (Acre)	Number of farmers	%
Less than one acre	1167	75.0
One – Less than two acres	264	17.0
Two - Less than three acres	67	4.3
Three - Less than five acres	31	2.0
Five - Less than ten acres	12	0.8
Ten acres and more	16	1.0
Total	1557	100.0

Source: The agricultural cooperative association of the village

3. METHODOLOGY

In order to achieve the objective of this research, the village maps were prepared and compared at different times. A hard copy of Shoeshay village map in 1930 was obtained from the Survey Agency in Cairo. A soft copy of this map was prepared and adjusted to be used with other maps obtained from Google Earth for the village and its surrounding Ezab at different points of time every three years through the period from 2003 to 2015. The residential areas on these maps were delineated and measured using GIS Arc map 10.2 tools. The overlay method was adopted to show the expansion of residential areas through the study period. The amount of increase in the residential areas and the annual increase were computed for different time intervals.

Data concerning the shape of buildings, their identity, number of floors, and building materials were gathered through the author's observation and a survey carried out on owners of buildings and some knowledgeable persons of the village.

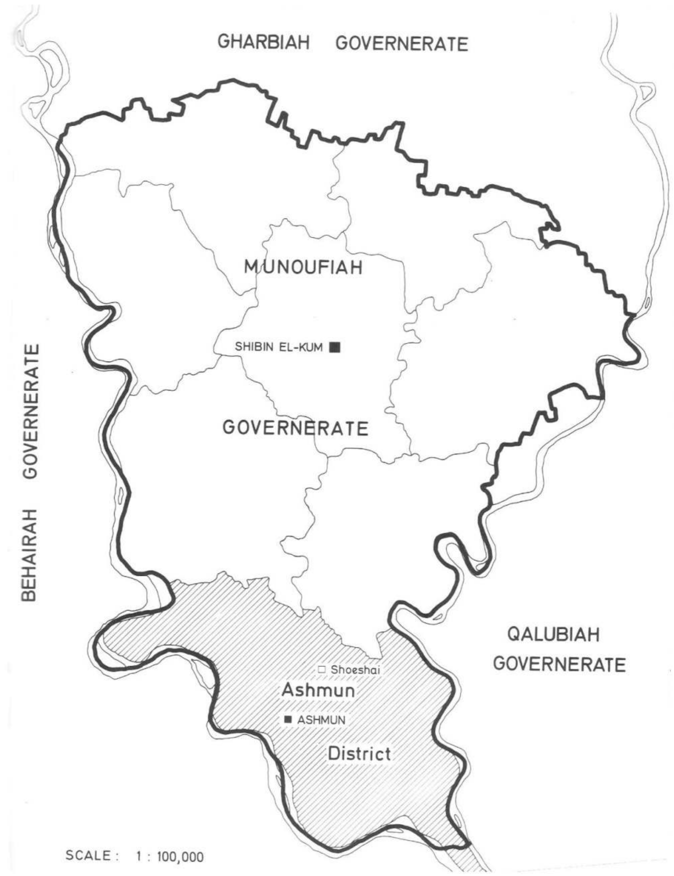

Fig. 1. The location of Shoeshay Village in Ashmoon District, Menoufiah Governorate, Egypt

4. RESULTS AND DISCUSSION

Based on the results of measuring residential areas of Shoeshay and its surrounding ezab using GIS Arc Map 10.2 tools at different points of time during the period 2003 – 2015 (Table 2), it can be observed that significant changes have occurred. These residential areas have increased from 98.7 acre in 2003 to 146.1 acre in 2015. Table 2 shows the development of areas under buildings at different time intervals. It can be seen from the data that the dramatic change of these areas has occurred in the last six years. Nearly 39 acre of agricultural lands have been transferred to buildings since 2009. The average annual increase in these residential areas has gone up from about 1.9 acre during the period 2003 – 2006 to 9.2 acre during the period 2012 – 2015. This expansion of the residential areas has occurred on the expense of the cultivated area of the village (Fig. 2).

Significant changes have occurred in the identity and shape of buildings due to change in the condition of buildings, the construction of new buildings and the reconstruction of most old building, change in building materials and the number of floors. Significant changes have occurred also in the type of buildings. Some types of buildings which existed in the past no longer exist and other types of buildings were established. Examples of these which the author witnessed in the late forties and early fifties are: Ten hand grounders which appeared in the 1930 map have disappeared and two mills were built in different locations, two cooperative associations started operations in 1960, the old compulsory school which was developed to be a primary school was removed and two schools (one for the primary stage and the other for the preparatory stage) were built in different locations in 1980, a youth centre and a post office started operations in 1982, a health unit was built in 1984, three religious institutes were built in 1992, 1996, and 2002, and a number of mosques. Some barns and pools which existed in the 1930 map disappeared and replaced by 34 buildings.

Table 2. Residential areas in Shoeshay Village and its surrounding Ezab through the period 2003 – 2015

Year	Residential areas (m^2)*	Residential areas (acre)	Increase in residential areas (m^2)	Increase in residential areas (acre)	Average annual increase in residential areas (acre)
2003	394743.5	98.7			
2006	417029.8	104.3	22286.3	5.6	1.9
2009	428661.3	107.2	11631.5	2.9	1.0
2012	474356.2	118.6	45694.9	11.4	3.8
2015	584297.0	146.1	109940.8	27.5	9.2
Total			189553.5	47.4	

** Measured from Fig. 2*

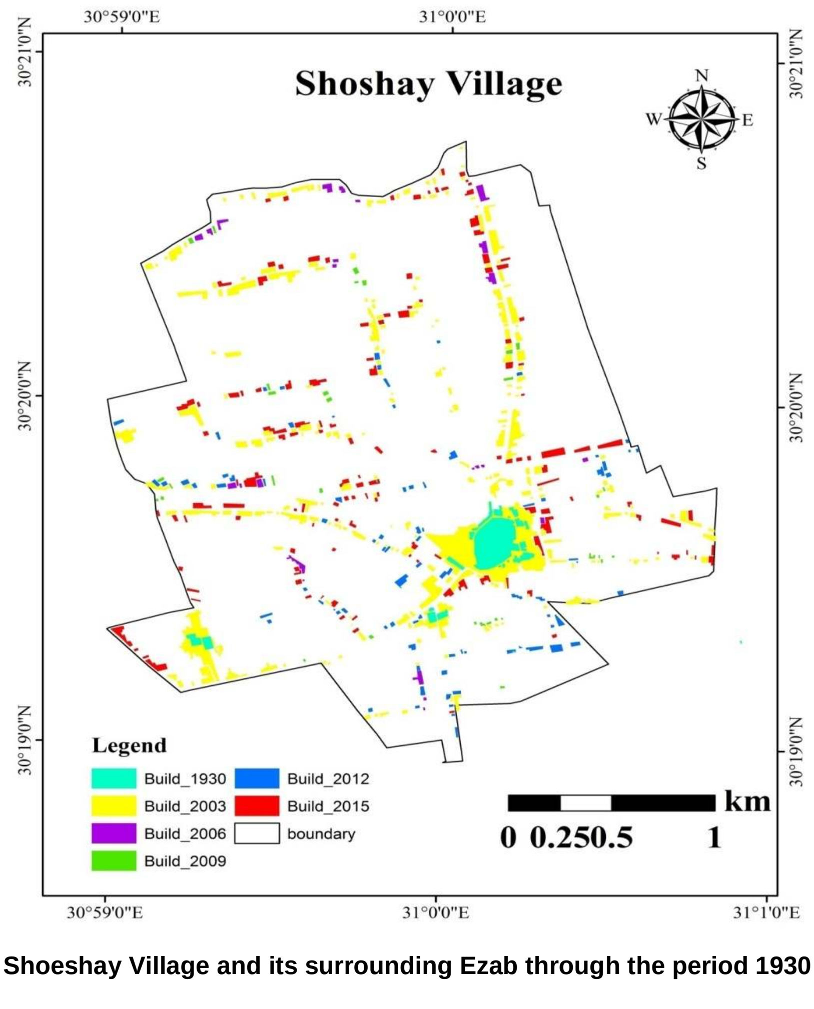

Fig. 2. Shoeshay Village and its surrounding Ezab through the period 1930 – 2015

Changes have occurred in the shape of buildings due to changes in building design, building materials and the number of floors of many buildings. In the past, mud brakes were used for constructing buildings which consisted of one or two floors only and lacked main facilities. But modern building materials (iron and cement) have been used for the construction or reconstruction of most buildings which consist of three to five floors.

The dramatic expansion of areas under buildings is connected with and caused by the problem of encroachment on agricultural lands in Egypt. As mentioned above, this problem was dealt with in a previous research study by the present author

[6]. Several reasons and drives for encroachment were identified. Among these are:

(1) Population growth.
(2) Socio-psychological reasons and drives such as the need for a bigger house due to the increase in family size, the need for an independent house, and the need for better housing conditions.
(3) The need to achieve economic profits.
(4) Ineffective application of conditions for issuing licenses for building on agricultural lands.
(5) Ineffective application of sanctions against encroachment.
(6) The availability of cash money needed for constructing new buildings.
(7) The need to save time and effort needed to transfer things, products, and materials from houses to fields and vice versa.
(8) The availability of electricity.

Great losses in the cultivated area of the village have occurred. The area under building has increased from 98.7 acre in 2003 to 146.1 acre in 2015. Over 82% of this increase has occurred during the last six years (2009 – 2015).

To solve this problem of encroachment on agricultural lands in Egypt, some people may suggest constructing high buildings. But the author believes that this is not a practical solution as it doesn't meet farmers' needs besides many other constraints. The only possible alternative to stop this phenomenon is to establish new communities in desert areas (agricultural and nonagricultural communities). All necessary infrastructure goods and services should be made available in these new communities. Attractive job opportunities, proper means for transportation and communication facilities should be provided. If, and only if, the government could provide this alternative, then efforts are needed to encourage people particularly youth to move to settle in these new communities.

If the government succeeded in achieving this, then a special Court is needed to deal with this problem of encroachment on agricultural lands in the country in order to take severe and quick decisions against it.

5. CONCLUSION

The above results showed that several kinds of spatial change have occurred in Shoeshay village and its surrounding Ezab. The most important of these changes are: The dramatic expansion in the residential areas through the study period particularly in the last six years. The losses in agricultural lands resulting from the horizontal expansion of building have negative effects on agricultural sustainability of the village. Other types of spatial change have also occurred. These changes may reflect improvements in housing conditions and standards of living of Shoeshay inhabitants. But the expansion of the residential areas has occurred on the expense of agricultural lands of the village. Such expansion has a negative effect on land conservation and hence on agricultural sustainability of the village. Great efforts are needed by the government to establish new communities in desert areas, build necessary infrastructure goods and services, and provide attractive job opportunities for youth. Then, special courts have to be established to take and implement serious decisions and severe sanctions against encroachment to put an end to this critical problem. Great efforts are needed by the agricultural extension organization at the Ministry of Agriculture to make people aware of the importance of land conservation and to encourage them to move to these new communities.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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