

Spatial change in an Egyptian village

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Abstract

The main 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 areas of the village and its surrounding ezab through the period 2003 – 2015, and some other aspects of spatial change. Different types of data were collected using different data collection techniques. Hard copies of the village maps were obtained from the Survey Agency and the Construction Planning Agency, Ministry of Housing and Construction 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 show a dramatic increase in the residential areas of the village on the expense of agricultural lands. Great efforts should be devoted by the government and the agricultural extension organization to stop this phenomenon in order to maintain agricultural sustainability in the country.

Key Words: 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 7.8 million faddan (5.4 million faddan in the old agricultural areas and 2.4

million faddan in the new reclaimed areas) (Ministry of Agriculture and Land Reclamation). 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 (Knox and Marston, 2007, p. 13). 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 (LU, *et. al.*, 2004: 2366; Xiuwan, 2002: 121).

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 health unit for a village will have positive effects on the environment, agricultural land degradation 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.

There are different methods and techniques for exploring spatial change. These methods and techniques have been described, summarized and reviewed by different researchers (Singh, 1989; LU, *et. al.*, 2004). 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. Examples of these are: Xiuwan, 2002; Schiagel and Newton, 1996; Salami, 1999; Salami, *et. al.*, 1999; Xiao, *et. al.*, 2006; Guler, *et. al.*, 2007; Shalay and Tateishi, 2007; Harris and Harris, 2008; Al-Ghatam, 2009; Dewan and Yamaguchi, 2009; Kelarestaghi and Jeloudar, 2011; Anil, *et. al.*, 2012; and Huang and Klemas, 2012).

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 (Schiagel and Newton, 1996: 839). The overlay method of maps was adopted to examine the spatial distribution of residential areas at different time periods.

Spatial change in Shoeshay village was explored for the first time by the present author in a recent study (Abdel-Maksoud, 2013). But the previous study focused on the central village only. 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, and measuring areas under buildings using GIS Arc Map 10.2 tools.

2. Objectives:

The main objective of this study was to explore different aspects of spatial change occurred in Shoeshai village, Ashmoon district in the governorate of Menoufia, Egypt through the period 2003 – 2015. 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, and the number of floors.

3. The Study Area:

This research was conducted on Shoeshai village, Ashmoon district, Menoufiah governorate,

Egypt. The village of Shoeshai 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) (Figure 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 expected to be around 15,000 in 2015, assuming that the annual rate of increase is 2% (Central Agency for Public Mobilization and Statistics). The total cultivated area of the village is 1268 feddan and the total number of farmers is 1557 with an average size of land holding of 0.81 feddan. Three quarters of farmers of the village hold less than one feddan and only 1% of them hold five feddan or more. The distribution of farmers according to holding size is given in Table 1.

4. 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.

4. Results:

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 (Figures 3 - 7), it can be concluded that significant changes have occurred in the residential areas of the village of Shoeshay and its surrounding ezab. These residential areas have increased from 94 feddan in 2003 to 139.2 feddan in 2015. Table 2 shows the development of these residential areas 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. Over 37 feddan of agricultural lands have been transferred to residential areas since 2009. The average annual increase in these residential areas has gone up from about 1.77 feddan during the period 2003 – 2006 to 3.6 feddan during the period 2009 – 2012 and to 8.7 feddan during the period 2012 – 2015. This expansion of the residential areas has occurred on the expense of the cultivated area of the village.

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 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 on the 1930 map have disappeared and two mills were established in different locations, two cooperative associations were established 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 established in different locations in 1980, a youth centre and a post office were established in 1982, a health unit was established in 1984, three religious institutes were established by self efforts of Shoeshai inhabitants in 1992, 1996, and 2002, and a number of mosques. Identified barns and pools on the 1930 map no longer exist and 34 new buildings were constructed on their locations.

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 most 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.

Conclusion:

The above results show 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 three years. The losses in agricultural lands resulting from the horizontal expansion of building have negative effects on agricultural sustainability of the village. Significant changes have also occurred in the identity of locations, changes in the shape and type of buildings, building materials, and the number of floors. 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 agricultural extension organization at the Ministry of Agriculture 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.

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

Size of holding (Feddan*)	Number of farmers	%
Less than one feddan	1167	75.0

One – less than two feddan	264	17.0
Two - less than three feddan	67	4.3
Three - less than five feddan	31	2.0
Five - less than ten feddan	12	0.8
Ten feddan and more	16	1.0
Total	1557	100.0

* One feddan = 4200 m²

Source: The agricultural cooperative association of the village

Table 2: Residential areas in Shoeshay village and its surrounding ezab
through the period 2003 - 2015

Year	Residential	Residential	Increase in	Increase in	Average annual
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	areas (m ²)*	areas (feddan)	residential areas (m ²)	residential areas (feddan)	increase in residential areas (feddan)
2003	394743.5	94.0			
2006	417029.8	99.3	22286.3	5.3	1.77
2009	428661.3	102.1	11631.5	2.8	0.93
2012	474356.2	112.9	45694.9	10.9	3.63
2015	584297.0	139.1	109940.8	26.2	8.73
Total			189553.5	45.1	

* Measured from maps using GIS Arc map 10.2 tools.

Source: Figures 3 – 7.

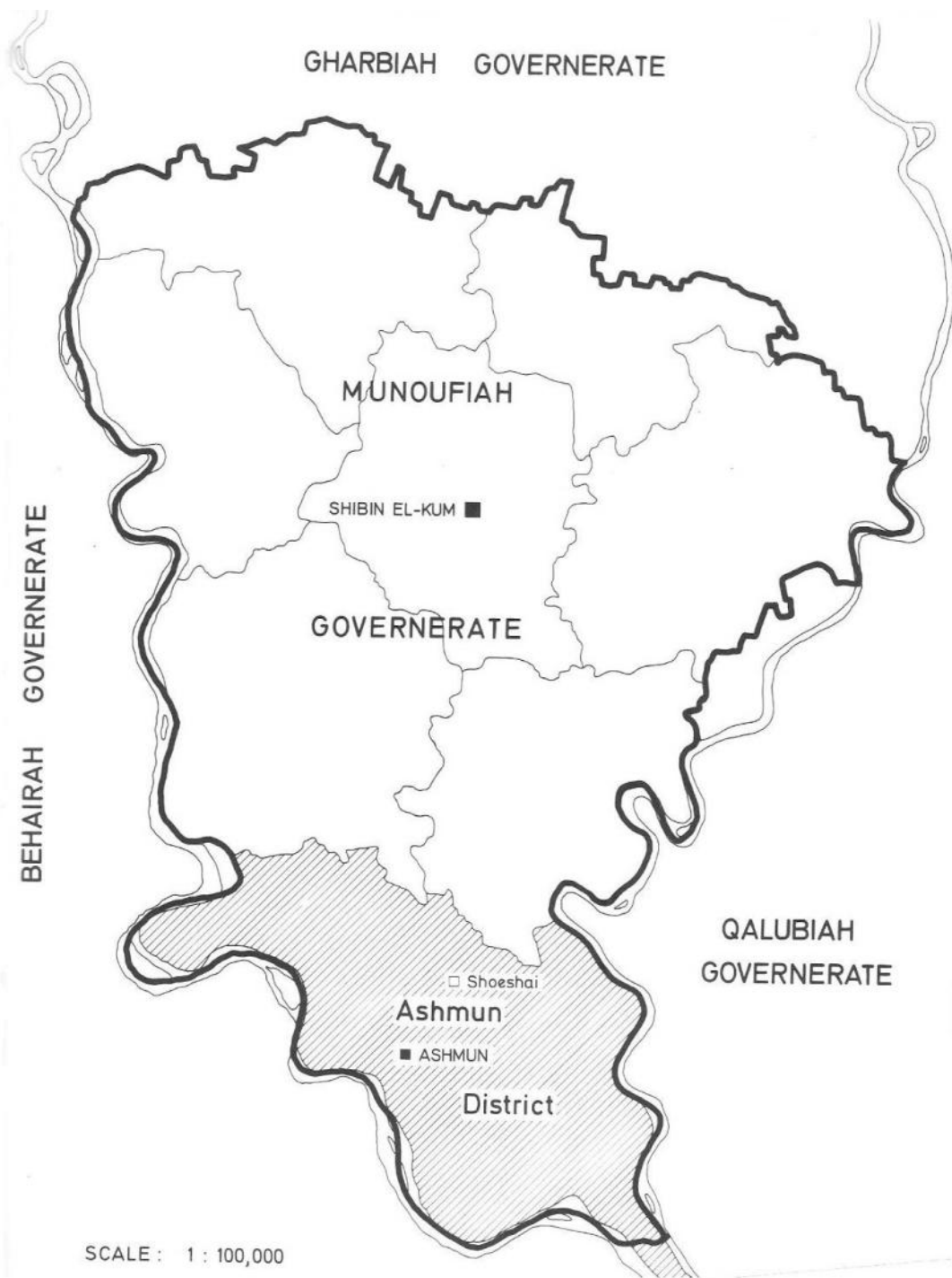


Figure 1: The Location of Shoeshay Village in Ashmoon District,
Menoufiah Governorate, Egypt

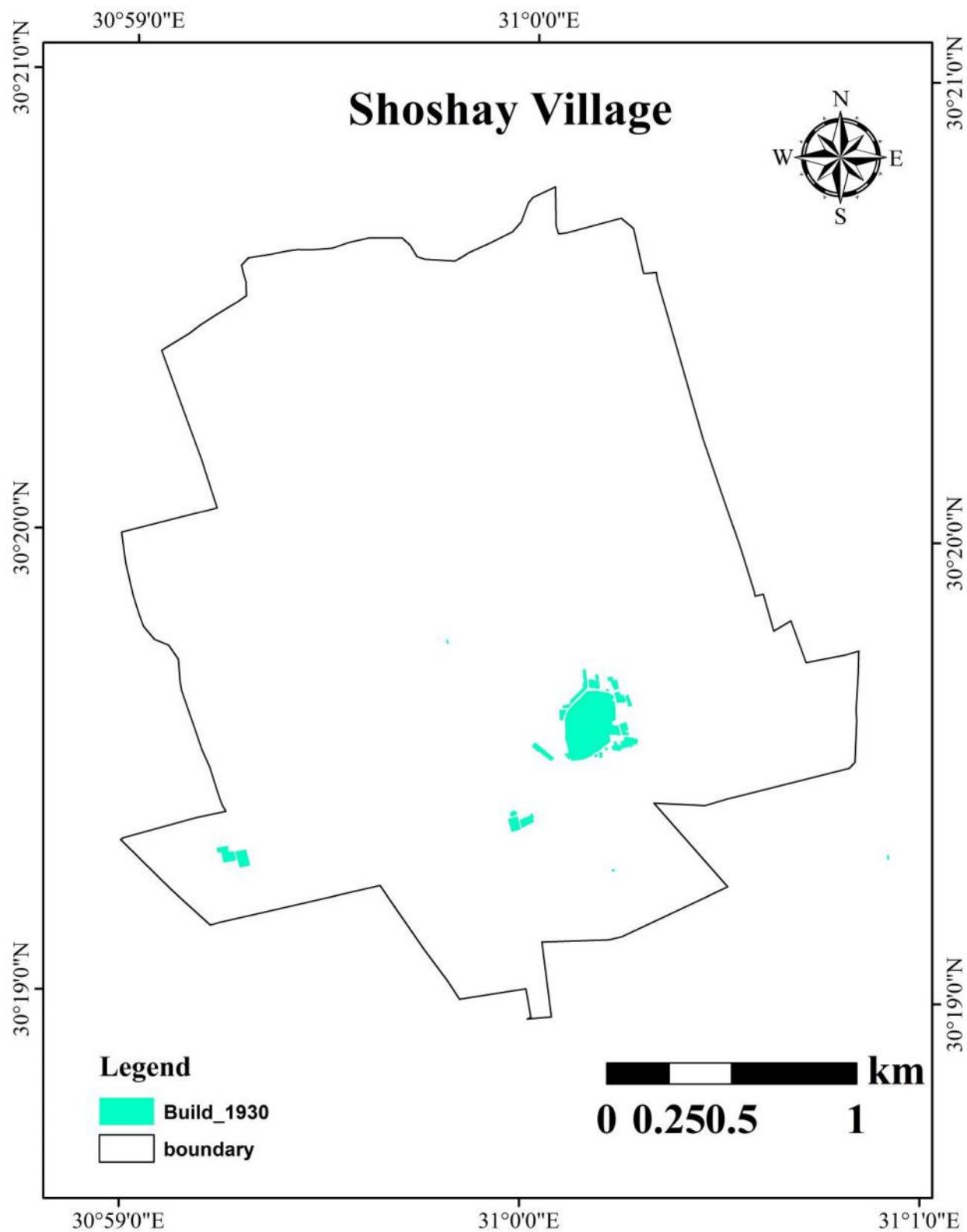


Figure 2 Shoeshay map in 1930

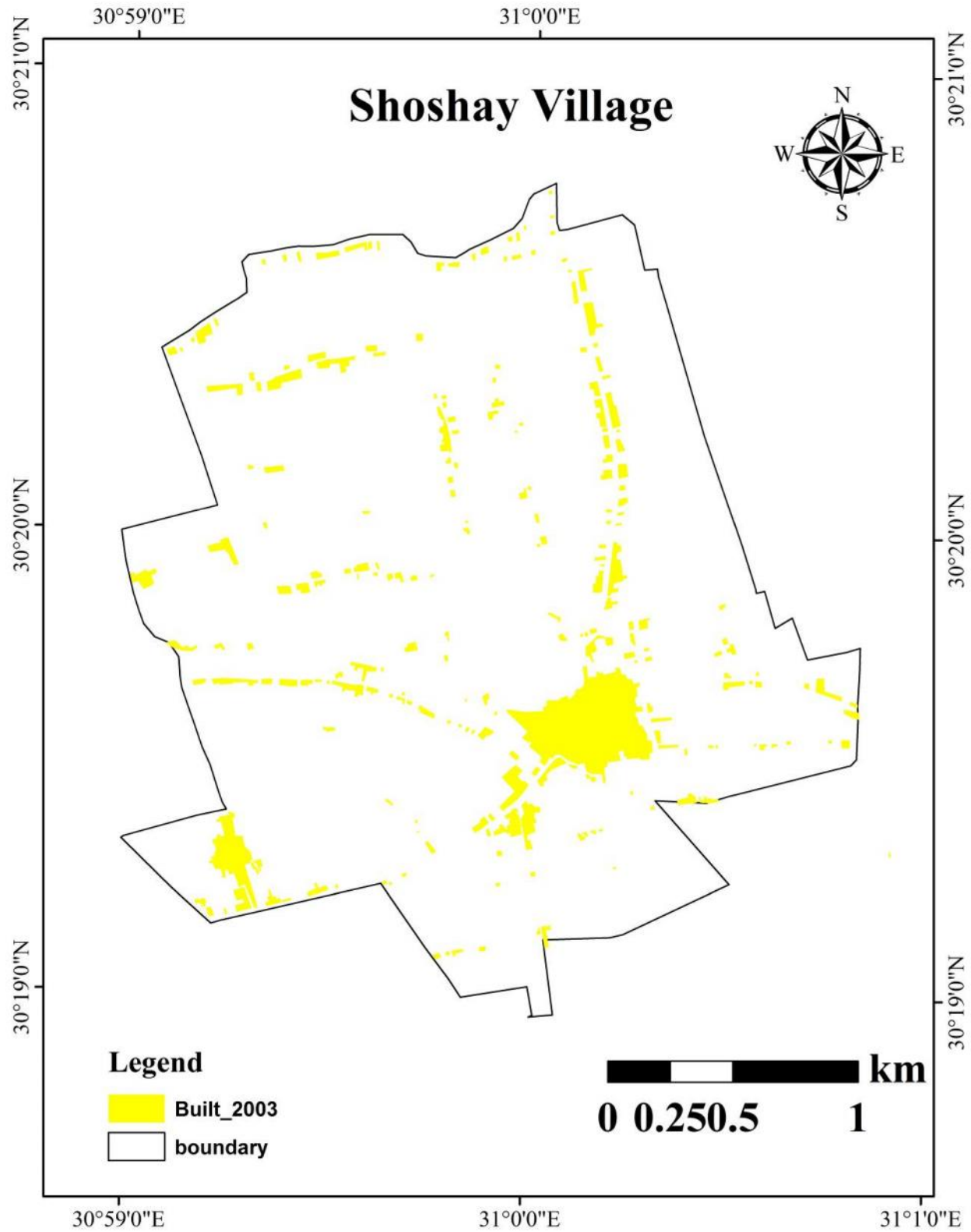


Figure 3: Shoeshay map in 2003

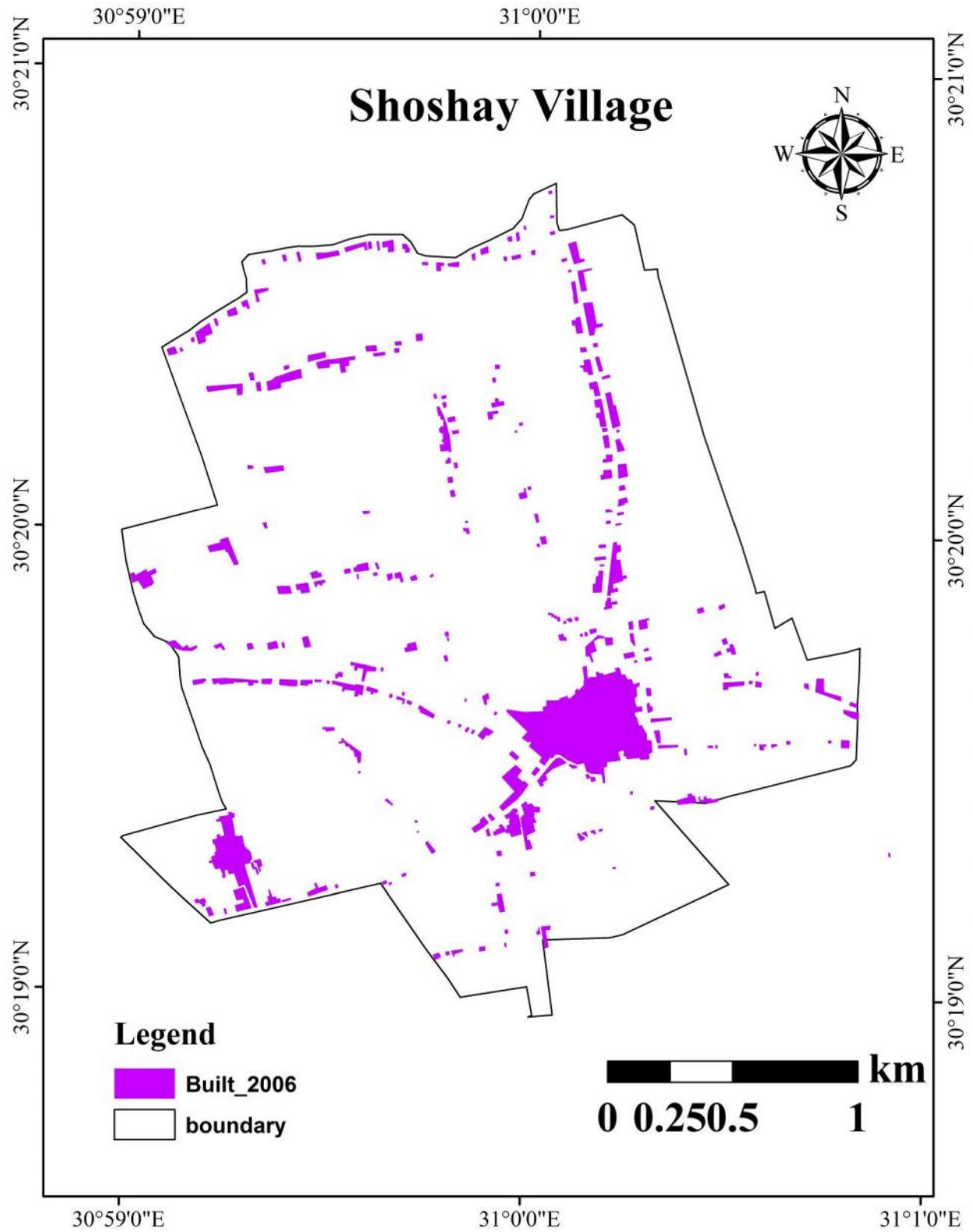


Figure 4: Shoeshay map in 2006

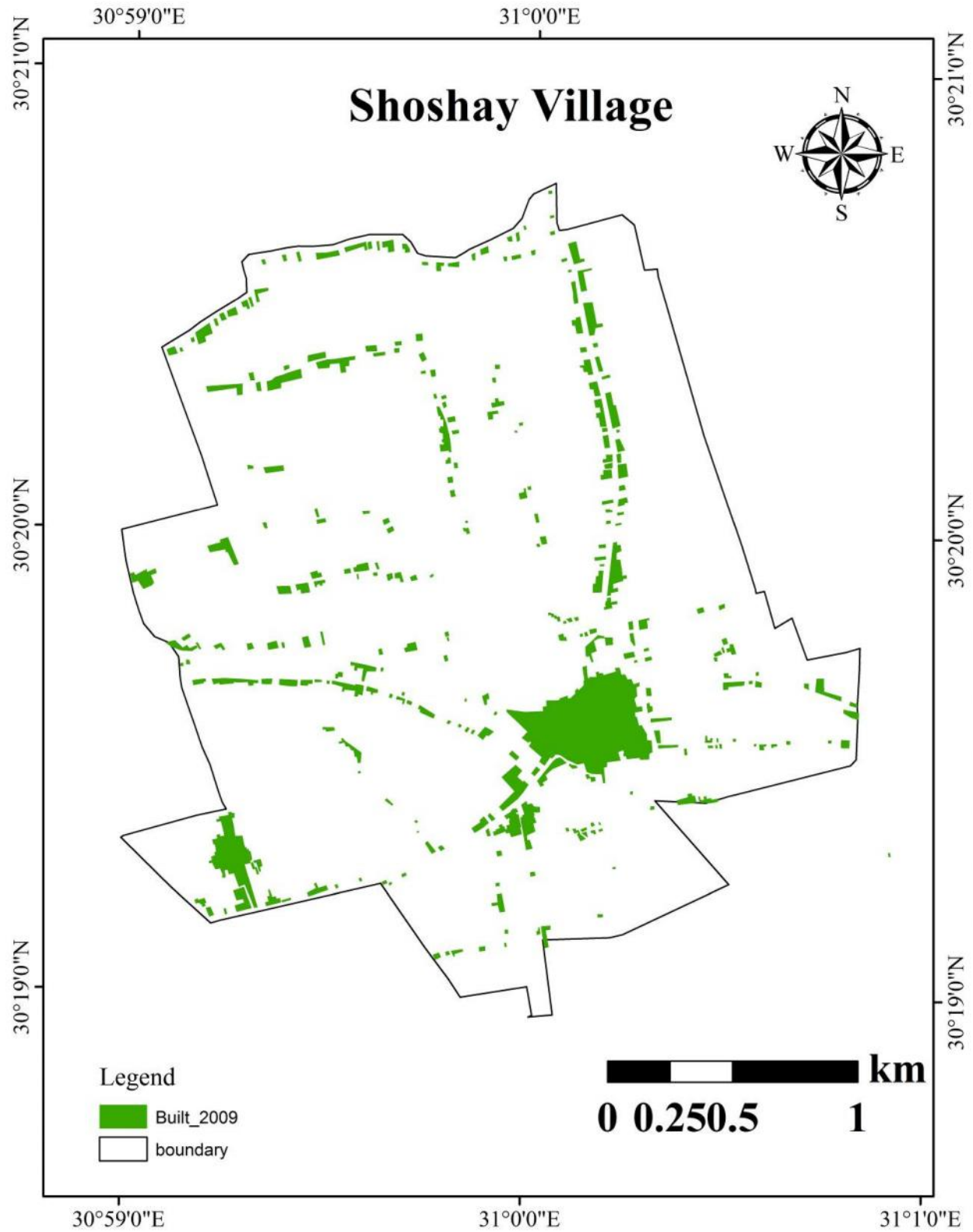


Figure 5: Shoeshay map in 2009

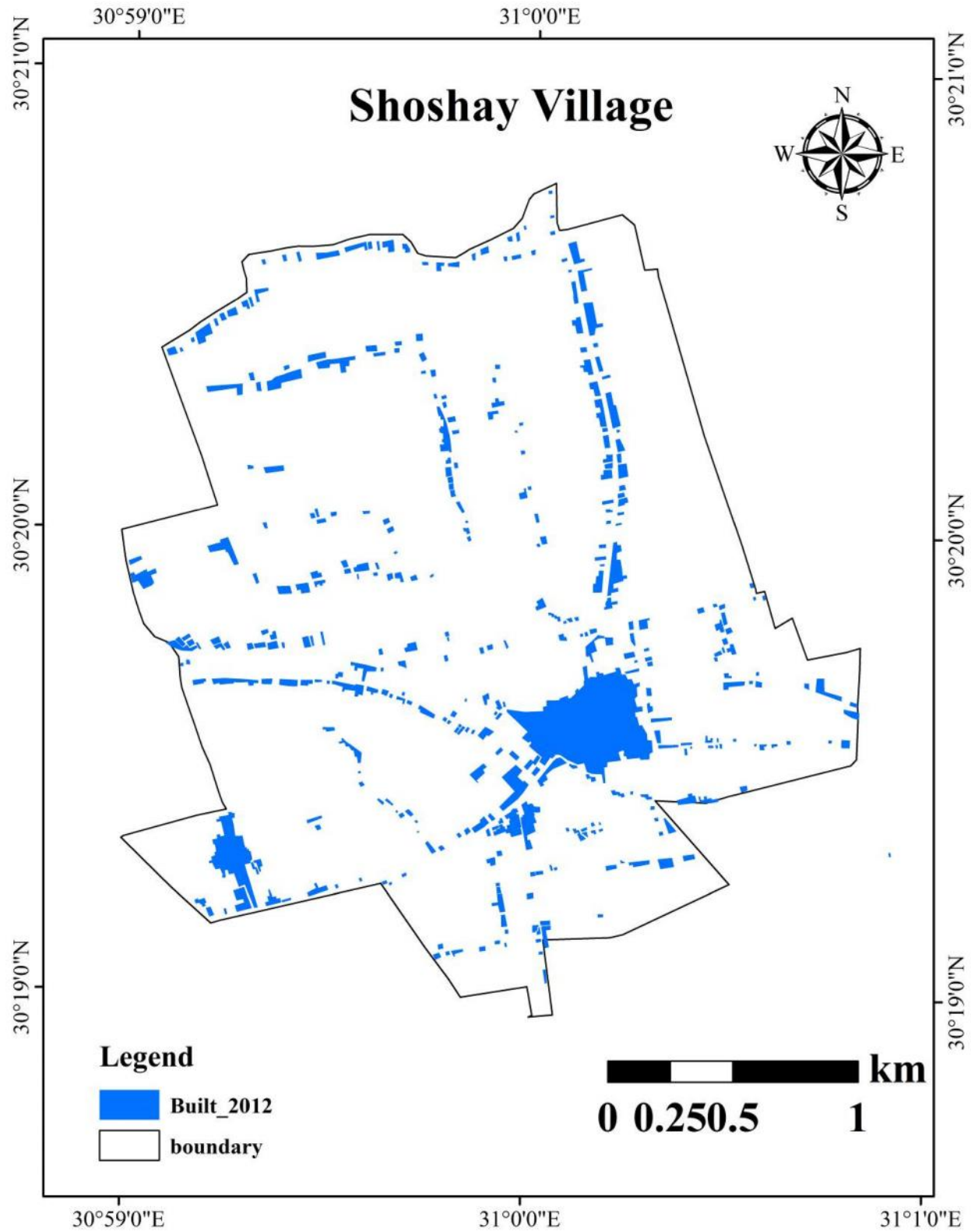


Figure 6: Shoeshay map in 2012

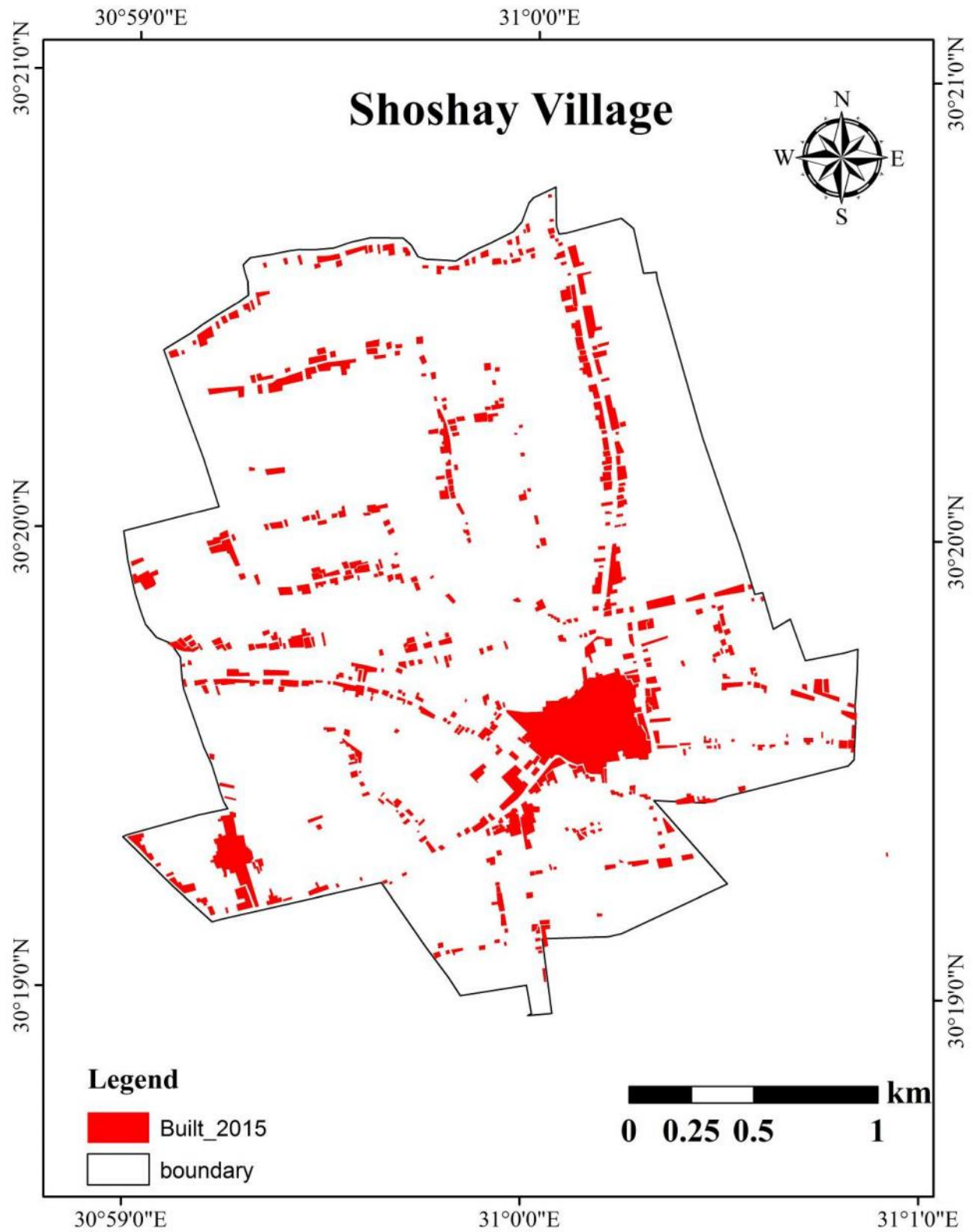


Figure 7: Shoeshay map in 2015

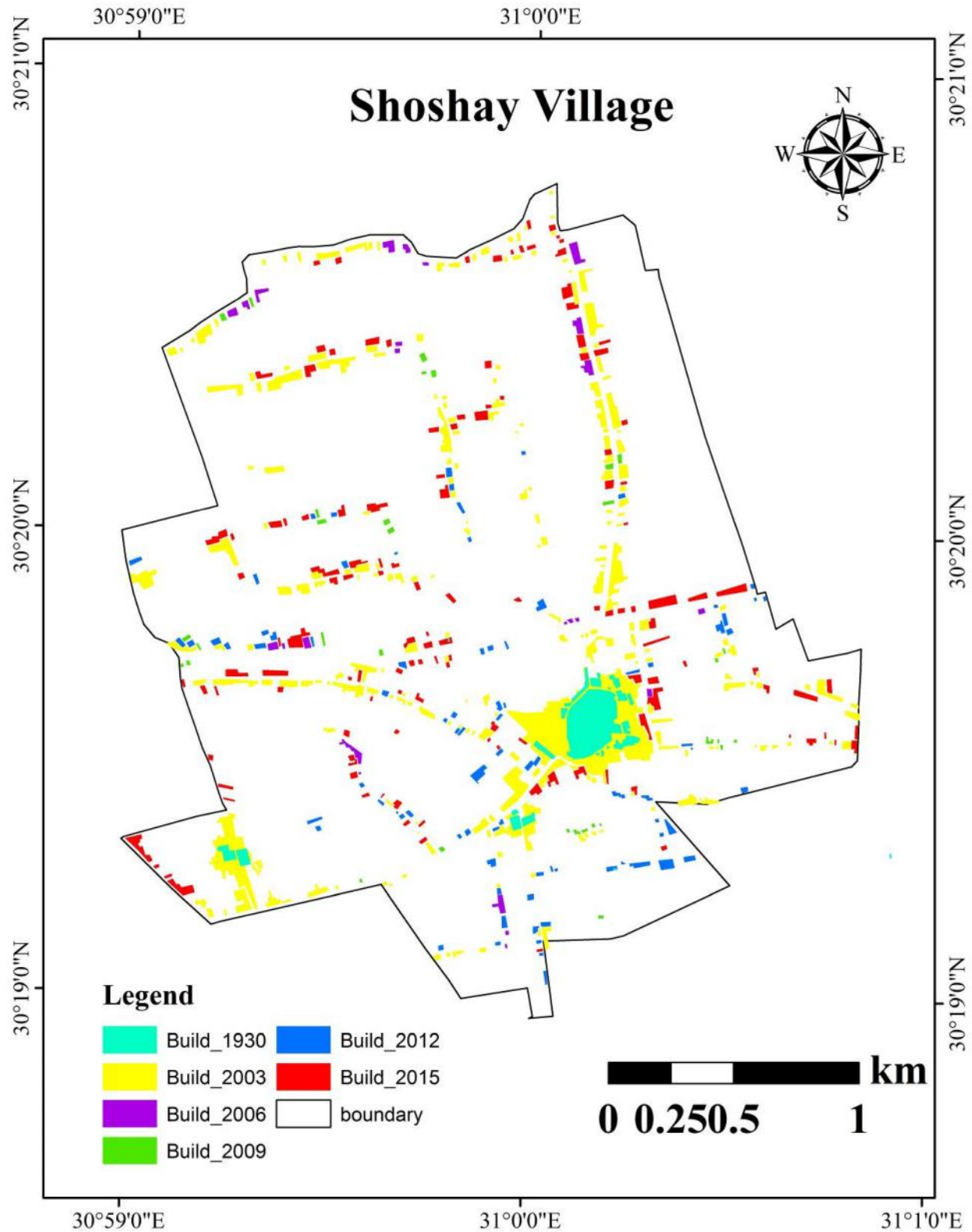


Figure 8: Shoeshay village and its surrounding Ezab through the period 1930 - 2015