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Rural Growth and Decay: Analysis of Physical-Spatial Transformation of Rural Area in Iran
(Case Staudy: Kahak Area of Qom Province)

*[1]Dewey Thorbeck, [*2]Ali Asghar Isalou, [3]Mostafa Bayat*

[1]Professor , Center for Rural Design, University of Minnesota, United States of America.
[2]Departman urban planning, Faculty of Art and architecture, University of Kurdistan, Sanndaj, Iran.
[3]Department of Geography and rural planning, Faculty of Earth Sciences, University of Shahid Beheshti, Tehran, Iran.

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ABSTRACT: Human settlements experience continual change. In recent years, many rural areas have experienced dispersed grow (rural sprawl) and population declines in traditional village centers (Hollowing). These paradoxical phenomena have occurred in most developing countries, including rural Iran. This study examines this phenomena in three Iranian villages of Kahak area of Qom province, and develops a model that can help predict how these trends will occur in the future. This study randomly selected 138 household for analysis. It analyzed eight variables that affect village development, including heritage, rural- urban migration, households' structure changes, land price, quality of buildings, and geometrical shape of village. findings indicate that inheritance and migration variables have the highest influence on settlement transformation. Based on this analysis, it is predicted that among the there villages, Veshnave and Khurabad will maintain balanced population, but Abarjis will experience hollowing and decay.

Keywords:
Transformation, Rural physical texture, Dynamic or decay, Rural settlements, Kahak area , Qom province.

INTRODUCTION

During recent decades, physical transformations of human settlements worldwide has been considered one of the most important and sensible transformations of urban and rural settlements (Long et al., 2011; Salvati et al., 2012; Ferreira & Condessa, 2012; Bhattaet al., 2013). Such that significant number of studies have been dedicated to discussing and investigating different social, economic and environmental effects of this phenomenon in local, regional and even global levels and fortunately, useful results have been obtained (Mann, 2009; Angel et al., 2011; Farber & Li, 2013).

Recently, two purely different phenomenon in the field of rural studies have been investigated and discussed by experts and researchers concerning physical transformations of rural areas called ―rural sprawl (rural expansion into rural areas) and rural hollowing (rural population decline in rural regions) (Engle, 2010; Hu et al., 2011).In this regard, some of these studies argue that economic factors and social changes have direct impacts on the growth and expansion of rural settlements and this finally has led to emergence of a new phenomenon called ―rural sprawl (MacDonald& Rudel, 2005; Hasanimeher & Shahoor, 2010; Su et al., 2011; Freeman et al., 2013).

Among these studies it can be refered to the study of Anbestani (2009) in which the physical effects of second homes growth in rural settlements of Iran are studied and analyzed. He believes that second homes that are developing on seasonal basis in touristic rural areas can be regarded as an effective factor in the development of rural areas of Iran. Xi et al., 2013 in a study analyzed similar issues related to the growth of rural settlements and their impacts on farms in China. They found that population increase, changes in the structure of rural households and cultural changes are effective social factors impacting rural sprawl.

Other studies focus on "hollowing out" of rural area due to population declines and changes of cultural and social structure of these communities. In a study Yansui et al. (2010) investigated and analyzed the issue of rural settlements hollowing in China. They conclude that easy access to cheap lands around the villages contributes to rural hollowing, in which the central areas of rural settlements deteriorate as residents abandon their older houses and build new ones at the rural fringe (Yansui et al., 2010)

Long et al. (2012) in their study investigated the process of hollowing and identified its impacts on villages located at

*Corresponding Author Email: *ali_isalou@yahoo.com*

Hwantai province in Shandong State of China. They believe that similar processes can be found in the abandonment of houses in China and deteriorating villages in some parts of eastern and Western Europe. They described a series of economic, socio-cultural, institutional- managerial and environmental factors which involve the development of this issue, but they believe that the phenomenon of urbanization and movement of rural people to urban cities is more pronounced than other factors.

These two phenomena, sprawl and hollowing, have been observed in both developing and developed countries; in some cases the two phenomena have occurred simultaneously in a certain place (Liu et al., 2009' Long et al., 2012). In such instances, often two forces namely, decadence (hollowing) and development (residential growth outside existing settlements) influence the life of rural communities. These trends can have various outcomes. In some cases, rapid residential growth has supported rural community survival and development. In other cases, rural hollowing makes contributes to rural community decay (Gude et al., 2006; Jie-Yong et al., 2013). This study investigates the impact of each of those two processes (forces) in three samples of villages located in Kahak District of Qom Province, Iran and determining the trend of their life continuance in future based on these analyses.

The villages located in Qom Province (state) like many rural settlements in Iran have experienced significant population decline during the last century. According to data presented by statistical center of Iran from 1956 up to present, rural population of Qom province has reduced from 39.7 percent of total population of this province to 4.8 percent (Statistical Center of Iran, 2012). This reflects a combination of some rural areas becoming urbanized, and the migration of rural residents to existing cities. The result is a gradual reduction in rural populations even though some villages aredeveloping while others are detoriating.

This complicated combination of two opposing phenomena is more significant in the villages of Kahak District of Qom Province than other parts of the Province, and. this study analyzes three rural villages of this region: Veshnaveh, Abarjis, Khurabad.

MATERIALS AND METHODS

Survey Procedure

The aim of this research is to investigate the effective factors impacting the development or deterioration of the rural villages, and use this information to help predict likely future demographic and economic trends. As stated in introduction, many factors are involved in the process of rural hollowing and sprawl. Based on previous studies, the components such as rural- urban migration, access to required services, low incomes, land prices, quality of buildings, organization of village plan (providing easy access to open lands located at the edge of village) are the most important factors in the process of growth or hollowing.. By considering all those variables , two other factors can be added in this study, namely inheritance and families' structure change (extensive families converted to mononuclear ones) to investigate the status of livability in rural settlements in Iran (Table 1).

Table 1: Effective factors impacting procreation or decadence of physical tissues of rural structures

Items	variables
Social	Heritage, rural-urban migration, households' structure change (extensive families converted to mononuclear ones)
Economic	Economic ability of family for renovation, land price
Physical	Quality of buildings, accessibility (land use pattern), geometrical shape of village (availability of easy access to open lands around the village)

For this study we identified permanent residents (not temporary or seasonal ones) in the three villages of Veshnaveh, Abarjis and Khurabad. Given that the conditions governing all three villages are different, we used classification sampling so that all under study subjects in the sample are in sufficient number, and be sure that subjects of population are present with a similar ratio as that of total population.

Cochran's formula was used as a suitable method for estimation of sample size of each category (rural points), such that confidence coefficient of 90 was selected as the basis for authors' calculations. As such, 138 families were estimated as sample size. Then, this value was distributed in proportion to the size of each community (category) in order to perform required investigations (Table 2).

Table 2: Number of population and families of central part villages

Groups (categories)	Population	Number of families	Sample size
Veshnaveh	365	143	20
Khurabad	1761	493	105
Abarjis	122	47	13
Total	2248	683	138

Data Analysis

In order to develop a strong relationship between the method and purposes of present research, logistic regression method is used. This method involves the ratio of possibility of occurrence of a phenomenon to the possibility of non- occurrence of that phenomenon (Habibpour & Safavi, 2011, 714). In fact, the goal of logistic regression is to find the best method to describe the relationship between a dependent variable and

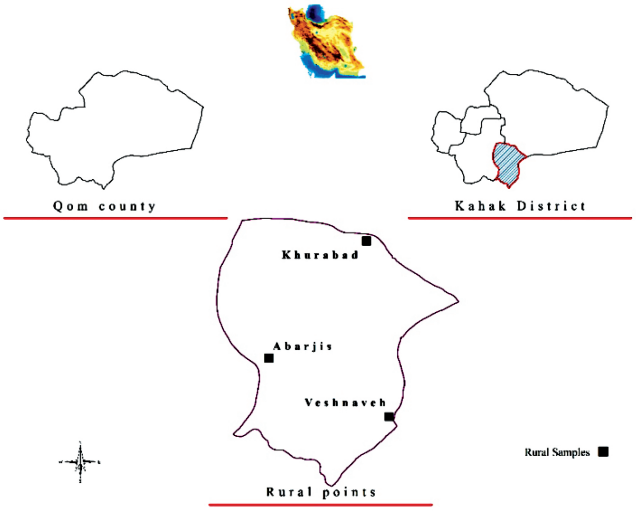


Fig. 1: Location of studied rural areas

multiple independent variables (Lee, 2005; Ohlmacher & Davis, 2003; Mc. Cullagh & Nelder, 1989). In this method, it is assumed that all independent variables are in spatial/ relative measurement level, while in practice it is not so and some of them are nominal of sequential as well. Moreover, independent variable of logistic regression can be binary or categorical. The assumption of normality is not necessary for this method hence logistic regression is advantageous compared to linear regression and logarithmic linear regression (Ozdemir, 2011). Generally, systematic sampling and random sampling are two tested sampling methods in logistic regression (Jokar Arsanjani et al., 2013). Logistic regression establishes functional relationship between binary codes of physical tissue (procreation or decadence) and different factors which play effective role in this regard. The general form of logistic regression is as follows:

$$(1)\quad y = a + b_1x_1 + b_2x_2 + b_3x_3 + \cdots + b_mx_m$$

$$(2)\quad y = \log_e\left[\frac{p}{1-p}\right] = logit(p)$$

$$(3)\quad p = \frac{e^y}{1+e^y}$$

Where a refers to the parameter of coordinates axis and x1, x2, xm are explanatory variables and y is a linear combination function of the explanatory variables representing a linear relationship. The parameters b1, b2. Bm are the regression coefficients to be estimated. If z is denoted as a binary response variable (0 or 1), value 1 (z = 1) means the presence of a spring, and value 0 (z = 0) indicates the absence of a spring. P refers to the probability of the occurrence of a spring, i.e., z = 1. Function y is represented as logit (P). When the value of y is increased the probability of p is also increased. Regression coefficients b_1,b_2,…,b_m of the contribution of each explanatory variable are indicated by probable value of p. positive sign for A implies that explanatory variable helps the probability of change being increased and negative sign implies the reverse effect.

Study Area

Kahak District, with an area equal to 648 Km2, is located at 50o, 43' 33" to 50o 43' 28" of eastern longitude, 34o 9' 20" to 34o 35' 14" latitude. Base on general census of population and housing in 2011, this area is consisted of two rural districts, 142 inhabited villages and 9 abandoned villages. The population of this district is 31543 individuals in the form of 6245 households of which 1037 individuals live in rural households and 29831 individuals live in 5899 households in the rural areas of Qom. Some of villages, despite reduction in their population, have been expanded and on the other hand, some parts of the character of those villages have been hollowed. In other words, two forces, namely expansion and reduction are coincided in the villages of Veshnaveh, Khurabad and Abarjis that were selected for this study (Fig.1).

RESULTS AND DISCUSSION

This section presents the findings and outputs obtained from logistic regression. At first, the variables left after statistical processes and the rate of effect of each one is presented in variable in the equation table. Afterwards, the status of rural settlements is indicated after being impacted by those variables. Also the outputs obtained from logistic regression are separately presented for each of studied villages.

Variable in the Equation Table

In interpreting Veshnaveh village it must be noted that the heritage variable alone is not significant for interpreting independent variable (7.39) and when i, migration variable is added, its presence becomes significant.

In part Exp (B) we can see that the ratio of heritage chance is lower than unity and with increase in the value of this variable, the possibility of occurrence of this phenomenon is reduced. If the ratio of migration chance is more than unity, the possibility of village deterioration is increased with increasing values of migration as an independent variable.

The migration variable is able to predict dependent variable changes in a direct and positive manner; it means that higher values of this variable are consistent to higher values of dependent variable. Also the heritage variable has a negative effect in the model (Table 3).

In the Khurabad village, the presence of heritage variable alone is not significant for interpreting independent variable (0.680). In part Exp (B) we can see that the ratio of heritage chance is more than unity, so that with increase of heritage independent variable value, the possibility of tissue decadence is increased. Therefore we can claim that heritage variable has not high capability for predicting the modes of dependent variable (Table 4).

Table 3: Variables remained in logistic regression model and their impact coefficients in Veshnaveh village[1]

Variables in the Equation							
		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]		-3.584	1.318	7.397	1	0.007	0.028
Step 2[b]		1.504	0.782	3.702	1	0.054	4.500
		-22.029	12030.871	0.000	1	0.999	0.000
		20.525	12030.871	0.000	1	0.999	2.301
		0.405	0.913	0.197	1	0.657	1.500

a. Variable(s) entered on step 1: HERITAGE.

b. Variable(s) entered on step 2: MIGRATION.

Table 4: Variables remained in logistic regression model and their impact coefficient in Khurabad village

Variables in the Equation							
		B	S.E.	Wald	df	Sig.	Exp(B)
Step 0	Constant	0.470	0.570	0.680	1	0.410	1.600

Moreover, in the Abarjis village, the presence of migration variable for predicting independent variable is not significant (7.069). In part Exp (B) the ratio of migration chance is more than unity, hence with increase in migration independent variable, the possibility of physical village deterioration is increased. Therefore, migration variable is not able to predict the changes of dependent variable directly (Table 5).

Categorization

Table 6 summarizes the performance of model and separability of households across the categories of dependent variable through drawing the responses in observed and expected categories. It helps evaluate the performance of model's predictability. In this table, diagonal cells indicate the number of correct predictions and non- diagonal cells indicate the number of false predictions.

In Veshnaveh village, despite the higher effect of independent variable, i.e. heritage and migration, the categorization accuracy of households is not changed and its value is 80% as before. This value indicates the accuracy of categorization and with 80% certainty it ca be said that by using 8 independent variables in this research we would be able to determine the changes of dependent variable of decadence or procreation of village's physical tissue. Based on Fig.2 it can be inferred that main tendencies in the village move toward persistence of the tissue and the value of this tendency is not so high but it is in equilibrium state.

In Khurabad village, migration variable has the highest effect compared to other variables in predicting dependent variable changes. This rate of accuracy in categorization in Abarjis village indicates that with 84.6% certainty we can claim that by using 8 independent variables ,the changes of dependent variable of village's physical tissue decadence can be determined. But according to the findings obtained from this village it can be inferred that in Khurabad village the main tendency in physical tissue is toward equilibrium (Fig. 3).

In Abarjis village, under the impact of heritage variable, the categorization accuracy of households is 63.8%. Yet with 63.8% certainty we can say that by using 8 independent variables the changes of dependent variable, namely decadence of village's physical tissue (Abarjis) would be able to determined. Also, categorization Fig.4 indicates that percent of tissues being in under decadence group is higher (66.1%), and we can state that the main tendency in this village is toward physical tissue

Table 5: Variables remained in logistic regression model and their impact coefficient in Abarjis village

Variables in the Equation							
		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	MIGRATION(1)	1.094	0.411	7.069	1	0.008	2.986
	Constant	-0.880	0.288	9.314	1	0.002	0.415

a. Variable(s) entered on step 1: MIGRATION.

Table 6: Summary of observed and predicted physical tissues categorization for Veshnaveh village

Classification Tablea					
Observed			Predicted		
			Tissue of settlement		Percentage Correct
			death	live	
Veshnaveh	Tissue	death	8	2	80
		live	1	9	90
	Overall Percentage		-	-	85
	Tissue	death	8	2	80
		live	1	9	90
	Overall Percentage				85
Khurabad	Tissue	death	5	0	100.0
		live	2	6	75.0
	Overall Percentage				84.6
Abarjis	Tissue	death	41	21	66.1
		live	17	26	60.5
	Overall Percentage		-	-	63.8

decadence (Fig.4).

Concerning categorization diagram it must be stated that point of distinction of predicted possibility equals 0.5. The first group value is equal to or lower than 0.5 possibility located on the left side of axis. The second group is higher than 0.5 possibility located on the right hand of axis. The closer the location of first group to the left hand of axis and the closer the location of second group to the right hand of the axis, so that the accuracy of categorization and prediction would be increased.

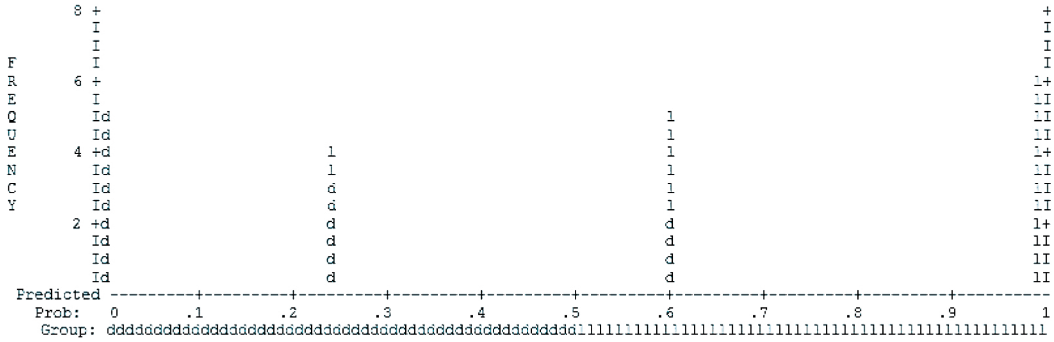
CONCLUSION

This study investigates the social factors that influence patterns of rural vllage development and deterioration. Based on previous studies in this field, it identofied eight effective factors (heritage, rural-urban migration, households demographic changes, land prices, quality of buildings, organization of the village) that impact rural settlement development patterns.

The findings of this study are consistent to the results obtained by Long et al. and Yansui et al., except that in the process of physical changes in Iran's rural settlements, specially the three studied villages, two factors, namely heritage and migration have more impact than any other parameter. Based on these results, future life trend of villages are grouped into three different types:seasonal, permanent and complete deterioration. More precisely, the results of our logistic regression analysis indicate that Veshnaveh and Khurabad villages tend to have arrived at a state of equilibrium in their life trend.There is significant difference in the future trend and tendencies; such that in Khurabad while it is hollowing due to different processes, most of new residents of this village are its native residents and the changes in their household structures (concentrated to mononuclear with small dimension) has led to equilibrium.. On the other hand, the Veshnaveh village's tendency is toward seasonal life (having second home) and the equilibrium observed between hollowing and increased construction does not indicate permanent life in this village. In the Abarjis village increased migration, poverty and effects of other parameters equally has endangered its life and it is predicted that continuation of its life is moving toward deterioration. However, from different actions between two tendencies, i.e. hollowing and increase of construction in villages we can identify three modes of future life of studied villages. Due to increased tendency toward seasonal residence in Veshnaveh village, it can be expected in future years, the village's life will remain stable , with seasonal populations. Khurabad village will continue its current life, but Abarjis village is moving toward permanent abandonment (decadence) (Fig.5 and 6).

Certainly rural systems behave like other systems and it is how the components interact that enhances quality of life or deterioration to this system. Understanding the currents, trends, and evolutions of rural settlements is the first step toward dynamicity of these locational- spatial systems.

At present, in order to overcome the process of hollowing in the study villages through economic and social solutions such as empowering and encouraging the villagers to renovate (particularly younger residents), reviewing ownership process for solving the problem of heritage, and increasing livability for stabilizing the population some of effective factors impacting depletion or sprawl of villages would be eliminated and the villages could once again regain their desired pattern of growth and development.

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Predicted Probability is of Membership for live
The Cut Value is .50
Symbols: d - death
         l - Live
Each Symbol Represents .5 Cases.
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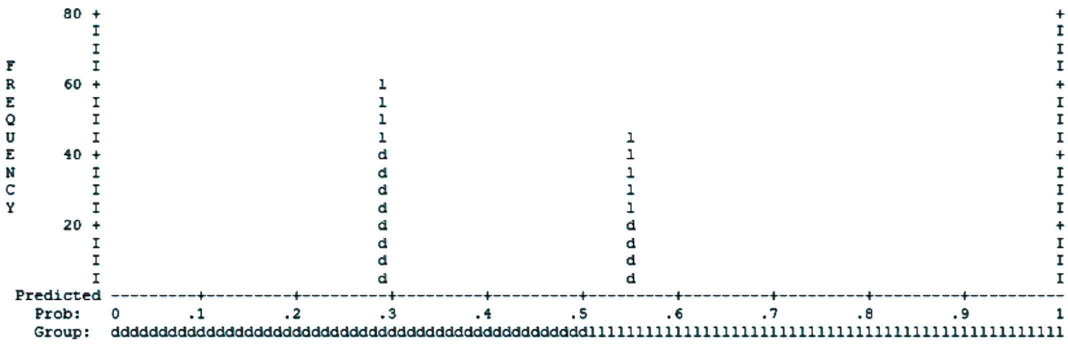
Fig. 2: Observed Groups and Predicted Probabilities in Veshnaveh

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Predicted Probability is of Membership for live
The Cut Value is .50
Symbols: d - death
         l - Live
Each Symbol Represents .5 Cases.
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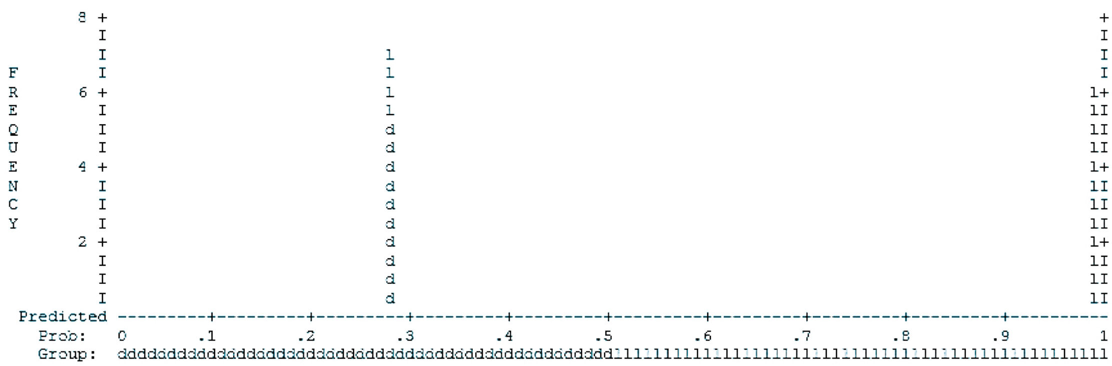
Fig. 3: Observed Groups and Predicted Probabilities in Khurabad

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Predicted Probability is of Membership for live
The Cut Value is .50
Symbols: d - death
         l - Live
Each Symbol Represents .5 Cases.
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Figure 4: Observed Groups and Predicted Probabilities in Abarjis

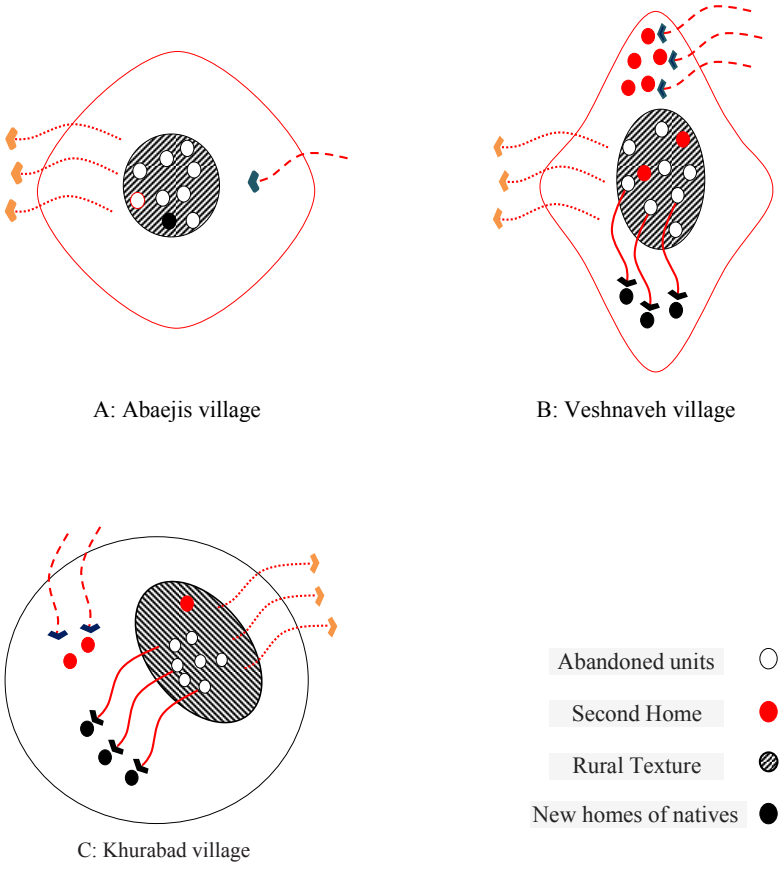

Fig. 5: Schematic model of the physical development of villages

Figure 6: Renovated and hollowed units in Veshnaveh village

ENDNOTES

1.B1 = logistic coefficient; S.E.2 = standard error of estimate; Wald3 = Wald chi-square values; df4 = degree of freedom; Sig.5 = significance; Exp(B)6 = exponentiated coefficient; 95.0% C.I. for EXP(B)7: 95% confidence interval for Exp(B).

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