The role of natural factors in stability of rural settlements (case study: Sabzevar county)

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Abstract

Development of human settlements, especially rural settlements has been largely dependent on ecological factors like suitable soil and water. Sabzevar region, enjoying all of these facilities, has Langley been a major human population center in eastern Iran. The study results show that, there is a Significant relationship between ecological factors like situation, water and farming lands and population changes as an index of rural population stability in 1966-2006, the Correlation between village Situation and annual growth rate was 0.216. Considering the study results, the following tasks are recommended to sustain the rural residency: efficient utilization of soil and water resources, supporting the rural economy, management of farmlands, deciding the farming patterns, correction of water consumption method.

Key words: rural population, situation, slope, altitude, water, farmland

Introdacuction

From a long time ago, man has been trying to take up residence in places where he could make maximum use of natural environment. Establishment of human settlements in river banks, delta beds and etc, along the history verifies this claim. Man has always been trying to organize his environment and make maximum use of the facilities around; nevertheless, following changes in industry, increasing speed and removal of distances, development of communications and etc, location planning has been introduced as a science which investigates the issues of locating and efficient location not only for natural factors but for inter-related and integrated social, economical and physic systems as well. Undoubtedly, development of rural settlements has largely been restricted to areas which possess (positive) environmental prerequisites. Suitable water, Soil, Vegetation and climate are of ecological factors and security, suitable stand for defense against invaders, ethnic and cultural relations, income sources and etc, are of effective socio-economical factors in development of rural settlements in spatial territories. Nevertheless, any of the above-mentioned factors whether human or ecological, may undergo radical changes in the course of

time, so that one factor may lose importance and one factor may gain importance. It is also possible that new necessities make changes and re-organization of these factors inevitable (Anabestani: 2008).

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Badri and Qanbari (2005) in their evaluation of the environmental potentials in rural development in Qale – Chai river basin of Ajab-Shir showed that the study area had suitable environmental potentialities for rural development. In this area, reliefs and geomorphological properties of land, in comparison to other projects, had less significant role in number and distribution of tourist resort projects. In utilization of natural potentials in parts of the study area, natural capacities had not been observed and were exploited, while in other parts, despite potentials for tourism and conversion industries, they were not properly utilized. Mahdavi, et al., (2001) in their investigation of the role of natural geographical factors in population instability and rural migration in Zanjan came to this conclusion that natural potential factors like topographical features, slop, temperature, rain and land potentials have had great effect in migration rate and villages being deserted. On the other hand, inability of the rural people (for a variety of reasons) in controlling the natural events like, flood, earthquake, landslide and soil erosion has pave the way for migration and abanding the rural resides, which would make the villages empty of population.

Este'laji and Ghadiri Ma'sum (2004) in their investigation of the role of geographical factors in rural residence development, emphasizing on used quantitative method, in Vilkaij region of Namin county showed that analysis of correlation coefficient and regression analysis of the study variants and distribution of residences reveal that there is a direct and significant correlation between land type and residence

distribution of settlements. Besides natural factors related with human factors, functional success also affects development of rural settlements. Although functional success is dependent on natural success, it also includes local, regional and trans-regional situation. Selahi Isfahani (2004) in his investigation of the role of water and irrigation in sustainable rural development in the rural area of Hakimabad – Akhtarabad showed that between natural and social environmental properties and water and irrigation problems aiming to promote rural living conditions a current predominates that is striving to reach sustainable rural development. The results of this study show that inappropriate recognition of rural people's needs and not allowing them especially women to participate in rural development are the primary issues. Furthermore, correction of irrigation system has got top priority in water and irrigation problems.

A large part of country's population still lives in rural areas while they are provided with the least facilities compared to others. Considering the process which has emptied the villages of their population and the importance of sustainability of rural settlements this study tries to investigate the role of ecological factors, including situation, altitude, water and farm lands on the continuation of rural social life, so that the study results could be used as a basis for future planning and organization in Sabzevar rural area and other areas too.

Materials and Methods
Study area

Sabzevar is a city in the Khorasn Razavi province in northeast of Islamic

republic of Iran. Sabzevar County borders Quchan, Esfaraein (Northern Khorasan province), and Jovein and Joghatay counties to the north, Neyshabur and Takhte – jolgheh to the east, and Kashmar to the south east, and Bardasakan to the south, and Shahrud (Sunman province) to the west. Sabzevar County is located in latitude of 35°, 27' to 36°, 52', in north and longitude of 56°, 43', 30" to 58°, 16' in east, and its area is approximately 14,328 square kilometers which equals to 12.3 percent of the Khorasan – Razavi Province, which makes it the largest county of this province. Sabzevar is the capital City of Sabzevar County. This county has 295 inhabited villages according to 2006 national census (Khorasan Razavi Governor, 2008).

Method

This study was conducted in descriptive – analytical method. Parts of the data were collected using field studies, questionnaires and interviews, Nevertheless parts of the study data like conceptual frame works, documents and census findings were obtained through library research. In the study area all the villages which had ten or more than ten habited households were selected. The questionnaires were filled out. Through the information obtained from 253 Islamic council and Dehyaries[1]. These 253 villages had a population of 122600. Having collected the data, we arranged and analyzed them in ArcGIS and SPSS and etc. After that we came to data analysis. The primary question in this study is that whether natural factors have any effect on sustainability of rural residence

distribution. Therefore, this study tries to find the answer to previous question and discover the relationship between ecological factors, annual population growth rate and rural population changes in the last four decades in the study area. In other words, this study has constructed the hypothesis that, there is a significant relationship between ecological factors and sustainable rural population.

Spatial distribution of the villages across the Sabzevar County

Up to 1937, Sabzevar was one of the eighteen counties of the khorasan province, and included Qasbeh block (Capital of Sabzevar County). Khamse kohMish, kah, Bashtin, Mazinan, Barakoh, Karrab, Tabas, Takab, Shamkan, RabeShamat, jovein, Baam and Safiabad. Local division's law was passed in 1937, and Sabzevar County included 23 Dehestan[2] and Humeh, Safiabad, Joghatay Sheshtamad and Davarzan District. In 1950, Baam & Safiabad was separated from Sabzevar and joined to Esfaraein. After that Sabzevar was the capital of the county and included joghatay, Davarzan, sheshtamad and Humeh Districts. No changes were implemented on the divisions of Sabzevar County up until execution of local division low. In 1985, after the execution of article 2 and 3 of the mentioned law and separation and attachment of some villages of Neyshabur in the surrounding area of Sabzevar, 23 Dehestan were established. These divisions were again changed and two other Dehestan of Robatjaz and Dasturan were added to Sabzevar, the three new Districts (Bakhsh) of Jovein, Rudab and

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[1] - Municipality for rural settlement

[2] - Rural agglomeration

Khushab were added to this County's Districts. In 2007, Jovein and Joghatay were separated and each was raised as a new County. Now, Sabzevar County includes five Districts and five towns of Sabzevar, Davarzan, Rudab, Sultanabad and Sheshtamad (khorason Razavi Governor, 2008).

Findings of the above table show that Kuh-homaie Dehestan with an area of 1701.8 square kilometers has the most population and Tabas with a population of 12270 namely 3257 households has the least population among other Dehestan of the County. It is noteworthy that Kuh-Homaie had the largest number of villages (34villages) among other Dehestan. According to the statistics of 2008, 85.75 percent of the county's villages have more than ten households. They included 32,035 households which comprise 99.7 percent of county's rural population. Therefore, only 0.3 percent of county's rural population lives in 42 villages that any of them have less than ten households. (12.25 percent), and every village would have an average of 2.2 households. Accordingly, these villages have no effect on County's spatial organization of the rural settlements and they are expected to become empty of population in near future. It is noteworthy that a significant number of these villages are actually stockbreeding, deep wells, brick kilns, old buildings and factories which are not principally villages and they were generally constructed for economical purposes.

Table 1 – Rural population distribution and density in Sabzevar County per Dehestan in 2008

Row	Dehestan Name	Total population	Number of households	Areakm^2	Density	Capital of Dehestan	Number of village	Number of ten plus household villages
1	Darre_Yam	11490	2621	673	17.1	Mashkan	30	27
2	Soltanabad	8088	1922	451.8	17.9	Soltanabad	14	14
3	Tabas	12770	3257	517.7	23.7	Shamabad	24	21
4	Rabat-Jaz	3548	929	130.8	27.1	Rabat-Jaz	4	3
5	Bashtin	5516	1583	742.7	7.4	Rivand	14	13
6	Kah	9510	2631	992.1	9.6	Sadkharv	15	13
7	Mazinan	6918	1939	685.5	10.1	Davarzan	13	12
8	Khvashod	5641	1483	1500.3	3.8	Bejdan	24	22
9	Forughan	4548	1144	1523	3	Qhalenov-rudab	11	10
10	Kuhhomaee	2335	533	1701.8	1.4	Ojnovard	34	23
11	Beyhaqh	5942	1508	772.6	7.7	Sheshtamad	20	14
12	Takab Kuhmish	7672	2110	753.4	10.2	Tondak	13	7
13	Rabe-shamat	5194	1213	662.9	7.8	Qhale-mydan	10	10
14	Shamkan	6352	1557	864.3	7.3	Shamkan	7	7

Table 1 continued

15	Robat	6559	1736	728.5	9	Rbat-sarposh	18	14
16	Eastern Ghasabeh	8715	2228	579.4	15	Izy	17	12
17	Western Ghasabeh	9273	2639	680.4	13.6	Khosrovgerd	18	13
18	Karrab	3525	1093	367.8	9.6	Belashabad	9	8
Total		123096	32126	14238	8.6	-	295	253

Reference: Razavi Khorasan Governor and Sabzevar County Health Center, 2008.

Population distribution in villages

Selection of rural settlements is dependent on both ecological and other factors and motivations, such as adaptation to the natural environment, possibility of gaining economic profits and development from that environments, communication facilities, political, military, cultural and religious motivations (Este'laji, 2005: 121). Population size in a human residence is one of the effective factors on the sustainability of the villages, because significantly large population in a village would pave the way for various economic activities, development of welfare facilities, etc.

Table 2 – Population distribution in the villages of Sabzevar County in 2008

Household classes	Number of Village	Percent	Population	Percent
Less than 10	42	14.2	917	0.7
Between 10-19	27	9.2	1453	1.2
Between 20-49	62	21	7981	6.5
Between 50-99	57	19.3	16598	13.5
Between 100-249	77	26.1	44862	36.6
Between 250-499	23	7.8	31492	25.7
Higher than 500	7	2.4	19343	15.8
Total	295	100	122646	100

Reference: Sabzevar County Health Center, 2008

A Stoical analysis connected on Sabzevar rural society in 2008, shows that from total 253 ten plus household villages, 77 villages with a population of 11860 households were in 100 to 249 household population group. In other words, 30.4 percent of villages comprised 37 percent of rural population in this population group. Furthermore, 27 villages with a population of 352 household were in 10 to 19 household population group, 64 villages with a population of 2228 households were in 20 to 49 household population group, 55 villages with a population of 4127 households were in the 50 to 99 household population group, 23 villages with a population of 8388 horsehides were in 250 to 499 household population group and 7 villages with a population of 5072 households were in

500 plus household population group. Therefore, we can say that number of villages with low population size (less than 100 households) namely 146 villages (57.7 percent) comprise 21 percent of total rural population of the county. These villages are mostly distributed in northern mountainside and highlands, southern desert margins and south west of the county.

Rural population change process

Investigation of rural population change process from one village to another village may reveal the existence of social infrastructure in one village and it's lacking in other villages. For this purpose, we attempted to investigate the annual growth rate in the villages of the study area during 1956 to 2006. According to the study results, in the villages of the study area from the total number of 253 ten plus households in 2008, 142 villages with the population of 12758 households had zero or negative growth rate. In other words, 56.1 percent of villages comprising 39.8 percent of rural population had negative growth rate. Furthermore, 29 villages with the population of 4274 households had a growth rate between 0.1 to 0.49 percent, 20 villages with a population of 3030 households had an annual growth between 0.5 to 0.99 percent, 16 villages with a population of 3716 households had a growth rate between 1 to 1.49 percent, 19 villages with a population of 4433 households had a growth rate between 1.5 to 1.99 percent and 27 pillages with a population of 3846 households had on annual growth rate of 2 percent and more. In a brief look, one would come to this conclusion that most of the villages located in west, southwest and north of the County had a negative growth rate and villages located around Sabzevar City and western part had more moderate growth rate.

Table 3 –Distribution of annual population growth rate in the villages of Sabzevar County in 1966-2006

Growth rate	Number of Village	Percent	Number of households	Percent
Less than zero percent	142	56.1	12736	39.8
Between 0.1-0.49	29	11.5	4274	13.3
Between 0.5-0.99	20	7.9	3030	9.5
Between 1-1.49	16	6.3	3716	11.6
Between 1.5-1.99	19	7.5	4433	13.8
Higher than 2 percent	27	10.7	3846	12
Total	253	100	32035	100

Reference: Statistical Center of Iran, 1966 to 2006.

Results and Discussion
Natural situation of the villages

Natural situation of the human settlements in the earth has played a great role in its sustainability or variation during the history. There have been great rural and urban residences in the past which have had great progress or have been

destroyed only due to their natural situations.

Accordingly, natural situation of Sabzevar villages were investigated in three categories of plain, mountainous and mountainside. In 2008, from 253 ten plus household villages in Sabzevar County, 123 village with a population of 18989 households were in plain situation, in other words 48.6 percent of villages comprising 59.3 percent of the total rural population,

were located in plain situation. Furthermore, 94 villages with a population of 8565 households were located in mountainous situation which comprised 37.1 percent of villages and 26.7 percent of rural population, and 36 villages were located in mountainside (the border between plain and mountain) which comprised 14.3 percent of the total number of ten plus household villages of the County.

Table 4 – Spatial distribution of villages in Sabzevar County by situation in 2008

Natural position	Number of Village	Percent	Number of households	Percent
Plain	123	48.6	18989	59.3
mountainside	36	14.2	4481	14
Mountainous	94	37.2	8565	26.7
Total	253	100	32.35	100

Reference: National Surveying Organization, 2008.

The altitude of the villages

Considering the different geographical locations and their distance from the nearest sea, the altitude of the villages would be variant. Settlements which are in low altitude locations are more easily accessible. Investigation of spatial distribution of the rural settlements would reveal their role in their sustainability.

Accordingly, altitude classes were defined and their spatial distributions were investigated in those altitude classes. The study results showed that in 2008, from 253 ten plus household villages, 139 villages with a population of 15622 households were located in the altitude of 1000 to 1500 meters above sea level. In other words, 54.9 percent of the villages whose population comprised 48.75 percent of the total rural population were located in that altitude classes. Furthermore, 55

villages with a population of 10110 households were located in the altitude of lower than1000 meters, 56 villages with a population of 6164 households were in the altitude of 1500 to 2000 and 3 villages with a population of 139 households were located in the altitude higher than 2000 meters. Therefore, it could be concluded that altitude lower than 1500 meters has had the highest density of rural population and highest number of villages. Accordingly, 76.7 percent of the villages comprise 80.3 percent of rural population. The pattern of spatial distribution in altitude classes changes from one Dehestan to another. Totally, the Dagestan's located in northern and southern parts of the County were higher than average altitude classes and central and western parts of the County were lower than average altitude classes.

Table 5 – Spatial distribution of villages in Sabzevar County by altitude in 2008

Altitude (m)	Number of Village	Percent	Number of households	Percent
Lower than 1000	55	21.7	10110	31.6
Between 1000-1500	139	54.9	15622	48.8
Between 1500-2000	56	22.1	6164	19.2
More than 2000	3	1.2	139	0.4
Total	253	100	32035	100

Reference: National Surveying Organization, 2008.

The slope of village location

The slope of a residence plays a great role in its sustainability. It is noteworthy that in high altitude locations (higher than 2000 meters) high altitude doesn't mean steep slopes. Thus, we can conclude that a village can be in a high altitude and its slope would not be troublesome, though, there could be a village in low altitude and its steep slope could be so troublesome that would render it unsustainable in social and economic aspects.

Table 6 – Distribution of land slopes on Sabzevar County

Row	Land slope Class (percent)	Area km^2	Percent
1	Less than 1	3968.2	27.7
2	Between 1 to 3	5063.7	35.3
3	Between3 to 5	1059	7.4
4	Between 5 to 10	1899.7	13.3
5	Between 10 to 15	906	6.3
6	Between 15 to 30	879.4	6.1
7	Between 30 to 50	440.2	3.1
8	More than 50	111.8	0.8
	Total	14328	100

Reference: Geographic Institute, 1989.

Investigation of Land slope map of Sabzevar County shows that 5063.7 square kilometers of the county's total area comprising 35.3 percent of its total are were in land slope between 1 to 3 percent. Though if areas having Land slope Less than one percent is added to those parts, you would see that 63 percent or nearly one – third of total area of Sabzevar County has a land slope less than 3 percent. Considering that land slopes between 5 to 5 percent, are suitable for human residency, distribution of these lands across the County equal to 7.4 percent (Tarh & Kavosh consulting engineers, 2008; 34).

Table 7 – Spatial distribution of villages in Sabzevar County by land slope scale in 2008

Land slope Class (percent)	Number of Village	Percent	Number of households	Percent
Less than 1	52	20.6	8376	26.1
Between 1 to 3	76	30	11231	35
Between3 to 5	28	11.1	3104	9.7
Between 5 to 10	59	23.3	5811	18.1
Between 10 to 15	14	5.5	1261	3.9
Between 15 to 30	13	5.1	1132	3.5
More than 30	11	4.3	1138	3.6
Total	253	100	32035	100

Reference: Geographic Institute, 1989.

Investigation of land slope map and spatial distribution of rural settlements in Sabzevar County, shows that 76 ten plus household villages with a population of 11215 households in 2008 were located in lands lope of one to three percent, in other words, 30 percent of villages comprising 35 percent of rural population are located in this area, 28 villages with a population of 3104 households were in land slope between 3 to 5 percent, 59 villages with a population of 5811 households were located in land slope between 5 to 10 percent, 14 villages with a population of 1261 households were located in land slope between 10 to 15 percent and 24 villages with a populations of 2270 households were located in land slope higher than 15 percent. Therefore, we can say that investigation of spatial distribution of villages in slopes reveals that nearly 50.6 percent of villages comprising 61.1 percent of rural population were located in land slope less than three percent. These villages are mostly located in central and western part of the county.

Available water resources in the villages

Water as a source of life, is one of the most important factors of life of all creatures especially human beings. Water shortage would naturally heat up competition for water among the residents of different geographical regions, and during this competition destruction of environment and ecological imbalance will increase. Thus, a per capita accessible water resource for people, animals, agriculture and industry is an important factor for evaluating the sustainability of a rural residence.

Table 8 – Spatial distribution of villages in Sabzevar County by per capita accessible water in 2008

Water per capita (cubic meters)	Number of Village	Percent	Number of population	Percent
Less than 250	34	13.4	8134	6.7
Between 250-499	26	10.3	9134	7.5
Between 500-999	27	10.7	13602	11.2
Between 1000-2499	44	17.4	21654	17.8
Between 2500- 4999	47	18.6	27518	22.6
Between 5000- 9999	43	17	26952	21.3
More than 10 thousand	32	12.6	15697	12.9
Total	253	100	121691	100

Reference: Tehran Boston Consulting Engineers, 2006.

According to statistics of water resources in Sabzevar rural community in 2006, we note that from total number ten plus household villages, 87 villages with a population of 30870, had a per capita water of less than 1000 cubic meters (per village in a year). In other words, 34.4 percent of villages comprising 25.3 percent of rural population were in this group. Furthermore, 91 villages with a population of 49172 had a per capita between 1000 to 4999 cubic meters, 43 villages with a population of 25952 had a per capital water between 5000 to 9999 cubic meters and 32 villages with a population of 15697 had a per capita water of higher than 10000 cubic meter for a year. Therefore, villages located across the County have limited access to water resources, as per capita water for per household in more than 70.4 percent of villages is less than 5000 m^3/a year which cannot satisfy the water needs for drinking,

agriculture and rural industry of a rural household in a year.

Irrigated farming in the villages

Agricultural products especially irrigated farming and gardening are major economic activities in the Iranian villages, Therefore per capita water and farming land are important factors for the evaluation of economic potentials of a rural residence. According to statistics of farms under cultivation and fallow irrigated farm lands across the rural community of Sabzevar, from total number of ten plus household villages in 2008, 96 villages with a population of 10227 households had a per capita irrigated farming land of less than one hectare per household. In other words, 37.9 percent of villages comprising 31.9 percent of rural population were in this group. Furthermore, 64 villages with a population of 10180 households had a per capita irrigated farming land between 1 to

1.99 hectares, 45 villages with a population of 5144 households had a per capita irrigated forming land between 2 to 3.99 hectares, 27 villages with a population of 7314 households had a per capita irrigated forming land between 4 to 5.99 hectares and 21 villages with a population of 3226 households had a per capita irrigated farming land more than 6 hectares.

Table 9 – Spatial distribution of villages in Sabzevar County by per capita irrigated farming lands in 2008

Irrigated farming (hectare)	Number of Village	Percent	Number of households	Percent
Less than one	96	37.9	10227	31.9
Between 1 to 1.99	64	25.3	10175	31.8
Between 2 to 3.99	45	17.8	5162	16.1
Between 4 to 5.99	27	10.7	3145	9.8
More than 6	21	8.3	3326	10.4
Total	253	100	32035	100

Reference: SCI, 2003 & Agricultural Jihad Office of Sabzevar County, 2008.

Above statistics reveal that villages in the geographical distribution of the County have limited potentiality in irrigated farming lands, in a way that per capita land for per family is less than two hectares in 63.2 percent of villages. Considering that one – third of these lands lie follow every year, they can rarely satisfy the economical needs of a rural household.

Dry farming in the villages

Some villages across the County are located in mountainous area and enjoy enough rain for dry (rain-feed) farming, according their economy are dependent on dry farming. Statistical investigation of the dry farming lands can reveal its important role in sustainability of the rural settlements.

According to statistics of cultivated and fallow farming lands in Sabzevar rural community in 2003, from total number of ten plus household villages in 2008, 125 villages with a population of 16132 households had a per capita dry farming land of less than one hectare per household. In other words, 48.6 percent of villages comprising 50.4 percent of rural population are in this group. Furthermore, 40 villages with a population of 5712 households have a per capita dry farming land between 1 to 1.99 hectares, 26 villages with a population of 4446 households had a per capita dry farming land between 2 to 3.99 hectares, 22 villages with a population of 2777 households had a per capita dry farming land between 4 to 5.99 hectares and 42 villages with a population of 2488 households had a per capita dry farming land higher than 6 hectares per household.

Table 10 –Spatial distribution of villages in Sabzevar County by per capita dry farming lands in 2008

Dry farming (hectare)	Number of Village	Percent	Number of households	Percent
Less than one	123	48.6	16132	50.4
Between 1 to 1.99	40	15.8	5712	17.8
Between 2 to 3.99	26	10.3	4426	13.8
Between 4 to 5.99	22	8.7	2777	8.7
More than 6	42	16.6	2988	9.3
Total	253	100	32035	100

Reference: SCI, 2003 & Agricultural Jihad Office of Sabzevar County, 2008.

The findings of the above table reveal that villages in the geographical distribution of the County are households which have a per capita dry farming land of less than two hectares. Considering that half of these lands lie fallow every year and rainfall in this County is not enough for annual dry farming , one cannot pin hope on dry farming for rural economic in the County.

Evaluating the sustainability of rural settlements by ecological factors

The concepts of sustainability and variant has its roots in human relations with its environment. Therefore, sustainability is not a new concept, and man has always had close relationship with its environment and his way of utilizing natural resources and his view of environment has been an effective factor relation between man and environment. Following great technological advances in

North (developed) countries and devastation of environmental resources, the concept of sustainability was formally introduced exactly before 1960s ecological precautions in development (Saeedi and Taleshi, 2004; 2). Sustainability includes other concepts like protection, preventing from damage, supporting, continuation, resistance, keeping alive and the last but not least one, the ability to live on (Ghazi, 2003; 129).

Development and sustainability of a population in a rural area are dependent on surrounding natural resources; therefore in this study we try to investigate the correlation between ecological factors including, the villages situation, altitude, land slope, available water resources, irrigated (rain–feed) and dry farm lands and population size, population changes (annual population growth rate) in 1966 – 2006 for every village.

Table 11 – Evaluating of relationship between ecological factors and sustainability of settlements by Pearson correlation coefficient

Detail		Situation	Altitude	Land Slope	Per capita water resources	Per capita Irrigated Farming	per capita Dry Farming
Growth Rate	Pearson correlation	0.216**	0.067	-0.187**	-0.142*	0.062	0.194**
	Significant level	0.001	0.286	0.003	0.024	0.326	0.002
	Amount	253	253	253	253	253	253
Population	Pearson correlation	0.194**	-0.098	-0.123	-0.034	0.036	0.011
	Significant level	0.002	0.122	0.050	0.593	0.574	0.865
	Amount	253	253	253	253	253	253
**. Correlation is significant at the 0.01 level (2-tailed).							
*. Correlation is significant at the 0.05 level (2-tailed).							

Reference: Research finding, 2008.

The figures of the above table are calculated using Pearson correlation between natural parameters and sustainability (the process of change) parameters of rural settlements in the study area. These findings show that from six ecological factors, namely, available water for human consumption and agriculture, farming lands (irrigated, dry and gardens) and ecological condition of the settlement (situation, land slope and altitude) four of them had verified relationship with the sustainability of the population (population growth rate in 1966 – 2006). In this case, the most significant relationship was between population growth rate and its physical situation with a correlation coefficient of 0.216, which means that plain villages had more sustainable population and on the other hand mountainous villages had least population sustainability.

After situation, the most significant correlation was between population growth rate and per capita dry farming land with a correlation coefficient of 0.194, it means that villages having high agricultural potentials have relatively high population sustainability. The third significant correlation was between land slope and population growth rate, which is a partial reverse correlation with a negative coefficient that equals -0.187, this figure, verifies the population sustainability in rural reason low land slope. Thus, the findings of the study show that there is a significant relationship between ecological factors and rural population sustainability (emphasizing on population growth rate). Furthermore, investigation of Pearson coefficient between rural population size and ecological factors show that, there is a significant relationship between population and physical situation of the village which

equals 0.194. Thus, the relationship between ecological factor and annual population growth rate in 1966-2006, and population size in 2008 produce different correlations.

For more investigation of statistical parameters of population in 2008 the following information were arranged and calculated in SPSS: annual population growth rate in 1966-2006, physical situation of the village, the altitude of the village, land slope of the village, per capita water consumption in 2008, per capita dry and irrigated farming land in 2008.

Table 12 – Statistical indexes of human and natural factors of villages in Sabzevar County

Description	No	Range	Minimum	Maximum	Sum	Mean	Mean Std. Error	Std. Deviation	Variance
Population (number)	253	4125	18	4143	303	481	35.13	558.768	293147.6
Annual growth rate at 1966-2006 (percent)	253	11.40	-4.90	6.50	-0.25	-.1929	0.108	1.71614	2.945
Situation	253	4	2	6	4	4.23	0.116	1.842	3.392
Altitude	253	4	2	6	6	4.86	0.083	1.317	1.734
Land Slope	253	6	0	6	2	3.01	0.118	1.881	3.540
Per capita water resources (cubic meters)	253	146390	0	146390	2302.1	5878.8	998.3	15878.5	212528841
Per capita irrigated farming (hectare)	253	76.45	0	76.45	1.34	2.58	0.33	5.3	28.2
per capita Dry farming (hectare)	253	212.3	0	212.32	1.12	3.93	0.88	14	195.4

Reference: Research finding, 2008.

Conclusion and Remarks

Ecological factors play great role in establishment, development and sustainability of human settlements in arid and semi-arid parts of the world. In this study, investigation of six ecological factors using Pearson correlation revealed the significant relationship between these factors (especially situation, land slope, per capita dry farming land) and population growth rate (in 1966-2006) in 253 ten plus household villages of Sabzevar County; while correlation coefficient between the mentioned ecological factors and rural population increase was relatively low. Thus,

ecological factors which provide natural resources and facilities play a great role in development and stability of Sabzevar rural population. However, inappropriate approaches in utilizing the natural resources in form of digging deep and semi – deep wells, inappropriate management of environment, and lack of appropriate investment for efficient utilization of local natural potentials have all opened the way for decrease in rural population growth rate in recent years. At the end, the following strategies and executive approaches emphasizing ecological potentials are proposed for more sustainability of rural settlements in the study area:

1) Making use of natural potentials of the local region with regard to land preparation plans and regional development projects.

2) Efficient use soil sources and local land capabilities to decrease side effects of excessive use of farming lands and grass lands.

3) Efficient utilization of local ground and surface water resources though controlling the running waters and changing the irrigation and water transmission methods.

4) Making attempts to increase income rate of the households through efficient use of local ecological potential, increasing economic activities in second and third economic sectors.

5) Job creation, enhancing the basis of rural economy, increasing the accessibility to public and sanitary facilities to prevent rural migration.

6) Due attention to farmland management for sustainable utilization of water and soil resources, and prevention from land erosion, fragmentation and change of application, organization of farming patterns, change in irrigation water consumption patterns,

7) Conducting soil science studies across the County and extending the available laboratories of soil and water,

8) To increase the faming land under cultivation, change in farming patterns to localize the production of yields, especially oil seeds (sesame, sunflower and brassicanapus), vegetables, etc.

9) To extend production cooperatives and farming companies, and employ educated experts giving priority to local work force.

10) To change, renew and mechanize the available garden and develop green houses.

11) To protect natural environmental resources through establishing range management cooperatives, range management through training farmers, to make balance between cattle size and range, to move from traditional stockbreeding to mechanized one.

12) Ecological management aiming to decrease pollution, to intensify biological attack against plant diseases.

13) To support technical association of agricultural engineering, to develop and mechanization, to level and integrate farming lands with the purpose of changing utilization system.

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