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Evaluation of farmers' socio-economic conditions and their influence on agrobiodiversity in Gharaviz area

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This study evaluated the effects of farmers' socio-economic conditions on crop biodiversity in three villages located within the non-hunting region of Gharaviz and four villages in the surrounding area in western Iran. Information used in the study was collected during farm visits and by way of questionnaires and interviews with farmers and agricultural experts in the region. The following parameters were used for evaluations; cultivated species, area under cultivation, farmer's age, farmers' level of education, and sources providing a farmer's income. Results suggested that farmers' average age in rural areas was 50 years and in terms of gender, men accounted for more than 87% of heads of households. Farmers' level of education in the region showed that 44% of them were illiterate and the condition was undesirable. An average size of a household in all rural areas was 5.4 persons, indicating moderately sized families. The main source of income for farmers' families was farming, which accounted for about 75% of their total income. Animal husbandry was identified as the second most important source of income for farmers. The correlation between these parameters and biodiversity indices showed that gender, education level, household size, and the percentage of a farmer's income from cultivation all had an effect on biodiversity indices in the area.

Keywords: Biodiversity indices, farming income, gender, household size, literacy level

INTRODUCTION

Biodiversity is a fundamental part of any ecosystem, and it enables the provision of goods and services (MEA, 2005; Pimm et al., 1995). Agrobiodiversity refers to the diversity of biota (living organisms) that is either inherent or cultivated in the agricultural context (Wood, Lenne, 1999). Research has also determined that agrobiodiversity provides the necessary conditions for agricultural sustainability (Cleveland et al., 1999).

Agrobiodiversity is fundamental in food production systems (Brush, 2004), but it also holds aesthetic and cultural values for human societies (Nabhan, 1989). The benefits of biodiversity to an ecosystem are numerous: improving yield,

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supporting high yield or pest resistant genotypes (Qualset, Shands, 2005), mixing cultivated genotypes (Zhu et al., 2000), using cover residuals (Jackson et al., 2004) or by mixed cultivation (Vandermeer et al., 2002), facilitating insect habitats that serve as biological pest control (Tscharntke et al., 2005; Altieri, Nicholls, 2003), and hosting leguminous species that serve to increase the nitrogen content of the soil (Drinkwater et al., 1998).

Genetic erosion is reported in many crops due to monoculture and other unsustainable farming operations (Baudry, 1989; Burel, Baudry, 1995; Stocking, 2001). Ample research has reported on the importance of biodiversity for increasing crop yield within sustainable production systems in agriculture (Almekinders et al., 1995; Collins, Qualset, 1998; Altieri, 1999; Gliessman, 2007).

Research implies that implementation of processes associated with social and natural capital are a high priority to enable protection of biodiversity (Uphoff, Wijayaratna, 2000; Pretty, Smith, 2004; Katz, 2000; Rodriguez, Pascual, 2004). In general, there have been fewer studies in Iran regarding the importance of biodiversity (Khoshbakht et al., 2009; Hashemi et al., 2009; Khoshbakht et al., 2006; Koocheki et al., 2008; Malakmohammadi et al., 2010).

Khoshbakht et al. (2006) evaluated relations between agroecology and home garden socio-economic aspects in Savadkouh area located at Mazandaran province. Rababah and Al-Qudah (2004) investigated determinant socio-economic factors of biodiversity in Ajlun province in Jordan. Willemen et al. (2007) dealt with some environmental and socio-economic indices effective on genetic erosion and biodiversity of Cassava in Amazon forest in Peru, while Rana et al. (2007) studied the impact of socio-economic factors on the management of rice cultivar diversity in Nepal.

To date, there have not been any investigations on biodiversity in the area examined in this study. The principal goal for conducting this research was to evaluate farmers' conditions in terms of socio-economic factors in relation to agrobiodiversity in Gharaviz area.

MATERIALS AND METHODS

The study area was located in western Iran (Fig. 1). Seven villages in the area were evaluated

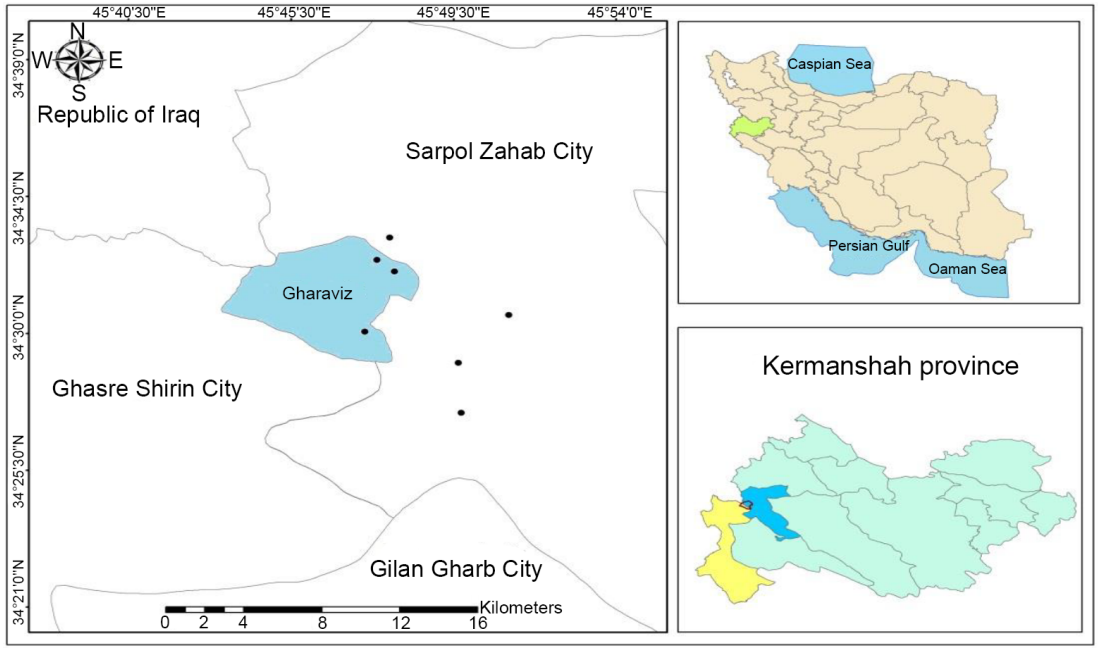

Fig. 1. The location of the study area in Kermanshah province in the west of Iran

in the study: three of these villages were located within the non-hunting region of Gharaviz and four villages were in the surrounding area (Table 1). The climate in the area has warm summers and mild winters. Mean annual rainfall was measured at 420 mm and the mean temperature was about 20°C.

Information for the study was collected during farm visits and questionnaires given to the farmers and experts in the area. The questionnaire included questions on species cultivated, areas of land under cultivation, and on the socio-economic conditions of the families such as farmer's age, gender, the level of education, experience, household size, and percentages of the sources of income. Interviews were conducted with at least 30% of heads of households; in less populated rural areas, a high percentage of farmers in the region were interviewed. Data analysis was done with EXCEL and SAS software packages. In order to assess the relationship between quantitative data, the Pearson correlation test and Spearman correlation in SAS software were applied.

Biodiversity indices including Species richness, Shannon-Wiener, Simpson dominance and Evenness were calculated for all studied farms with specific software, Ecological Methodology. These indices compared the means for each village.

RESULTS AND DISCUSSION

Farmers' socio-economic conditions

1. Age of the head of household

The average age of farmers in villages was over 50 years, the main reason for this being that young people were generally unwilling to continue their involvement in agriculture and farming activities due to low income in the agricultural sector. Farmers also reported that most of the young people had chosen jobs different from those of their fathers. Davari (2010) reported that farmers' average age was determined as over 50 years because the youth had moved to cities. Evaluations for the average age of farmers in the examined villages showed that heads of households in Gharaviz had the highest (59 years) and those in Golamkabod olia had the lowest (50.8 years) means of the average age. It can therefore be concluded that the farmers in Golamkabod olia were younger than those in Gharaviz (Table 2).

The largest percentage of people aged over 60 years in a village was recorded in Gharaviz, and the highest percentage of people aged below 30 years in a village was recorded in Gharebolagh.

There was a negative correlation between the age of the farmers and literacy of the head of household ($r = -0.625^{**}$): it can probably be explained by a lack of education facilities in

Table 1. **Geo and demographic characteristics and sampling results of villages in the study areas**

Area	Village	Longitude	Latitude	Altitude (m)	Distance from urban centre (km)	Number of households	Sampling unit
Gharaviz non hunting	Gharaviz	45°47' E	34°29' N	573	5.5	119	40
	Golamkabod olia	45°47' E	34°29' N	510	11.5	50	16
	Dastak	45°48' E	34°32' N	522	10	15	12
Marginal area	Golamkabod sofla	45°47' E	34°32' N	509	12.5	20	15
	Zarinjob	45°49' E	34°30' N	562	5.5	80	27
	Rikhak	45°49' E	34°27' N	554	6.2	12	10
	Gharebolagh	45°49' E	34°29' N	530	4.5	40	14

Table 2. **Social characteristics of the study area**

Variable		Gharaviz	Golamka-bod olia	Dastak	Golamka-bod sofla	Zarinjob	Rikhak	Ghare bolagh
Age		59	50.8	58.33	51.53	51	55.8	53.21
Experience		24.82	31.31	29.16	25.85	28.59	28.8	35.42
Household size		4.5	5.56	5.41	5.46	5	4.5	7
Gender (%)	Men	62.5	100	91.67	93.33	100	100	100
	Women	37.5	0	8.33	6.67	0	0	0
Literacy (%)	Academic	0	0	8.4	6.6	3.7	0	28.5
	Secondary education	12.5	19	16.6	1.3	40	20	21.4
	Unfinished secondary education	22.5	43.5	50	46.6	29.6	40	14.2
	Illiterate	65	37.5	25	33.3	25.9	30	35.7

the past. Research by Gauchan et al. (2005) reported significant differences between evaluations for an age group and the level of education, showing that aged farmers were mostly uneducated. There was a direct and significant relationship between this parameter and the household size. According to these evaluations, older heads of household had larger families, showing that they had produced more children.

2. Gender of farmers

The parameter of the gender of farmers determined that there were some women heads of households in the villages of Dastak and Golamkabod sofla; women made up 37.5% of heads of household in the village of Gharaviz. This village recorded the highest percentage of women heads of household that were also involved in farming operations. In other villages, all heads of households were men. In the Gharaviz area, the number of women farmers was higher than in other villages and most had become involved in farming activities following the death of a spouse, so they generally had only low-level farming experience (Table 2).

Comparison of the means determining gender indicated a significant difference between all villages (32.42^{**}) and Gharaviz villages (10.64^{**}), but the difference between marginal villages (3.4^{ns}) was not significant. This means that there was no difference between marginal villages in terms of gender. There was also a significant correlation between gender and the use of modified seeds ($r = 0.007^{**}$), demonstrating the impact of gender on the use of modified seeds, but their type and the outcome were not recognized.

3. Experience of heads of household

The average level of farming and cultivation experience of the farmers in the village of Ghare bolagh (35 years) was much higher than that of others, and the farmers of the Gharaviz country side had the least experience (24 years) among the studied villages (Table 2). A comparison of the means of the farmers' experience indicated no significant difference between villages. The correlation between farmer's experience and the number of family members working on the farm ($r = 0.17^{*}$) was significant: reports showed that longer farming experience led to more members of a family being involved in farming operations.

4. Literacy of heads of household

Literacy was evaluated in terms of four levels; illiterate, unfinished secondary education, secondary education, and academic education. A number of farmers had unfinished secondary education (about 32%). Rostami (2011) conducted a study in the Ghalajeh region and reported that 45% of the farmers had unfinished secondary education. Among the examined villages, 65% of farmers in Gharaviz village were uneducated, and as such were the least educated; the farmers of Gharebolagh had the highest level of education. Farmers of Gharaviz, Golamkabod olia, and Rikhak did not have academic education. The level of farmers' education can have an impact on the diversity of crops. Neighbouring villages had better conditions in terms of the level of education than those located within the Gharaviz region (Table 2).

Comparison of the data from the villages in terms of education indicated significant differences between all villages (16.43^{*}). There was also a significant difference within Gharaviz (6.68^{*}), but there was no significant difference among marginal villages (1.65^{ns}), namely, there was no considerable difference between marginal villages in terms of evaluations for education (Fig. 2).

Correlation between the level of education and the number of members in a farmer's family ($r = -0.196^{*}$) was negative and significant, indicating that a higher level of education of a farmer corresponded to fewer family members that continued to work on the farm and showing that family members had other vocations. There was a significant correlation between cultivation ($r = 0.026^{*}$) and the use of harvesting tools ($r = 0.002^{**}$). Investigation showed that more educated families displayed a higher tendency to buy and use tools for cultivation and harvesting.

5. Household size

The means for family size in villages showed close correlation in the study. The least and highest numbers of people in a family were 12 and two, respectively (Table 2). In the village of Gharaviz, 50% of families had three to six members on average. The highest average of the number of members of a family was observed in Gharebolagh village (seven people), and the village of Rikhak (4.5 people) had the least populated families. The large numbers of members of a family in some villages indicated that they still followed some traditional customs.

The correlation between the size of family and the percentage of income obtained from ranching operations ($r = 0.221^{**}$) was significant, indicating that in larger families a higher portion of the household income came from farming, but its correlation to the percentage of family income from cultivation ($r = -0.263^{**}$) was negative and significant, indicating that

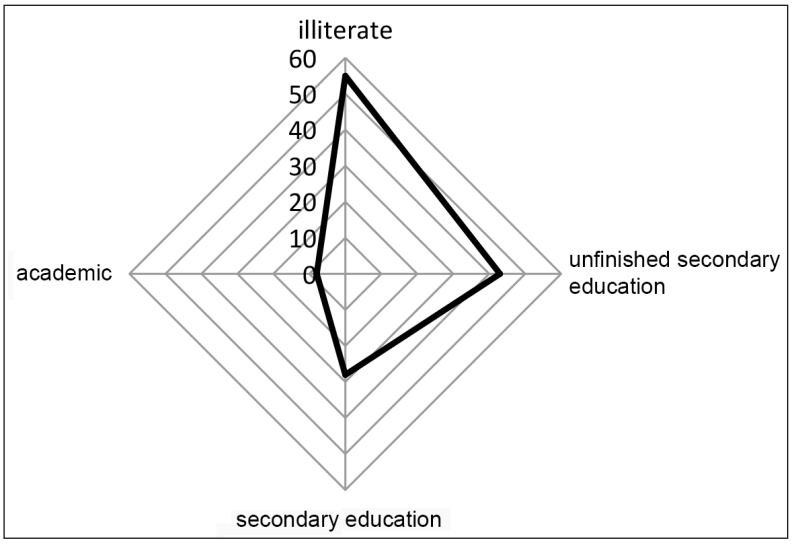

Fig. 2. Literacy status of farmers in the area

larger families had proportionately less household income from cultivation. In other words, farming accounted for a bigger contribution to the household income than cultivation in larger families.

6. Sources of subsistence of farming households

This section of the questionnaire was related to the various ways that farming families sourced their subsistence income. Farmers were asked to state the contribution to their subsistence needs made by animal husbandry, cultivation, horticultural and other jobs as a percentage of their total annual income (Fig. 3).

6.1. Income from animal husbandry

On average, animal husbandry accounted for about 20% of farmers' income in all regions and was identified as the main source of income after cultivation. Among the seven studied villages, the farmers of Gharebolagh had the lowest percentage of their income from animal husbandry compared to that of other villages, indicating that animal husbandry in that village did not provide a good source of income. In the villages of Gharaviz, Golamkabod olia, Dastak, and Golamkabod sofla, 75% of families sourced from 0 to 50% of their income from husbandry. Gharebolagh (2.85%) had the lowest percentage of income from animal husbandry, while the highest percentage was observed in the village of Dastak (27.5%), where animal husbandry was beneficial and most of its inhabitants tended to cultivation followed by livestock.

There was a significant difference among the seven villages (17.74*) in terms of the contribution of husbandry to providing for subsistence needs of families. There was a negative and strong significant correlation between the contributions of animal husbandry and cultivation (–0.853**).

6.2. Income from agronomic activities

Among all studied villages, cultivation was the most important occupation among agricultural activities. On average, cultivation accounted for 75% of farmers' income in the studied villages. However, Rostami (2011) reported that cultivation contributed 52% to farmers' income in Ghalajeh, this report confirms the importance of cultivation in the village. About 75% of farming families in the villages of Zarinjob, Rikhak, and Gharebolagh had income from commodities that accounted for 70% of total income. In the villages of Gharaviz, Dastak, Golamkabod olia, and Sofla, more than 50% of the total income in 75% of families was from cultivation. Davari (2010) reported on the importance of cultivation in Varamin compared to other sources of income. On average, cultivation contributed 60% to income in all villages, which

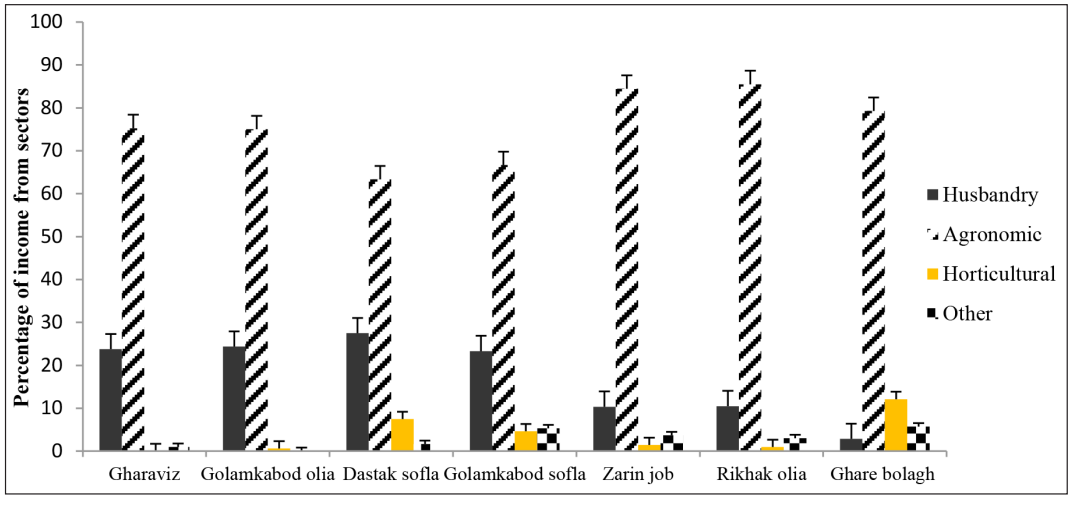

Fig. 3. Percentage of income from various sectors in the villages studied

shows that cultivation was identified as the main source of income in these areas. This was more apparent in marginal villages compared to those in the Gharaviz region.

There was a significant difference in the means between the percentages of income from cultivation among marginal villages at the probability level of 99%. Its relation to the application of chemical fertilizers (0.296**) and modified seed consumption was significant and positive, which shows that increased income from the cultivation section led to an increased use of chemical fertilizers and modified seeds.

6.3. Income from horticultural activities

In terms of providing for inhabitants' income, the contribution of horticultural activity in the studied area was lower. In the village of Gharebolagh, 10–30% of total income was accounted for by horticultural activities of 50% of inhabitants. Also in Dastak, the contribution of horticultural activities to income was between 10 and 40%, which catered for 25% of a family's demands. In other villages, the contribution of horticultural activities was smaller or non-existent. In Gharebolagh and Dastak, the contribution of horticultural activities to income was 12% and 7.5% on average, respectively. It was zero per cent in the village of Gharaviz. In rural areas, a comparison of the means indicated a significant difference among the seven villages (40.7**), the villages within Gharaviz region (10.55**), and marginal villages (19.53**), which showed that the villages varied in terms of the percentage of income from horticultural activities in meeting financial demands.

6.4. Income from other sources

Other sources that added to the income of farming families did not make a considerable contribution. In the village of Gharaviz and some other villages, contributions to a family's subsistence needs were met by horticultural activities and cultivation. In the village of Golamkabod olia, other sectors did not amount to a percentage of farmers' subsistence. On average, Gharebolagh had the highest (6%) contribution compared to the villages of Golamkabod olia, Gharaviz, and Dastak with 0, 1, and 1.5%, respectively.

Factors affecting agrobiodiversity

The correlation between the gender of the head of household and the evenness index (r = 0.19*) was significant: the families supervised by women had a higher value on this index and the evenness of cultivated yields increased or, in other terms, women tended to cultivate mixed crops in similar scales (Table 3).

The correlation of farmers' literacy level on the evenness index (r = –0.181*) was negatively significant, which means that a higher level of education resulted in a lower value of the evenness index and the evenness of cultivated crops (Table 3). Malakmohammadi et al. (2010) reported that there was a significant correlation between the literacy level of the head

Table 3. **Correlation coefficients between social-economic factors with biodiversity indicators**

	Variable	Correlation coefficients			
		Species richness	Shannon-Wiener	Evenness	Simpson
Economic-social	Age	–0.099^{ns}	–0.097^{ns}	0.056^{ns}	0.071^{ns}
	Gender	–0.143^{ns}	–0.063^{ns}	**0.19***	0.03^{ns}
	Experience	0.019^{ns}	0.01^{ns}	0.043^{ns}	0.022^{ns}
	Level of literacy	0.086^{ns}	–0.009^{ns}	**–0.181***	0.014^{ns}
	Household size	0.139^{ns}	**0.193***	**0.267****	**–0.214***
	Agronomic income	–0.109^{ns}	**–0.179***	**–0.266****	**0.183***
	Animal husbandry	0.164^{ns}	**0.213***	**0.299****	–0.168^{ns}
	Horticultural activities	–0.017^{ns}	0.017^{ns}	0.154^{ns}	–0.021^{ns}
	Other sources	–0.095^{ns}	–0.067^{ns}	–0.012^{ns}	–0.037^{ns}

of household and the number of cultivars and species. Farmers with a high level of education generally tended to have more diverse yields because of better awareness (Winters et al., 2006).

Correlation between the household size and the Shannon-Wiener index ($r = 0.193^{*}$) was positive and significant: as the family size increased, the index value also increased. In other words, larger families had higher values of the Shannon-Wiener index. This increased index value indicated increased crop diversity in farms. Its relation to the evenness index ($r = 0.267^{**}$) also was significant, and larger families had higher values for crop diversity, such that the area occupied by species on the farm was equal. Also, there was a significant correlation between Simpson dominance index and household size ($r = -0.214^{*}$) (Table 3). This was true in respect of inverse correlation between dominance and evenness. Larger families had lower values on this index indicating that one or some species reduced dominance. Hashemi et al. (2009) observed a significant relation between species richness and the household size. Benin et al. (2004) reported a significant relationship between agricultural yield diversity and the number of members of a family working on the farm.

There was a significant correlation between cultivation contribution in providing for families subsistence and the indices of Shannon-Wiener ($r = -0.179^{*}$), evenness ($r = -0.179^{*}$), and Simpson dominance ($r = 0.183^{*}$) (Table 3). Families with lower income from farming had a stronger tendency to monocultural agricultural systems and cultivation of few cost-effective crops. As a result, on the values of the Shannon index decreased, and and those of the Simpson index increased. Species richness was affected by income and cultivation to meet a family's subsistence needs. Saxena et al. (2005) stated that dealing with cultivation operations to increase income led to deterioration of biodiversity.

CONCLUSIONS

Results of this study present a clear indication of the conditions of agrobiodiversity and socio-economics in the study area. To obtain useful knowledge about conditions and increasing agrobiodiversity in a region, the sustainability of the agricultural system will be ensured. The results showed that since the socio-economic conditions of the people in rural areas have an effect on crop biodiversity, these contributing factors can be applied to maintaining and increasing biodiversity in the area. The results of environmental and socio-economic factors indicate that biodiversity is affected by biotic and abiotic factors. For instance, such factors as gender, education level, family size, and the amount of contribution made by cultivation to a farming family's income are effective on species diversity. Evaluation of farmer's economic conditions in this area showed that the farmers in the villages of Rikhak, Zarinjob, and Gharebolagh had better conditions than others. Most farmers depended on income from cultivation for subsistence, so cultivation was the main source of income for inhabitants in the region.

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Ashkan Asgari, Korous Khoshbakht, Saeid Soufizadeh

ŪKININKŲ SOCIOEKONOMINĖS PADĖTIES ĮVERTINIMAS IR JOS POVEIKIS AGROBIOĮVAIROVEI GHARAVIZO RAJONE

Santrauka

Tyrimo metu įvertintas socioekonominių sąlygų poveikis pasėlių biologinei įvairovei ne medžioklės regionų trijuose kaimuose Gharavizo rajone ir keturiuose, išsidėsčiusiuose Vakarų Irano apylinkėse. Tyrimui reikalinga informacija buvo renkama ūkiuose pildant klausimynus, taip pat kalbantis su regiono ūkininkais bei žemės ūkio ekspertais. Vertinimui naudoti šie kriterijai: auginamos rūšys, apdirbamas ūkio plotas, ūkininko amžius, ūkininko išsilavinimas ir pajamų šaltinis. Rezultatai atskleidė, kad ūkininkų vidutinis amžius kaimo vietovėse buvo penkiasdešimt metų, kaip namų ūkio vadovai dominavo vyrai (87 %). 44 % tirtų ūkininkų buvo neraštingi, raštingumas buvo nepageidaujamas. Vidutinis namų ūkio dydis visose kaimo vietovėse buvo 5, 4 žmonių, t. y. vidutinio dydžio šeimos. Pagrindinis ūkininkų pajamų šaltinis – ūkininkavimas – sudarė 75 % visų pajamų. Gyvulininkystė buvo antras svarbiausias pajamų šaltinis. Šių kriterijų ir biologinės įvairovės rodiklių koreliacija atskleidė, kad lytis, išsilavinimo lygis, namų ūkio dydis ir iš ūkininkavimo gaunamų pajamų procentas turėjo įtakos biologinės įvairovės rodikliams šiame rajone.

Raktažodžiai: bioįvairovės indeksas, ūkininkavimo pajamos, lytis, namų ūkio dydis, raštingumo lygis