


The role of pastoralists' livelihood diversification strategy in reducing dependence on summer rangelands in the Eastern Mazandaran Province, Iran

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Abstract:

Pastoralists in eastern Mazandaran Province, Iran are seeking a transition from pure pastoralism to a Livelihood Diversification Strategy (LDS) to ensure the sustainability of their livelihoods. Knowledge of LDS can help pastoralists to obtain a sustainable livelihood. The objective of this study was to determine the role of LDS adopted by pastoralists in reducing their dependence on summer rangelands of Hezarjarib district, Behshahr, Iran. It was an applied study that was conducted using a descriptive-analytical research method through semi-structured interview and cluster sampling methods using a questionnaire tool (85 items). The content validity of the questionnaire was confirmed by the experienced professors. Cronbach's alpha (0.87) was used to calculate the internal consistency of the research tool. Different types of district pastoralists' livelihood strategies were evaluated from 2020 to 2021. Regression Function Estimation (RFE) and the Ordinary Least Squares (OLS) method were used to analyze the revenues earned from the livelihood strategies of the rangelands. Moreover, the Lagrange Multiplier Test statistic was used to assess the heterogeneity of variance, and the chi-square distribution test (δ^2). Results showed that the pastoralists had adopted 10 mono- and multi-livelihood strategies. Pastoralism and medicinal plant harvesting had the largest (2.01%) and the smallest shares of stakeholders' net income (0.14%), respectively. Multi-livelihood income crop cultivation + pastoralism + medicinal plant harvesting had the highest share of income with an average profit of 297 million IRR/household (900 \$/household). OLS regression showed all of the explanatory variables of the model except the share of annual total net income were significant ($p \leq 0.05$ and 0.01). The set of independent variables used in the regression explained 65% of the total income variation. The pastoralists' multi-livelihood diversification activities, age and education had a negative effect on the total income. The results showed that more revenues earned from multi-livelihood jobs will decrease or increase the total household income depending on the decreased or increased rangelands. So, an increase in multi-livelihood household income will increase employment opportunities that may reduce the reliance on rangeland resources. Therefore, it should be attempted to take into consideration that the lack of diversity in pastoralists' income-generating activities can make them more vulnerable than other pastoralists who enjoy multiple livelihoods.

Keywords: Alternative income; Multi-purpose use; Diversification; Traditional livestock husbandry; Hezarjarib-Behshahr

Introduction

Rangelands have a lot of direct and indirect benefits to society as fodder production, water supply, water and soil conservation, preservation of biodiversity and plant genetic resources, medicinal herbs production, climate modification, food production, ecotourism services, and recreational services (Zare et al., 2013). The optimal and sustainable use of this renewable natural resource requires proper man-

agement. However, some products such as fodder directly and publicly consumed by livestock are more important than non-fodder ones for pastoralists (Rastgar et al., 2013; Raufirad et al., 2016).

In connection with range management, it is necessary to consider that a single-product economy is fragile and the most important issue in this regard is the proper use of rangeland to maintain its sustainability for the long term (Jawan et al., 2011). This means that the economy of pastoralists,

who are mostly rural people, is very unstable and fragile as long as only rangeland fodder is considered for livestock raising; in that case, the retrogression of rangelands and the erosion and destruction of the soil is inevitable (Eshaghi Milasi et al., 2017; Mirjalili et al., 2019). External disturbances including climate changes and environmental conditions on natural ecosystems have recently threatened the traditional livelihood of summer rangelands in the eastern Mazandaran province to such an extent that many pastoralists are no longer able to make a living based on traditional pastoralism and have to turn to other revenue-generating activities, which is why they are looking for livelihood strategies (Riahi and Nouri, 2015).

These types of strategies are the choice and combination of activities that people choose to achieve their livelihood goals, and they consider them as tools to face external disturbances and maintain livelihood capacity (Helmy, 2020). In this regard, we need to consider three key concepts to analyze livelihood strategies and their underlying factors. The first is “livelihood”, which means abilities, assets, and activities needed to give meaning to life (Kariuki et al., 2018). A livelihood is sustainable when it can cope with or cover stresses and shocks, and support or increase capital and assets in the present and future while not damaging the basic natural resources. The second concept is “livelihood assets or capitals”, which refers to the basic resources of a society and different household groups and can be categorized into human, natural, physical, financial, and social capital. The third is “livelihood strategy” referring to a range and combination of activities that people choose and apply to use their assets and thus achieve their livelihood goals (Ghazali et al., 2023).

Different livelihood strategies have obvious effects on the livelihoods of different communities in different ways such as poverty alleviation, food security, and natural resource management (Loison and Loison, 2016). Livelihood strategies are adopted, applied, and diversified for a variety of reasons including risk management, risky dependence on a single livelihood, increase in revenue, improvement of living conditions, reduction of pressure on resources, proper reaction and management in dealing with threats and opportunities, and improvement of living standards (Abera et al., 2021; Asfaw et al., 2018; Torell et al., 2017; Kavandi Habib et al., 2014).

There is little research on natural resources and their relationship with livelihood diversification (LD) of rural communities in Iran, especially about rangeland ecosystems. In connection with the diversification of economic activities and its role in economic stability and prosperity, the largest share of revenues in rural areas in many countries comes from non-agricultural activities, and the largest share of households comes from the diversification of revenue streams (Davis et al., 2010). In this regard, Jawan et al. (2011) found that the lack of diversity in economic activities in their study area had created unfavorable conditions for households while the diversification of revenue streams in agricultural and non-agricultural sectors has brought relatively more favorable conditions for them.

Shamsi et al. (2020) found a high correlation between eco-

nomics diversification and biological well-being so that an increase in the diversification of their economic activities improved their biological well-being.

The results of a study on the diversification of economic activities and the sustainability of villages in Khorramdarreh County, Zanjan also indicated a significant relationship between the diversification of economic activities and economic sustainability (Davis et al., 2010). The non-agricultural economy plays a major role in reducing the negative impacts of economic problems in rural areas. Some issues such as open and disguised unemployment, lack and instability of income, and rural poverty mainly occur in the structures in which livelihood agriculture and especially activity in the agricultural sectors play a major role in people’s employment and income in the absence of other revenue streams, and this type of economy reduces migration in the rural areas of Semrom, Iran (Alavizadeh and Mirlotfi, 2013; Yasour and Javan, 2015).

Parhizkari et al. (2015) in evaluating the factors affecting household income found that variables such as gender, household size, and non-agricultural income (revenues earned from livestock, side jobs, and combined income) were effective in total household income. Gebru et al. (2018) in Ethiopia concluded that 81% of farmers were able to diversify their revenues from non-agricultural sources. Some other researchers have mentioned the positive effects of household education level, access to financial facilities, income level (Riahi, 2019), membership in cooperatives and the negative impact of the age of pastoralists, reception of subsidies (Dai et al., 2019), level of reliance on rangeland (Torell et al., 2017), number of household members, access to consultancy services, distance to the market and the number of livestock (Yasour and Javan, 2015) in choosing livelihood diversification strategy (LDS).

Sabyrbekov (2019) and Lenaiyasa et al. (2020) concluded that income diversification among households differs depending on the number of heads of livestock which a household owns and regional differences. In addition, the study found no statistically significant result showing that a high perception of range degradation would lead to the adoption of non-livestock livelihoods, i.e. tourism. Aloba Loison (2019) found that economic and livelihood diversification is positively correlated with household demographic characteristics such as age, gender, education level, and hiring labor in rural areas of Kenya. Therefore, given the important influence of rangeland resources on the economic status of the farmers of the Hezarjarib District, Behshahr, good knowledge of the livelihood strategies adopted by the pastoralists in the region can help guide them towards more suitable strategies, thereby ensuring their sustainable livelihood and reducing reliance on pure pastoralism and rangeland degradation. According to the cause, there has been no comprehensive research on livelihood diversification and its relationship to reduce the reliance on summer rangelands in the zone and district; furthermore, no research has been undertaken in this area to determine the influence of livelihood diversification on economic status; this research aims to add to the body of knowledge by empirically linking stakeholder’s status to livelihood diversification in

rural households and also tries to answer the following questions:

1- Which of the economic activities of the pastoralists in the study area has a greater share of their income and livelihood?

2- How do the pastoralists' livelihood diversification activities (multi-activity jobs) affect their total income?

Based on the questions, this study aimed to identify the most beneficial activities of pastoralists that affect their total income.

Material and methods

Study area

The study area is a part of Zarem Rud catchment area in Hezarjarib District, Behshahr. It is located 80 km far from Behshahr city on the Behshahr-Damghan road, considered part of the heights of Hezarjarib, Behshahr. It is located at the longitude of 54°00'00" to 54°09'40" E and the latitude of 36°26'10" to 36°31'45" N. Its altitude ranges from 1800 to 2700 masl and is the highest part of Hezarjarib District. It has a cold and dry climate, with mountains and many ups and downs. It has 10 rangeland units including Bezansām, Tirpero, Hashtpader, Mianband, Hajikord, Sefidkhani, Siahhkhani, Zereshki, Shah Aram, and Kolya lands. The total area of the rangeland is 8616 ha, 35 ranchers and 2820 heads of livestock (figure 1). Sorkh Geriveh and Kolya villages have a total population of about 450 people (146 households), which rises to 1500 people in spring and summer. These two villages have about 20 permanent households whose main jobs are agriculture and pastoralism. Their side jobs also include beekeeping, medicinal

herb harvesting and agriculture (Riahi, 2019).

Sampling method and data collection

This study was performed using the descriptive-analytical method. The research method was a combination of qualitative (questionnaire) and quantitative (field) research techniques (Motiei Langroudi et al., 2018; Sharifiyan Bahraman et al., 2014). Data were collected using a questionnaire. All economic and social investigations were conducted using field surveys, observation, and interviews through questionnaires during 2020 – 2021. Due to the large number of rangeland units (RUs), 10 out of 40 RUs were selected and sampled by clustering method in the Bezansām, Tirpero, Hashtpader, Mianband, Hajikord, Sefidkhani, Siahhkhani, Zereshki, Shah Aram and Kolya. The study population consisted of all the 85 summer pastoralists of Sorkh Geriveh and Kolya villages. Therefore, a semi-structured questionnaire was developed in several parts during one grazing period to estimate the pastoralists' net income. The first part was related to their demographic information including age, level of education and occupation while the second part was related to their cost and revenues in each of the main activities (mono-livelihood) and (multi-livelihood) (Riahi, 2019). The content validity of the questionnaire was confirmed using the content validation method and expert assessment. The questionnaire was initially distributed among some pastoralists in the district whose corrective comments contributed to the content validity of the questionnaire (Kalantari, 2013). The items in the questionnaire were measured by a 5-point Likert-type scale, which ranged from Always-5, Often-4, Sometimes-3, Rarely-2 and Never-1. The information gath-

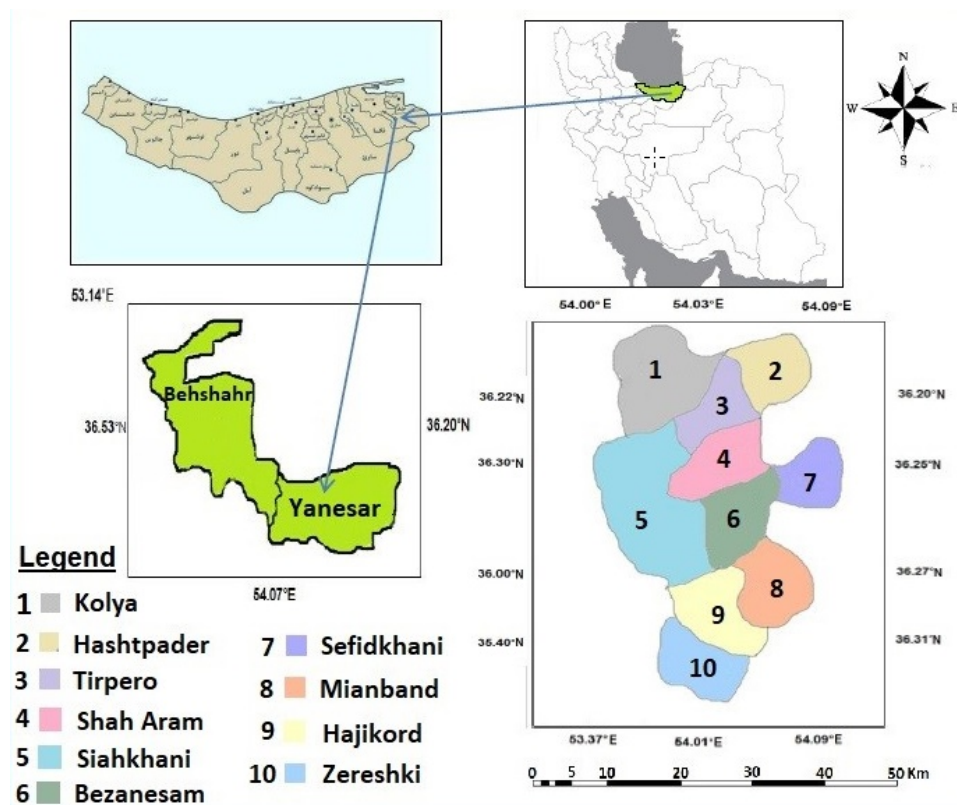


Figure 1. The location of the study area in Behshahr city and Mazandaran province.

ered from the questionnaires was entered into Excel 2013 software and the final information was entered into SPSS 24 for statistical analyses.

The linear regression analysis method was used in Eviews version 5.0 to see how the income diversity of the livelihood strategies adopted by the pastoralists affects their total income and how they help to reduce their reliance on rangeland. For this purpose, first, the economic status of the household, i.e. the net income of all productive activities of the pastoralists (mono- and multi-livelihood activities) is defined through (equation (1)).

$$\text{TNR} = \sum_{i=1}^n gm_i \times prod_i \quad (1)$$

where:

TNR is the annual net income,

gm_i is the gross profit per unit of the product in each production activity,

$prod_i$ is the amount of production in each activity including the main job (mono-livelihood activity) and side jobs (multi-livelihood activities).

Net income is the total value of final products minus the total value of production inputs. In traditional societies, many rangeland plants are harvested through minimal investment, and the opportunity cost of unskilled rural labor is very low. In such a scenario, capital and labor costs are unimportant. Therefore, to estimate rangeland profit, we do not deduce capital costs (depreciation), intermediate input costs, and family labor costs from the value of rangeland products (Heidari Zahiri et al., 2015). Next, the total income function of pastoralist households was estimated in the following steps:

Estimation of the total income function of pastoralists

RFE and OLS methods were used to analyze the total income earned from mono- and multi-livelihood activities of pastoralists. Equation (2) represents the OLS regression model (Mosteller and Tukey, 1977). In the case of the model with 6 explanatory variables, the OLS regression

model writes:

$$Y = \beta_0 + \sum_{j=1..p} \beta_j X_j + \varepsilon \quad (2)$$

where:

Y is the dependent variable, β_0 is the intercept of the model, and X_j corresponds to the j^{th} explanatory variable of the model ($j = 1$ to 6) such as gender, age and education level, net income from mono-livelihood activities, and net income from multi-livelihood. Also, ε is the random error with expectation 0 and variance σ^2 .

After estimating the pastoralists' total estimation function, the Lagrange Multiplier (LM) test statistic was used to test the heterogeneity of variance and the chi-square distribution test (δ^2) with the degree of freedom K (explanatory variable) was used to test the distribution normality of the disturbance term. Variables affecting the total income of pastoralists include individual characteristics (gender, age and education level), net income from mono-livelihood activities, and net income from multi-livelihood ones shown in Table 4.

Results

Descriptive characteristics of pastoralists

The results of descriptive characteristics of pastoralists revealed that 98.82% of them were male and 1.18% were female. Their mean age was 53.08, ranging from 22 to 82 years. The highest frequency belonged to illiterate people (29.42%) while the lowest one belonged to those with academic education (7.06%) as shown in (Table 1).

Livelihood strategies adopted by the pastoralists

According to the information obtained from the questionnaires as shown in Table 2, the number of pastoralists adopting the mono-livelihood strategy including farmers, pastoralists, beekeepers, and medicinal herb harvesters, totaled 40 people. Among these, only pastoralism had the highest (27.01) and only medicinal plant harvesting had the lowest share of stakeholders' net income (0.14%), respectively. Other pastoralists (52.94%) had side jobs and

Table 1. Frequency and percentage of gender, age and education of the pastoralists.

Variables	Levels	Frequency	Percentage
Gender	Woman	1	1.18
	Man	84	98.82
Education	Illiterate	25	29.42
	Elementary school	21	24.7
	Guidance school	12	14.12
	High school	21	24.7
	Academic education	6	7.06
Age	20-40 years	18	12.17
	41-60 years	42	49.41
	61-80 years	23	27.05
	> 81 years	2	2.35

Table 2. Distribution of annual net income of beneficiaries based on selected livelihood strategies (US \$*).

Livelihood strategy	Frequency household	Net income /Household	Net income	Income	Cost	Frequency (%)	Share net income (%)
Agriculture	11	132.7	1462.1	2398.2	936	12.94	2.96
Pastoralism	20	667.3	13345.5	17686.3	4341	23.53	27.01
Beekeeping	8	193.6	1548.5	9318.2	7770	9.41	11.73
Medicinal plants	1	69.7	69.7	106	36	1.18	0.14
Cultivation + pastoralism	12	873.3	10480.0	20947	10467	14.12	21.23
Cultivation + pastoralism+medicinal plants	10	900.3	9003.3	19384.5	10381	11.76	18.24
Cultivation + medicinal plants	10	210	2098.8	3144.8	1046	11.76	4.25
Pastoralism + medicinal herb harvesting	5	362	1810.6	5301.5	3491	5.88	3.66
Cultivation + beekeeping	4	719	2875.2	4427.3	1552	4.71	5.82
Beekeeping + medicinal plants	4	607.5	2430.9	4408.5	1978	4.71	4.92
Total	85		4936.73				100

*1 \$USD = 330000 IRR in 2020 – 2021.

were involved in multi-livelihood activities including crop cultivation-pastoralism, crop cultivation + pastoralism + medicinal herb harvesting, crop cultivation + medicinal herb harvesting, pastoralism + medicinal herb harvesting, crop cultivation + beekeeping, and beekeeping + medicinal herb harvesting. They stated that their main occupation was other than pastoralism and that they were involved in pastoralism activities in addition to their main occupation. Among the multi-activity jobs, crop cultivation + pastoralism + medicinal plants and crop cultivation + pastoralism, respectively had the highest share of net income with an average profit of (900.3\$) and (873.3\$) per household. The highest frequency (14.12%) and the highest share of net income obtained from livelihood sources (21.23%) were obtained from the “crop cultivation + pastoralism” activity whereas the lowest level of income from side activities obtained from the pastoralism-medicinal herb harvesting (3.66%) (Table 2).

Table 3 shows the results of heterogeneity of variance and distribution normality of the disturbance term of the total income’s estimated function (u). The value of the chi-square (X^2) distribution statistic is estimated to be 1.18 ($n = 10$), which is less than its critical value (3.27). Therefore, the null hypothesis of the normality distribution of the disturbance term is not rejected ($p \leq 0.05$) at which it is not possible to provide evidence of non-normality of the disturbance term of the estimated function of the total household income. The value of the LM statistic for the heterogeneity of variance test is estimated to be 4.57, indicating that the disturbance components of the model do not have the variance heterogeneity problem at the significance level ($p \leq 0.01$).

Effect of LDS variables on the pastoralists’ total income

The results of the regression model (Table 4) show that all explanatory variables (gender, age, multi-livelihood income (were significant ($p < 0.01$) except for the share of net income. This indicated that the coefficients are jointly significant and the explanatory power of the factors included

in the model is satisfactory. The positive coefficients of the variables of gender (X1) and income earned from mono-livelihood jobs (X5) indicate that an increase in each unit of the above variables increased the pastoralists’ total income by 0.389 and 0.682 units, respectively ($p \leq 0.05$). The result confirmed the negative impact of age and multi-livelihood activities on total income where a 1% increase in Beta coefficient in these variables increases the total income by 0.452%, and 0.586%, respectively. The livelihood diversification (LD) measures multi-livelihood activities adopted by the pastoralists had a negative impact on the total income of the rangeland ($p \leq 0.01$). The value of the coefficient of determination (R^2) of the estimated regression function was about 0.65 and the goodness of fit was estimated to be 0.528, which indicates a good fit considering the cross-sectional nature of the data. The results concluded that the independent variables were able to explain 65% of the variations in the dependent variable. The probability of F-statistic determining the regression model significantly explained the variation in the dependent variables ($p \leq 0.05$).

Discussion

The OLS regression was used in this study to evaluate income diversity and its effect on the economy and income generation of those using the summer rangelands of Hezarjarib District, Behshahr, Iran. Different livelihood strategies (LDS) adopted by the pastoralists were evaluated during 2020 – 2021. These data were estimated using the information gathered from the 85 questionnaires as well as face-to-face interviews with the pastoralists using econometric methods in Eviews version 5.0 to see which economic activities of the pastoralists in the study area had a greater share in their income and had an important role in their livelihood, and how the pastoralists’ LD activities (multi-activity jobs) affect their total income.

The pastoralists’ use of the rangelands in the district is not limited to fodder; they have other exploitations including harvesting of by-products. They have adopted four livelihood strategies based on pure pastoralism, crop cul-

Table 3. Results of heterogeneity of variance tested by Lagrange Multiplier (LM) Test and distribution normality tests of the disturbance term (u).

Test	Statistic	Statistic value	Probability value	P-value
Distribution normality of the disturbance term	χ^2	1.18	0.683	0.04
Heterogeneity of variance test	LM	4.57	0.825	0.01

tivation, beekeeping, medicinal herb harvesting as well as multi-activity strategies (livelihood diversity). They were involved in multi-livelihood activities including crop cultivation + pastoralism, crop cultivation + pastoralism + medicinal herb harvesting, crop cultivation + medicinal herb harvesting, pastoralism + medicinal herb harvesting, crop cultivation + beekeeping, and beekeeping + medicinal herb harvesting. They stated that their main occupation was other than pastoralism and that they were involved in pastoralism activities in addition to their main occupation. According to the results, pastoralism and medicinal herb harvesting had the largest and smallest shares of the total livelihood resources (27.03% and 0.18%), respectively. Similar studies have also shown that pastoralists were more involved in pastoralism related activities than in activities not related to pastoralism, which has resulted in their greater reliance on rangeland resources because of their larger number of livestock and the need to supply fodder for them from the rangeland. A household's involvement in pastoralism affects its income more than other mono-livelihood activities in the district. This finding has been confirmed by other researchers (Heidari Zahiri et al., 2015; Karimi and Karami Dehkordi, 2015). Raufirad et al. (2016) also found that the profit earned from pastoralism exceeds the profit earned from other exploitations, which is consistent with the results of this study. The development of livestock activities through the production of hybrid livestock improved their performance and efficiency and can be an effective step in reducing reliance on rangeland resources and rangeland degradation.

Medicinal herbs are less profitable than other products, and the pastoralists of the study area harvest them more for personal and local use than for sale. Their share of the total

household income in the district was 0.18%, which was not significant. Therefore, measures should be taken to develop their crop cultivation and sale through a rural cooperative service company in the district as an effective step to ensure the villagers' welfare and reduce their reliance on rangeland (decrease in rangeland degradation). Similar studies have been reported the share of medicinal herbs' revenues from the total household income to be low, 2.6% (Heubach et al., 2011), 0.29% (Mahmoudi and Eshaghi Milasi, 2017), and 0.32% (Zare et al., 2013) of the total household income. Therefore, the proper management of resources in Iran, especially in the study area, requires finding a way to combine local and indigenous exploitations that are compatible with the environment, natural resources and nature conservation. The findings of this study revealed that most of the studied households earned their revenues through alternative livelihood strategies. The diversity of revenue streams of forest dwellers and villagers was reported in studies performed by (Soltani2010; Rayamajhi et al., 2012; Zare, 2014; Torell et al., 2017; Dai et al., 2019). Multi-purpose use of the rangeland must be made in compliance with all permitted uses of it. Proper management can help pastoralists earn good revenues by selling non-livestock products such as hunting concessions; wildlife visits; ornamental, medicinal and industrial herbs; and beekeeping. However, households with a variety of revenue streams in the agricultural and non-agricultural sectors have relatively favorable conditions and enjoy more stable revenues and sustainable livelihoods, which improves their quality of life. This finding is consistent with the findings of (Motiei Langroudi et al., 2018; Javan et al., 2018; Abimbola and Oluwakemi, 2013). However, it should be noted that this may not be the case in all locations or circumstances.

Table 4. The results of the regression analysis of the livelihood activities of the stakeholders on the total income dependence on rangelands.

Descriptive variables	Standard	Unstandardized		T value	P-value
	Coefficient	Coefficient	SE-B		
	Beta	B			
Constant	-	4.83	0.593	0.621	0.71
Gender	0.389**	0.342	0.014	18.05**	0.00
Age	-0.452*	4.181	0.038	4.20**	0.00
Education	-0.522*	0.384	0.276	-14.02**	0.051
Share of net income	2.770	2.67	0.201	1.37	0.57
Mono-livelihood income	0.682*	0.538	0.287	2.17*	0.021
Multi-livelihood income	-0.586*	0.468	0.236	-2.40*	0.030

$R^2 = 0.65$ $\bar{R}^2 = 0.528$ $F = 157.8^*$

*, **, significant at the 5% and 1% probability levels, respectively.

The effect of the selected livelihood strategies on the pastoralists' total income demonstrated that their LD measures (multi-activity jobs) had a negative impact on their total income ($P < 0.01$). Given the negative sign of the multi-livelihood income coefficient, the more the revenues earned from multi-livelihood jobs, they will decrease (or increase) and the total household income dependence on rangelands increases (or decreases). In other words, an increase in multi-livelihood household income will increase employment opportunities that may reduce reliance on rangeland resources. This finding is consistent with the findings of studies conducted by (Parhizkari et al., 2015; Heidari Zahiri et al., 2015; Karimzade et al., 2016; Gebru et al., 2018). However, it is not in line with the finding of (Liao et al., 2015), reporting that LD not effective in the income level of the pastoralists of Tianshan, China did not improve their welfare in mountainous rangelands due to the little possibility of livelihood diversity among them. Among the mono-livelihood jobs, pastoralism can generate significant income and employment among the people of the region if used optimally, better managed and combined with beekeeping, medicinal herb harvesting and crop cultivation. This finding is in line with the findings of (Sabyrbekov, 2019; Karimi and Karami Dehkordi, 2015; Motamedi et al., 2018), who concluded that pastoralism in combination with other exploitations had been effective in increasing income. This indicates that the livelihood of rural households cannot be sustained only through pure pastoralism using a small number of livestock, and it is less profitable than other exploitations in the region (Heidari Zahiri et al., 2015; Zakeri and Tavili, 2014; Butt, 2010). Therefore, pastoralists need to turn to other jobs such as beekeeping and medicinal herb harvesting to earn their living. With this in mind, any program that turns more attention to other productive functions in the rangeland will prove to be effective in improving the pastoralists' livelihood and help them reduce their reliance on the revenues earned from pastoralism, which is in line with the findings (Afsharnia et al., 2022). Therefore, the increase in household income will increase important employment opportunities, thereby decreasing reliance on rangeland resources and the relative income earned from rangeland resources.

Conclusion

Conservation of water and soil resources requires special attention to the multi-purpose use of rangelands in the managerial and executive sectors. The lack of diversity in the economic activities of the surveyed households in the study area can create unfavorable conditions for the households with such characteristics making them more vulnerable than the pastoralists who enjoy livelihood diversity. The findings of this paper provide two policy implications for promoting livelihood diversification, enhancement, sustainable and effective development of pastoral in the studied region and other parts of the Eastern Mazandaran province with similar situations. First, diversified strategies rather than a mono livelihood strategy would be more effective in stimulating smallholders' initiative for LD. Second, multi-livelihood strategies (crop

cultivation-pastoralism-medicinal plant harvesting) (CPM) had the most share of income and that's why have great potential for development by extending the agricultural industry chain and promoting industrial integration based on local characteristics such as milk and meat processing, cultivating and selling medicinal plant and tanning. CPM can also add value to pastoralism by orderly developing a creative industry of pastoral culture and ecotourism; therefore, the study suggests that diversified economic activities provide rural households in the study areas with an opportunity to manage household food security, reduce dependence on rangelands, and improve living conditions.

Authors contributions

Authors have contributed equally in preparing and writing the manuscript.

Availability of data and materials

The data that support the findings of this study are available from the corresponding author, upon reasonable request.

Conflict of interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

- Abera A., Yirgu T., Uncha A. (2021) Determinants of rural livelihood diversification strategies among Chewaka resettlers' communities of southwestern Ethiopia. *Agric and Food Secur* 10:30. DOI: <https://doi.org/10.1186/s40066-021-00305-w>.
- Abimbola A.O., Oluwakemi O.A. (2013) Livelihood diversification and welfare of rural households in Ondo State, Nigeria. *Journal of Development and Agricultural Economics* 5 (5): 549–557.
- Afsharnia A., Rahmani B., Taj Sh. (2022) The effect of diversification of economic activities on sustainable livelihoods of rural households with emphasis on animal husbandry (Case study of villages in Malekshahi city of Ilam province). *Geographical Engineering of Territory* 6 (3): 525–540.
- Alavizadeh S.A.M., Mirlotfi M.R. (2013) The role of the non-farm economy on rural immobility in rural settlements Semirrom country. *Regional Planning* 3 (10): 71–82.
- Alobo Loison S. (2019) Household livelihood diversification and gender: Panel evidence from rural Kenya. *Journal of Rural Studies* 69:156–172.
- Asfaw S., Pallante G., Palma A. (2018) Diversification strategies and adaptation deficit: Evidence from rural communities in Niger. *World Development* 101:219–234.
- Butt B. (2010) Seasonal space-time dynamics of cattle behavior and mobility among Maasai pastoralists in semi-arid Kenya. *Journal of Arid Environment* 74:403–413.
- Dai X., Zh. W., Yao F., Li B., Yang Z., Nan B., Bi X. (2019) Characteristics and determinants of livelihood diversification of different household types in far Northwestern China. *Sustainability* 12 (1): 1–20.
- Davis B., Winters P., Carletto G., Covarrubias K., Quinones E.J., Zezza A., Diguseppe S. (2010) A cross-country comparison of rural income generating activities. *World Development* 38:48–63.
- Eshaghi Milasi F., Mahmoud B., Yarali N. (2017) Economic dependencies of forest dwellers on forest resources of central Zagros in Lordegan City. *Iranian Journal of Forest* 9 (2): 289–300.

- Gebru G.W., Ichoku H.E., Phil-Eze P.O. (2018) Determinants of livelihood diversification strategies in Eastern Tigray region of Ethiopia. *Agric and Food Secur* 7 (62)
DOI: <https://doi.org/10.1186/s40066-018-0214-0>.
- Ghazali S., Zibaei M., Azadi H. (2023) Impact of livelihood strategies and capitals on rangeland sustainability and nomads' poverty: A counterfactual analysis in Southwest Iran. *Ecological Economics* 206:107738.
- Heidari Zahiri N., Amirnejad H., Hosseini Yekani S.A. (2015) The economic contribution of forest resources use to rural livelihoods (Case study: Hezar Jarib area of Behshahr City). *Iranian Journal of Agricultural Economics and Development Research* 46 (2): 207–2015.
- Helmy I. (2020) Livelihood diversification strategies: resisting vulnerability in Egypt; GLO Discussion Paper. *Global Labor Organization (GLO), Essen*, no. 441, 1–30.
- Heubach K., Wittig R., Nuppenau E.A., Hahn K. (2011) The economic importance of non-timber forest products (NTFPs) for livelihood maintenance of rural West African communities: A case study from northern Benin. *Ecological Economics* 70 (11): 1991–2001.
- Javan F., Afrakhte H., Riahi V. (2018) Investigation of the potentials and obstacles for diversifying livelihood leading to sustainable rural development (Case Study: Rezvanshahr County). *Journal of Research and Rural Planning* 6 (4): 89–106.
- Jawan J., Alavizadeh S.A.M., Kermani M. (2011) The role of economic activities diversification in sustainable rural development case study: county of Semiroom. *Geography* 9 (29): 17–43.
- Kalantari Kh. (2013) Structural equation modeling in socio-economic research (with LISREL and SIMPLIS). *Farhang Saba Publishing*, 243.
- Karimi K., Karami Dehkordi A. (2015) Exploitation of pastures and the need to diversify the livelihood of rural households, a case study: Mahenshan city. *Journal of Rural Research* 6 (2): 343–368.
- Karimzade H., Valaei M., Manafi Azar R. (2016) Ghryzray employment and its role in sustainable rural economy Case Study: Marhamat Abad district center, Miyandoab Township. *Geographical Planning of Space* 6 (20): 129–144.
- Kariuki R., Willcock S., Marchant R. (2018) Rangeland livelihood strategies under varying climate regimes: model insights from Southern Kenya. *Land* 7:47. DOI: <https://doi.org/10.3390/land7020047>.
- Kavandi Habib R., Gholamali Heshmati Gh.A., Siroosi H. (2014) Evaluation of alternative livelihoods status in arid and semiarid regions of Iran to improve sustainability. *Journal of Rangeland Science* 4 (4): 306–318.
- Lenaiyasa M.L., Bruyere B.L., Salerno J., Pickering T. (2020) Pastoralists' use of income diversification as a strategy for adapting to social-ecological change in Samburu, Kenya. *Regional Environmental Change* 20 (21): 1–11.
DOI: <https://doi.org/10.1007/s10113-020-01612-x>.
- Liao Ch., Barrett Ch., Kassam K-A. (2015) Does diversification improve livelihoods? Pastoral households in Xinjiang, China. *Development and Change* 46 (5): 1302–1330.
- Loison S.A., Loison S.A. (2016) Rural livelihood diversification in Sub-Saharan Africa: A literature review rural livelihood diversification in Sub-Saharan Africa: A literature review. *The Journal of Development Studies* 51:1125–1138.
- Mahmoudi B., Eshaghi Milasi F. (2017) Dependence analysis of local communities on medicinal and edible plants harvesting in Sardasht customary region in Lordegan Township. *Journal of Natural Ecosystems of IRAN*, 8(1): 8 (1): 65–78.
- Mirjalili B., Heydari Gh., Baghestani Meybodi N., Rastgr S.H. (2019) An investigation of income and cost of traditional husbandry in arid and desert rangelands of Yazd province (Case study: Nodoshan Rangelands). *Iranian Journal of Range and Desert Research* 26 (1): 89–102.
- Mosteller F., Tukey J. (1977) *Data Analysis and Regression: A Second Course in Statistics*. Pearson
- Motamedi J., Tofighi Azar T., Molaei M. (2018) The economic valuation of forage production function and utilization of orchid in Targavar grasslands of Urmia. *Iranian Journal of Natural Resources* 71 (3): 797–807.
- Motiei Langroudi S.H., Riahi V., Jalalian H., Ahmadi A. (2018) Analysis of factors affecting the diversification of economic activities from the perspective of villagers (case study: Saqez villages). *Human Geography Research* 51 (1): 193–209.
- Parhizkari A., Mirzaee M., Rahmani S., Alini M. (2015) A Survey on the situation of income distribution and its diversity and impact on the economy of rural households (Case Study: Alamout Region). *Journal of Economic Research* 50 (1): 49–74.
- Rastgar S.H., Darijani A., Barani H., Ghorbani M., Ghorbani J., Sheikh V.B. (2013) A new approach to economic valuation of the function of forage production of rangelands (case study: summer rangelands of Nour-rud watershed in Mazandaran province). *Journal of Range and Watershed Management* 66 (3): 347–357.
- Raufirad V., Bagheri S., Jafari M., Mirtalebi A. (2016) Estimation of economic value of *Astragalus gossypinus* and *Astragalus verus* in comparison with income from rangelands forage of Isfahan rangelands. *Journal of Renewable Natural Resources Research* 7 (4): 45–57.
- Rayamajhi S., Smith-Hall C., Helles F. (2012) Empirical evidence of the economic importance of Central Himalayan forests to rural households. *Forest Policy and Economics* 20:25–30.
- Riahi N. (2019) Comparison of livestock income and secondary exploitation of rangelands in summer rangelands of Hezarjarib-Behshahr. *MSc thesis. Sari Agricultural Sciences and Natural Resources University, Sari, Iran*, 83.
- Riahi V., Nouri A. (2015) Variation of economic activities and achievement of rural sustainability Case: Khoramdareh. *Journal of Space Economy & Rural Development* 3 (10): 113–128.
- Sabyrbekov R. (2019) Income diversification strategies among pastoralists in central Asia: findings from Kyrgyzstan. *Pastoralism*, no. 9, 14.
DOI: <https://doi.org/10.1186/s13570-019-0152-x>.
- Shamsi M., Khorasani M.A., Motiee Langroudi S.H. (2020) The effects of diversification into economic activities on the welfare of the rural community case study: the central district of Kerman County. *Journal of Regional Planning* 10 (37): 47–62.
- Sharifiyan Bahraman A., Barani H., Abedi Sarvestani A., Haji Mollahosseini A. (2014) Analyzing effective factors on rangeland exploitation by using A'WOT (Case study: Aq Qala Rangelands, Golestan, Iran). *Journal of Rangeland Science* 4 (2): 159–170.
- Torell E., McNally C., Crawford B., Majubwa A.G. (2017) Coastal livelihood diversification as a pathway out of poverty and vulnerability: experiences from Tanzania. *Journal Coastal Management* 45 (3): 199–218.
- Yasour M., Javan F. (2015) Analysis of limitation in rural economy diversification case: Upper Ashkevar in Rudsar County. *Journal of Space Economy and Rural Development* 4 (13): 19–37.
- Zakeri A., Tavili A. (2014) The economic value of (*Glycyrrhiza glaobra*) compared to the income of the forage of rangelands: Cse of Taze Ghale region. *Journal of Renewable Natural Resources Research* 5 (2): 17–28.
- Zare A. (2014) The role of multipurpose use of rangelands in improving the economic conditions of producers in dry areas (case study: forests and rangelands in Khatam. *MSc thesis, Islamic Azad University, Tehran*, 245.
- Zare A., Arzani H., Javadi S.A., Eslami M.R., Baghestani Meybodi N. (2013) Evaluation of the income of forage products and byproducts of *Amygdalus scoparia*. *Jour.Biodiversity and Environmental Sciences (JBES)* 3 (12): 92–100.