

Article

Forest Dwellers' Dependence on Forest Resources in Semi-Arid Environments

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Abstract: Forests remain an important resource in Iran, as most of the livelihood activities of local communities, especially in the semi-arid environment of the Zagros forests, are dependent on forest resources. The aim of this study was to identify the type and extent of forest dependency. Semi-structured interviews and questionnaires were used to collect data from 170 households in Central Zagros. Results show that using firewood for fuel and non-fuel uses, harvesting edible and medicinal plants, agriculture and horticulture, and livestock grazing were the main forest livelihood activities undertaken by the households in the study area. On average, each household harvested 18.08 cubic meters of oak per year for water heating (bathing), baking bread, heating, cooking, heating milk and buttermilk, agricultural tools, house building, warehouses and shelters, fencing, branches for livestock, charcoal and harvesting firewood for sale. Of rural households, 72% used edible plants, and 86% used medicinal plants. Age, job, residence status, number of livestock, crop farming and household size were found to be correlated with forest dependency. Findings from this study contribute broadly to an integrated understanding of the bio-human dimensions of forest ecosystems, with specific reference to the study area.

Keywords: forest dwellers; forest products; Central Zagros forests; Iran



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1. Introduction

The significance of forests as a source of livelihood is globally recognized by international treaties, such as the United Nations Framework Convention on Climate Change (UNFCCC), the Sustainable Development Goals and the Bonn Challenge, whereby world leaders endorsed the reforestation of 350 million hectares of land by the year 2030 [1]. According to the Food and Agriculture Organization (FAO) (2015), approximately one billion people depend heavily on forest extraction for their income, and about 20% of the global population relies on forest resources to provide for their basic needs [2]. Thus, the role of forest resources in the livelihood of local communities and their dependence on forest ecosystem components are critical [3,4], especially when it is considered as a mean of increasing income and counteracting the effects of poverty for both urban and rural dwellers [5–7]. The process of extracting forest goods, such as food, fuel wood, building supplies and medicinal plants for use in cooking or for sale, is known as forest extraction [8–10]. The existing literature acknowledges that all human societies and individuals depend on natural resources and ecosystems for food, materials and energy that are taken from the environment in one way or another [11]. However, it is also well documented that a person's vulnerability to systemic shocks might increase if they are overly reliant on a single resource. A community may be vulnerable to the effects of changes in supply and demand if its economic, social or environmental priorities are solely focused on a single resource, whether because of the relative availability of that resource or the absence of better alternatives [12].

Zagros is one of the five forest habitats in Iran, with an area of 5.2 million hectares constituting approximately 36% of Iran's total forests [13]. As the largest forest habitat in Iran, Zagros forests have a special role in the economic and social development of the country. Zagros forests are the main source of water supply, as they provide more than 40% of the country's water resources. Several decades ago, these forests had more than 10 million hectares, but after long and varied exploitation, their area has since been reduced by half [14]. More than 9.8 million people live in the Zagros mountains, of which 1.5 million live within forest ecosystems and are heavily dependent on forest resources as a vital source of livelihood [15–17]. Although wood in Zagros has no commercial value and is primarily used by forest dwellers as fuel, they form a rich source of non-forest wood products (NWFPs), such as fruits, oak galls, natural gums and herbal extracts [18].

Zagros forests are divided into three geographical regions, namely the north, south and center. The area of Central Zagros forests is estimated to be 707,941 hectares, which covers 14.1% of the Zagros forests. Furthermore, there are 91 different types of trees and shrubs identified in the form of 29 families and 47 genera, and this represents 54.5% of the wood distributed in Zagros [19]. In Iran, livestock grazing, forest farming, fuel supply and rural consumption, charcoal, the sale of firewood and the use of non-wood forest products are traditional forms of exploitation, and this is particularly evident in the Central Zagros forests, having a devastating effect on the ecological potential of these forests [14]. Reducing the height of forest stands, decreasing the canopies of trees, lacking regeneration, reducing soil fertility and reducing biodiversity are some of the most important factors that contribute to the traditional exploitation of these forests [20]. Having greater insights to the type and extent of local dependence on forests can offer a better understanding of the human dimensions of forest ecosystems. For sustainable forest management, it is necessary to identify dependencies and plan to reduce damage to the forest structure.

In many developing countries, forest resources provide a vital role for the livelihood of people or households living in and around forests, with an estimate of about one billion people in the world who are heavily dependent on forest ecosystems for their livelihood and which may account for up to 50% of the annual income of these communities [7,21–23]. Income from forest timber is between 13% and 18% of total household income in Benin [24], 12% in northern Ethiopia [25] and 23% in southern Ethiopia, whereby the use of firewood accounts for a larger share of wood-related income [10]. Of the total market income in the local communities of eastern Honduras, 18% is related to the sale of forest products [26]. Furthermore, a study conducted by Jo et al. [27] in South Korea on forestry household income (FHI) identified three key elements: forestry income (FI), non-forestry income (NFI) and transfer income (TI), in which the impact of household assets and livelihood strategies on each income are evaluated.

Knowing the types and amount of dependence on forests in developing countries, such as Iran, where local communities have a significant dependence on forest resources, can provide further insights for understanding how to better manage forests and implement social forestry. As evident in the forests of Central Zagros of Iran, a lack of recognition of the dependence of the local people on forests has resulted in forest managers not being able to design a model of local and social forestry that meets the needs of the people and that attains sustainable forestry [28–30].

Previous studies on the dependence of forest dwellers in Zagros in Iran have generally focused on links among poverty, forest dependence and degradation, the spatial distribution of trees, non-timber forest products and the livelihoods of forest dwellers, including research on livelihoods and woodland resources among other studies [17,21–23]. However, none of the existing studies have investigated the type and extent of dependence among forest dwellers in the context of Iran. As such, there is a lack of knowledge on the type and extent of these dependencies among forest dwellers in Iran.

In this research, an attempt is made to investigate the types and amount of consumption of local forest-dwelling communities in the Central Zagros forests of Iran to clarify the dependence of households living in forest areas on forest resources. The main hypothesis

of this research posits that forest resources are widely intertwined with people's lives and livelihoods, which could have a close correlation with the social and economic indicators of local forest-dwelling communities. In fact, the main research question seeks to identify the types of usage and to what extent local people benefit from forest resources in their livelihood. An analysis of different forms of dependence on the forest with social and economic variables is also conducted. These variables include the age and level of education of the head of the household, the size of the household, agriculture, livestock grazing, total household income and household income from the forest, which have been investigated in international studies conducted in different countries, especially developing countries.

2. Materials and Methods

2.1. Study Area

Central Zagros covers the entire surface of Chaharmahal and Bakhtiari Province, the northern part of the Kohgiluyeh and Boyer-Ahmad Province, the southwest of Isfahan Province, the northwest of Fars Province, the northeast of Khuzestan Province and parts of the southeast of Lorestan Province. This area is located in a mountainous area at an altitude of between 830 to 4416 m above sea level, with an average height of 2332 m [28]. The study area is Lordegan Township and the Sardasht customary region located in Chaharmahal and Bakhtiari Province (Figure 1). The northwest to the southeast of Lordegan township is covered by Zagros forests, with an area of 159,000 hectares and constituting about 43% of the township. The type and extent of dependence of people living in five villages of the Sardasht customary region, namely Hossein-abad, Hajia-bad, Ahmad-abad, Alia-bad and Shahrak-Mamour, were evaluated.

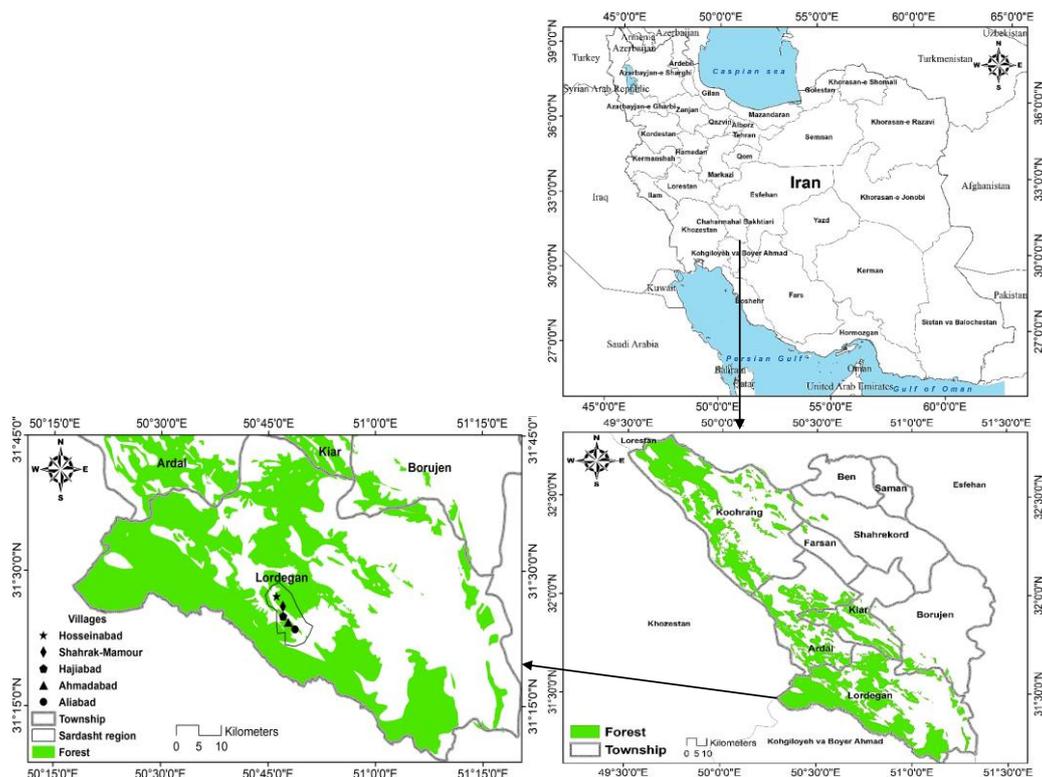


Figure 1. Location of study area.

The villages are in a mountainous area of approximately 5000 ha, with an average altitude of 2040 m above sea level. A total of 906 forest households with a population of 5824 live in these five villages, all of which are in Bakhtiari. The main forest cover in the region is Persian oak [30].

2.2. Methodology Framework

In this study, a descriptive and analytical approach was undertaken to investigate local communities' dependence on forest resources and was conducted in two stages: (1) survey and questionnaire analysis and (2) estimation of firewood consumption. These two stages followed five steps, as shown in Figure 2: the determination of the number of sample households; interviews and the completion of questionnaires; the investigation of the socioeconomic characteristics of households; the estimation of the type and level of dependence on forest resources; and the establishment of the correlation between forest utilization type and the socioeconomic factors of the households.

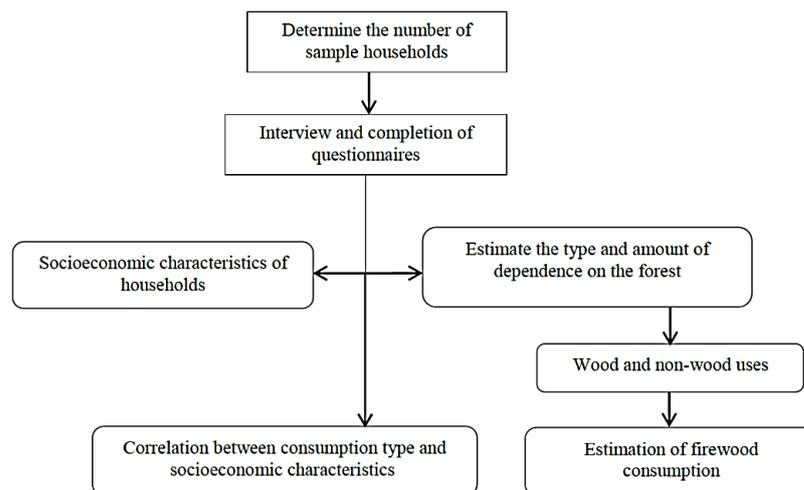


Figure 2. Research framework.

2.3. Data Collection

A questionnaire was developed to elicit information on the various livelihood strategies adopted by the villagers, their income level, social and economic characteristics and the types and amounts of forest products harvested and sold. The use of questionnaires is the most common approach for studying social and economic issues and elucidating how local communities depend on forest resources [31,32].

According to Table 1, the total number of households in the five investigated villages was 906 households. Based on Cochran's formula with an error acceptance rate of 0.07%, 170 households were randomly selected for interviews [33]. Of the total statistical population, 18.7% participated in the questionnaire. Because the heads of each household had more complete information than other family members about the types and amount of forest harvested, questionnaires were therefore completed through interviews with the heads of each household. The content validity approach based on Cronbach's alpha coefficient was used to determine the validity of the questionnaire, and the reliability of the questionnaire was computed to be 0.77. After collecting and categorizing the data, we assessed the role of each livelihood strategy, especially the contribution of income from forests in the household economy, and quantified the income derived from forests separately for wood-based and non-wood forest products. Information on non-wood and the amount of firewood consumption was gathered from the interview results.

2.4. Estimation of Firewood Consumption

Using the data collected from the questionnaires, the amount of timber consumed by each household was estimated via the following. First, the number of trailers, assault loads or charcoal packs used over a year was determined based on the respondents' answers. Next, the average number of wooden parts used per volumetric load was estimated using responses from the questionnaire, and the available volumetric loads were evaluated. Finally, the average diameter and average length of wooden parts in each unit of volumetric

load were determined using the Huber volume formula [34]. As shown in Equation (1), the volume of wooden parts was estimated as follows:

$$V = \frac{\pi \left(\frac{d_1 + d_2}{2} \right)^2}{40,000} L \quad (1)$$

where V is the volume of the piece of wood (m^3); d_1 is the diameter of the piece on the thin head (cm); d_2 is the diameter of the piece on the thick head (cm); and L is the length of the piece (m).

Table 1. Number of selected questionnaires in each village.

Number of Questionnaires	Number of Households	Villages
24	126	Hosseinabad
9	54	Hajiabad
8	41	Ahmadabad
25	135	Aliabad
104	550	Shahrak-Mamour
170	906	Total

2.5. Assessing the Correlation between the Types and Amount of Forest Exploitation and the Social and Economic Variables of Households

The age and level of education of the head of the household, the size of the household, agriculture, livestock, total household income and household income from the forest were investigated. These factors have been used in international studies in different countries, especially developing countries, to analyze the relationship between the social and economic conditions of local communities and the amount of forest consumption [7,10,35–42]. Correlation coefficients were used to evaluate links between social and economic variables and their dependences on the forest, and a logistic regression model was used to identify the most effective variables. Data analysis was conducted with the SPSS software.

3. Results

3.1. Socioeconomic Characteristics of Households

Results of the socio-demographic characteristics of the households for the five villages are presented in Table 2. The findings indicate that the majority of the heads of households were male (94%), with the remaining 6% being female. Most of the interviewees were between 40 and 49 years old (32%), followed by 30–39-year-old interviewees (26%). The average household size was 6.2 people, whereby 79.4% were permanent residents and 20.6% were nomads. The majority (45%) of respondents were illiterate, and only approximately 8% had a bachelor's degree. Table 3 shows the annual average household income sources across the five study villages. The average annual household income was 153 million Iranian Rials, with a minimum of 20 million and a maximum income of 384 million Iranian Rials. The three highest average income sources were derived from labor (26.9%); the forest (18.1%); and livestock (15.7%).

3.2. Dependence on the Forest

The results indicate that the households living around the forests of Central Zagros primarily used the forests for five main purposes, namely (1) firewood harvesting, (2) non-wood forest products, (3) seeds and forest fruits, (4) forest farming and (5) livestock grazing. Each of these is discussed in turn in the following.

Table 2. Socio-economic characteristics for each study village.

Indicators		Hosseinabad	Hajiabad	Ahmadabad	Aliabad	Shahrak-Mamour
Average household dimension		6	6.30	6	6.20	6.50
Average age of household heads		42	36.30	35.80	48.30	45.10
Gender (%)	Male	91.6	100	100	98	93.3
	Female	8.3	0	0	2	6.7
Residence (%)	Permanent residence	95.80	100	100	56	77.90
	Nomadism	4.20	0	0	44	22.10
Education (%)	Illiterate	58.30	44.40	25	44.40	43.30
	Elementary	29.20	33.30	50	33.30	26.90
	Sixth elementary	8.30	11.10	25	11.10	13.50
	Diploma	0	0	0	0	7.70
	Bachelor	4.20	11.10	0	11.10	8.70

Table 3. Annual average household income sources across the five study villages.

Income Sources	Average Income (in Million Rials)	Maximum Income (in Million Rials)	Standard Deviation (in Million Rials)	Total Household Income (%)	Rank
Agriculture	14.71	100	23.69	9.60	5
Gardening	0.29	2	0.23	0.02	10
Livestock	24.07	200	42.75	15.68	3
Employee	11.82	240	37.04	7.71	6
Labor	41.31	200	48.73	26.93	1
Shopkeeper	11.38	150	29.36	7.40	7
Driving	15.03	170	37.38	9.80	4
Handicrafts	5.54	200	19.75	3.61	8
Forest income	27.72	180	41.38	18.07	2
Other	1.80	100	12.22	1.18	9
Total income	153.42	384	75.08	100	—

3.2.1. Firewood Harvesting for Various Uses

The findings show that there were 12 types of wood consumption as presented in Table 4. Accordingly, the sale of firewood had the highest average consumption (5.61 cubic meters), and the manufacture of agricultural tools had the lowest average consumption (0.0008 cubic meters). Four (i.e., harvesting firewood for sale, cooking, charcoal and branches for livestock) of the twelve types of wood consumption accounted for 89% of the total consumption. On average, a household used 18.07 cubic meters of firewood per year, of which 54% was for fuel, and the rest was for non-fuel purposes.

Table 4. Statuses of different wood consumption (cubic meter) per household per year.

Wood Consumption	Wood Consumption Type	Average (m ³)	Max (m ³)	S.D.
Fuel use	Water heating	0.26	12.31	1.42
	Baking bread	0.54	24.50	2.75
	Heating	0.83	60.12	5.83
	Cooking	4.24	54	5.74
	Heating milk and buttermilk	0.18	6.82	0.72
	Charcoal	3.71	75.04	9.77
	Agricultural tools	0.0008	0.06	0.004
	House building	0.007	0.74	0.07
	Warehouse and shelter	0.11	2.52	0.33
Non-fuel use	Fencing	0.07	1.27	0.18
	Branches for livestock	2.52	20.44	4.62
	Harvesting of firewood for sale	5.61	150.10	18.09

3.2.2. Non-Wood Forest Products

The findings suggest that harvesting non-wood forests products (NWFPs) in Central Zagros was mainly for the purpose of medicinal plants, edible plants, seeds and forest fruits. Table 5 shows seven types of medicinal plants and fourteen edible plants used by forest dwellers. The results reveal that, for non-wood forest products, 72% of the households harvested edible plants, and 86% harvested medicinal plants. The annual total average medicinal plant consumption was 15.72 kg, whereas that of edible plants was 32.93 kg. The medicinal plant type with the highest consumption was *Arnebia euchroma*, which equates to 6.36 kg per household per year. On the other hand, the largest harvested edible plant type was *Allium akaka*, which accounted for an annual average harvest of 4.86 kg.

Table 5. Medicinal and edible consumption.

Consumption Type	Types	Households (%)	Average (kg)	Max (kg)	S.D.
Medicinal	<i>Thymus kotschyanus</i>	34	1.19	11	2.23
	<i>Achillea wilhelmssi</i>	56	2.18	16	2.85
	<i>Anchusa italica</i>	11	0.20	4	0.71
	<i>Artemisia maritime</i>	18	0.35	9	1.13
	<i>Teucrium polium</i>	5	0.21	13	1.27
	<i>Arnebia euchroma</i>	31	6.36	302	25.64
	<i>Dracocephalum</i>	20	5.23	62	13.78
Edible	<i>Allium akaka</i>	74	9.20	69	11.91
	<i>Allium jesdanum</i>	45	4.86	53	10.43
	<i>Biarum bovei</i>	20	0.73	22	2.82
	<i>Cichorium intybus</i>	27	1.72	55	4.92
	<i>Falkaria vulgaris</i>	39	2.97	26	5.32
	<i>Gundelia tournefortii</i>	92	1.82	32	4.69
	<i>Dorema aucheri</i>	6	0.54	32	3.12
	<i>Ferula Assa-foetida</i>	3	0.15	21	1.63
	<i>Agaricus bisporus</i>	62	7.22	56	9.42
	<i>Cardaria draba</i>	5	0.15	8	0.83
	<i>Biarum cardachrum</i>	2	0.04	7	0.59
	<i>Eremurus persicus</i>	3	0.13	11	0.95
	<i>Allium hirtifolium</i>	41	3.35	54	6.92
	<i>Echinophora platyloba</i>	2	0.05	6	0.43
	Sum		48.5	869	111.59

3.2.3. Seeds and Forest Fruits

Table 6 indicates the seeds and fruits of the forest types harvested by forest dwellers either for their own household consumption (i.e., as a source of income derived from the sale of the fruits and seeds) or as a source of livestock feed. Of the studied forest households, 49% on average used approximately 31.45 kg of oak fruit (*Quercus Persica*) annually, and this represents 81.1% of the total consumption of forest fruits in the region.

Table 6. Seeds and forest fruits consumption.

Types	Households (%)	Average (kg)	Max (kg)	S.D.
<i>Quercus Persica</i>	49	31.45	502	59.93
<i>Pistacia mutica</i>	44	3.02	63	6.26
<i>Pistacia khinjuk</i>	34	1.55	11	2.79
<i>Crataegus melanocarpa</i>	31	1.57	19	3.64
<i>Berberis Vulgaris</i>	15	1.18	31	4.25
Total		38.77	622	76.87

3.2.4. Forest Farming

As shown in Table 7, there were five types of agricultural crops grown: wheat, barley, lentil, blister vetch and horticultural crops (which included tomatoes, cucumbers, cantaloupes, apples, cherries, apricots and walnuts). Households harvested an annual total average of approximately 1638 kg of agricultural products. The most commonly grown crop was wheat, which 65% of households had cultivated. The total average amount of harvested wheat was 819.55 kg annually.

Table 7. Crops harvested from forest farming.

Crops	Households (%)	Average (kg)	Max (kg)	S.D.
Wheat	65	819.55	8075	1090.87
Barley	55	722.3	9002	1177.42
Lentil	15	69.59	2205	257.02
Blister vetch	7	25.58	1100	116.32
Horticultural crops	2	1.24	93	9.45
Total		1638.26	20,476	2651.08

3.2.5. Livestock Grazing

According to Table 8, 45% of the households had goats and yearlings, and 28% of them had sheep and lambs that grazed in the forest lands. In fact, 73% of households used light livestock in the forest, and only approximately 12% had heavy livestock (i.e., cows and calves), which were directly or indirectly dependent on the forest for their grazing.

Table 8. Number of domestic animals.

Domestic Animals	Households (%)	Average	Max	S.D.
Cows and calves	12	0.30	4	0.89
Sheep and lambs	28	12.55	101	24.53
Goats and yearlings	45	17.85	205	28.15
Mules	3	0.05	3	0.25
Asses	39	0.80	3	1.34
Total		31.55	316	55.16

3.3. Determinants of Forest Dependency

The results (as shown in Table 9) show that education level, residence status and livestock grazing were correlated with all four types of forest dependence. The variables of age, household size, household income and forest farming were positively associated with wood consumption, the use of medicinal plants and the use of edible plants, whereas education level had a negative correlation with forest dependencies. This indicates that, as the education level of the head of the household increases, the amount of dependence on the forest decreases. In addition, the forest income variable had a significant correlation with the amount of wood consumption, the use of edible plants and the harvesting of forest seeds and fruits. Table 10 shows the statuses of factors determining dependence on the forest in the logistic regression model. According to this table, the age of the head of the household, household size, forest income, agriculture in the forest, livestock grazing, residence status and household income, respectively, had the greatest effect on the dependence of households on the forest.

Table 9. Correlation between socio-economic variables and forest dependency.

Socioeconomic Variable	Wood Consumption	Medicinal Plant Use	Edible Plant Use	Seeds and Forest Fruits
Age	0.188 *	0.226 **	0.226 **	0.081
Education level	−0.514 **	−0.226 **	−0.311 **	−0.424 **
Household size	0.195 *	0.249 **	0.206 **	0.135
Residence status	0.418 **	0.631 **	0.584 **	0.341 **
Household income	0.057	0.262 **	0.345 **	0.127
Livestock	0.291 **	0.493 **	0.443 **	0.353 **
Forest farming	0.292 **	0.249 **	0.428 **	0.111
Forest income	0.199 *	0.127	0.232 **	0.572 **

** Correlation is significant at the 0.01 level. * Correlation is significant at the 0.05 level.

Table 10. Determinants of household forest dependency (logistic regression model).

Variables	B	S.M	Wald	Sig.	Exp (B)
Age	0.6547	0.012	18.24	0.00	2.5621
Education level	−0.3514	0.085	3.20	0.00	1.0242
Household size	0.5685	0.076	11.003	0.00	1.0354
Residence status	0.1650	0.190	8.908	0.00	0.672
Household income	0.1591	0.884	4.079	0.00	0.820
Livestock	0.1924	0.855	9.253	0.00	1.097
Forest farming	0.1992	0.043	9.920	0.00	1.120
Forest income	0.3941	0.751	10.018	0.00	1.502

4. Discussion

This study sought to evaluate the situation of firewood consumption, livestock grazing, the use of medicinal and edible plants, and forest farming in the customary region of Sardasht, Lordegan township. The consumption of firewood, forest farming, livestock grazing, the use of medicinal and edible plants and harvesting forest fruits are the main forms of demand and dependence of local communities in and near the forest areas in Central Zagros. A study on forest subsurface agriculture in the Bazoft River basin showed that 2805 hectares of the 23,595 hectares of forests in this basin (11.9%) were enclosed in rainfed agriculture [35]. In the study area, farming under forests was the most common type of agricultural activity in the forests of Central Zagros. More than 50% of the households cultivated wheat and barley in the forest, which indicates that local communities were strongly dependent on forest resources. Of the total rural population in the Chaharmahal and Bakhtiari Province, approximately 28.5% (i.e., 96,885 people within 25,153 households) were forest dwellers. Although the average size of forest households in the province was 3.8 people per household [20], in the customary area studied, the average household size was 6.2 people (extended family), which indicates the population density of forest areas.

The findings show a positive relationship between the household dimension and the quantity of wood gathered for food preparation, housing building and rural equipment, charcoal production and firewood sales, and the total amount of wood consumed. This indicates that the utilization of forest wood increases along with the size of the family, aligning with previous studies conducted in Nigeria [33] and Honduras [37]. The use of oak for fuel or non-fuel purposes has been one of the most important forms of dependence in the Zagros forests by forest dwellers [14]. The results of this study show that a household in the customary area used an average of 18.07 cubic meters of oak per year for 12 different types of wood consumptions. Of this amount, 54% (i.e., 9.80 cubic meters) was spent on fuel, and the remaining (46%) was for non-fuel-related purposes. These findings support earlier studies. For example, Khajedin and Ebrahimi Rostaghi [38] measured the dimensions of wood stored in rural households located in cold regions of the Chaharmahal and Bakhtiari as well as Kohgiluyeh and Boyer-Ahmad Provinces, and the annual consumption of each rural household in these areas was calculated to be 36 cubic meters. Another study by

Ebrahimi Rostaghi [39] showed that 18,830 households in the Chaharmahal and Bakhtiari Province used firewood to supply fuel, with an average per capita consumption of 26 cubic meters. Bazgir et al. [28] estimated the amount of wood consumption in the forests of Khorramabad city as 24.18 cubic meters. Imani Rastabi et al. [40] considered agriculture the main method for the livelihoods of the forest dwellers of Kalgachi village of Lordegan township. However, people's income from the forest was estimated to be very low, and according to this study, more than 79% of the people had a low income from the forest (i.e., the total household income was about 170 USD per month, and the income from the forest was about 120 USD per month). A study by Tugume et al. [41] revealed that agriculture was the main source of household income, which led to a decrease in people's dependence on forests.

This study found that there was a positive correlation between age and total wood consumption, medicinal plant consumption and edible plant consumption. As the average age of the household head increases, the households tend to exploit the use of wood, medicinal plants and edible plants more than those in younger households. This finding supports the study by Godoy et al. [37], who found that forest dependence increases with age of the household head, but it contradicts that of Garekai et al. [42], who found that forest dependence reduces with age.

In a study by Jo et al. [27], it was stated that the total income of a forest household could be explained by the age of the head of the household, but the specific income from the forest was notably different. In the local communities of the Central Zagros forests, older people were less educated, had forest-related jobs such as agriculture and used edible and medicinal plants; thus, their livelihood dependence on the forest was greater because the forest was their only source of livelihood. In contrast, younger people were less dependent on the forest due to their employment in non-agricultural and forestry jobs. In Zagros, young people were less interested in forest exploitation due to their higher level of education and the possibility of employment in government and labor jobs, which often offer a higher income. In the study of Garekai et al. [42], it was reported that young people in Botswana, South Africa, were more likely to rely on forest products than their older counterparts. The difference between this study and those conducted in South Korea and South Africa is mainly related to the social and economic context of the studied areas, which requires a further comprehensive comparative study.

The results of this study show a positive correlation between jobs and total wood consumption. The occupation types and the amount of wood harvested for food production, housing construction and rural tools, livestock warehouse construction, and charcoal production and firewood sales were positively correlated. This implies that people with a formal occupation, such as employed workers and shopkeepers, used forest wood much less than people with agricultural and livestock jobs. Bazgir et al. [28] pointed to the relationship between agricultural and livestock occupations with the amount of wood harvested in their study of forests in Lorestan Province. Similarly, Henareh Khalyani et al. [29] suggested that ranchers consumed the forest the most in their study on the forests of North Zagros. Other findings, including those of Khosravi et al. [30], also confirmed that, if forest inhabitants had access to alternative revenue streams, including income from agricultural development and cross-border trade, their reliance on forests would decrease.

In the South Korean context, Jo et al. [34] found that the age of the household head, the household head's work capacity, savings, the type of business and the size of cultivated land were significantly related to forest household income. This study suggests that forest income was influenced by labor capacity, the size of cultivated land, the type of business and the portfolio of the forestry business.

There was a negative correlation between the level of education and the amount of wood harvested for food preparation, the construction of housing and rural tools, branches for livestock, and charcoal production and firewood sales, and in general, there was a negative correlation between education level and total wood consumption. Accordingly, as the level of education became higher, the rate of forest wood use became lower, followed by

the rate of deforestation. This suggests that people with a bachelor's degree were the least dependent on the forest. The findings also show that the only dependence of people with a bachelor's degree on the forest was the use of the forest as agricultural land. Hegde and Enters [43] suggested that people with higher education had less livelihood dependence on forest resources. This could be explained by having a better education leading to increased employment opportunities [30]. This finding also aligns with a study by Garekai et al. [42], who found that forest dependence reduced with increases in education. In addition, Jo et al. [27] found that households with higher education levels tended to secure more transferable income (TI), such as government subsidies. Given the enhanced technological efficiency and marketing skills, their forest family's income would be higher.

In the social context of the local communities of the Central Zagros forests, older people were often poorly educated, and in fact, many of them could be completely illiterate and therefore more likely to be dependent on the forest for their livelihood. On the other hand, educated young people in a forest household were less inclined to engage in activities in the forest because they were able to gain a higher income from the government and labor jobs. Furthermore, young people with higher education were less satisfied with the forestry working environment.

Residency status was also positively correlated with forest dependence, which implies that households that lived near the forests were more dependent on forests than those living further away. This is consistent with past research that found that households that were closer to forests were more likely to rely on forest products than those that were further away [42–46].

The logistic regression model shows that three variables, the age of the head of the household, household size and household income from the forest, had the greatest dependence effect on the forest. This indicates that households whose head was older and who had more family members were more dependent on forest income for their livelihood. These households were more likely to be facing poverty issues, which could have intensified their dependence on the forest.

5. Conclusions

This study investigated all dependencies and usages of forest wood (fuel and non-fuel consumption) by forest dwellers in the Central Zagros forests. Forest dwellers were in close and constant contact with their forest areas for their livelihood, and they constantly used forest products. Firewood for fuel and non-fuel uses, harvesting edible and medicinal plants, agriculture and horticulture crops and livestock grazing were the main forest livelihood activities of households. There were 95% of households using forest products, and on average, 68% of the wood consumed in the area was needed for fuel supply. The annual total average harvested oak for each household was approximately 18.08 cubic meters, mainly for water heating (bathing), baking bread, heating, cooking, heating milk and buttermilk, agricultural tools, house building, warehouses and shelters, fencing, branches for livestock, charcoal and harvesting firewood for sale. The findings from this study also indicate that age, education level, household income, household size, residence status, livestock and forest farming were correlated with forest dependence. The lack of data on the type and extent of forest use in recent years to be used for comparison with the current situation and interpreting the trend of dependence on the forest over time is a major drawback in this study. Another limitation of this study is a lack of consideration for the cultural dimensions and indicators of the region, which can potentially affect the type of dependence on the forest. Future research may seek to investigate all forest villages of Central Zagros and provide valuable data on the type and extent of dependence of the people in this region, thus being able to better generalize the findings. Different uses of forests in this region have caused a lot of structural damage to those forests. Appropriate development activities can be reduced if job development activities are planned to create jobs, increase income and subsequently change lifestyles in the region.

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