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Livelihood dependency on woodland resources in southern Zagros, Iran

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ABSTRACT
This study aims to investigate the relationships between people's livelihoods and the woodland resources of the Ganaveh watershed in southern Zagros, Iran, as a basis for suggestions of strategies for sustainable management of the woodland resources and improvement of the livelihoods of people in the community. Household data were collected through interviews with heads of households and members of the village council with a focus on uses of the woodland products. Canonical correlation analysis and pairwise correlation analysis were used to detect significant relationships between the socioeconomic variables of the households and the variables of the collected or used woodland products by the households. Results show that animal husbandry is the most important activity for providing villagers' income. Fuel wood, seeds and ground fodder are collected woodland products in the area. Among the key socioeconomic characteristics of the households, increased educational status and cash incomes from sources other than the woodland are associated with less dependency on the woodland resources, and consumption of energy has a positive correlation with the collection of fuel wood.

Keywords: *Animal grazing: Fuel wood: Oak forests: Socioeconomic.*

INTRODUCTION
The forests of Iran cover an area of about 12.4 million ha and comprise 7.4% of the area of the whole country, and the Zagros woodlands, with an area of around 5 million ha, and account for almost 40% of the country's forests (Sagheb-Talebi et al., 2004). These woodlands, provide a home and livelihood for approximately 10% of Iran's population (DoE/GOIRI, 2004). These primary oak woodlands stretch along the Zagros Mountains in western Iran from north to south. Based on the differences in oak species and climatic conditions, the Zagros vegetation zone can be divided into two distinct regions, where the southern region has lower humidity than the northern region. These woodlands are classified as semiarid forests, sometimes referred to as dry forests (Jazirehi & Ebrahimi, 2003; Sagheb-Talebi et al., 2004). The lack of regeneration in these woodlands because of increased grazing pressure on regenerating trees is a major concern, and there are no commercial-sized trees left in Zagros (Pourhashemi *et al*., 2004). Moreover, in many areas utilization of non-timber forest products is of greater value than utilization of timber (Jazirehi & Ebrahimi, 2003; Sagheb-Talebi et al., 2004). Forests and rangelands in Iran are under governmental authority and the supervision of the Forest, Range and Watershed Management Organization (FRWO). Since 2000, the FRWO has developed new, long-term programmes for the preservation, conservation, and sustainable use of the Zagros woodlands. Reducing the direct dependency of inhabitants' livelihoods on the

natural resources is one of the goals of these programmes.

Improved forest management requires `attention to the livelihoods of people living in forests because of the links between their livelihoods and the forests (Sunderlin et al., 2005). Understanding the relationship between people's livelihoods and natural resource capacities in rural areas can help policy makers design and implement effective strategies for poverty alleviation, livelihood improvement, conservation and sustainable resource use (Vedeld et al., 2004; Debnath & Dasgupta, 2006). Studies around the world have dealt with forest-based incomes in order to evaluate the contribution of forest products to the household economy and suggest improvements for livelihoods and forest conservation (e.g., Gunatilake et al., 1993; Hegde et al., 1996; Reddy & Chakravarty, 1999; Arnold & Perez, 2001; McSweeney, 2002; Adhikari et al., 2004; Abdallah & Monela, 2007; Ali et al., 2007). Further, it is recognized that men and women have different livelihood options, which in turn affect the livelihood and environmental dependency of household (Valdivia & Gilles, 2001; Colfer, 2005).

In the current study, the relationship between people's livelihood and the woodland resources of the Ganaveh watershed in southern Zagros, Iran were investigated. More precisely, the study examined the following questions. (1) What are the socioeconomic characteristics of the woodland users? (2) What woodland products are utilized and what is their importance? (3) What is the relationship between the socioeconomic characteristics of woodland users and utilized woodland products? The results indicate possible strategies for sustainable management of the woodland resources and improvement of household livelihoods.

Forest dependency and livelihoods

Livelihoods comprises the assets, activities and access to these (mediated by institutions and social relations) that together determine the living gained by the individual or household (Ellis, 2000a). In this context, assets are defined broadly by many authors and include natural (e.g., land, water, flora and fauna), social (e.g., community, family and social networks), financial (e.g., jobs, savings and credits), human (e.g., education, labor, skills, health and nutrition) and physical (e.g., roads, buildings, tools and machines) assets (Chambers, 1991; Carney, 1998; Bebbington, 1999; Ellis, 2000a; DFID, 2001; Dalal-Clayton et al., 2003). These assets determine the size and form of people's income (Dalal-Clayton et al., 2003). Natural assets are very important to those who derive all or part of their livelihoods from natural resource-based activities (DFID, 2001).

Woodland-based income, referred to as environmental income is rent captured through alienation or consumption of natural assets at the first link in the resources-use chain that starts where household members extract or appropriate natural capital (Sjaastad et al., 2005) for their livelihood activities. In rural areas, people farm or depend on natural resources (Dalal-Clayton et al., 2003), and environmental income may contribute to an important part of their total income. In this study, incomes from the woodland are monetary as well as nonmonetary incomes gained from woodland resources. The composition and level of income at a given point in time is the most direct and measurable outcome of the livelihood process (Ellis, 2000a). Income derived from forest products is interpreted in many studies as livelihood dependency on forests (e.g., Hegde *et al.*, 1996; Adhikari et al., 2004; Masozera & Alavalapati, 2004). In the Ganaveh watershed, our preconception of its livelihood system allows us to approach this mainly as a woodland-based livelihood system.

MATERIALS AND METHODS

Study area

The study was conducted in the Ganaveh watershed (30°27′N, 50°50′E), located 15 km north of the city of Dow Gonbadan (Gachsaran), the center of a bourgeoning oil and gas industry in the province of Kohgiluyeh and Boyer Ahmad, Iran (Fig. 1). The mountainous watershed with steep

slopes covers an area of 6621 ha. Ganaveh village is located in the center of the watershed.

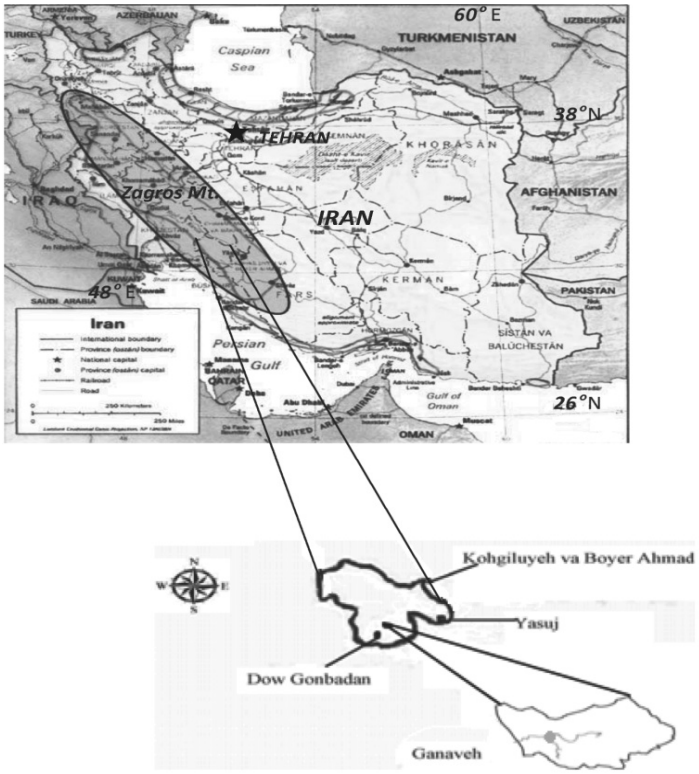

Fig 1. Location of the study area within the province of Kohgiluyeh va Boyer Ahmad, Iran.

The vegetation types, mainly oak trees and shrubs/bushes, extend between 1200 and 2300 m (a.s.l.) and are differentiated and mixed in different parts of the area depending on ecological factors. The following figures are based on woodland inventory data gathered by the Headquarters of Natural Resources of Yasouj (HNRY) in 2003: oak (*Quercus persica*) 79%, wild almonds *(Amygdalus* spp.) 9%, wild pistachio (*Pistacia mutica*) 5% and other species (7%) are the most abundant woody species. Crataegus sp. and Acer cinerascens are the most frequent of the shrub species.

From measurements over a 15-year period (1986–2001), average annual precipitation is approximately 500 mm, and the mean annual temperature is 22.5 °C. The mean minimum temperature for January is 5.3 °C, the mean maximum temperature for July is 42.7 °C, and the mean number of days with a minimum temperature of 0 °C or lower is nine days. Soils vary from moderately deep, well-drained sandy loams to steep gravel slopes with rock outcrops. These soils are classified mainly as lithic leptosols and calcaric regosols (HNRY data, 2003). According to HNRY data, the woodland and shrub/bush land extend more than 5848 ha, and there are 133 ha of village and agricultural lands and another 640 ha of rocky area without any vegetation cover.

Data collection

Following the guidelines for data collection by interviews (Andersson et al., 2004; PEN, 2007) and our preliminary knowledge about forest use in the Zagros region (Jazirehi and Ebrahimi, 2003; Sagheb-Talebi et al., 2004; Salehi et al., 2008), a questionnaire to interview heads of households in Ganaveh was prepared. We interviewed households as the social units that are most appropriate for investigating livelihoods (Ellis, 2000a).

The final version of the questionnaire had a general overview on the livelihood

characteristics of the households in relation to their uses of the woodland products. To understand the livelihood system of the Ganaveh and its relationship with woodland resources, we investigated the sources of their woodland-based incomes as well as other sources contributing to their livelihood system. Thus, the respondents were asked to state the relative contribution of sources of the annual cash incomes for the households. This was done by using the ranking method (Chambers, 1981), in which the proportions of woodland and nonwoodland-based cash incomes of the households were appraised by the respondents. Moreover, they were asked to report all items derived from the woodland, including the number of livestock and the amount of agricultural land owned. Some socioeconomic information about the households, such as household size, the age and education level of members and the quality and quantity of different energy sources used for cooking and heating, were also examined. This background information included data on household possession of 11 items (electricity and piped tap water, telephone connection, TV set, personal computer, washing machine, water heater, cooler, motor bike, car and house in urban areas), hereafter referred to as family assets.

The interviews were conducted by one of the authors, working with two assistants with a background in natural resources education. Pretesting of the questionnaire and training of the assistants took place on the first day of the survey with seven randomly selected households in the village. This resulted in the revision of some questions about family assets and some woodland products used by households. It was our intention to acquire information about the total annual monetary income of the household. This question was however met with some reluctance by respondents and was subsequently deleted from the questionnaire. Thus, only information about the relative cash incomes was obtained. All interviews took place in April 2008 over four days. The aim was to interview all households in the village; however, only 32 out of the 45 households were reached. Approximately three hours were spent to interview with the village council members about public assets, institutions, markets, laws, prices and so forth.

Standardizing data

In order to compare the relative importance of different sources of woodland-based incomes, the different acquired items were converted to a common monetary value. This could be justified by the fact that resources are traded at tangible prices. Therefore, the values were calculated by multiplying the yearly collected amounts by their prices. Local prices were identified by (i) asking the respondents, (ii) averaging the acquired numbers and finally (iii) asking for confirmation by the members of the village council (Table 1).

Table 1. Prices of different items derived from the woodland ($/kg) (2008)*

Fodder	Fuel wood	Acorn	Wild Almond	Wild Pistachio
0.1104	0.0327	0.0887	0.3329	0.4449

*The exchange rate between U.S. Dollar and Iranian Rial (2008) was U.S. $1 = IR 9000.

Referring to the respondents, the average length of the annual grazing period was determined as nine months. In the other three months of year, that is wintertime, when the number of livestock is then reduced and it is fed by collecting dry fodder and acorns from the woodland and by buying forage from outside of the area. The value of the grazed fodder of the woodland understory for each household was computed as follows:

Value of the grazed fodder for each household in the grazing period = no. of animal units × daily consumption of pasture fodder × 270 days (the annual grazing period)× village-based price of pasture fodder.

The assumption for the valuation was that if a household could not send its livestock for grazing, it had to buy an amount of fodder at a village-based price;

grazing provides the corresponding amount of fodder for free. The average daily consumption of pasture fodder for both goats and sheep were set to 1 kg per day, and 6 kg per day for mules. These amounts of consumption of pasture fodder have been suggested for these animals in this region in barn conditions (Mohammadi, 2003). Food and medical herbs were not evaluated because they were collected in such small amounts.

Local units were used by respondents to quantify the amounts; they were then standardized to metric units. Loads of fuel wood were estimated at between 80 and 120 kg, and we used an average of 100 kg per load as the conversion unit. Bushels of acorns were estimated at between 13 and 17 kg, and we used an average of 15 kg per bushel for conversion.

The total woodland-based income for each household was computed by summarizing the value of the items described above. The calculated incomes represent gross incomes because no collection costs (e.g., cost of labor, transportation, etc.) were included.

In order to assess household dependency on different energy sources, all amounts of consumed fuels, including fuel wood (kg), kerosene (l) and liquefied petroleum gas (LPG; reported as the number of 11 kg cylinders), were converted into megajoules (Mj) with the conversion rates of 16.0 MJ/kg, 44.0 MJ/l and 49.2 MJ/kg for fuel wood (air-dried), kerosene and LPG (with a mixture of 60% propane and 40% butane) (Pemberton-Pigott, 2006), respectively.

Statistical methods for data analysis

Canonical correlation analysis (CCA) and pairwise correlation analysis (Pearson correlation) were used to explore any significant relationships between the utilized woodland products and households' socioeconomic variables. CCA is a statistical method used to highlight correlations between many dependent and many independent variables, acquired on the same experimental units (Quinn & Keough, 2002). Using CCA, linear combinations of variables (components) from the two sets of original variables (dependent and independent) are extracted. The correlation between the two sets of variables is called canonical correlation. Canonical correlation reflects the percentage of variance in one set of canonical variables explained by the other set of canonical variables.

The function *cancor ()* in software $R_{2.2.1}$ (R Development Core Team, 2005) was used to compute the CCA. With households as the experimental units, the dependent set of variables (u_1) of utilized woodland products consisted of the number of animal units and the amount of collected fodder, fuel wood and seed. Other than the number of animal units (used to represent the grazed fodder) and two omitted collinear variables, the other socioeconomic variables presented in Table 3 were used as the set of independent variables(v_1) in the CCA. The number of animal units was used instead of the estimated amount of grazed fodder. The reason was that converting animal units to grazed fodder with a conversion factor would only introduce additional assumptions. Because of the high correlation between "family size" and "no. of members in the productive age group", we omitted the last variable from the analysis. Moreover, because of collinearity with "annual cash income from other sources", we omitted the variable "annual cash income from woodland resources" for the CCA. The selected variables for the dependent and independent sets are presented in Table 5.

Because the selected original variables for the CCA had different scales, before being included in the analysis all variables were normalized from zero (minimum) to one (maximum) by dividing each variable by the maximum value of that variable (Quinn & Keough, 2002). Bartlett's X^2 statistic test was performed to test the significance of the canonical correlation (Manly, 1994; Krzanowski, 2000). In this study, we will only deal with the first canonical correlation and the first pair of canonical variates (u_1 and v_1) to explore the significant relationships between the original variables. The pairwise correlations between the canonical variates and their original variables are used to determine the original variables that contribute significantly in these variates (Manly, 1994; Garson, 2008). The original variables with correlations of 0.3 or above

(Table 6) are to be interpreted as being part of the canonical variates (Garson, 2008). Then the interpretation of the canonical variates depends on the signs associated with the original variables significantly contributed within each variate. In this way, similar signs of original variables indicate combining correlations, and different signs indicate contrasting correlations. To have a reliable interpretation of the results of the CCA, the results should be checked by pairwise correlations (Quinn & Keough, 2002).

RESULTS

Socioeconomic characteristics of households

Only 32 households out of 45 households were reached in interviews. According to local information, some families live in the nearby city for more than six months per year for their children's education and their jobs. Normally, they return to the village during summers. Eight households were absent in our interviews for this reason. Five households refused to answer our questions mostly because the head of the household was absent. The village data are presented in Table 2. They show a village with some signs of modernization in terms of infrastructure. According to HNRY, the village has experienced a population decline of 15% over the period 2003–2007. Approximately 22% of households owned a house in urban areas. These families were households headed by retired people.

Table 3 presents the socioeconomic variables averaged for the households in the village. Family size ranged from one to 10 members and had a correlation of 0.91 (p-value 0.000) with the number of members in the productive age group. Average age among the households ranged from 17 to 70 years. All but nine (approx. 28%) of the interviewed households had male heads. The average age of the 72% of people in the village who had a school education was 23 years, and the average age of the 28% who were illiterate was 54 years.

Table 2. The socioeconomic profile of Ganaveh village in 2008

Attribute	Quantity
No. of households	45
Males	53%
Females	47%
Total population	185
School	One elementary school
School education	72% of population
Illiteracy	28% of population
Piped water available	All households
Electricity available	All households
Telephone available	Most households
Connecting road to the nearest city	15 (km) (asphalt)

Table 3. Socioeconomic variables averaged for the households in Ganaveh

Household characteristics	Mean	St. Dev.
Family size	4.9	2.6
Average age of members	35.5	15.0
No. of members in the productive age group*	3.6	2.3
Average school years of members	4.2	2.6
Annual cash income from woodland resources (%)	30	31.8
Annual cash income from other sources (%)	70	31.8
Family assets (no. of items)	5.4	1.5
Annual consumption of energy from LPG (MJ)	11365	6061
Annual consumption of energy from kerosene (MJ)	26153	16139
Annual consumption of energy from fuel wood (MJ)	43800	24475
Active agricultural lands (ha)	1.6	3.2
No. of goats	32.3	45.2
No. of sheep	2.7	7.9
No. mules (animal unit)**	4.9	8.0

*The productive age group is between 15 and 65 years old.

**Each goat and sheep is counted as one animal unit and each mule is counted as six animal units.

Based on respondent's own relative estimates, in average 30% of annual cash income for the households, came from woodland resources (Table 3). Moreover, the income from the woodland resources was considered an important source of revenue by 47% of all interviewed households while approximately 25% of the households earned more than 50% of their cash income from the woodland resources. The other 70% of cash income came from sources other than the woodland resources and included pensions and governmental salaries (33%), remittances and allowances (25%), labor and services (10%) and agriculture and other sources (2%). Most of the agricultural lands, which were without irrigation, had been abandoned because of their low fertility and the urban migration of owners. The total active agricultural lands for barley and wheat, as well as for orchards (mainly fig trees), were 51 ha, with ownership distributed among 34% of the households. The agricultural products were mainly for self-consumption, and only 9% of households (3 households) who owned orchards sold a small amount of figs in local markets. Data on household possessions showed the family assets were at a maximum of eight items for three households and at a minimum of two items for two households.

On average, fuel wood provided approximately 54% of the total consumed energy for cooking and heating and it was used by 29 out of the 32 interviewed households. The incentive for using fuel wood was its accessibility and cheapness compared with fossil fuels. Three respondents also replied that customarily they preferred using fuel wood rather than other fuels. Still, all households used some fossil fuels (LPG and kerosene) to greater or lesser extents.

Nine of the 32 interviewed households were identified as having no or very small woodland-based income combined with a specific demographic constitution. They had essentially no dependence on the woodland resources, at least not directly, and received at least 95% of their cash income from other sources, such as pensions (provided by The National Iranian Oil Company), salaries, allowances and remittances. This group was characterized by a family size of only one or two; this applied to all but one of the households in the group and to none of the rest of the households. Furthermore, none of the families had members below the age of 15. The average age of people in a household in this group was 52 years. Furthermore, with two exceptions, this group contained households headed by women. The average number of family assets for this group was 4.6, while it was 5.7 for the rest of the households (p-value 0.05). Because these nine households had essentially no forest resource activities, they will henceforth be referred to as nonactive households, in distinction to the active households.

Woodland product use

The households in Ganaveh are the only natural resource users of the watershed. Depending on the abundance of the resource, locals graze their animals and collect fuel wood, seeds and ground fodder (Table 4) in the watershed area without recognizing any territorial limits for their activities except for seeded areas, fenced areas and similar areas announced by the forest authority.

Table 4. Percentage of households involved in the utilization of the woodland products, mean amount of utilized products by user and all households, the average gross income from the woodland resources(users, all) and the estimated proportion of cash income from the woodland resources in total annual income of households

Forest product		Involvement in utilization (%)	utilized products (kg)				Av. income		Cash income (all; %)
			users		all		(users; $)	(all; $)	
			Mean	St. Dev.	Mean	St. Dev.			
Grazed fodder		50	21516	11490	10758	13540	2375	1188	24
Fuel wood		72	4043	2457	2906	2774	132	95	2
Seed	Acorn	63	2022	2768	1264	2384	179	112	4
	W. Pistachio	13	120	96	15	50	53	7	
	W. Almond	28	36	30	9	22	11	3	
Food & Medical herbs		6	75	35	5	20			
Collected fodder		34	713	291	245	382	79	27	-
Total		-	-	-	-	-	2829	1432	30

Animal husbandry, and in particular the raising of goats, was the most important activity for providing woodland-based income in the village's livelihood system. It was practiced by half of the households in the village and was the main occupation of the heads for 25% of the households. On average, income from animal husbandry amounted to more than 80% of the average gross income for those engaged in animal husbandry (Table 4). The livestock was not evenly distributed among the households. Livestock ownership ranged between 28 and 212 animal units per household, and about half the livestock was owned by five families.

Fuel wood was gathered as deadwood by 23 households with an average of 4043 kg and a range from 1200 kg to 11000 kg. Approximately 50% of fuel wood was collected by seven households (22%). Although charcoal making was prohibited, two households informed us that they made charcoal for selling. Six households had a deficit and acquired from neighbors, and three had a surplus for selling (there was a 5400 kg difference between total collection and consumption because of different assessments by sellers and buyers).

Seeds were gathered from oak (*Q. persica*), wild pistachio (*P. mutica*) and wild almond (*Amygdalus spp.*), all to be sold to local traders on an opportunistic basis in the village or to be used for self-consumption. Selling seeds and acorns provided cash income for 15 households (47%) with a range between 2% and 20% of their total cash incomes. Three households accounted for more than half of the collected seeds and acorns of the village. The major use of acorns was for feeding animals in winter; women in some households (44%) baked a kind of bread from acorn flour. Only three households processed acorns by taking off their shells before selling. This processing doubled the value of this product. Acorn gathering is highly seasonal. Based on information from respondents, oaks have a good production of acorns every two years. One of these years was in 2007, and 63% of households collected acorns with a range from 300 kg to 12000 kg and a mean of 2022 kg per household. Seeds of wild pistachio were collected by 13% of households, with a mean of 120 kg per household, and seeds of wild almond were collected by 28% of households, with an average of 36 kg (Table 4).

Fodder from the woodland understory, mostly grasses and herbs, was reaped, dried and used by some households to feed their animals in winter. This product was collected by 69% of households who owned livestock. The average amount of forage collected by this group was approximately 713 kg (dry weight), with a range between 300 kg and 1000 kg. More than half of the fodder was collected by four households.

In 74% of the active households, women and children participated in deriving household income from woodland resources mainly on the seed and acorn gathering. Fuel wood gathering and caring for animals were mostly the responsibility of the men. Analysis of data revealed that gender composition of households (no. of females) had no correlation with any of the mentioned used woodland products at a statistically significant level.

Only two households collected food and medical herbs to sell. Due to the limited extent (150 kg), it was excluded from further analysis. Nobody gave an answer regarding the cutting of trees for construction materials or the lopping of oaks for livestock fodder (the cutting of trees is prohibited by the forest authority). The leaves and twigs of oaks are unpalatable to goats during the growing seasons. However, in very dry summers, when there is no alternative feed for livestock, people dry leaves to feed the animals. Hunting game is prohibited by the Bureau of the Environment, which is in charge of wildlife protection in the region. We did not receive any reports about that either. Each year, many visitors come to the area for recreation; so far, no direct revenue has been earned by locals from these visitors.

3.3. Relationships between household characteristics and utilized woodland products

Table 5 presents the weights (coefficients) of the original variables of the two sets of data (utilized woodland products vs. socioeconomic) in the first pair of canonical variates (u_1 and v_1), which have a canonical correlation of 93% at a level of 90% probability. Note that this analysis only

includes the active households according to the definition given above. The pairwise correlation analysis between the canonical variates u_1 and v_1 and their original variables shows the original variables that contribute significantly in these variates (Table 6 in bold italic). There are contrasting correlations (negative relationships) between "average school years of family members" as well as "cash income from other sources (%)" and the three variables "collected fodder", "collected fuel wood" and "no. of grazing animal units". On the other hand, there are combining correlations (positive relationships) between the consumption of the energy from fuel wood and kerosene and the three mentioned woodland products.

Table 5. Results of the canonical correlation analysis for the first pair of canonical variates (u_1 and v_1)

Woodland collected products		Socioeconomic characteristics	
Original variables	Coefficients in u_1	Original variables	Coefficients in v_1
Collected fodder	0.23	Family size	0.29
Collected fuel wood	0.77	Average age of members	1.14
Collected seed collection	–0.25	Average school years of family members	–0.39
No. of grazing animal units	0.31	Cash income from other sources (%)	–0.70
		No. of family assets	–0.21
		Consumption of energy from LPG (MJ)	–0.62
		Consumption of energy from kerosene (MJ)	0.21
		Consumption of energy from fuel wood (MJ)	0.26
		Area of active agricultural lands (ha)	0.04
R_1 = 0.93; Bartlett's X^2 = 47.63, df = 36; p-value <0.10			

Table 6. Correlation between the first pair of canonical variates (u_1 and v_1) and the standard scores of their original variables. Significant relationships are in bold italic

Utilized woodland products		Socioeconomic characteristics	
Original variables	Correlation with u_1	Original variables	Correlation with v_1
Collected fodder	***0.4***	Family size	0.0
Collected fuel wood	***0.7***	Average age of members	0.1
Collected seed	0.0	***Average school years of family members***	**–0.4**
No. of grazing animal units	***0.4***	***Cash income from other sources (%)***	**–0.6**
		No. of family assets	0.2
		Consumption of energy from LPG (MJ)	–0.1
		Consumption of energy from kerosene (MJ)	**0.3**
		Consumption of energy from fuel wood (MJ)	**0.5**
		Area of active agricultural lands (ha)	0.1

The results of the pairwise correlation analysis, to test the results of the CCA, conducted between variables of each utilized woodland products and the acquired socioeconomic variables show that there is a significant correlation between the "no. of grazing animal units" and "cash incomes from other sources (–0.55, p-value 0.007). Moreover, "consumption of energy from fuel wood" (correlation 0.49, p-value 0.02) and "average

school years of family members" (correlation -0.38, p-value 0.07) have significant correlations with "collected fuel wood". The pairwise correlations between the other variables of socioeconomic characteristics and utilized woodland products were too low to be considered. Comparison of average school years for males and females in the active households showed that there is a statistically significant difference for males (6.0 years) and females (4.5 years) (p-value 0.04).

DISCUSSION

The woodland resources of Ganaveh were used communally by its inhabitants. The woodland-based incomes were mainly obtained by performing different kinds of traditional practices, including animal grazing and the collection of fuel wood, seeds and ground fodder. The Ranking method revealed that 30% of average cash income of households came from woodland resources, and 47% of the interviewed households considered their cash income to be highly dependent on the woodland resources and households counted on this income on an annual basis.

Traditional animal husbandry (mainly goat husbandry) based on the pasture fodder was the most important activity for providing woodland-based income to the villagers. It constituted more than 80% of the assessed total income from the woodland resources. Therefore, the households who owned livestock were the most dependent on the woodland resources. Second in importance, according to assessed values (Table 4), was seed collection. It was also linked to animal husbandry, as the major use of acorns was for feeding animals in winter. It was less evenly practiced than animal husbandry: three households accounted for more than half of the collected seeds and acorns of the village. The collection of seeds is highly seasonal, and households were involved in this activity in mast years. Fuel wood may have a low assessed value but still provided approximately 54% of the total consumed energy. The above examples show that most households in Ganaveh have a dependency on woodland resources. Masozera and Alavalapati (2004) assumed that households whose income from forests accounted for 40% or more of their total income were considered highly dependent on forest resources. Our finding about the dependency of the livelihoods of Ganaveh's inhabitants on the woodland resources is in agreement with the reports of Ghazanfari et al. (2004) about the inhabitants of the rural areas in other parts of the Zagros region.

Natural regeneration and the seeds of woody species seem to be the most sensitive part of the woodland system (Salehi et al., 2008) when it comes to livestock grazing and seed gathering, especially in drought conditions when the area is confronted with a shortage of fodder. Even though wood is an important source of fuel, it does not amount to more than about 16 kg ha^{-1} $year^{-1}$, which is far less than the estimated production of 518 kg ha^{-1} $year^{-1}$ (0.7 m^3 ha^{-1} $year^{-1}$) (Jazirehi & Ebrahimi, 2003). Judging from this, the dependency does not seem to have the same detrimental effect on the natural resource base as reported in other cases from woodland areas (e.g., Abdallah & Monela, 2007).

The results of CCA reveal that the average number of school years of the family members and cash income from other sources have a negative relationship to collected fodder, collected fuel wood and no. of grazing animal units, whereas consumption of energy from fuel wood have a positive relationship to the three aforementioned woodland products. Therefore, the more income diversification, especially from the forestry sector, and the better the education of households the less dependent the households are on woodland resources. Although the results of CCA show that the consumption of kerosene adds to the dependency on woodland resources, the results of the pairwise correlation analysis do not show any significant correlations between kerosene consumption and any of the variables of the utilized woodland products.

Adhikari et al. (2004) reported from Nepal that the collection of forest products from community forests was dependent on various socioeconomic variables, among which some variables, such as livestock holdings, education of family members and household economic status, were consistent with the findings in this study. There appears to be no relationship between the utilized woodland products and family size. This agrees with the results of a study on rural villages in South Africa (Shackleton *et al.*, 2002) that also indicated that the use of resources does not necessarily

increase linearly with an increase in family size. The limited dependency of the livelihood system on agriculture in this village is corroborated by an analysis of the areas actively under cultivation.

It is generally believed that diverse livelihood systems are less vulnerable than undiversified ones (Ellis, 2000b). It is therefore important to investigate other potential sources of income. Further processing of woodland products—such as processing the gathered seeds and acorns before selling—could be an opportunity to increase the household cash income from natural resources without increasing the stress on these resources. This is an even more interesting option because Iran has an established position in world markets for pistachio and almond nuts (Pourreza et al., 2008). Moreover, using the local knowledge for making bread from acorn flour could be applied in an industrial manner, for sale in the local markets, to add some value to the forest products. Yet another way of diversifying would be to stimulate the recreational use of the woodland by exploiting the existence of the asphalt road and the proximity to urban areas.

Diversification could also improve the position of the women and children since the aforementioned activities engage these group. A number of relevant studies emphasize that women are important actors in natural resource use (Gupte, 2004; Fonjong, 2008; Shandra *et al.*, 2008). Due to the difference between the levels of average school years of males and females in the village, investing in education, and training of women should be more attended. In doing that, it could be advantageous to have education and training also related to the use of the woodland resources like further processing of seed and acorn.

Our study was conducted in a village that had a small number of households, and this let us conduct a relatively thorough survey. However, it is possible to use the applied method of data analysis for a larger area, i.e., the Zagros region, by using different sampling methods applicable to socioeconomic studies (e.g., Adhikari *et al.*, 2004; Masozera & Alavalapati, 2004; Pandit and Thapa, 2004).

While trying to identify the role of key socioeconomic factors on household forest activities, one should not forget the effects of external factors such as market changes, mast years for seed gathering, climate change, law, etc. For instance, some activities, such as animal husbandry and seed collection, are highly dependent on precipitation and climatic conditions. These all affect the livelihoods of households, and we do not have sufficiently good data regarding them. Investigating the effects of such factors on the woodland products was beyond the scope of our study. The study refers to the particular conditions in that year and as aforementioned factors are important, it points to the need for further studies in this region.

One drawback of the data collection method was that it had to be limited to head of households and data that could illuminate sub-household conditions, such as gender strategies within the household, could not be reliably reflected.(Wilde & Mattila, 1999; Tempelman, 2000). This precluded a more thorough analysis of certain internal mechanisms of the households, such as the gendered division of work and responsibilities. Since all but two of the household heads of the active households were male, it is not unlikely that a bias in terms of utilized woodland products on the part of women work afflicts the data.

Another drawback of the study was that the respondents were reluctant to answer questions about their monetary income and capital assets in absolute terms. There was, thus, no alternative to us than to use the ranking method. Although there are some biases, such as biases of personal contact, dry season bias, biases of politeness, protocol, etc. (Chambers, 1981), it seems that the ranking method was a cost and time efficient method that yielded data of utmost value for the study. Still, income share reporting using the ranking method is not the same as actually obtaining figures on all sources of household income and calculating the income share from these.

CONCLUSION

The study shows a high dependency of households on woodland resources. At the same time, it also reveals that households are diversifying in terms of income-generating activities that are not based on woodland resources. These two aspects are strongly interconnected when the goal is to have a sustainable use of these resources. The following

seem to be the most important, though not the only, lessons to be drawn from the study with respect to development strategies for the sustainable use of the natural resource base:

- Improve the educational system, and especially with respect to women, because more education appears to lessen the dependency on forest resources.
- Stimulate activities that yield cash income from sources other than those derived from woodland products.
- Investigate options for diversification of income from natural resources that do not increase the environmental load. With respect to activities that households already have experience in, further processing of seeds is one option. Another is to support an increased recreational use, with associated incomes.
- The study indicates that agencies working in dialogue with the households could focus on certain strata of the households. For instance, more than half the seeds and acorns are collected by only three households.

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وابستگی معیشتی به منابع جنگلی در زاگرس جنوبی، ایران

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چکیده

هدف از این مطالعه بررسی ارتباط بین معیشت مردم و منابع جنگل در زیر حوضه آبخیز گناوه در شهرستان گچساران در منطقه زاگرس جنوبی می‌باشد. این مطالعه می‌تواند به عنوان پایه‌ای برای پیشنهادات راهبردی برای مدیریت پایدار منابع جنگل و بهبود معیشت مردم در این منطقه باشد. اطلاعات اقتصادی – اجتماعی از طریق مصاحبه با سرپرست خانوارها و اعضای شورای روستا با تمرکز بر استفاده از منابع جنگل جمع آوری شد. تحلیل همبستگی کنونیکال و تحلیل همبستگی جفتی برای تشخیص ارتباط بین متغیرهای اقتصادی– اجتماعی خانوارها و متغیرهای استفاده از منابع جنگل مورد استفاده قرار گرفتند. نتایج نشان می‌دهد که دامداری عمده‌ترین فعالیت برای تامین درآمد روستاییان می‌باشد. استفاده از چوب سوخت، بذر درختان جنگلی و علوفه کف جنگل از دیگر منابع مورد استفاده در این منطقه می‌باشند. از میان مشخصه‌های اصلی اقتصادی – اجتماعی خانوارها، افزایش سطح تحصیلات افراد و کسب درآمد از منابع دیگر غیر از منابع جنگل باعث وابستگی کمتر خانوارها به منابع جنگل می‌شود، همچنین میزان مصرف انرژی در خانوارها رابطه مثبتی را در ارتباط با جمع‌آوری چوب سوخت در منطقه نشان می‌دهد.