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*Research Paper***Non-wood forest products, the utilization, and harvesting methods in Sardasht, North West Iran**

Rostam Mousavi

Urmia University, Urmia, Iran

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Abstract: Non-wood forest products include all kind of services which forest offers except woody production. People were using the forest resources over many centuries to fulfill the daily needs. However, only in the last decades non-wood forest products have gained more attention in world trade. Sardasht region in the northwestern Iran with a considerable forest cover was chosen as a study area. In order to carry out the study, questionnaires were prepared and distributed among local people, and the results were analyzed. All kind of non-wood productions which could be exchanged for money were listed. Other kind of non-market services such as protection of soil resources and recreation were not evaluated. Different forest by-products were recognized in the area including acorn, foliage leaves, galls, turpentine, pistachio (*Pistacia vera*) nuts, leaves and fruits of roses, cherry elaeagnus (*Elaeagnus edulis*), hawthorn (*Ceratagus spp.*), wild plum (*Prunus spp.*), bitter almond (*Amygdalus communis*), walnuts (*Juglans spp.*), manna of oak trees, wild pear (*Pyrus spp.*), sumac (*Rhus coriaria*). Among all these products, turpentine is the only non-wood forest product which can be exported to neighboring countries. Other non-wood forest production has not widely spread in the market, but is being consumed at local scale for household needs by local people. However, the non-wood products play an important role fulfilling the peoples' needs through both non-market and market means. It is possible to improve the role of non-wood forest products in the daily life of local people with providing facilities such as better transportation system and marketing.

Key words: non-wood forest products, Sardasht, turpentine, manna of oak.

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Introduction

The Zagros Mountains is the largest mountain range in Iran with a total length of 1.500 km, from northwestern Iran to southwestern Iranian plateau. The mountains are covered with forest. These forests start from Piranshar in northwest of Iran in West Azerbaijan province to Firooz Abad in Fars province in the southern part of Iran. This mountain range supports oak-dominated deciduous forests and pistachio-almond forests with some other species which are widespread in the forest. The total surface areas of these forests are 5 million hectares with canopy cover more than 5 percent (Jazirei and Ebrahimi Rostaghi 2003).

Zagros Mountains harbour very fragile ecosystem, and it had been damaged significantly in the last decades. However, due to ecological condition, production of commercial wood was not possible even in the last century but the forest offers different goods and services to the community. One of the main benefits of these forests is providing income for rural people by collecting non-wood forest products. Non-wood forest products include all kind of forest products which can be gained from forest except wood. This production can be used as a raw material for industry or medicine, or it can be used as a food. It can be obtained from different parts of plants including leaves, stems, fruits, bark, and juice.

Although economic value of wood products in Iran is not comparable with non-wood forest products, due to new forest policy wood removal is banned in many parts of Iranian forests except in the Hyrcanian Forest. In the western part of Iran and in the Zagros forest, woody products are not economically tradable and only non-wood forest products are being traditionally used by people. However, some of these products have high value and can be sold in local, regional, national, or international markets.

Sardasht region in northwest of Iran with a considerable forest cover was chosen as a study area. In order to carry out the study, questionnaires were prepared and distributed among local people, and the results were analyzed. All kind of non-wood production which could be exchanged for money were listed, and other kind of non-market services such as protection of soil and water resources, and recreation facilities were not evaluated.

Several studies about non-wood forest products have been done in Iran, and different criteria have been studied and discussed. Eslmai Manochehri (1992) studied non-wood forest products and their role in daily life of people and destruction of forest. Pour Shafie Zanganeh (1997), studied different types of galls and its usage as a raw material in industry and Drug Company in Kermanshah province. Mahdavi (2006) studied non-wood forest products in Kamyaran. Different kind of production was recognized and investigated in his research.

In this study, non-wood forest products in Sardasht region located in the northwestern Iran in the Zagros Mountains was studied. These forests offer large variety of goods and services to many people. These products are known and utilized by people but their use was never documented, therefore the study was necessary.

Objectives of this study are: (1) recognition of different non-wood forest products; (2) finding economic value of these products; (3) finding out the application of these products.

Material and methods**Study area**

The study was conducted in North West Iran, Azerbaijan Province, Zagros forests in 2010. The study area was located between 35°9' and 36°6' N, and between 45°0' and 45°6' E (Figure 1).

The nearest meteorological station is situated in Sardasht. On the basis of the meteorological observations and according to Köppen's classification (Kimmel 2001), the climate of the area is Mediterranean; the mean annual temperature is 14.7°C. In general, the relative humidity is not high, however, the average rainfall varies between 331 mm per year in 2001 to 1045 mm per year in 2003 (Action Plan 2000).

Geologically this area belongs to the ancient basement formation. Alkaline soils (pH >5.5) predominate, which can be hindering factor for growth of some species. The soil texture of the forest area varies from sandy loam clay to sandy loam.

Forest stand composition, canopy height and size class distribution vary considerably from place to place, but most of the area is dominated by oaks (*Quercus spp.*). Also other species such as pistachio (*Pistacia atlantica*), maple (*Acer campestre*), elm (*Fraxinus excelsior*), hawthorn

(*Crataegus* spp.), wild pear (*Pyrus communis*) can be found in these forests. The average height of the tallest trees is usually 3-5 m, and some individuals may reach a height of 15 m or more (Action Plan 2004).

Data collection

In order to collect the required data, a questionnaire was developed. In the questionnaire, production type, production season, production rate and price was included. Moreover, the required number of workers and workers' cost and method of processing products were mentioned. Due to difficulties to access all the study area, there were arranged meetings with the producers (collectors) in the local market where they bring their goods for selling. Totally 200 questionnaires were distributed among local people in different villages around the entire region.

Altogether 178 interviews were carried out (22 questionnaires were not responded). The interviews were one-on-one and respondents were carefully selected with average age over 40 years old. Experience has shown that older people have more traditional knowledge than younger people do. The interviews were carried out mainly in afternoons and on holidays when the local people were at home or in access.

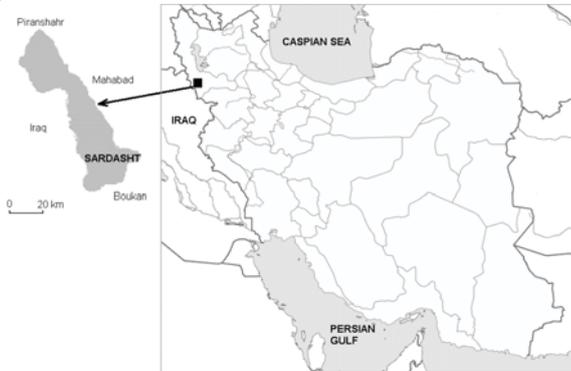


Figure 1. Location of the study area.

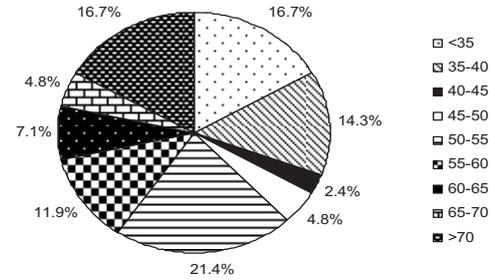


Figure 2. Distribution of husbandmen age in the study area

Results

Information of husbandman in the forest area

According to information provided in the study, about 79 percent of husbandmen in the area are illiterate and none of them has an academic degree. The number of families in 41 percent of homes was less than 5 which is followed by 6 people (34 %). Figure 2 shows the age of husbandmen in the selected area.

Recognition of different forest products

Different non-wood forest products are used by local people and villagers. After consulting with an expert at the natural resources office, these products are listed. Since turpentine is the main non-wood forest product which can bring high income, it is explained in more detail and summarized individually in Table 1. The other non-wood forest products are summarized in Table 2.

Table 1. Non-wood forest product types. Local, Persian and scientific names are provided

No.	Productions	Local name (name used in local dialect)	Persian name (Latin transcription)	Parts of plants used	Scientific name
1	Turpentine	Bnesht	Saghez	Juice	<i>Pistacia atlantica</i>
2	Hawthorn	Goyzh	Zalzalak	Fruits	<i>Crataegus melanocarpa</i>
3	Pistachio	Ghazvan	Bane	Fruits	<i>Pistacia atlantica</i>
4	Almond	Cheghale	Badam	Fruits	<i>Pistacia khenjuk</i>
5	Sumac	Somagh	Somagh	Fruits	<i>Rhus coriaria</i>
6	Oak seeds	Baru	Balot	Fruits	<i>Quercus persiaca</i>
7	Galls	Mazu	Mazoj	Galls	<i>Quercus infectoria</i>
8	Wild plum	Haloche	Aloche	Fruits	<i>Prunus spp.</i>
9	Wild pear	Keyola	Golabi	Fruits	<i>Pyrus spp.</i>
10	Oak leaves	Glabro	Balot	Leaves	<i>Quercus spp.</i>
11	Pistachio	Gala Ghazvan	Baneh	Leaves	<i>Pistacia atlantica</i>
12	Rose flowers	Sheylan	Nastaran	Sepals	<i>Rosa canina</i>
13	Manna	Ghazoo	Gazoo	Manna	<i>Quercus spp.</i>
14	Silverberries	Senjoo	Senjed	Fruits	<i>Elaeagnus angustifolia</i>
15	Rose fruits	Sheylan	Nastaran	Fruits	<i>Rosa canina</i>
16	Walnuts	Goyz	Gerdo	Fruits	<i>Juglans regia</i>

Turpentine

Turpentine is a fluid obtained by distillation of resin collected from trees. Turpentine is being extracted from stem of a tree, e.g. *Pistacia atlantica* when the bark is deeply wounded. The maximum extraction of turpentine is on July and August. In order to extract turpentine, harvesting groups move to the forest with especial tools and equipment. The common tools for extraction are axes. The other required material is clay soil and water for making a bowl (each bowl volume is around 250 mm). Two workers are needed for extraction; one of them is responsible for making bowls and creating grooves in the tree, while the other one is mixing soil and water. About 10 days after wounding the tree, wound should be fresh because trees are healed during the time and fluid flow is cut. In the last day, all wounds are covered by wet soil for preventing fungi attack. Minimum diameter of tree for getting turpentine is 20 cm and the maximum number of groove per tree is 25 cm. An accepted dimension for groove is 2-3 cm width, 5-7 length, and 1-1.5 cm depth. According to the Action plan (2004), the average production of turpentine varies between 0.5-1 kg per tree in harvesting period. Table 2 shows the summary of production and cost of collecting turpentine in the study area. According to the information provided in the Action plan (2004), total annual production is 3298 kg in an area over 800 ha. Table 4 shows the production rate and cost and profit from other non-wood forest products (regional prices are applied).

Table 2. Productivity and cost of collecting turpentine

Price per kg, \$US	10
Total income, \$US	$3298 \times 10 = 32980$
Average production per labor	200 kg
Total number of working days per year	50
The number of required workers	17
Labor cost per hour, \$US	1.25
Total working hours per day, \$US	4
Total labor cost, \$US	$17 \times 4 \times 1.25 \times 50 = 4250$
Processing cost, \$US	$32980 \times 10\% = 3298$
Net value, \$US	$32980 - 4250 = 28730$
Stumpage price, \$US	$28730 \times 0.2 = 5746$
Net income, \$US	$28730 - 5746 = 22984$

Table 3. Production and cost of other non-wood forest products in the study area. NA = information not available

Production type	Production rate per tree, kg	Production rate per day, kg	Price per kg, US\$	Number of required workers	Total income, US\$	Total cost, US\$	Total profit, US\$
Pistachio	3 kg	15-20	2-3	1-2	30-40	10	20-30
Pistachio leaves	NA	60-70	NA	NA	NA	NA	NA
Rose fruits	NA	6-8	5-10	1	30	10	20
Rose sepal	NA	5	3	1	15	10	0
Hawthorn	NA	20	1	2	20	10	10
Almond	NA	20	1	2	20	10	10
Sumac	NA	8-12	1.5	2	12-18	10	2-8
Oak seeds (acorns)	NA	100-120	0.1-0.2	2	10-12	10	0-2
Galls	NA	8-10	2-3	1-2	16-30	10	6-20
Oak leaves	NA	NA	NA	NA	NA	NA	NA
Manna	NA	5	7-10	2-3	35-50	10	25-40
Wild plums	NA	10-15	1-1.5	2	10-22.5	10	12.5
Wild pears	NA	15-20	1-1.5	2	15-30	10	5-20
Silverberries	NA	15-25	3-4	2-3	45-100	10	35-90
Walnuts	NA	30-40	1.5-2	2-3	45-80	10	35-70

Time and period of harvesting

Harvesting time is very important factor on collecting non-wood forest products. Seeds, fruits and leaves and other parts should be collected on time, otherwise it does not have good quality. According to the information provided in this research, the best time and period of collecting non-wood forest products is presented in Table 4.

Table 4. Season for gathering different type of non-wood forest products

Production	Months (January, February,...November, December)												Harvesting period
	J	F	M	A	M	J	J	A	S	O	N	D	
1 Turpentine													3 months
2 Pistachio													5 months
3 Pistachio leaves													4 months
4 Rose fruits													3 months
5 Rose sepals													2 months
6 Hawthorns													3 months
7 Almonds													3 months
8 Sumac													3 months
9 Oak seeds													5 months
10 Galls													2 months
11 Oak leaves													3 months
12 Manna													3 months
13 Wild plums													3 months
14 Wild pears													3 months
15 Silverberries													3 months
16 Walnuts													3 months

Tools and equipment

Perhaps the most common tools for harvesting turpentine is a special axe for making a deep wound in the tree. The tools are made by villagers and are very cheap, so that everybody can have it. Other tools used in harvesting the production are also simple, are made by the villagers themselves and does not have any market cost.

Indirect value of forest for local people

Zagros forest not only offers goods and services to people directly, but also provides food and space for domestic animals. According to information gathered from Sardasht veterinary office in 2010, there were 111160 goats and sheep in the forest whose value is over 44464000 US\$. Moreover, these forests are producing center for dairy production and it is very important in peoples' life.

Discussion

The study reflects the regional importance of non-wood forest products and their role in the peoples' lives in North West Iran, Azerbaijan Province, Zagros forest at the beginning of the 21st century.

Due to difficulties for accessing the area, it was not possible to collect data from all villages and villagers but I tried to get access to the information in other ways rather than meet them in the villages. Non-wood forest products, their usage, income, product collection, and processing are different aspects which were investigated in this research.

Turpentine is one of the most important non-wood forest products in Sardasht. The utilization of these products is done according to a scheduled plan which is provided by natural resources experts. According to the study, for turpentine the total gross income per kg is 10 US\$ and it is the most precious non-wood forest product which is followed by manna. Turpentine is used traditionally for digestive system problems. It is used as raw material for producing chewing gum, perfume and hair softener.

Similarly to turpentine, manna is precious non-wood forest product which is collected from oak trees. Manna is not produced every year, and it is the negative point for getting income continually. According to the information extracted from questionnaire, with average daily production of 7-10 kg per day, earning 100 US\$ per day is possible. This is 10 times higher than an average daily labor cost in the particular region. Manna has sweet taste and it is used as natural sweetener with food. Hawthorns are a large group of hardy deciduous trees or shrubs. The fruits vary from species to species; therefore different size, taste and color of these fruits can be diagnosed. Hawthorns as a non-wood forest product are common everywhere in the Zagros forest area. The fruits are red and yellow, edible and are used by people and sold to nearby cities. People believe that they have tonic effect on the heart, and they are used in the treatment of weak heart conditions (Khoshbakht and Hammer 2005). In some parts of these forests, it is possible to collect 20 kg per day which is worth 25 US\$ per day. Since hawthorn is resistant against dryness, it can be used as a parent plant for hybridization of other species, e.g. pear.

Walnuts are non-wood forest product, the walnut tree belong to native flora of the study area. Walnuts in the forest should be collected according to the plan which is certified by natural resources offices. However, walnuts collected in the forest do not have high quality, but it offers fruits without any direct costs, therefore it is important. Different parts of walnut tree are used for utilization. In order to increase the quality and income from walnut it is possible replace the wild walnuts with trees producing higher quality production. Walnuts are rich in phenol compounds which are preventing the formation of free radicals. Walnuts, rich sources of omega-3 alpha- linolenic acid, could improve artery function and heart health. Walnuts are rich in fat, a diet supplemented with walnuts had a beneficial effect on blood lipid, lowering blood cholesterol and lowering the ration of serum concentration of low density lipoprotein (Özcan 2009).

Galls are natural reaction of tree against insect attack. It is one of the non-wood forest products which can be used as raw material for industries. Collecting galls is not interesting for people anymore because of too low interest in trading this production. However, there are buyers which come to area for buying galls, but they come occasionally and it does not have good profit. Galls are used as raw material for dyeing industries (Pour Shafi Zanganeh 1997).

One of the most profitable non-wood forest products in the area is the sumac which can be produced and sold in huge amounts. It can bring good income for collectors. However, in the study area most of trees are cultivated and are rarely found in wild form. Sumac can survive in an area with the annual precipitation around 500–600 mm (Bloschenko and Letchamo 1996). A suitable soil for sumac is acidic soil; however it is resistant to alkaline soils as well. The trees need enough light for growing and fruiting. Sumac is traditionally used as a table spice in the region. Sumac has an acidic sour taste due to its indigenous organic acids and is mainly sprinkled on various kinds of kebabs. Sumac is used in Iran and it is preventing of formation of free radicals (Fazeli et al. 2007).

Wild pear is one of non-wood forest product which is spread in the area. Fruits are small and its trading is not common unless in local market. Since it has low price, income from selling it is not considerable.

Other non-wood forest product such as wild plums, silverberry and almond is not a source of income for local people. The main reason is low production rate and low prices. Non-wood forest products such as tree leaves are not commercial. Collecting this product is just for personal usage. Fruits of wild roses are products which despite of high amount of it are not involved in trade. Oak seeds (acorns) are being collected for feeding domestic animals. In the Zagros Mountains, traditionally the acorns were used for making bread but it is not common anymore. Collecting acorns can make problem for regeneration therefore it should be taken into consideration when planning the forest protection against overexploitation.

Using forest for non-wood forest production in most cases does not harm forest but sometimes it can have destructive affect on forest ecosystem (e.g. collecting oak seeds, cutting oak and pistachio branches). People can go to forest for collecting these products, but in many of these forest areas only nearby village people traditionally have some rights of collecting non-forest products. Although these rights are not legal, they are accepted by local rural people.

Since the main job of people is agriculture and pasturing animals in forest, people use non-wood forest products for their daily needs and in some cases for local market. However, there is no statistic information available on the numbers how many people are using these products and what is the total income from this production. From economical point of view turpentine is the most important forest non-wood product that could be exported to other countries, but there is no registered information about the total amounts in the country and region.

It is possible to improve the role of locally collected and produced non-wood forest products in the daily life of local people with providing facilities such as better transportation system and marketing.

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