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Potentials and Opportunities of Wild Edible Forest Fruits for Rural Household's Economy in Arasbaran, Iran

Sajad Ghanbari ^{1,*}, Gerhard Weiss ², Jinlong Liu ³, Ivan Eastin ⁴, Omid Fathizadeh ¹
and Gholamhosein Moradi ⁵

¹ Department of Forestry, Ahar Faculty of Agriculture and Natural Resources, University of Tabriz, Ahar 53548-54517, Iran; omid.fathizadeh@yahoo.com

² Department of Economics and Social Sciences, University of Natural Resources and Life Sciences, A-1180 Vienna, Austria; gerhard.weiss@boku.ac.at

³ School of Agricultural Economics and Rural Development, Renmin University of China, Beijing 100872, China; liujinlong_jl@hotmail.com

⁴ School of Environment and Sustainability, University of Michigan, Ann Arbor, MI 48109, USA; ieastin@umich.edu

⁵ School of Natural Resources and Desert Studies, Yazd University, Yazd 89158-18411, Iran; moradi@yazd.ac.ir

* Correspondence: ghanbarisajad@gmail.com; Tel.: +98-414-4237-717

Abstract: Non-timber forest products (NTFPs) contribute to local people's livelihood in many regions around the world. This article investigates the types of NTFPs collected, processed, and traded in the Arasbaran region of Iran, the roles of these products in household economies, and the potential contribution to rural household economies through the collection, processing, and marketing of NTFPs. Data were collected using household and community surveys as well as through secondary sources on the role of NTFPs within Arasbaran forests in Iran. The main NTFPs harvested by local people were fruits. The fruits from 14 woody species, including trees and shrubs, were harvested by local people. The average share of forest-harvested fruit to household income was 27 percent. The mean annual income derived from the harvest and sale of sumac and reddish blackberry in the sample rural household incomes was USD 1822 and USD 142, respectively. In regard to processing efficiency, plum, cornelian cherry, and sumac exhibited the highest processing efficiency. Better policy support would be needed along the whole value chain, starting with the forest management plans, to include fruit species. In addition, measures to support processing facilities as well as to promote trade and marketing beyond the local area would be highly important to develop the potential of forest fruits and other NTFPs. Besides technical and financial support, measures should include regulatory revisions as well as information, training, and awareness raising.

Keywords: non-timber forest products (NTFPs); food; livelihood; management; processing; marketing



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1. Introduction

Non-timber forest products (NTFPs) provide a wide range of products, including food, aromatics, medicinal, and decorative plant material [1,2]. These products contribute significantly to the livelihood of local people [2,3] and are important sources of income for rural households living in or near forests [4–6]. About one billion people worldwide derive foods from forests, and around 300 million of these people depend extensively on NTFPs [7]. In many developing countries, as much as 25% of rural people's income can be derived from the harvesting processing and sale of natural resources [3,7], and NTFPs can contribute as much as 90% of rural household income [2,8]. Wild edible fruits (WEFs) are a subset of NTFPs and an important source of nutrition for one in six people worldwide. WEFs provide an important source of nutrition for people with lower incomes while also representing an important source of income for improving the standard of living within rural communities [9]. Many WEFs also possess medicinal properties that are effective in

treating many common ailments. Finally, WEFs can be used for a wide variety of other end uses, including producing cosmetics, crafts, fiber, and fuel [7].

Over the last two decades, interest in improving knowledge and understanding of the importance of NTFPs for food, medicine, and other essential items has increased tremendously [1,10,11]. NTFPs are usually processed and then used and sold [12,13]. Processing plays an important role in adding value to NTFPs [14–17] by expanding opportunities for rural income [18,19], employment [19], the diversity of products offered [15], identifying appropriate storage techniques to reduce perishability [20], and providing opportunities in new markets [14,21]. Interest in commercialization and identifying new market opportunities for NTFPs has more recently been expressed by governments as a means to improve rural livelihoods in an environmentally sound way [22]. Interest in NTFPs is growing in both developing and industrialized countries for use as commodities as well as for specialized high-price products. In industrialized countries, demand for natural, traditional, or regional products or experiential services as a component of sustainable forestry is an important trend that provides new opportunities from NTFPs [23,24]. As markets develop, demand and consumption of these new products is expected to increase [25]. Market value and demand for NTFPs has grown considerably over the last two decades [26]. Specific market opportunities for WEFs may be seen both in their traditional value [24] as well as in the natural quality of specific ingredients which are often marketed as superfoods [27]. These wild edibles are often sold at a local level with only a few being sold within the larger regional market. Access to larger markets is often determined by the availability, supply, and demand of these products which influences the income available to rural communities [28]. Specific challenges for the marketing of WEFs include the seasonality of the harvest, annual variations in production, short shelf lives, and the need for quick processing [27]. Marketing approaches to increase income availability could include regional, organic, or other types of certification labels [27]. Given the high economic importance of the whole value chain, our study also includes the processing, trade, and marketing of NTFPs.

Any support measures for realising the potential of NTFPs should study the whole value chains as well as the governance and innovation systems to identify bottlenecks and purposeful support instruments [29]. Support measures range from the provision of information and technical support to networking and strengthening of institutional structures [30–32].

NTFPs are important to people's livelihoods across Iran as well. In Iran, NTFPs account for approximately 30% of household incomes (total household income in 2008 was IRR 69 million) for rural people living within the Zagros forests [33], almost 32% of income of the rural communities in Dehloran County in Ilam province, and 58% for rural communities located in Baneh County of the Kurdistan province in the Zagros forests of Iran [34]. Studies of other forest areas, such as the Hyrcanian and Arasbaran forests, (mean of household income from NTFPs was 250 USD in 2012) reveal similar proportions of 23% and 21%, respectively [35,36]. Other studies have consistently reported that NTFPs play a major role in supporting rural livelihoods in Iran [37–41]. Despite these findings, the importance of NTFPs is largely unknown because of a substantial lack of data [42–44]. This lack of information about NTFPs is an obstacle to rural development and the development of supportive policies which ultimately contributes to land use conversion away from forestry towards agriculture or industry [45]. As a result, limited awareness by policy-makers of the economic and environmental relevance of NTFPs may lead to institutional barriers and a lack of support for NTFP business development and innovation [4,24,46,47].

The Arasbaran forest region located in East Azerbaijan, with semi-humid forests, has been identified as a global biosphere reserve because of its tremendous plant diversity [48]. As such, it is a conservation and protected zone, and harvesting of wood products for commercial purposes is not allowed. However, local people are allowed to harvest NTFPs for consumption and sale, although information on the volumes or values of NTFPs harvested is generally unknown. Assessment of the economic importance of NTFPs is mostly incomplete, undocumented, and certainly underestimated. The lack of systematic

harvest data on NTFPs reduces awareness of their economic and social importance, which leaves them not being fully considered in rural development and forest and land-use-related plans and policies. This is especially important within the context of a developing bioeconomy in which forests are expected to play an important role [35,49,50].

Despite the socioecological importance of NTFPs in the Arasbaran forests, insufficient research has focused on NTFPs to truly capture their significant contributions to society. This study aims to address this shortfall. The main objective of this paper is to synthesize the body of knowledge of NTFPs within the Arasbaran forests of Iran. This paper investigates the major non-timber forest products collected, consumed, and traded in this region and the role that these products play in rural household economies. It shows that WEFs are the most important of those products.

2. Methods and Materials

2.1. Study Area

The Arasbaran biosphere reserve is situated in the north of Iran along the border with Armenia and Azerbaijan in the Caucasus Iranian Highlands. Arasbaran is a high mountainous region with an elevation ranging from 256 m to 2896 m above sea level. The Arasbaran vegetation is of particular importance among the vegetation of the country because of its uniqueness. Over 1000 plant species can be found in the reserve that survived the ice age and may be considered living fossils [51]. The reserve encompasses mountains, high alpine meadows, semi-arid steppes, rangelands and forests, and rivers and springs (Figure 1) [52]. The most important woody plants include oak (*Quercus petraea* and *Q. macranthera*), yew (*Taxus baccata*), pliant (*Viburnum lantana*), wig (*Cotinus coggyria*), juniper (*Juniperus foetidissima*), and cornelian cherry (*Cornus mas*). The mean annual temperature is 14 °C, and the annual rainfall within the region ranges from 300 to 500 mm [48].

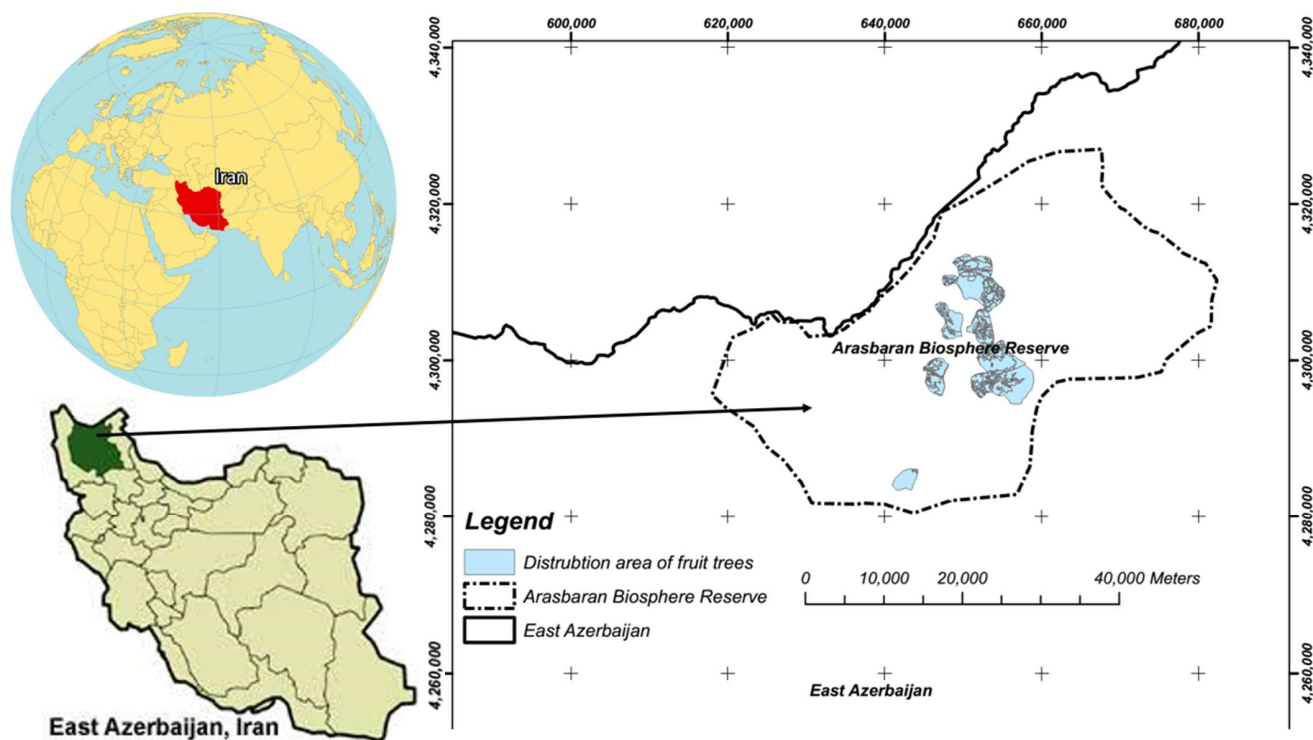


Figure 1. The location of the Arasbaran forests in the East Azerbaijan province, Iran.

2.2. Data Collection and Analysis

Primary and secondary data were used for this study. Primary data were collected through interviews and informal discussions, household surveys, and focus groups, while

secondary data were collected from the published literature. In total, we reviewed more than 800 articles published in international and national journals, books, and reports focused on Iranian forests. Articles were retrieved mainly from scientific databases, including Scopus, CAB Abstracts, the UN Food and Agriculture Organization (FAO), and Web of Science (WoS). We also used Internet search engines such as Google Scholar. Keywords included “non-wood forest products (NWFPs)”, “non-timber forest products (NTFPs)”, and “NWFPs collection”. Findings from secondary sources support the descriptions of the situation with NTFPs in Iran specifically focused on Arasbaran.

Based on the results of the secondary sources, we collected socioeconomic data during the field study on two aspects: NTFPs overall and sumac explicitly. There are 90 villages with a total of 3960 households living in the territory of the Arasbaran forests, with a total population of 14,322 inhabitants living in this area. The main economic activities consist of farming, gardening, honeybee production, and livestock production. Among these villages, we did rapid rural appraisals (RRA) to identify the villages and households involved in collecting NTFPs [53]. To examine the importance of all NTFPs within the Arasbaran region, we administered a survey to 96 households that identified as collecting NTFPs. The number of households surveyed was estimated following the Cochran’s formula [54], as reported in numerous studies (e.g., Cochran (2007) and Singh and Masuku (2013)). This technique allows one to draw inferences or generalize about the population from the sample data [55–57]. The sample size by the Cochran’s formula was estimated using a margin of error of 10 percent. Cochran’s sample size formula for categorical data for an alpha level a priori at 0.1 (error of 10%) with a community size of 3960 households was 93 households as the sample size, where n is the sample size, t is the value for the selected alpha level, e.g., 1.96 for (0.25 in each tail) a 95 percent confidence level. p is the estimated proportion of an attribute that is present in the population. q is $1-p$. $(p)(q)$ is the estimate of variance. d is the acceptable margin of error for the proportion being estimated or the confidence interval in decimals.

Respondents were asked about the role of NTFPs in the household economy, amounts collected, consumed, processed, and sold in order to allow for an estimate of the contribution of NTFPs to total household incomes. The contribution of NTFPs to total household income including sales and consumption (i.e., relative NTFP income) was assessed as the household dependency on NTFPs [5]. Other sources of household income included in the survey were animal husbandry, farming, beekeeping, and off-farm employment. Questions related to household income and cost of activities were included to allow us to estimate the contributions of other income sources for each activity during past production periods. To estimate income and cost, we asked questions about inputs (labour, fodder, fertilizer, and seed,) and outputs (harvest, raw and processed selling, and self-consumption amount of diverse products). Finally, we estimated the annual household incomes from different sources of livelihood. Based on total annual NTFPs collection by the household and the market price of each product, the income of each product was calculated and then summed to provide an estimated total income from NTFPs [58]. The market prices of different species were collected through interviews with 37 local collectors of NWFPs, which was a sub-sample of the household interviews, and through direct observation at local markets [44]. When market prices were not available, a cost-based methodology was used [59,60]. The fruit price was calculated by dividing daily wages given to the collectors with per capita quantum harvested per day [60]. IRR stands for Iranian Rials, which is the local currency in Iran. The exchange rate used during this analysis was IRR to USD = 1:42,000.

According to the literature [35,38,61], three forest fruit species including cornelian cherry, reddish blackberry, and sumac play a major role in the household economy and have a high potential for improving rural incomes. For this reason, we describe the collection and use of the three main forest fruits harvested in the Arasbaran region and the processing and trade of these products. Cornelian cherry and reddish blackberry were collected from forests as wild fruits. These fruits were processed and traded by local people.

Sumac was included in the study in Hurand County located in the eastern part of the Arasbaran region. Sumac is collected from natural populations and is also planted within their farmlands by local people under the Forests, Rangelands, and Watershed Organization (FRWO) supported agroforestry systems program. A rapid rural appraisal (RRA) showed that sumac plays a main role in the village economy. For this reason, we focused on sumac. The questionnaire was pretested on 18 randomly selected households, and the necessary adjustments were made before being used in the main data collection procedure. Then, the sample size by Cochran's formula was estimated by the margin of error of 10 percent. The household survey generated 63 samples from four villages (Rahimbayglu, Vurujan Sofla, Mollalu, and Tabestanagh) that collected sumac fruits. Information obtained from two focus groups from each village, involving four to five individuals, was used to triangulate, check, and confirm the data collected through the household interviews [62].

3. Results

The study results are described in four sections. Two sections focus on NTFPs including forest fruits and one section describes the processing industry and marketing aspects of these products. According to the literature, local people had a high dependency on three species collected in some parts of Arasbaran forests due to economic and medicinal values specifically. These species were sumac, cornelian cherry, and reddish black berry, and they will be described in terms of socioecological aspects.

3.1. Forest Fruits

Fruit forest products were the main products collected, consumed, and traded within the Arasbaran forest. Our findings identified the fruits from 14 woody species including trees and shrubs that were harvested (Table 1). Of these species, cornelian cherry, sumac, and reddish blackberry were the main harvested species in terms of their economic benefits for local households. Other NTFPs harvested include raspberry (*Rubus* sp.), dog rose (*Rosa canina*), pear (*Pyrus* sp.), hawthorn (*Crataegus* sp.), wild apple (*Malus orientalis*), pomegranate (*Punica granatum*), pistachio (*Pistacia mutica*), medlar (*Mespilus germanica*), barberry (*Berberis* sp.), and hazelnut (*Corylus avellana*) (Table 1). The cornelian cherry fruit was collected in the greatest quantity, with about 359 kg per household collected annually. Despite the high price of reddish blackberry, its collection was confined to 10% of households. Differentiation in density, efficiency of fruit production, the geographic distribution, and fruit price can be mentioned as the main factors for the difference in quantity collection between the fruits. The households derived the highest annual incomes from cornelian cherry followed by walnut, plum, and barberry, etc. The monetary value of different fruit-providing species ranged from \$0.94 USD to \$14,903 USD per year for all of the involved households in the fruit collection.

Table 1. Quantities and incomes from different fruit-providing species by households (HH) in Arasbaran forests, Iran.

Common Name	Species Name	HH Engaged in Harvesting (%)	HH Engaged in Sale (%)	Price (USD/Kg)	Kg/HH/Year (\pm SD)	USD/Total HH
Cornelian cherry	<i>Cornus mas</i>	41.7	21.3	0.83	359.3 (\pm 298)	14,903.02
Walnut	<i>Juglans regia</i>	33.3	7.5	1.25	236.9 (\pm 484)	11,823.21
Plum	<i>Prunus</i> spp.	57.5	3.2	0.47	56.8 (\pm 239)	1835.06
Barberry	<i>Berberis</i> sp.	15.8	0	2.91	8.5 (\pm 8)	467.72
Reddish blackberry	<i>Ribes biebersteinii</i>	10	3.6	8.9	4.1 (\pm 2.8)	440.76
Dog rose	<i>Rosa canina</i>	11.7	0	1.14	13.4 (\pm 7.5)	212.78
Pomegranate	<i>Punica granatum</i>	3.3	25	0.16	153.1 (\pm 232)	100.33
Pear	<i>Pyrus</i> sp.	19.2	4.2	0.3	11.9 (\pm 16)	81.14
Raspberry	<i>Rubus</i> sp.	5	0	0.91	12.2 (\pm 6)	66.73
Sumac	<i>Rhus coriaria</i>	0.8	0	1.17	50 (\pm 0)	58.49
Medlar	<i>Mespilus germanica</i>	5.8	0	0.44	8.6 (\pm 14)	26.53
Wild apple	<i>Malus orientalis</i>	4.2	0	0.8	5.6 (\pm 1)	22.32
Hawthorn	<i>Crataegus</i> sp.	0.8	0	0.63	1.5 (\pm 0)	0.94

According to our surveys, local households typically collected fruits between July and November. Plum was collected by 57% of households, while 42% of households collected cornelian cherry and 33% collected walnut. According to our surveys, the average share of forest-harvested fruit to household income in the region was 27%. Animal husbandry (30%), farming (20%), and beekeeping (23%) were the other main sources of household income.

3.1.1. Sumac (*Rhus coriaria*)

Sumac, a shrub species used in the agroforestry system of the study site, grows to 3–4 m in height. The main location of households engaged in sumac harvesting was in the Eastern part of Arasbaran forests, Hurand County, Iran (Figure 2). Almost all households interviewed were intensively involved in sumac harvesting. These households' samples were different from the category of households surveyed in food forest products in Section 3.1 (as explained in the methods section). The amount of sumac harvested annually ranged from 144 kg per household in Mollalu to 776 kg per household in Tabestanagh. Three villages, Rahimbayglu, Vurujan Sofla, and Tabestanagh, started planting sumac on sloping lands in 2001. In these three villages, people know well the importance of sumac in their household incomes. The village of Mollalu started planting sumac later (in 2006) because of a delay in the provision of extension services and governmental support. The contribution of sumac income to total household income is indicative of rural people's dependence on this product. The mean annual sumac income in the sample rural household income was 1822 USD (range = 550–2958 USD) (Table 2). In all villages, except Mollalu, sumac harvests contributed 30–40% of total household income. In Mollalu, where livestock is the most important income source, sumac contributed to only 10% of total income (Table 2).



Figure 2. Sumac trees and fruit harvesting by local people in Arasbaran forests.

Table 2. Mean of annual household incomes (USD) (AHI/yr) and share of different income sources in sumac collected area.

Village	Rahimbayglu		Vurujan Sofla		Mollalu		Tabestanagh	
	AHI/yr	Share (%)	AHI/yr	Share (%)	AHI/yr	Share (%)	AHI/yr	Share (%)
Farming	1000	18.8	1438	23.6	623	12	1470	19.8
Sumac collecting and sale	1952	36.6	1829	30	550	10.6	2958	39.8
Gardening	357	6.7	457	7.5	794	15.3	559	7.5
Animal husbandry	952	17.9	1664	27.3	1931	37.2	1140	15.3
Off-farm activities	1071	20.1	707	11.6	1292	24.9	1303	17.5
Total	5333	100	6095	100	5190	100	7431	100

3.1.2. Cornelian Cherry (*Cornus mas*)

The geographic distribution of cornelian cherry in Iran extends from northwest Azerbaijan (Arasbaran forest), Zanjan and Qazvin, to north Guilan [63]. Cornelian cherry is one of the main fruit-providing species in Arasbaran forests [61,63]. Alijanpour (2017) reported that the revenue derived from selling the fruit was between 3.6% to 7.3% of household income. Our survey results showed that about 42% of rural households harvest the fruit from the cornelian cherry. The average amount of cornelian cherry fruit harvested by local people was 359.2 kg per year (Table 1). Cornelian cherry is one of the most highly demanded fruits in local markets, and demand for this fruit is also gradually increasing in the national markets.

3.1.3. Reddish Blackberry (*Ribes biebersteinii*)

Reddish blackberry is native to Arasbaran forests, and people harvest its fruit between July and August (Figure 3). In traditional medicine, this fruit is used for curing blood pressure issues. While some households reported selling reddish blackberries fresh, none reported that they consume the fruit fresh. The mean annual household income in the Kalasur village derived from the sale of reddish blackberry was 142 USD. The total annual household income in Kalasur village was about 5714 USD in 2019. The share of reddish black berry in total annual household income was about 2.5%. One of the most important issues reported in harvesting forest products, especially fruit, is the cost of processing the fruit in order to increase their added value or shelf life. Fruits are cleaned and dried for consumption and sale by storing them in the shade before allowing them to be dried in the sun. After drying, the fruits typically lose about 80% of their weight. Our research found that the processed fruit of the reddish blackberry was about five times more valuable than the raw fruit. Dried fruits are usually consumed by making tea.



Figure 3. Fruit and leaves of the reddish blackberry (*Ribes biebersteinii*) in Arasbaran forests.

3.2. Processing and Trade of NTFPs

According to our results, most fruits were collected and processed locally. Most fruits, such as cornelian cherry, walnut, and hazelnut, were simply dried, preserved, shelled, and stored. Other processing activities were done for specific species; for example, sauce was made from pomegranate fruit, jam was made from fig and hawthorn fruit, fruit bars were made from cherry plum fruit, and cornelian cherries were sometimes pickled. Fruits of only two species, cornelian cherry and sumac, were processed by small scale industries in the Arasbaran region. The quantity of selling of NTFPs at the household level with and without processing was 4.2% and 15.1%, respectively.

Only a small number of local fruit species were sold to markets outside the local area (national or international markets). The market level of the products varied from local markets for raspberry, walnut, fig, and pomegranate, to national for cornelian cherry and

sumac, to international for sumac and dog rose. The most important international market for sumac and dog rose was the country of Azerbaijan.

Results showed that most of the fruit collected was processed and consumed locally. For some fruit species, investments in processing increased income by six-fold (Table 3). The largest increase was observed for three fruit species—cornelian cherry (6 times), plum (5.2 times), and reddish blackberry (4.2 times). In regards to processing efficiency, plum, cornelian cherry, and sumac exhibited the highest processing efficiency [35].

Table 3. Value addition of NTFPs processing and processing efficiency.

Common Name	Price before Processing (USD/Kg)	Price after Processing (USD/Kg)	Value Addition (Ratio after to before Processing)	Processing Efficiency
Plum	0.4	2.1	5.2	3.83
Cornelian cherry	0.72	4.3	6	3.6
Walnut	1.08	1.63	1.5	1.9
Barberry	2.5	4.03	1.6	2.38
Reddish blackberry	7.68	32.27	4.2	2
Raspberry	0.79	1.21	1.5	2.6
Sumac	1.01	1.41	1.4	3

The most recent law contained within the sixth five-year development plan for Iran (2016–2021) sets out the socioeconomic development direction of the country for 2016–2021 and focuses government investment on the processing activities needed to create job opportunities in rural areas. The government of Iran has approved this law, and it includes 20 investment strategies which is focused on forests and the environment. Investment in small-scale processing factories in the rural areas is another priority investment strategy in the five-year plan, and it provides an opportunity for rural people to obtain governmental support to develop these activities. In addition, food security is another priority of the five-year plan, and forest products (usually NTFPs) are being included as a main source of food security. Article 31 of the agriculture section of the five-year development plan aims to expand agroforestry systems and medicinal plants in low return areas as well as sloped lands and rangelands.

4. Discussion

4.1. Potential of Forest Fruits in Rural Household Economy

More than 100 trees and shrubs species with the potential of providing NTFPs have been documented in the Arasbaran region [48], but according to our findings, just a few species were harvested and traded by local people. Although policymakers and researchers mention these products as a main source of income to empower local people [35,64], few forest management plans have been focused on the sustainable management of these species. Sumac, which is supported by several government programs, is widely planted. Adding other NTFP species to the management plans would possibly result in more of these plants being used and could increase the NTFP contribution to rural household incomes.

Our research provides an estimate of the amount that NTFPs contribute to rural household incomes within the Arasbaran forests. The average share of NTFPs to total household incomes was about 27% in this region with 73% of household income being derived from other sources. This result is consistent with research that has been conducted in other regions of the country [39,54,65]. Keyvan Behjou and Ghanbari (2017) estimated that the share of hazelnut income to total household income was 20 percent (total household income was about 950 million IRR in 2014). Khosravi et al. (2017) estimated the dependency of local people on NTFPs between 10% and 21% among different income groups in the Zagros forests of Iran, suggesting that the household annual net income was approximately 189 million IRR in 2013 [39]. Other researchers have estimated this ratio to be as high as 30% [66] to 33% in the Zagros forests [54]. The mean annual income of a rural household in Arasbaran derived from the harvest and sale of reddish blackberry and sumac was about 142 USD (2.5% of total annual household income) and 1822 USD (10–40% of total annual

household income among different villages), respectively. Our estimate of income was for one species, while in the Zagros forests, income was obtained from several different wild fruits. Reddish blackberry can play an important role in rural household economies compared to other NTFPs and the share of income varied among villages. In some villages, the time frame for NTFP collection did not coincide with the period of farming activities, and this may have increased the share of NTFP income to total household income. In other areas, NTFP collection coincided with the period of farming activities and fodder harvesting in rangelands. In these cases we found that employment in other activities substantially reduced the importance of NTFPs in total household income. Similarly, the spread of small-scale commercial tea cultivation has led to a decline in the role of NTFPs in household income [67].

The dependency of local people on forest fruits has been mentioned for different parts of Iran [39,54,65]. Different wild fruits in Zagros forests (3.8% of total household income or about 230 million IRR in 2008) [37] have been used by local communities with different levels of dependency. Also, hazelnut is an important fruit product in a different region of Iran. For instance, it constitutes 20.3% of total household income (total household income was about 950 million IRR in 2014) in the Fandoglu forests of Ardabil province, Iran [68]. Hazelnut also grows naturally in Arasbaran forests and they are harvested as an income source [69]. Hazelnut is a potential species for cultivation in the farmlands within an agroforestry system and can be traded in national and international markets. Iran, with 23,535 hectares of hazelnut orchards, is the eighth-largest producer of hazelnuts in the world [49]. Moreover, one of the major producers of hazelnut is Guilan province in Iran. Guilan province in northern Iran, with more than 17,000 hectares of hazelnut orchards, produces about 20,000 tons of hazelnuts annually. As other researchers have noted, approximately 50,000 tons of hazelnuts, valued at USD 150 million, were produced and exported respectively, from the country of Azerbaijan in 2017. With about 200 hazelnut trees planted per hectare of orchard, a revenue of AZN 6000–7000 [USD 3000 to USD 3800] can be generated [70]. This potential in Iran and its neighbour countries can be considered in the planning for the increase of rural income.

WEFs represent a potential income source for locals in the Arasbaran forests; they already engage in harvesting activities to a substantial degree. In recent years, just a few species have been traded in the local and regional markets, although there is a high potential for them to be traded in the large national markets and to be exported into international markets. Lack of market information and market access limit the income sources from harvesting and processing of NTFPs for many rural communities.

The role of NTFPs in industrialised country economies has declined in the past, but they are generating renewed interest as business opportunities [24]. There is a marked growing demand across Europe for foods which are in some sense ‘authentic’—meaning they are ‘natural’, ‘healthy’, or ‘pure’. This is most often expressed as a demand for organic or local produce. Wild fruits are an important sector within these markets and have experienced sustained growth over the past decades [47]. Other researchers have also noted that the international trade of wild and cultivated forest products is increasing, both as a consequence of trade within Europe and as a consequence of increased imports from non-European countries, reflecting a general increase in global interest [27]. This growing international interest can provide a new marketing opportunity for the export of NTFPs to these countries. Other scholars have also found that access to market and new marketing opportunities influence the trading of NTFPs [6,60]. Due to the increasing prices paid for these products, the demand for the collection of NTFPs is likely to increase in the future. As a result, fruit-providing species may be prone to overexploitation in the future [5,71]. Increasing accessibility to forests by regulating some laws for these communities would be beneficial; however, regulating that increase is necessary in order to maintain sustainability. Although forest resource ownership in Iran is public, and all people have access to these resources, nevertheless, access priority is regulated within each village. Open access to these resources increases pressure on them as an increasing number of people look to gain

access to the resources [72]. Poor people have a high dependency on these products [22]. In this situation, increasing the supply area through forest enrichment (i.e., planting of these commercially and ecologically valued species) and increasing tree density through more intensive silvicultural practices would help to increase the forests' economic value and promote sustainable management, thereby helping to lift people out of poverty [5,47].

Expanding agroforestry systems by increasing the abundance and density of fruit-providing species may be a viable alternative approach to economic development. A strategy for improving the role of NTFPs in the household economy is planting native tree species in agroforestry systems [71]. Cornelian cherry, for instance, has been planted by villagers in the Kalaleh village. The fruit of cornelian cherry is collected by villagers, and its benefits are shared among all households. A similar situation has been mentioned for the anise tree (*Illicium griffithii*) in India [60]. To make progress through forest management activities, a change is required among perceptions and positions of villagers regarding the planting of other fruit-providing species in native forests. This shift among villagers' perceptions will require an understanding that additional fruit diversity through enrichment planting will supplement post-harvest-processing activities and subsequently enhance the creation of new market opportunities in order to increase value addition.

Based on our results, FRWO supports the strategy of expanding the sumac agroforestry system in the private and public lands, so it can be carried out in the low return farmlands and also rangelands for increasing the financial benefits by planting these species. In recent years, FRWO developed and implemented policies to support the planting of fruit-bearing species (e.g., sumac, walnut, and cornelian cherry) to promote conservation and rural development [73]. The policy of mixed cultivation, such as agroforestry, is followed by the ministry of Agriculture-Jihad in Iran, and it has been emphasized on national programs, such as five-years plans of economic, social, and cultural development of Iran. Article 31 of the agriculture section of the fifth plan aimed to expand agroforestry systems and medicinal plants in low return, sloped lands and rangelands. Tree density and diversity distinguish agroforestry systems and influence the economic performance at field scale. Planting density and diversity would help to ensure relatively high yields and sales of fruits and other products with relatively high shares of self-consumption [74,75].

4.2. Potential of Processing and Marketing

Value addition to NTFPs through semi-processing, drying, and grading can increase local people's income substantially [60,76]. The fruits of reddish blackberry and sumac were dried and sold in the market. In contrast, the fruits of cornelian cherry, pomegranate, and dog rose were sold fresh in the local and international markets at lower prices. Several other researchers have stated the importance of processing in value addition [62,76]. However, as noted by other scholars, processing activities are not always profitable. NTFP processing profitability is highly dependent on the relative levels of the different costs involved, labour, and use of specialized technology [76]. Most of the fruits and other plant parts studied in this project received limited processing. With regard to NTFP diversity, the motivation of local people can be increased by the installation of local processing facilities as small scale factories for NTFPs, especially for fruits [60]. Processing activities are reported to be profitable and recommended for species such as plum, cornelian cherry, and reddish blackberry. For other products, including walnut, barberry, sumac, and raspberry, it may be better to sell them without processing to maximize earnings. Generating income from the NTFPs trade alone does not necessarily lead to rural development, but the creation of small-scale processing industries and cooperatives, focusing on species of high abundance, and increasing market information and connections to markets would make a positive impact on poverty alleviation at the rural household level.

5. Conclusions

Developing a thorough understanding of the potential of the collection of wild forest fruits and agroforestry systems requires the awareness by decision-makers and the public

and support for landowners in terms of technical know-how and access to and choice of appropriate planting species and management.

We conclude that increasing the abundance and density of fruit-providing species is an important way to improve livelihoods and food security in rural areas. Also, based on our results, sumac agroforestry systems played an important role in supporting rural household economies. For this reason, creating and expanding agroforestry systems in these villages and other regions for sumac species and other fruit-providing species must be prioritized by the governmental-supporting programs. We suggest continued research to better consider and understand the effects of governmental policies on supporting local communities in expanding agroforestry systems and increasing the cultivation and processing of fruit-bearing species, such as sumac, walnut, and cornelian cherry.

Our study found a weak and underdeveloped local processing industry, suggesting that additional inputs to the post-harvest process could be economically beneficial. Therefore, providing funding to support the creation of small-scale processing factories in villages where there is a high potential for harvesting forest fruit products could improve rural household incomes. Another challenge identified in our research was related to the small markets currently available for selling these products. Developing access to new markets at the regional, national, and international levels could help to increase household income derived from NTFPs.

Better policy support is needed along the whole value chain, starting from the forest management plans to include the cultivation and harvest of forest fruit species. In addition, measures designed to support local processing facilities and the trade and marketing of these products beyond the local area would be highly effective in developing the potential of those forest fruits and other NTFPs. In addition to providing expanded technical and financial support, other measures that should be considered include regulatory revisions as well as the more effective provision of market information, technical training, and market awareness within rural communities.

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References

1. Babulo, B.; Muys, B.; Mathijs, E. Economic valuation methods of forest rehabilitation in exclosures. *J. Drylands* **2006**, *1*, 165–170.
2. Lovrić, M.; Da Re, R.; Vidale, E.; Prokofieva, I.; Wong, J.; Pettenella, D.; Verkerk, P.J.; Mavsar, R. Non-wood forest products in Europe—A quantitative overview. *For. Policy Econ.* **2020**, *116*, 102175. [[CrossRef](#)]
3. Kamanga, P.; Vedeld, P.; Sjaastad, E. Forest incomes and rural livelihoods in Chiradzulu District, Malawi. *Ecol. Econ.* **2009**, *68*, 613–624. [[CrossRef](#)]
4. Amici, A.; Beljan, K.; Coletta, A.; Corradini, G.; Constantin Danila, I.; Da Re, R.; Ludvig, A.; Marčeta, D.; Nedeljković, J.; Nichiforel, L.; et al. Economics, marketing and policies of NWFP. In *Non-Wood Forest Products in Europe. Ecology and Management of Mushrooms, Tree Products, Understory Plants and Animal Products*; BoD—Books on Demand GmbH: Hamburg, Germany, 2020.
5. Vacik, H.; Hale, M.; Spiecker, H.; Pettenella, D.; Tomé, M. *Non-Wood Forest Products in Europe—Ecology and Management of Mushrooms, Tree Products, Understory Plants and Animal Products: Outcomes of the COST Action FP1203 on European NWFPs*; Books on Demand: Norderstedt, Germany, 2020; pp. 125–202.

6. Heubach, K.; Wittig, R.; Nuppenau, E.-A.; Hahn, K. The economic importance of non-timber forest products (NTFPs) for livelihood maintenance of rural west African communities: A case study from northern Benin. *Ecol. Econ.* **2011**, *70*, 1991–2001. [[CrossRef](#)]
7. Paumgarten, F.; Shackleton, C. Wealth differentiation in household use and trade in non-timber forest products in South Africa. *Ecol. Econ.* **2009**, *68*, 2950–2959. [[CrossRef](#)]
8. Sardeshpande, M.; Shackleton, C. Wild edible fruits: A systematic review of an under-researched multifunctional NTFP (non-timber forest product). *Forests* **2019**, *10*, 467. [[CrossRef](#)]
9. Shackleton, C.M.; Pandey, A.K. Positioning non-timber forest products on the development agenda. *For. Policy Econ.* **2014**, *38*, 1–7. [[CrossRef](#)]
10. Ahmed, R.M.A. Contribution of Wild Edible Fruits to Rural Peoples Income. In *Wild Fruits: Composition, Nutritional Value and Products*; Springer: Berlin/Heidelberg, Germany, 2019; pp. 83–90.
11. Adepoju, A.A.; Salau, A.S. *Economic Valuation of Non-Timber Forest Products (NTFPs)*; Ladoké Akintola University of Technology & University of Ibadan; Munich Personal RePEc Archive: Munich, Germany, 2007; p. 18.
12. Andersen, J.; Nilsson, C.; de Richelieu, T.; Fridriksdottir, H.; Gobilick, J.; Mertz, O.; Gausset, Q. Local use of forest products in Kuyongon, Sabah, Malaysia. *ASEAN Rev. Biodivers. Environ. Conserv.* **2003**, *2*, 1–18.
13. Adeayo, A.; Oyin, M.; Kadeba, O. Access of rural women to forest resources and its impact on rural household welfare in North Central Nigeria. *For. Policy Econ.* **2010**, *12*, 439–450. [[CrossRef](#)]
14. Avatefi, H.M.; Shamekhi, T. Traditional knowledge and techniques of forest villagers people in utilization of some Non-wood forest products (Case study in Chitan village). *Q. J. Soc. Sci.* **2006**, *13*, 149–179.
15. Jensen, A. Valuation of non-timber forest products value chains. *For. Policy Econ.* **2009**, *11*, 34–41. [[CrossRef](#)]
16. Mayett, Y.; Martínez-Carrera, D.; Sinchez, M.; Macías, A.; Moraaf, S.; Estrada-Torres, A. Consumption trends of edible mushrooms in developing countries: The case of Mexico. *J. Int. Food Agribus. Mark.* **2006**, *18*, 151–176. [[CrossRef](#)]
17. Pettenella, D. Marketing perspectives and instruments for chestnut products and services. *For. Snow Landsc. Res.* **2001**, *76*, 511–517.
18. Saha, D.; Sundriyal, R. Utilization of non-timber forest products in humid tropics: Implications for management and livelihood. *For. Policy Econ.* **2012**, *14*, 28–40. [[CrossRef](#)]
19. Gram, S. Economic valuation of special forest products: An assessment of methodological shortcomings. *Ecol. Econ.* **2001**, *36*, 109–117. [[CrossRef](#)]
20. Kalu, C.; Rachael, E. Women in Processing and Marketing of Non-timber Forest Products: Case Study of Benin City, Nigeria. *J. Agron* **2006**, *5*, 326–331. [[CrossRef](#)]
21. Pettenella, D.; Secco, L.; Maso, D. NWFP&S marketing: Lessons learned and new development paths from case studies in some European countries. *Small-Scale For.* **2007**, *6*, 373–390.
22. Stoian, D. Making the best of two worlds: Rural and peri-urban livelihood options sustained by nontimber forest products from the Bolivian Amazon. *World Dev.* **2005**, *33*, 1473–1490. [[CrossRef](#)]
23. Belcher, B.; Ruíz-Pérez, M.; Achdiawan, R. Global patterns and trends in the use and management of commercial NTFPs: Implications for livelihoods and conservation. *World Dev.* **2005**, *33*, 1435–1452. [[CrossRef](#)]
24. Živojinović, I.; Weiss, G.; Wilding, M.; Wong, J.; Ludvig, A. Experiencing forest products—An innovation trend by rural entrepreneurs. *Land Use Policy* **2020**, *94*, 104506. [[CrossRef](#)]
25. Weiss, G.; Emery, M.R.; Corradini, G.; Živojinović, I. New values of non-wood forest products. *Forests* **2020**, *11*, 165. [[CrossRef](#)]
26. Alexander, S.; Oswald, S.N.; Emery, M.R.; Emery, M.R.; Emery, M.R. *Nontimber Forest Products in the United States: Montreal Process Indicators as Measures of Current Conditions and Sustainability*; US Department of Agriculture, Forest Service, Pacific Northwest Research Station: Corvallis, OR, USA, 2011.
27. Greene, S.M.; Hammett, A.; Kant, S. Non-timber forest products marketing systems and market players in Southwest Virginia: Crafts, medicinal and herbal, and specialty wood products. *J. Sustain. For.* **2000**, *11*, 19–39. [[CrossRef](#)]
28. Pettenella, D.; Corradini, G.; Da Re, R.; Lovric, M.; Vidale, E. NWFPs in Europe—consumption, markets and marketing tools. In *Non-Wood Forest Products in Europe: Seeing the Forest around the Trees*; European Forest Institute: Joensuu, Finland, 2019; pp. 31–53.
29. Sundriyal, M.; Sundriyal, R. Wild edible plants of the Sikkim Himalaya: Marketing, value addition and implications for management. *Econ. Bot.* **2004**, *58*, 300–315. [[CrossRef](#)]
30. Weiss, G.; Hansen, E.; Ludvig, A.; Nybakk, E.; Toppinen, A. Innovation governance in the forest sector: Reviewing concepts, trends and gaps. *For. Policy Econ.* **2021**, *130*, 102506. [[CrossRef](#)]
31. Weiss, G.; Ludvig, A.; Zivojinovic, I.; Asamer-Handler, M.; Huber, P. Non-timber innovations: How to innovate in side-activities of forestry—Case study Styria, Austria. *Austrian J. For. Sci.* **2017**, *1*, 231–235.
32. Ludvig, A.; Corradini, G.; Asamer-Handler, M.; Pettenella, D.; Verdejo, V.; Martínez, S.; Weiss, G. The practice of innovation: The role of institutions in support of Non-Wood Forest Products. *BioProducts Bus.* **2016**, *1*, 73–84.
33. Živojinović, I.; Nedeljković, J.; Stojanovski, V.; Japelj, A.; Nonić, D.; Weiss, G.; Ludvig, A. Non-timber forest products in transition economies: Innovation cases in selected SEE countries. *For. Policy Econ.* **2017**, *81*, 18–29. [[CrossRef](#)]
34. Soltani, A.; Shamekhi, T.; Noori, N.M.; Arabmazar, A. Effects of forest resources on income distribution and poverty (Case study: Watershed of Tang Tamoradi). *J. For. Wood Prod. (JFWP) Iran. J. Nat. Resour.* **2011**, *63*, 369–385.

35. Ahmadi lashkarani, L. An introduction on the most economic non-wood products of Zagros forests in North of Iran: A case study of Armardeh forest of Baneh County. Master's Thesis, Faculty of Natural Resources, The University of Kurdistan, Sannadaj, Iran, 2011; p. 84.
36. Ghanbari, S.; Heshmatol Vaezin, S.M.; Shamekhi, T.; Eastin, I.L.; Lovrić, N.; Aghai, M.M. The economic and biological benefits of non-wood forest products to local communities in Iran. *Econ. Bot.* **2020**, *74*, 59–73. [[CrossRef](#)]
37. Moayeri, M.; Barani, H.; Shahraki, M.; Behmanesh, B. Investigating the type and amount of utilization of forest resources by rural people in marginal villages (case study: Hezarjerib region-Mazindaran province). *Iran. J. For.* **2013**, *5*, 151–160.
38. Mahdavi, A.; Sobhani, H.; Shamekhi, T. Investigation on Non-wood forest products and the utilization methods in kamyaran forests. *Iran. J. For. Poplar Res.* **2009**, *16*, 507–520.
39. Ghanbari, S.; Heshmatol Vaezin, S.M.; Shamekhi, T.; Eastin, I.L. Market expansion's influence on the harvesting of non-wood forest products in the Arasbaran forests of Iran. *For. Chron.* **2014**, *90*, 599–604. [[CrossRef](#)]
40. Khosravi, S.; Maleknia, R.; Khedrizeh, M. Understanding the contribution of non-timber forest products to the livelihoods of forest dwellers in the northern Zagros in Iran. *Small-Scale For.* **2017**, *16*, 235–248. [[CrossRef](#)]
41. Keyvan Behju, F.; Ghanbari, S.; Moradi, G. Evaluation of the production and collection of cherry plum (*Prunus divaricata* Ledeb.) fruit and its role on forest dwellers income (case study: Rudsar, Gilan province). *Iran. J. For. Poplar Res.* **2017**, *25*, 528–539.
42. Ghanbari, S.; Vaezin, S.M.H.; Zobeiri, M.; Shamekhi, T.; Elahiyan, M.R. Financial evaluation of non-wood forest products in Arasbaran Forests: A case study on Cornelian Cherry (*Cornus mas*) fruit in the forests of Kalaleh Village, Kalibar. In Proceedings of the II. International Non-Wood Forest Products Symposium, Isparta, Turkey, 8–10 September 2011.
43. Viet Quang, D.; Nam Anh, T. Commercial collection of NTFPs and households living in or near the forests: Case study in Que, Con Cuong and Ma, Tuong Duong, Nghe An, Vietnam. *Ecol. Econ.* **2006**, *60*, 65–74. [[CrossRef](#)]
44. Cai, M.; Pettenella, D.; Vidale, E. Income generation from wild mushrooms in marginal rural areas. *For. Policy Econ.* **2011**, *13*, 221–226. [[CrossRef](#)]
45. Saeed, A. *Fundamentals of Practical Economics in Forest Management*; University of Tehran: Tehran, Iran, 1992; p. 341.
46. Buttoud, G.; Kouplevatskaya-Buttoud, I.; Slee, B.; Weiss, G. Barriers to institutional learning and innovations in the forest sector in Europe: Markets, policies and stakeholders. *For. Policy Econ.* **2011**, *13*, 124–131. [[CrossRef](#)]
47. Wolfslehner, B.; Prokofieva, I.; Mavsar, R. *Non-Wood Forest Products in Europe: Seeing the Forest around the Trees. What Science Can Tell Us 10*; European Forest Institute: Joensuu, Finland, 2019; Volume 10.
48. Sagheb-Talebi, K.; Pourhashemi, M.; Sajedi, T. *Forests of Iran: A Treasure from the Past, a Hope for the Future*; Springer: Berlin/Heidelberg, Germany, 2014.
49. Koukios, E.; Monteleone, M.; Carrondo, M.J.T.; Charalambous, A.; Giro, F.; Hernández, E.L.; Mannelli, S.; Parajó, J.C.; Polycarpou, P.; Zabaniotou, A. Targeting sustainable bioeconomy: A new development strategy for Southern European countries. *The Manifesto of the European Mezzogiorno. J. Clean. Prod.* **2018**, *172*, 3931–3941. [[CrossRef](#)]
50. Prokofieva, I.; Lovric, M.; Pettenella, D.; Weiß, G.; Wolfslehner, B.; Wong, J. What is the potential contribution of non-wood forest products to the European forest-based bioeconomy? In *Towards a Sustainable European Forest-Based Bioeconomy*; European Forest Institute: Joensuu, Finland, 2017; Volume 132.
51. UNESCO. Arasbaran Biosphere Reserve, Islamic Republic of Iran. 2021. Available online: <https://en.unesco.org/biosphere/aspac/arasbaran> (accessed on 11 December 2021).
52. FAO. *Global Forest Resources Assessment, Country Report Iran*; FAO: Rome, Italy, 2010; p. 42.
53. Ghanbari, S. Values, socio-economic potentials and limits of Non-Wood Forest Products (NWFPs) of woody species in Arasbaran forests, Iran. Ph.D. Thesis, Faculty of Natural Resources, University of Tehran, Karaj, Iran, 2015; p. 320.
54. Soltani, A.; Angelsen, A.; Eid, T.; Naieni, M.S.N.; Shamekhi, T. Poverty, sustainability, and household livelihood strategies in Zagros, Iran. *Ecol. Econ.* **2012**, *79*, 60–70. [[CrossRef](#)]
55. Guwahat, S. Chapter 2 Determination of appropriate Sample Size. *Bull. Gauhati Univ. Math. Assoc. Int. J. Appl. Math. Stat. Sci.* **2013**, *12*, 28.
56. Cochran, W.G. *Sampling Techniques*; John Wiley & Sons: Hoboken, NJ, USA, 2007.
57. Singh, A.S.; Masuku, M.B. Fundamentals of applied research and sampling techniques. *Int. J. Med. Appl. Sci.* **2013**, *2*, 124–132.
58. Schaafsma, M.; Morse-Jones, S.; Posen, P.; Swetnam, R.; Balmford, A.; Bateman, I.; Burgess, N.D.; Chamshama, S.; Fisher, B.; Freeman, T. The importance of local forest benefits: Economic valuation of Non-Timber Forest Products in the Eastern Arc Mountains in Tanzania. *Glob. Environ. Change* **2014**, *24*, 295–305. [[CrossRef](#)]
59. Croitoru, L. Valuing the non-timber forest products in the Mediterranean region. *Ecol. Econ.* **2007**, *63*, 768–775. [[CrossRef](#)]
60. Ghanbari, S.; Heshmatol Vaezin, S.M.; Shamekhi, T. Identification and economic prioritization of non-wood forest products of Arasbaran forests based on traditional harvest statistics (Case Study: Ilganachay Watershed). *Iran. J. For.* **2017**, *9*, 411–425.
61. Ghanbari, S.; Aghai, M. The way towards getting back financial benefits from agroforestry systems and improving food security (the case of Arasbaran Biosphere reserve). *Ecopersia* **2020**, *9*, 33–41.
62. Alijanpour, A. Cornelian cherry (*Cornus mas* L.) fruit as a non-timber forest product of Arasbaran biosphere reserve forests in Northwest of Iran. *For. Stud.* **2017**, *67*, 72–85. [[CrossRef](#)]
63. The Iranian Consultative Assembly. The Law of the Sixth Five-Year Economic, Social, and Cultural Development Plan of Islamic Republic of Iran. In: 946. Edited by Assembly IC, vol. 104/105986. Tehran Rozname Rasmi Keshvar (Official Newspaper of Country). Available online: <https://policy.asiapacificenergy.org/node/3671> (accessed on 30 June 2015).

64. Henareh Khalyani, J.; Namiranian, M.; Vaezin, S.H.; Fegghi, J. Development and evaluation of local communities incentive programs for improving the traditional forest management: A case study of Northern Zagros forests, Iran. *J. For. Res.* **2014**, *25*, 205–210. [[CrossRef](#)]
65. Salehi, A.; Karlton, L.C.; Söderberg, U.; Erikson, L.O. Livelihood dependency on woodland resources in southern Zagros, Iran. *Casp. J. Environ. Sci.* **2010**, *8*, 181–194.
66. Fu, Y.; Chen, J.; Guo, H.; Chen, A.; Cui, J.; Hu, H. The role of non-timber forest products during agroecosystem shift in Xishuangbanna, southwestern China. *For. Policy Econ.* **2009**, *11*, 18–25. [[CrossRef](#)]
67. Keyvan Behju, F.; Ghanbari, S. Economic valuation of non wood forest products of Ardebil Fanduglu Forest (hazelnut fruit production) and its role in household economics. *Ecol. Iran. For.* **2017**, *5*, 56–62. [[CrossRef](#)]
68. Ghanbari, S.; Vaezin, S.M.H.; Shamekhi, T.; Zobeiri, M. Identification and Financial Valuation of Main Woody Species in Arasbaran Forests, Iran. In Proceedings of the III. International Non-Wood Forest Products Symposium, Kahramanmarssh, Turkey, 9 July 2014.
69. Guliyev, O.; Liu, A.; Endelani Mwalupaso, G.; Niemi, J. The determinants of technical efficiency of hazelnut production in Azerbaijan: An analysis of the role of NGOs. *Sustainability* **2019**, *11*, 4332. [[CrossRef](#)]
70. Mahapatra, A.K.; Tewari, D.D. Importance of non-timber forest products in the economic valuation of dry deciduous forests of India. *For. Policy Econ.* **2005**, *7*, 455–467. [[CrossRef](#)]
71. Sunderlin, W.D.; Angelsen, A.; Belcher, B.; Burgers, P.; Nasi, R.; Santoso, L.; Wunder, S. Livelihoods, forests, and conservation in developing countries: An overview. *World Dev.* **2005**, *33*, 1383–1402. [[CrossRef](#)]
72. FRWO. *National Program of Forest Conservation*; FRWO: Teheran, Iran, 2008; p. 87.
73. Notaro, M.; Gary, C.; Deheuvels, O. Plant diversity and density in cocoa-based agroforestry systems: How farmers' income is affected in the Dominican Republic. *Agrofor. Syst.* **2020**, *94*, 1071–1084. [[CrossRef](#)]
74. Salazar-Díaz, R.; Tixier, P. Effect of plant diversity on income generated by agroforestry systems in Talamanca, Costa Rica. *Agrofor. Syst.* **2019**, *93*, 571–580. [[CrossRef](#)]
75. Avocèvou-Ayisso, C.; Sinsin, B.; Adégbidi, A.; Dossou, G.; van Damme, P. Sustainable use of non-timber forest products: Impact of fruit harvesting on *Pentadesma butyracea* regeneration and financial analysis of its products trade in Benin. *For. Ecol. Manag.* **2009**, *257*, 1930–1938. [[CrossRef](#)]
76. Coulibaly-Lingani, P.; Tigabu, M.; Savadogo, P.; Oden, P.-C.; Ouadba, J.-M. Determinants of access to forest products in southern Burkina Faso. *For. Policy Econ.* **2009**, *11*, 516–524. [[CrossRef](#)]