

Economic Valuation of Honey Production and Medicinal Plants (Case Study: Taleqan County)

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Abstract

Conservation of natural resources and the environment is a concern for human. Given the strong relationship between human and nature and the importance of this concern, one of the best methods for protecting the natural ecosystem of any region is empowering the local community to safeguard their areas. When this protection also brings economic benefits to the people, they are more likely to take responsibility for preserving their region. Therefore, creating nature-based businesses designed according to the capacity and capabilities of each natural ecosystem is a suitable solution for achieving sustainable development. This research, conducted in the field, examines and evaluates the economic value of the rangelands in the Taleqan county in terms of products derived from beekeeping activities and the harvesting of medicinal plants. The results indicate that the rangelands of Taleqan have a suitable economic value for beekeeping and the collection of medicinal plants, and they possess good potential for investment and the development of nature-based business plans.

Keywords: "Taleqan county, Nature based business, Beekeeping, Medicinal plants, Economic valuation"

Introduction

Today sustainable development, which involves the conservation of natural resources, the environment and our future also benefits, is of great interest. This type of development is

neither meaningful nor possible without the environment and its conservation [1]. Considering that human society is a part of the biosphere and the environment, and also that it has a significant dependence on natural resources and the changes in the environment to achieve social development, one of the important dimensions of sustainable development on a global scale is the impact of human activities on the natural environment [2]. According to the Secretary-General of UNESCO: "The environment encompasses everything or almost everything. It includes both humans and nature, and their relationships which influence each other [1]. Accordingly, the resilience of the ecological system and its potential to support human life are fundamental issues for the global community and humanity [3]. Separating ecological and social systems as two distinct subjects is not feasible [4]. Therefore, by protecting the environment, sustainable development provides better and more beneficial outcomes from the functioning of both natural and artificial environments. Given the deep connection and bond between humans and nature, human society is heavily dependent on the capacity and capability of the surrounding ecosystem to utilize the goods and services of the environment for development [4]. In recent decades, ecosystem services, which connect ecology and human well-being, have been extensively studied [5]. Ecosystem services are the benefits derived from the ecosystem for human society [6]. These services are the result of interactions between social-ecological systems and the central mediating system between social and ecological systems. Although some ecosystem services can be partially valued economically, a wide range of these services cannot be quantified economically. Nevertheless, the importance of these services remains valuable in their own right [7]. Pricing or valuing ecosystem services is an important step in correcting economic decisions that regard the natural environment as a free commodity and lead to its excessive and unsustainable use [8]. For this reason, the confrontation between the economy and the environment in past decades has given way to interaction between these two fields. Considering the mentioned points, it is necessary to incorporate the value of natural assets into the feasibility studies of

development projects, and these assets should not be regarded as free. Estimating the economic value of ecosystem services is essential, even if it involves approximation. Valuation is not the goal; rather, it is a means to protect the environment. The development and acceptance of valuation require capacity building. Engaging in the assessment of ecosystem values in the long term will lead to sustainable development [9]. The rangeland ecosystem is considered one of the most important renewable natural resources of any country. Given the ongoing degradation and reduction of rangeland areas in the country, there has been increased attention in recent years to utilizing human and social capital through participatory management involving local community stakeholders in the protection and restoration of natural resources in many developing countries. This approach aims not only to prevent further degradation but also to contribute to the sustainability of the ecological conditions in the region and the livelihoods of the beneficiary families [10]. Sustainable development is achieved through the protection of the environment; therefore, in any ecosystem where people's livelihoods are intertwined with the natural environment, sustainable development becomes significant. Thus, the connection between sustainable development and the preservation of ecosystems, the economy, and the livelihoods of rural residents is very strong. Achieving sustainable development in rural areas is possible through the establishment of sustainable businesses and, in fact, the creation of sustainable income for rural residents. This is because rural residents can utilize natural resources such as rangelands and ecosystem services to enhance security and improve rural livelihoods and agricultural products in local ecosystems [11]. In this regard, the economic assessment of the functions and resources harvested from the rangeland ecosystem is a useful method for optimal resource management at the local level [12]. Once the existing potentials in a natural ecosystem such as rangeland are identified, it is necessary to conduct an economic evaluation to allocate funds for the services provided by that ecosystem, in order to inform policy-making aimed at planning for the establishment of a sustainable business [13]. Considering that the grasslands of Iran cover an area of

approximately 86 million hectares, which constitutes over 53 percent of the country's land area [14], it seems there is significant potential for utilizing the services of rangeland ecosystems and creating businesses for those who benefit from these ecosystems. Therefore, this research focuses on two products of Iran's rangeland ecosystem, namely honey bees and medicinal plants, for examination and economic valuation. According to studies, highland rangelands and mountainous regions with a temperate climate and abundant vegetation are suitable for honey bees and the cultivation of medicinal plants. In contrast, lowland areas lacking sufficient vegetation or experiencing hot and dry winds in the summer are not particularly suitable for cultivating these products. Consequently, Taleqan County, which possesses the necessary conditions for the development of these two products, has been chosen for the examination and economic valuation of this research [15].

Material and methods

The Taleqan County, part of Alborz Province with an area of 1,124 square kilometers and centered in Taleqan, consists of two districts, four rural districts, one city (Taleqan), and 83 inhabited villages [16]. The easternmost point of Taleqan is located at 36 degrees, 5 minutes, and 20 seconds north latitude and 51 degrees, 11 minutes, and 22 seconds east longitude, while the westernmost point is at 36 degrees, 21 minutes, and 30 seconds north latitude and 50 degrees, 20 minutes, and 54 seconds east longitude [17]. This county is located in a semi-mountainous region, and its climatic conditions are primarily influenced by the meteorological regime of the southern Alborz, considering the topographical features of the area. Only in the heights of the northern ridges is it affected by the Caspian climatic regime. According to the climatic classification method of Amberger, the Taleqan basin is entirely categorized within the highland climate, and in the Gausen classification system, the entire Taleqan watershed falls under the territory of a cold steppe climate [18]. The precipitation distribution in various locations ranges from 250 to 1000 milliliters [19]. The main economic and social activities in the study area include retail, gardening, agriculture, animal husbandry, and service activities such as transportation, repair workshops, and similar

enterprises, as well as industrial activities. Taleqan County, with 85,181 hectares of rangelands (77.38% of the total county), hosts

510 rangeland species across 72 families [18]. “Figure 1” shows the location of the studied area within the province and country.

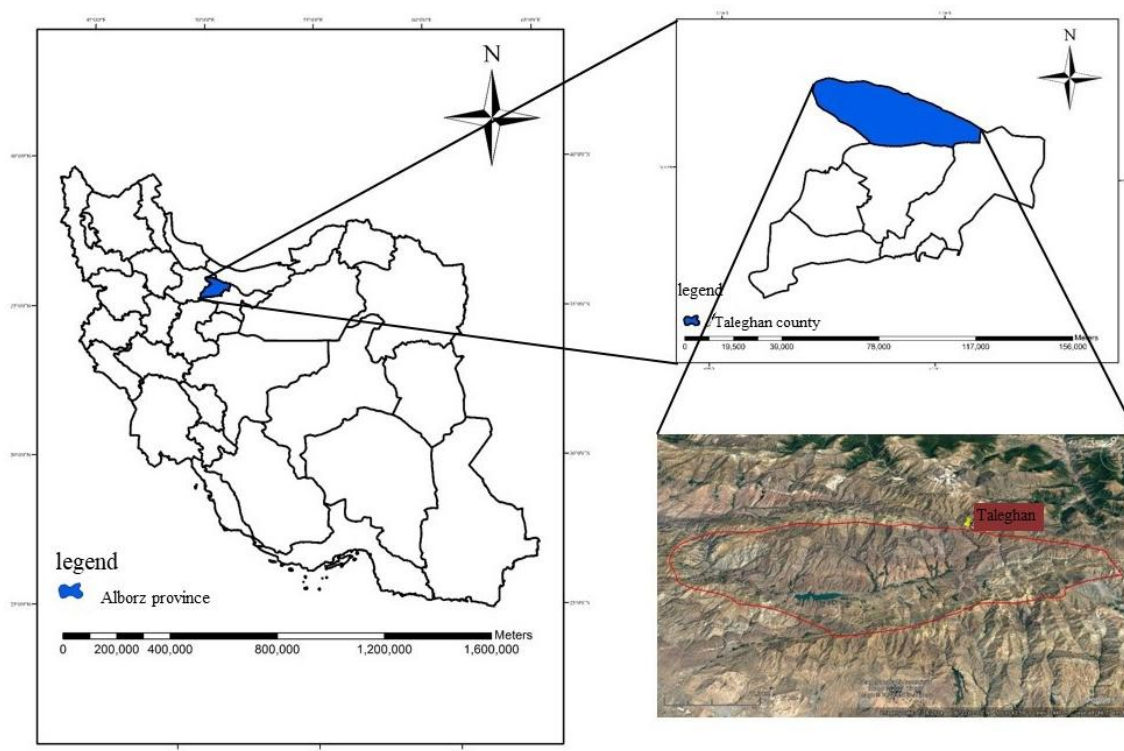


Figure 1: Location of the study area in the province and country

Considering the ecological conditions of the area, which is a mountainous and pastoral ecosystem, this region has local advantages including the harvesting of medicinal plants, beekeeping, and honey production. Due to the rich rangelands cover and suitable climatic conditions for beekeeping and the growth of medicinal plants, the Taleqan region was selected for this research. Since medicinal plants grow in the spring (generally from late May to early July) and the temperature in Taleqan is favorable for beekeeping in the summer (from late June to early September), this study was conducted from early June to mid-August 2023. Given that Taleqan is extensive, comprising two districts, four sub-districts, one city (Taleqan), and 83 inhabited villages, along with a very rich rangelands cover with a large area (85,181 hectares – 38.77% of the total county), the study was

conducted conveniently with beneficiaries; beekeepers and harvesters of medicinal plants residing in various areas of the whole Taleqan county were randomly selected to complete the interview questionnaire. Interviews were conducted and questionnaires were completed with 30 resident or migratory beekeepers and 30 harvesters of medicinal plants from the rangelands in different parts of Taleqan county. Considering that the respondents to the medicinal plant questionnaire harvested various types of plants, Excel software was utilized to determine the five dominant medicinal plant types that are harvestable in the region, and calculations regarding the valuation of the region's rangelands concerning these plants were also performed using the same software. For the valuation of products resulting from beekeeping in the area, calculations were

carried out after entering the necessary quantitative data into Excel.

Results

After completing the questionnaires, the necessary data were entered into Excel, and tables were created regarding the yield and

price of each product. “Table 1” pertains to the production and sales of honey by each beekeeper in the Taleqan County, while “Table 2” relates to the quantity harvested and selling price of five dominant plant species harvested in Taleqan County: thyme, mint, wild tea, chicory, and mint by each harvester.

Table1: The amount of honey production and sales by each beekeeper in Taleqan county.

Beekeeper	Number of hives	Average Honey Production per Hive per Year (Kg)	Selling price per Kg of honey(\$)
1	55	5.45	9866.4
2	40	5	6427.4
3	100	7	6394.0
4	150	15	5217.0
5	100	17.5	7512.5
6	100	7.5	9682.8
7	60	7.08	8347.2
8	100	11	5008.3
9	270	7.4	7729.5
10	600	3	8764.6
11	180	5.5	8597.7
12	200	12	8347.2
13	100	4	8764.6
14	120	5	8764.6
15	400	6	6343.9
16	650	6.5	7095.2
17	980	7.5	10567.6
18	200	10	9182.0
19	45	5	8347.2
20	400	4	7512.5
21	47	6.38	10016.7
22	450	5	8347.2
23	25	4.5	6677.8
24	170	7.6	8347.2
25	300	15	7512.5
26	100	5	8347.2
27	650	4	8347.2
28	100	5	8347.2
29	100	7	8347.2
30	78	7	8347.2

Table 2: Data related to the harvest rate and selling price of 5 top medicinal plant species in Taleqan county.

Plant user		Harvest rate (Kg per year)	Harvest rate (Kg per year)
<i>Thymus Vulgaris</i>	1	6	120
	2	10	250
	3	15	250
	4	5	260
	5	200	150
	6	4	100
	7	3	100
	8	2000	100
	9	10	100
	10	150	75
<i>Mentha pulegium</i>	1	3	125
	2	50	275
	3	150	75
	4	30	160
	5	300	150
	6	40	150
	7	5	100
	8	10	120
<i>Stachys lavandulifolia</i>	1	10	100
	2	2	120
	3	150	75
	4	300	90
	5	3	200
	6	20	120
	7	4	150
<i>Cichorium intybus L</i>	1	150	75
	2	50	65
	3	1	60
	4	400	50
	5	80	70
	6	2	55
	7	15	60
<i>Mentha</i>	1	150	75
	2	3	80
	3	20	150
	4	50	200
	5	3	160
	6	25	120

Results Discussion

A study titled "Determining the Economic Value and Exploitation of Medicinal Plants in the Freezy Pastures of Khorasan Razavi" mentioned that, in general, ecologically-based utilization of medicinal plants can play a significant role in enhancing livelihoods, increasing welfare, empowering pasture users, preserving pasture ecosystems, and improving ecosystem services associated with them. This issue should be considered in policy-making regarding medicinal plants and in multifunctional pasture management plans [21]. Additionally, a study entitled "Economic Valuation of Medicinal and Forage Functions in the Plant Types of Jalmbadan Rangelands, Jun County" stated that the exploitation of medicinal plants is a high-value economic activity and a good source of income for pasture users and exploiters. Besides forage harvesting as a source of income for pasture users, the collection of medicinal plants and their processing can be utilized for maximizing pasture use and minimizing damage to them [22]. Furthermore, through a study titled "Economic Valuation of Some Ecosystem Services in the Malashore and Gorgu Pastures of Boyerahmad County," it was concluded that the area's pastures have an average honey production value of 131,800 rials per hectare per year, with forage production accounting for the highest percentage of total economic value [23]. Therefore, considering the diverse results of research conducted in this area and the geographical position of Taleqan County, this study addressed the economic valuation of honey and medicinal plants in this county.

Valuation of Honey Production Function from Beekeeping Activities in the Rangelands of Taleqan County

The valuation of rangelands in the beekeeping business can be examined from two viewpoints: the first perspective is the value of rangelands

in pollination, in which honeybees play a role, and the second perspective concerns honey production, from which beekeepers benefit by establishing hives in rangelands and feeding bees from rangelands plants. One of the most important characteristics of beekeeping activities is the creation of jobs with low capital investment. Thus, an individual can establish a suitable source of income through this activity with minimal investment [24]. This study examines the value of rangelands in honey production in the year 2023. Field studies indicate that some species of honeybees, which feed on rangelands, can venture at least several hundred meters [25] and even kilometers (2.2 kilometers) away from their nests [26]. Approximately 25 percent of observations recorded the distance of bees from the hive to be between 1500 and 1750 meters [27]. Therefore, considering that Taleqan County has 85,181 hectares, equivalent to 38.77 percent of rangelands coverage [18], it is an appropriate area for beekeeping activities. The average foraging radius of each bee is approximately 1.75 kilometers. According to the formula for calculating the area of a circle ($A = \pi r^2$), a rangelands area of approximately 61.9 square kilometers can be suitable for feeding the bees of each apiary.

Considering that the current research involved questioning 30 beekeepers, all of whom were engaged in honey production, the overall honey production performance has been examined over an area of approximately 48.288 square kilometers, equivalent to 28,848 hectares of rangelands land. The area studied represents about 33.8 percent of the total rangelands land area in the Taleqan County. Based on the information in Table 3, the economic value of the rangelands in Taleqan can be calculated in terms of honey production.

Table 3: Information on honey production and sale prices in the rangelands of Taleqan County by 30 beekeepers in the year 2023

Name of Region (County)	Number of Hives	Honey Production (Kg)	Average Honey Production per Hive per Year (Kg)	Average Selling Price per Kilogram of Honey (\$)
Taleqan county	6870	46762.91	6.81	81510.1

Based on “Table 3”, the economic value of 28,848 hectares of rangelands in the Taleqan county can be calculated for honey production using the following method:

$$\text{Economic Value (\$)} = \text{Number of Hives} * \text{Average Honey Production (Kg) per Hive per Year} * \text{Average Selling Price of Honey (\$) per kg}$$

According to calculations based on the above formula and the information in “Table 3”, the economic value of honey production from 33.8% of the rangelands in Taleqan County in the year 2023 is equivalent to 3813427535.8 \$. In other words, the total economic value of honey production from all rangelands in Taleqan county for this year amounts to 495422563.7 \$. Based on conducted interviews, among the plants that provide nourishment for bees in the rangelands of this county, one can mention thyme, astragalus, sage, wild sugar cane, thistle, various types of wild legumes, wild mint, borage, wild peppermint, wild lavender, savory, and rosemary. On average, 49.6% of the products derived from beekeeping are sold within Taleqan county itself.

Valuation of the medicinal plant production function in the rangelands of Taleqan county

In this study, in order to estimate the production value of medicinal plants in the rangelands of Taleqan county, based on 30 interviews

conducted with medicinal plant harvesters, the market price and the quantity harvested of each of these plants in the year 2024 were used to estimate the production value of medicinal plants at the rangelands level. Considering that the main medicinal plants harvested and sold in these villages include five species (Thymus Vulgaris, Mentha pulegium, Stachys lavandulifolia, Mentha & Cichorium intybus L), the value of the rangelands in the county in terms of medicinal plants was estimated based on these five plants. According to the interviews conducted with the medicinal plant harvesters, there are other medicinal plants with various types present in the rangelands of Taleqan county; however, since this research focuses on examining these five predominant species, their economic value has been disregarded in the calculations. Based on the results in “Table 4”, the value of the harvested medicinal plants in the entire Taleqan county was calculated to be 429135050215.3 \$, which means that, on average, each hectare of rangelands from which medicinal plants were harvested generated a value of 6956556.3 \$. Based on the conducted interviews, the mentioned medicinal plants are harvested manually and traditionally, and often the harvesters, finding that selling fresh plants is not profitable for them, create added value by either drying, packaging, and selling these plants or by producing by-products such as herbal essences and herbal teas (whether solo or combined with other plants) and selling them.

Table 4: Current Status of Medicinal Plant Harvesting in the Rangelands of Taleqan County(HA - Kg - \$)-Year 2024

Plant Name	<i>Thymus Vulgaris</i>			<i>Mentha pulegium</i>			<i>Stachys lavandulifolia</i>		
Region Name	Average Harvest Amount (Kg)	Average Selling Price (per Kg/\$)	Average Harvest Area (HA)	Average Harvest Amount (Kg)	Average Selling Price (per Kg/\$)	Average Harvest Area (HA)	Average Harvest Amount (Kg)	Average Selling Price (per Kg/\$)	Average Harvest Area (HA)
Taleqan County	240.3	25125.2	85181	73.5	24102.6	85181	69.85	20390.9	85181

Plant Name	<i>Cichorium intybus L</i>			<i>Mentha</i>			Top Five Medicinal Plants	
Region Name	Average Harvest Area (HA)	Average Selling Price (per Kg/\$)	Average Harvest Amount (Kg)	Average Harvest Area (HA)	Average Selling Price (per Kg/\$)	Average Harvest Amount (Kg)	Value of Medicinal Plants per Hectare (\$)	Value of Collected Medicinal Plants (\$)
Taleqan county	99.71	10374.2	85181	41.83	21841.9	85181	11181511.5	952452338547.28

Conclusions

Natural resources are important assets for current and future generations, playing a crucial role in ecosystem balance, income generation, and rural development. Sustainable protection of these resources requires management based on the cooperation of rural people, as they are the primary stakeholders in local communities. Valuing ecosystem services and creating jobs through these tools is a way to protect the environment and natural resources, with the aim of safeguarding these resources by local people. The rich rangeland cover, spanning approximately 85,181 hectares in the Taleqan county, has led to the establishment of nature-based businesses dependent on the rangeland ecosystem in this studied area. Therefore, this study examines the extent of beekeeping activities and the harvesting of medicinal plants in this county, which are among the products that enhance ecosystem services, as well as their economic valuation. According to the results obtained, Taleqan County has

investment potential in beekeeping and the cultivation and harvesting of medicinal plants, which, relying on the principles of indigenous knowledge and local community management, will lead to sustainable utilization of rangelands and can also be considered an economic tool for environmental protection. Engaging in these two activities can be a priority for individuals interested in entrepreneurship in natural resources, allowing them to develop their business plans based on these areas of activity. The production of venom, due to its potential for export and application in the pharmaceutical industry, is one of the most profitable by-products of beekeeping. However, none of the surveyed beekeepers could afford to engage in this activity due to the need for venom extraction tools and human resources. It is suggested that individuals collaborate with beekeepers or invest more independently to initiate this activity. Additionally, one of the issues that most beekeepers in the Taleqan

county criticized was the lack of an integrated system for managing and organizing beekeeping activities. It is recommended that the relevant organization increase its oversight of this activity. According to the conducted interviews, another significant issue that reduces the production of beekeepers' products is bee diseases. It is suggested that the veterinary department of the county conduct comprehensive and continuous monitoring regarding the examination and treatment of bee diseases. Furthermore, regarding the utilization of medicinal plants, due to the importance of preserving rangelands and preventing the degradation and encroachment on the region's natural resources, it is better not to harvest wild plants from the rangelands. However, considering the county's potential for the growth of medicinal plants, it is recommended that permits for cultivating these plants be issued in the county so that rangelands are not harmed and nature-based businesses can thrive. Additionally, based on the interviews conducted, the people of this county, given the region's potential, are inclined to create added value from medicinal plants. Therefore, it is suggested that new industries, including the production of herbal combination medicines, the expansion of herbal teas and distillates, as well as the production of cosmetic and hygiene products, be established to economically benefit from ecosystem services.

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