Benefits Brought by the Abundance and Importance of Forest Fruits from Bistrita-Nasaud County

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Abstract

Non-woody forest products (NWFPs) represent an important forest resource which can be exploited, becoming in this way, an important economic role in human societies. In addition, NWFPs are used both in households and as commercial products for human well-being. Due to the fact that Romania has a wide variety of relief forms, numerous NWFPs can be found on her territory, the most important ones being the forest fruits. Their benefits come especially from their chemical composition, because of the richness in vitamins and antioxidant properties, being used in alimentation, medicine and the cosmetic industry. On the other hand, their importance is gained by the social and economic impacts, most of them being positive. The paper exposes the most representative forest fruits from Bistrita-Năsăud County which were analysed by using an analytical hierarchy process, being a multi-criteria method in decision making. Based on this process, forest fruits were classified by 19 well-established criteria.

Keywords: analytical hierarchy process, forest fruits, market potential, multi-criteria, non-woody forest products

Introduction

FAO estimates that approximately 80% of populations from developing countries use NWFPs in food and medical industries.

Our department has launched in 1991 a priority program for the development and promotion of non-timber products. These NWFPs include forest fruits, medicinal plants, resins, edible mushrooms, seeds, hunt etc. NWFPs are utilised in medical purposes, in the food and cosmetics industry as well as in constructions (Janse and Ottitsch, 2005).

The consumption of forest fruits has a significant importance due to their flavonoid content, which is appreciated for its antioxidant properties, contributing to the decrease of

cardiovascular diseases (Knekt *et al.*, 1997, Kanodia *et al.*, 2011, Milivojević *et al.*, 2011).

The definition proposed by FAO describes non-woody forest products (NWFP) as "products of biological origin other than wood derived from forests, other wooded land and trees outside forests". There are excluded from definition the raw materials (charcoal, chips, fuelwood) and products that were collected in agricultural or agroforestry systems, including products as rubber, gum arabic, resin, latex, Christmas trees and so on (FAO, 2015). For the harvesting activity of forest fruits it is important to follow two main essential aspects: to fulfill the sustainable principle of forest resources and not to affect the biodiversity of the environment (Vasile *et al.*, 2016).

Figure 1. Location of Bistrita-Năsăud County
(<https://www.wikipedia.org>)

During the past decades, the role of the forest has changed in Europe. Besides wood, its principal source, non-timber resources have become of interest. According to the Food and Agriculture Organization (FAO), the term which characterizes these resources is “non-timber forest products” (NWFPs). Furthermore, from economic point of view, through the STARTREE project (www.startree.eu), using UN Comtrade database, NWFP estimates the values and volumes in international trade. There were examined cork, tannins, mushrooms, nuts, berries, foliage and honey. Wild harvested NWFPs amounted 4.69 billion USD, from the total sum of 12 billion USD which was registered at global trade (Prokofieva *et al.*, 2017). The Romanian Forest Code (Law 46/2008), according to Article 58, paragraph (3) specifies that “non-woody forest products include fauna of hunting interest, fish from mountain waters, forest fruits, forest seeds, truffles and edible mushrooms, medicinal and aromatic plants, resin, and so on” (Enescu *et al.*, 2018). However, when planning the forest management process it’s important to take into account the increase in consumption and popularity of NWFPs, and also their harvesting and exploitation, both being important aspects (Blaga *et al.*, 2019).

The scope of the present paper is to identify and to extract from the abundance of non-woody forest products, only the most important forest

fruits from Bistrita-Năsăud County, Romania. From a geographical point of view, this County is situated in the North-East part of Transylvania’s Plateau, being crossed by the river Bistrita. Its estimated surface reaches 5.355 square kilometres. According to INSSE the forest surface has occupied 187837 hectares in 2017, with a predominance of hardwood forests which occupy 106320 hectares and softwoods, with approximately 81517 hectares. The regenerated surface in 2017 summed up a total of 1336 hectares (<http://www.insse.ro>).

The following forest fruits can be found in Bistrita-Năsăud County: roseberries (*Rosa canina* L.), blackberries (*Rubus hirtus* W. et K.), blueberries (*Vaccinium myrtillus* L.), blackthorns (*Prunus spinosa* L.), hawthorns (*Crataegus monogyna* L.), wild apples (*Malus sylvestris* L.), blackcurrant (*Ribes nigrum* L.), wild strawberries (*Fragaria vesca* L.) and others.

Material and methods

The Bistrita-Nasaud Directorate is a unit included in the National Forest Administration, which administrates 14% of the total surface of Bistrita-Nasaud County, the remaining of 86% being administrated by other accredited silvicultural bodies. In compliance with the evidences in 2018, the managed total surface was of 27.691 hectares, from which 12.315 hectares represent forest

fund of state property, while the other 15.376 hectares were the property of other units such as localities, physical persons and so on. One of the traditional activities of the National Forest Administration is represented by the valorification of the non-woody forest products. Among these, the forest fruits are the most important under the quantitative and valoric aspect. Annually, the National Forest Administration offers and sells over 3000 tons of fruits, most of them being from the spontaneous flora of Romania and can be certificated as ecological agroalimentary products. The main forest fruits promoted by the National Forest Administration including here Bistrita-Nasaud Directorate, which are valorified are: blueberries, raspberries, blackberries, sea buckthorn, roseberries, blackthorns, hawthorns and so on offering to customers the special taste of forest fruits from Carpathians of Romania.

Furthermore, for enhancing the profit, the Bistrita-Nasaud Directorate organizes auctions for other non-woody forest products, such as edible mushrooms (*Boletus edulis*, *Chantarellus cibarius*, *Tuber sp.*, and so on) and also medicinal plants being harvested from the spontaneous flora. As basic materials, there were used different reports of the economic situation of Bistrita-Nasaud Directorate, relevant documents and also some projects implemented in the annual process of valorification. For the present report, as method, it was used an AHP (The Analytical Hierarchy Process), for estimating and evaluating the potential of forest fruits. This kind of analysis was developed in 2008, by the expert Thomas Saaty, it is based on multiple criteria, being important in decision making (Saaty, 2008). This method is a structured technique for organizing and analyzing complex decisions, based on mathematics and psychology. AHP helps decision makers find one that best suits their goal and their understanding of the problem. It comprises few steps as follows: i) Decompose the decision problem into a hierarchy of more easily comprehended sub-problems, ii) Evaluate the elements of hierarchy by comparing them to each other two (pairwise comparison) at a time, iii) Convert these evaluations to numerical values that can be processed and compared over the entire range of the problem and iv) Calculate the numerical priorities for each of the decision alternatives.

In our case, the steps which were followed to bring the results for analysis include the 19-well established multi-criteria such as: 1) harvesting period, 2) harvested quantity/ worker/8 hours, 3) harvesting cost, 4) knowledge for harvesting, 5) tools needed for harvesting, 6) complexity of the harvesting process, 7) development of the harvesting process, 8) knowledge for recognition, 9) distribution range, 10) biotic threats, 11) abiotic threats, 12) perishability, 13) market potential, 14) market demand, 15) "celebrity" of the product on market, 16) the price of the raw product, 17) the price of the derived product, 18) portfolio of derived products and 19) Transport (harvesting - storage centre). The used scale for evaluating the criteria is constituted of absolute numbers between the interval 1 to 8. Once the alternatives were fixed, the criteria must be attributed to the available alternatives that suits best for the analyzed part. Also, for estimating the sensivity of the forest fruits involved in the process, the AHP uses special technique by the Expert Choice Desktop software, which is adapted for mathematical calculations and for making graphics for all the alternatives involved. These criteria have also been used in other similar studies from different counties such as: Maramures (Enescu *et al.*, 2017), Bihor (Timis-Gânsac *et al.*, 2018), Gorj (Vechiu *et al.*, 2018), Prahova (Enescu *et al.*, 2018), Timis (Enescu *et al.*, 2018).

Results and discussions

Table 1 shows the relationship between berries and the attributed criteria, and also the potential alternatives established which were taken into consideration for analysing the most important forest fruits from Bistrita-Năsăud County. Based on this analytical hierarchy process (AHP), the most popular and requested forest fruits are roseberries (*Rosa canina*), blackberries (*Rubus hirtus*), blueberries (*Vaccinium myrtillus*), blackthorns (*Prunus spinosa*), hawthorns (*Crataegus monogyna*), wild apples (*Malus sylvestris*), black currants (*Ribes nigrum*) and wild strawberries (*Fragaria vesca*). It can be observed that the best ranking are the blueberries, reaching the maximum number of alternatives given for the different criterias such as tools needed for harvesting, harvesting cost, market potential, market demand, portfolio of derived products and transport. Also, wild strawberries (*Fragaria vesca*) registered a

Table 1. AHP-The number of alternatives reached by berries for each criterion (1-19)

	Criterion	Berries							
		<i>Rosa canina</i>	<i>Rubus hirtus</i>	<i>Vaccinium myrtillus</i>	<i>Prunus spinosa</i>	<i>Crataegus monogyna</i>	<i>Malus sylvestris</i>	<i>Ribes nigrum</i>	<i>Fragaria vesca</i>
1	Harvesting period	8	5	2	4	7	6	3	1
2	Harvested quantity/worker/8 hours	7	2	3	5	6	8	4	1
3	Harvesting cost	5	2	8	4	6	7	3	1
4	Knowledge for harvesting	6	2	7	4	8	3	5	1
5	Tools needed for harvesting	5	2	8	4	6	7	3	1
6	Complexity of harvesting process	6	2	7	4	8	5	3	1
7	Development of harvesting process	5	1	7	4	6	8	3	2
8	Knowledge for recognition	5	1	4	8	6	3	7	2
9	Distribution range	8	6	3	2	7	4	1	5
10	Biotic threats	2	7	3	1	6	8	5	4
11	Abiotic threats	3	6	7	2	1	5	4	8
12	Perishability	1	7	6	4	3	2	5	8
13	Market potential	4	7	8	1	5	3	2	6
14	Market demand	5	6	8	1	4	3	2	7
15	"Celebrity" of the product on market	5	7	8	1	4	3	2	6
16	Price of raw product	4	6	7	2	5	1	3	8
17	Price of the derived products	5	6	7	1	3	2	4	8
18	Portfolio of derived products	5	7	8	2	3	1	4	6
19	Transport (harvesting - storage center)	4	5	8	2	3	4	6	7

maximum number of alternatives (8) in abiotic threats, perishability, the price of raw product and the price of the derived products (Fig.2) being the sign that this fruit has a quiet sensibility in terms of conserving or protecting, being exposed to the natural diseases. The positive aspect is that wild strawberries have a lot of alternatives in market demand, for satisfying the taste and wellbeing of the costumers. In the case of hawthorns (*Crataegus monogyna*), there are a lot of alternatives in the sense of knowledge for harvesting. This requires a good understanding how to harvest these fruits to avoid the depreciation. The harvested quantity of roseberries, hawthorns and wild apples within 8 hours is larger in comparison with blackberries, blueberries, blackthorns, black currants and wild strawberries. On the other hand, wild strawberries and blackberries are the most perishable forest fruits. Roseberries and hawthorns have a wide distribution range in this county, being well spreaded in the entire region.

The most appreciated forest fruits are *Vaccinium myrtillus* L., *Fragaria vesca* L. and *Crataegus monogyna* Jack. as observed from Figure 3. *Vaccinium myrtillus* L. is a low-stem thick and leafy shrub, with a green stem that can reach 30-60 cm and angular branches. The leaves are short-petiolated, small, oval, denticulate (creased on the edge) and green on both sides. As such, they have antibacterial properties, favorably modifying the intestinal and antidiuretic pathogenic flora. The flowers are red, white or pinkish green with bell-shaped thin petals (1-2 in the leaf axilla). It usually blooms in May-June.

Fragaria vesca L. is a perennial diploid species that can reach 15-30 cm in height. The flowers are white and bisexual while the fruits are fleshy, red and very aromatic (Albani *et al.*, 2004, Oosumi *et al.*, 2006) originally from West Ural Mountains it has expended on the entire Globe. Strawberries are rich in vitamin C, A and B2 and contain mineral salts, calcium, magnesium, iron and phosphorus

Figure 2. Ranking of alternatives

(Hummer *et al.*, 2011, Kanodia *et al.*, 2011, Dyduch-Siemńska *et al.*, 2015). Strawberries are also used in medicine for treating intestinal diseases, tuberculosis, hypertension, asthenia, rheumatism, kidney stones, and for cleansing the body of toxins (Dias *et al.*, 2016).

Crataegus monogyna Jack. is a shrub (2-6 m) of the *Rosaceae* family, with white flowers and red fruits that have a characteristic smell and bitter taste. Fruit extracts are primarily used to ameliorate disorders related to nervous and cardiac problems. Hawthorn tea has an unpleasant odour and a breeze, but it can be flavoured with lemon or other extracts. In Figure 3 it is illustrated the diagram of the most popular species through the Expert Choice Desktop software (v. 11.5.1683). From this diagram, we can observe that the most demanded from the forest fruits are blueberries, wild strawberries and hawthorns taking into consideration the high numbers of alternatives which are involved in making decisions.

There are plenty of studies related to the important values of non-woody forest products in different regions of Romania. Pocol *et al.*, (2013)

specifies in her article that in Bistrita-Nasaud County in some small rural communities it was confirmed the existence of forest resources which contribute to their development: forest fruits, handicraft products and traditional foods. In 2012, significant quantities of forest fruits were collected in concordance with the data attained by Bistrita Forestry Department, mainly exported, the profit rate reaching 15%. The quantity of blueberries reached 32 tones, which was the most significant ass compared with the quantities of cranberries (6 tones), sea buckthorns (5 tones), roseberries (4 tones), raspberries (3 tones) and hawthorns (1 tone) (Pocol *et al.*, 2013). For example, in Prahova County, the selected NWFPs besides fruits, consisted in mushrooms (honey fungus), medicinal plant wild garlic (*Allium ursinum* L.) and some of animal origin such as European roe-deer (*Capreolus capreolus* L.) and pheasant (*Phasianus colchicus* L.). Regarding the results of this analytic hierarchy process (AHP), it is shown that the highest potential of NWFPs was occupied by the roe deer, raspberry and pheasant (Enescu *et al.*, 2018). Another example is in Bacau

Figure 3. Diagram of the most popular forest fruits

County, where the AHP was implemented for other non-woody forest products. According to the results from Timis County obtained by Enescu *et al.*, (2018), the most representative non-woody forest product was from the mushrooms class, the *Boletus* genus, which is recognized in the entire Europe for the specific and delicious taste. The most important non-woody forest products from Bacau County, based on the AHP results, were truffles and penny bun, while the least important ones were coniferous foliage and common nettle (Blaga *et al.*, 2019).

Conclusions

The NWFPs have an important economic and social role, being a renewable resource from the forest. Bistrita-Năsăud County has a wide distribution range of forest fruits on its territory. With the help of the analytical hierarchy based on the criteria taken into account, the most representative forest fruits from this region are: blueberries, wild strawberries, hawthorns, blackberries and blackthorns. Based on this analytical hierarchy process (AHP), the most popular, sought and demanded forest fruits are roseberries (*Rosa canina*), blackberries (*Rubus hirtus*), blueberries (*Vaccinium myrtillus*), blackthorns (*Prunus spinosa*), hawthorns (*Crataegus monogyna*), wild apples (*Malus sylvestris*), black currants (*Ribes nigrum*) and wild strawberries (*Fragaria vesca*).

Most of them have a high potential in the market zone, being plenty alternatives which bring important economic benefits. The best ranked fruits, based on the AHP, were wild strawberries, blueberries and blackberries. In Bistrita-Nasaud County, forest fruits meet the necessary conditions for growth and development because the region presents different relief forms which comply with the ecological requirements of the species. As such, specialists should take into account the areas populated with all these species and to try different methods for conserving and extending them.

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