FOREST FRUITS FROM SIBIU COUNTY

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Abstract: *In Romania, the most well-known non-wood forest fruits (NWFPs) are represented by forest fruits, edible mushrooms and medicinal plants. These NWFPs are used from the earliest times due to their nutritive substances. As such, these products are used in medicine for reducing cancer risk as they are rich in vitamins and bioactive compounds. According to Romsilva, the National Forest Institute, the quantity of forest fruits harvested in Romania is of 3000 tons / year. The main forest fruits that are capitalized are: raspberry, blue berry, blackberry, brier, sea buckthorn, cranberry, blackthorms etc. The purpose of this paper is to synthesize forest fruits present in Sibiu County. Located in the country's center, its diverse relief favors a large array of forest fruits: blackberry (Rubus hirtus W. et K.), blue berry (Vaccinium myrtillus L.), cranberry (Ribes nigrum L.), wild pear (Pyrus piraster L.), Wild service treeus torminalis L. fruits, hazelnut (Coryllus avellana L.), Juniperus sp. fruits and mast (Fagus sp). The most important forest fruits from Sibiu County were determined with an analytical hierarchy process (AHP) developed by Thomas Saaty and based on 19 well-established criteria. Based on this analysis, blue berry and blackberry are the most sought after fruits, while the least requested ones are mast and wild pear. The fruits that require a higher degree of knowledge for being recognized and harvested are blue berry, wild service tree and juniper fruits. Hazelnut, wild service tree fruits and mast generate the highest quantity of fruits that can be harvested by a worked in 8 hours, while the highest market prices are recorded for derived blueberry, blackberry and hazelnut products. Blueberries, blackberries, hazelnut and wild service treeus torminalis L. fruits has a rich portfolio of derived products, such as syrups, marmalade, juices, tea, alcoholic drinks or sweets. Wild service treeus torminalis L. Crantz is renowned for its wood from which a qualitative veneer is obtained, highly requested on the European market.*

Keywords*: forest fruits, blueberry, AHP, Sibiu*

INTRODUCTION

The concept of „Non wood forest products" (NWFPs) refers to forest fruits that exclude wood. According to FAO (The Food and Agriculture Organization), NWFPs are "goods of biological origin other than wood derived from forests, other wooded land and trees outside forests" (FAO, 1999). Amongst the most well-known NWFPs are forest fruits, edible mushrooms, medicinal plants, resin and essential oils.

In Romania, Romsilva (The National Forest Directory) has an annual activity for capitalizing NWFPs, especially forest fruits. The main forest fruits are: raspberry, blueberry, blackberry, brier, sea buckthorn, cranberry, blackthorms etc. The annual quantity of forest fruits that are sold by Romsilva is of 3000 tones (http://www.rosilva.ro).

Forest fruits are rich in vitamins and bioactive compounds (phenolic acids, ascorbic acid, and anthocyanin). Due to this fact, forest fruits can act as antioxidants, being used in the medicine industry for reducing cancer risk (SKROVANKOVA *ET AL*., 2015).

The purpose of this paper is to synthesize the forest fruits that are found in Sibiu County. The county is located in Romania's center, in Transylvania's Plateau, in North of Southern Carpathians (Figure 1). Due to its geographic position, this county has a diversified relief formed on plateaus, mountains and basins (NICULA, POPȘA, 2018; (http://www.adrcentru.ro). In 2018, the surface occupied by forest was of 6418,2 thousand hectares from which 1917,5 thousand hectares are covered by resinous and 4500,7 thousand hectares by broad-leaved species (http://statistici.insse.ro).

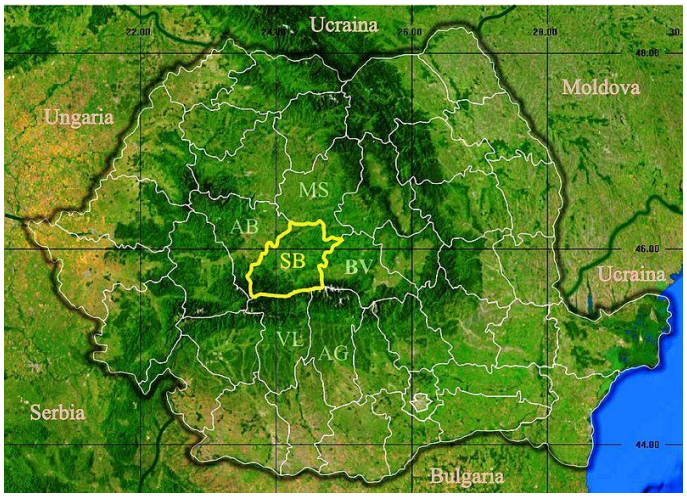

Fig.1. Location of Sibiu County (source https://ro.wikipedia.org)

MATERIAL AND METHODS

Thomas Saaty, has developed an analytical hierarchy process (AHP) that can be used for complex decision making using well established criteria (SAATY, 2008). In the case of the present work, 19 criteria were used, and for their measurement, a scale of 1 to 8 was applied as follows: harvesting period (1= the shortest harvesting period … 8= the longest harvesting), harvested quantity / worker / 8 hours (1= the lowest quantity … 8= the highest quantity), harvesting cost (1= the lowest cost … 8= the highest cost), harvesting knowledge (1= most recognizable product … 8= hardest recognizable product), tools needed for harvesting (1= the least … 8= the more), complexity of the harvesting process (1= lowest … 8= highest), development of harvesting process (1= undeveloped … 8= extremely developed), knowledge for recognition (1= the less knowledge necessary … 8= most knowledge necessary), distribution range (1= lowest … 8= highest), biotic threats (1= the fewest threats … 8= the most threats), abiotic threats (1= the fewest threats … 8= the most threats), perishability (1= lowest … 8= highest), market potential (1= low … 8= high), market demand (1= lowest … 8= highest), "celebrity" of the product on market (1= the least known …8= the most popular), the price of raw product (1= lowest … 8= highest), the price of the derived product (1= lowest … 8= highest), portfolio of derived products and transport (1= the smallest number of deriver products … 8= the highest number of derived products).

These criteria were used in other papers that have studied non-wood forest products from our country. As such, similar works were realized in Tulcea (CIOACĂ *et al.*, 2018), Timiş (ENESCU *et al*., 2018a; VECHIU, DINCĂ M., 2018a), Ialomiţa (ENESCU, 2017), Bihor (TIMIŞ-GÂNSAC *et al*., 2018), Gorj (VECHIU *et al*., 2018b), Dâmboviţa (BRAGĂ, DINCĂ, 2019), Prahova (ENESCU *et al*., 2018b) and Cluj (ENESCU *et al*., 2018).

RESULTS AND DISCUSSIONS

The forest fruits selected for the alternative AHP hierarchy and based on the experts' opinion were: bluberry (*Rubus hirtus* W. et K.), blackberry (*Vaccinium myrtillus* L.), cranberry (*Ribes nigrum* L.), wild pear (*Pyrus piraster* L.), *Wild service treeus torminalis* L. fruits, hazelnut (*Coryllus avellana* L.), *Juniperus* sp. fruits and mast (*Fagus* sp).

The classification of the 19 criteria used in the AHP analysis are rendered in Table number 1.

Table 1.

AHP alternative ranking

Criterion		Berries							
		Rubus hirtus W. et K.	*Vaccinium myrtillus* L.	*Ribes nigrum* L.	*Pyrus piraster* L.	*Wild service treeus torminalis* L.	*Coryllus avellana* L.	*Juniperus* sp.	*Fagus* sp.
		1	2	3	4	5	6	7	8
1	Harvesting period	2	3	1	4	5	7	8	6
2	Harvested quantity / worker / 8 hours	4	1	2	5	7	8	3	6
3	Harvesting cost	5	8	3	1	4	6	7	2
4	Knowledge for harvesting	2	4	5	1	8	6	7	3
5	Tools needed for harvesting	5	8	2	1	6	4	7	3
6	Complexity of harvesting process	4	8	2	1	5	6	7	3
7	Development of harvesting process	1	8	2	3	6	4	7	5
8	Knowledge for recognition	1	7	5	2	8	3	6	4
9	Distribution range	8	7	1	2	3	5	4	6
10	Biotic threats	8	7	6	2	3	5	1	4
11	Abiotic threats	8	7	2	5	6	4	1	3
12	Perishability	7	8	6	5	4	2	3	1
13	Market potential	7	6	4	2	5	8	3	1
14	Market demand	7	8	4	2	5	6	3	1
15	“Celebrity” of the product on market	8	7	3	2	5	6	4	1
16	The price of raw product	6	8	3	2	5	7	4	1
17	The price of the derived products	7	8	4	2	3	6	5	1
18	Portfolio of derived products	8	7	3	2	5	6	4	1
19	Transport (harvesting - storage center)	6	8	5	1	4	2	7	3

According to criterion 14 and 15, the most sought and popular forest fruits on the market are blueberry and blackberry. Furthermore, these are also the most widespread and perishable ones amongst all the analyzed forest fruits. The fruits that require a higher degree of knowledge for recognizing and harvesting them are blueberry, wild service tree and juniper fruits. According to criterion 2, hazelnut, wild service tree fruits and mast have the highest

quantity of fruits that can be harvested by a worked in eight hours. The highest market prices are reserved to products derived from blueberry, blackberry and hazelnut.

Based on the analytical hierarchy process (AHP), the most important forest fruits from Sibiu County are blueberry, blackberry and hazelnut, while the least important ones are mast and wild pear (Figure 2).

Blueberry is one of the most common crawling shrub from the forest's litter (*Rubus hirtus* W. et K.). This is well spread in resinous and broad-leaved forests as well as in resinous common beech mixtures. The fruits are black edible polidrups, used in the food and pharmaceutical industries (NICUȚĂ *et al*., 2014; KOH *et al*., 2018). Blueberry occupies the third place in the top of the most important forest fruits from Timiș County (VECHIU, DINCĂ, 2018a).

Blackberry (*Vaccinium myrtillus* L.) is a shrub that prefers acid soils and that is widespread in Europe, North America and Asia (ȘOFLETEA, CURTU, 2007; COUDUN, GÉGOUT, 2007). Blackberries ripen from July to September and are very popular on the market because they contain a high content of nutrients. These fruits have a very diversified portfolio of derived products such as syrups, marmalade, juices, tea, alcoholic drinks or sweets (MIKULIC-PETKOVSEK *et al*., 2015; DE GOMES *et al*., 2019). Blackberries are among the most sought products in Gorj County, occupying the third place in the forest fruit hierarchy from this county, while in Maramureș County are less important, occupying only the sixth place (ENESCU *et al*., 2017; VECHIU *et al*., 2018b). The quantity of blackberries that can be harvested ranges between 200-350 kg/ha (VASILE *et al*., 2016).

Wild service tree (*Wild service treeus torminalis* L. Crantz) is a shrub of the second height, spread out in field and low hill areas (DINCĂ, 2003), in stands composed of broad-leaved mixtures where it appears disseminate (DINCĂ, 1998). The species has numerous usages from its edible fruits to marmalade or drinks. However, the species is renowned for its wood from which a qualitative veneer is obtained, highly requested on the European market (DINCĂ, 1996). For this reason, its price is the highest so that even if the species has ten of samples per hectare, it can extremely improve the quality of our stands.

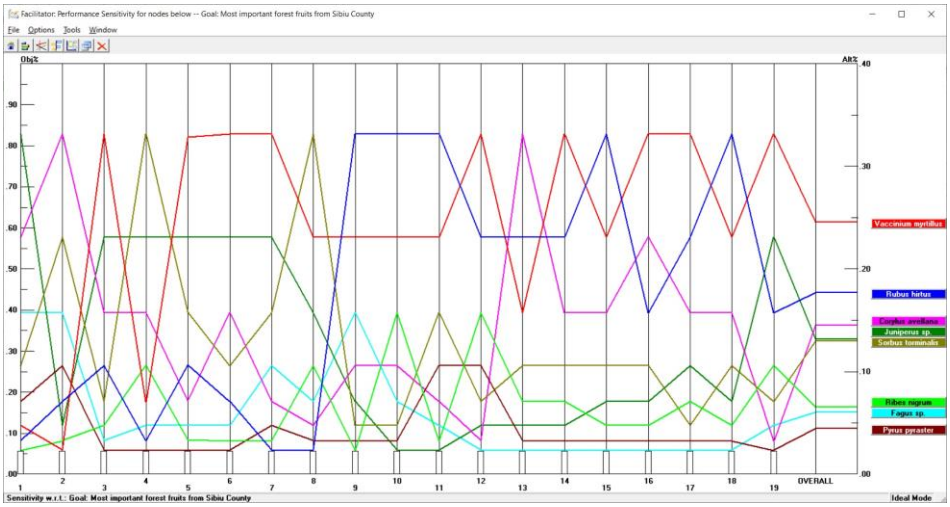

Figure 2. Ranking for the eight types of forest fruits

CONCLUSIONS

Sibiu County has a high diversity of forest fruits due to its diverse relief that sustains their growth conditions. Forest fruits have a high market potential especially as numerous tourists transit this area.

The analytical hierarchy process has emphasized blueberry and blackberry as the most requested forest fruits. This forest fruits are used in the food and pharmaceutical industries and have a very diversified portfolio of derived products such as syrups, marmalade, juices, tea, alcoholic drinks or sweets.

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