THE MOST IMPORTANT FOREST FRUITS FROM BRASOV COUNTY

V. CRIȘAN[1], L. DINCĂ[1]

[1] "Marin Drăcea" National Institute for Research and Development in Forestry, Brașov, Romania, Closca street, no.13.
Corresponding author: vlad_crsn@yahoo.com

Abstract. *In Romania, the most familiar non-wood forest products (NWFPs) are represented by forest fruits, edible mushrooms and medicinal plants. According to Romsilva, the National Forest Administration, the quantity of forest fruits harvested in Romania is more than 3000 tons/year. The aim of this paper is to present forest fruits present in Brasov County. In this county, mountain regions are covered by coniferous forests, mixture forests (beech and coniferous) and beech forests. In the hills and plateau regions there are deciduous forests in wich beech and common oak are the main forest species in contrast with hills and plains where Quercus species are dominant. Therefore, the most important forest fruits that were found in this area are: blueberry (Vaccinium myrtillus L.), blackberry (Rubus hirtus W. et K.), elder (Sambucus nigra L.), Cornelian cherry (Cornus mas), Juniperus sp. fruits, wild apple (Malus sylvestris), hazelnut (Coryllus avellana L.) and mast (Fagus sp). The most important forest fruits from Brasov County were determined with an analytical hierarchy process (AHP) developed by Thomas Saaty and based on 19 well-established criteria. These criteria were used in other papers that have studied non-wood forest products from Romania. The analytical hierarchy process has emphasized hazelnut and blueberry as the most requested forest fruits while blueberries are the most important fruits from Brasov County according AHP hierarchy. Regarding harvesting cost and tools, blueberries are the most expensive berries while blackberries are the cheapest ones. These extreme values of hierachy are the same when experts analyse criteria „Complexity of harvesting process" in which blueberries are representing the highest harvesting process while blackberries representing the lowest harvesting process. Using the analytic hierarchy process in estimating the importance of fruit species from a certain County proved to be an efficient method to classify them based on the largest quantity of criteria that can be considered.*

Keywords: *forest fruits, Brasov County, NWFP, AHP, blueberry.*

INTRODUCTION

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

In Romania, the National Forest Administration (Romsilva) is the largest and most traditionally supplier of forest fruits selling annually more than 3000 tones. According to Romsilva, the most appreciated and requested berries from the spontaneous flora of Romania are blueberries, raspberries and blackberries. (www.rosilva.ro).

The aim of this article is to present the main forest fruits that are found in forests from Brasov County. Brasov County is situated in the centre of Romania (fig. 1). The vegetation is determined by the relief and by pedo-climate elements. Mountain regions are covered by coniferous forests, mixture forests (beech and coniferous) and beech forests. In the hills and plateau regions there are deciduous forests in wich beech and common oak are the main

forest species in contrast with hills and plains where Quercus species are dominant. (www.insse.ro).

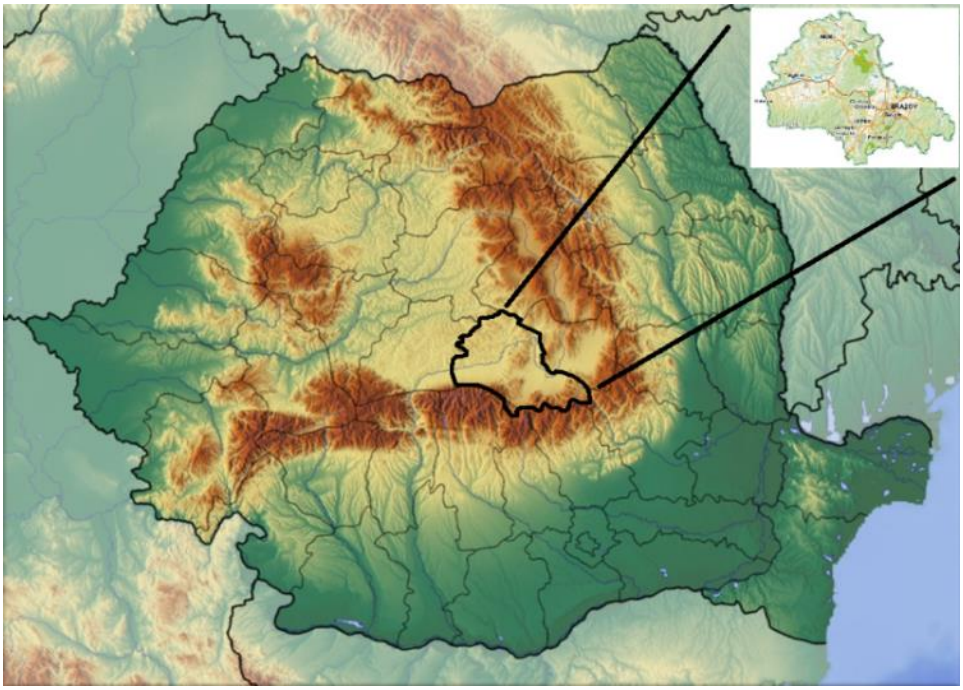

Fig.1. Location of Brasov County

MATERIAL AND METHODS

In this article it was used an analytical hierarchy process (AHP) elaborated by Thomas Saaty. This process can be used for complex decision making using well established criteria (Saaty, 2008). In this article, a number of 19 criteria have been used. In order to measure all criteria we used a scale from 1 to 8. The harvesting period was the first criteria wich we analyzed. The team wich gave grades had to choose a grade from "1" wich means the shortest harvesting period to "8" wich means the longest harvesting period (table 1). The second criteria analyzed was the quantity that one worker can harvest during a day's work, respectively 8 hours. The grade had to be in the same interval from "1" to "8", meaning that the lowest grade was given for the lowest quantity and the highest grade was given for the highest quantity. The third criterion was "harvesting cost" and the team had to grade it with a score from "1" meaning the lowest cost until "8" meaning the highest cost. Regarding the harvesting knowledge the lowest grade had to be given for the most recognizable product, while the biggest grade had to given for the hardest recognizable product. The same situation was in the case of the "knowledge for recognition" criterion where the smallest grade "1" was given for the less knowledge required to recognize the product. The highest grade "8" was given for the most knowledge required to recognize the product. Another criterion refers to tools needed for harvesting: the more tools you need to harvest a product, the higher the grade the team gave. When the complexity of the harvesting process was analyzed, the team needed to consider grades starting with the lowest complexity of the process "1" and finish with the highest complexity of the process

"8". Of course, that "development" is another characteristic for the harvesting process and represents another criterion. Depending on how developed it is, people from the team can give the smallest grade if the process is undeveloped and the highest grades if the process is extremely developed. The ninth criterion refers to the product distribution range. If the product chosen has a lower distribution range, the team needs to give a small grade. On the other hand, if the team considers the product has a higher distribution range, then it will obtain a higher grade. Criterion 10 and 11 refer to biotic threats like living components such as diseases, pathogens, human influence and abiotic threats like non-living components such as light, heat, soil and air humidity, atmosphere components and winds, acidity, soil nutrients and so on. If there are fewer threats, the grade is lower and if there are a lot of threats, the higher is the grade. The next criterion refers to product perishability. If the product is very fast decomposable, then it has low perishability and a lower grade. If the product is decomposable over a long period of time, it is given a higher grade. In order to have a good analysis of the product it is necessary to refer also to market and price and their characteristics.

Regarding market characteristics grades are low if the market potential is low and if the market demand is low. Grades are low also if the product is least known on the market. In contrast, grades will be higher if the product has a high market potential and a high market demand (criterion 13 and 14 from table 1). Grades are higher also if the product will be very popular, having a great "celebrity" on the market (criterion 15 from table 1). It is the same situation when we refer to price criterion and its characteristics. When the price of raw product is low and the price of derived product is low the grades are low. Also when the number of derived products is low then the grades are low. In the same time, if the price of raw product is high and the price of derived products is high then the grades are high. Also, when the number of derived products is high then the grades are high. The last criterion refers to the transport process from the place of harvesting to the storage centre. Depending on how complex and expensive this process is, grades will be lower or higher. If this process is an easy one, then the grades will be lower. If the process is difficult, implying special vehicles and high fuel consumption then the grades will be higher.

These criteria were also used in other scientific articles that have studied non-wood forest products from Romania. Similar works were made for the counties like Dâmbovița (Braga, Dinca, 2019; Cântar, Dincă, 2020), Vrancea (Tudor, Dincă, 2019), Dolj (Cântar et al., 2018), Arad (Pleșca I. M. et al., 2019; Enescu, Dincă, 2020), Bacau (Blaga, T., et al., 2019).

RESULTS AND DISCUSSION

The forest fruits from Brasov County selected for the alternative AHP hierarchy were: blueberry (*Vaccinium myrtillus* L.), blackberry (*Rubus hirtus* W. et K.), elder (*Sambucus nigra* L.), Cornelian cherry *(Cornus mas)*, *Juniperus* sp. fruits, wild apple (Malus sylvestris), hazelnut (*Coryllus avellana* L.) and mast (*Fagus* sp). This AHP process is based on the experts' opinion regarding all 19 criteria.

The classification of the 19 criteria used in the AHP analysis can be seen in Table number 1.

Table 1

AHP alternative ranking (Brasov)

Criterion		Berries							
		Vaccinium myrtillus	*Rubus hirtus*	*Sambucus nigra*	*Cornus mas*	*Juniperus* sp.	*Malus sylvestris*	*Corylus avellana*	*Fagus* sp.
		1	2	3	4	5	6	7	8
1	Harvesting period	2	1	4	3	8	5	6	7
2	Harvested quantity / worker / 8 hours	1	2	4	3	6	8	5	7
3	Harvesting cost	8	1	2	3	7	4	6	5
4	Knowledge for harvesting	8	1	2	3	7	4	5	6
5	Tools needed for harvesting	8	1	2	3	4	5	7	6
6	Complexity of harvesting process	8	1	2	3	6	5	7	4
7	Development of harvesting process	8	1	2	3	7	4	6	5
8	Knowledge for recognition	4	3	6	8	7	1	2	5
9	Distribution range	1	8	5	4	2	3	6	7
10	Biotic threats	7	8	6	5	1	2	3	4
11	Abiotic threats	7	8	3	4	2	5	6	1
12	Perishability	7	8	6	5	3	4	2	1
13	Market potential	6	7	2	3	4	5	8	1
14	Market demand	7	6	4	2	3	5	8	1
15	"Celebrity" of the product on market	6	8	4	2	3	5	7	1
16	The price of raw product	8	6	2	4	5	3	7	1
17	The price of the derived products	5	8	2	4	6	3	7	1
18	Portfolio of derived products	7	6	5	2	4	3	8	1
19	Transport process (harvesting place - storage center)	8	7	5	6	3	4	2	1

Regarding harvesting cost and tools, blueberries are the most expensive berries while blackberries are the chippest ones. These extreme values of hierachy are the same when experts analyse criteria „Complexity of

harvesting process" in which blueberries are representing the highest harvesting process while blackberries representing the lowest harvesting process.

The most important forest fruits from Brasov County that have resulted from the AHP analysis are blueberries, forest hazelnuts and blackberries, while the least important ones are elderberry fruits (Fig. 2).

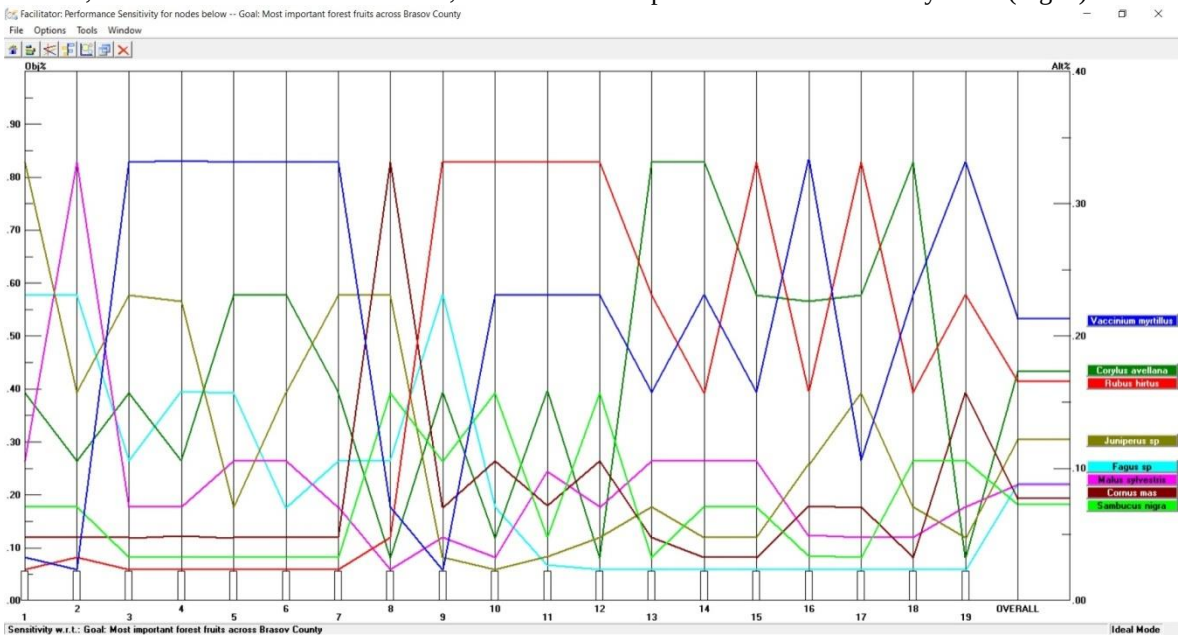

Figure 2. Ranking for the types of forest fruits from Brasov County

Blueberry (*Vaccinium myrtillus* L.) is a shrub wich generally grows on acid soils and it is widespread in Europe, North America and Asia (Șofletea, Curtu, 2007; Coudun, Gegout, 2007). Processing these berries it can be obtained various products like: syrups, jam, juices, tea, drinks or sweets (Mikulic-Petkovsek et al., 2015; De Gomes et al., 2019). These fruits are the most important fruits from Brasov County according AHP hierarchy. Blackberries are occupying third place in the forest fruit hierarchy in Gorj County (Vechiu et al., 2018), and second place in Sibiu County (Vechiu, Dinca, 2019). The quantity of blackberries that can be harvested in the forests of Romania ranges between 200-350 kg/ha (Vasile et al., 2016).

Juniperus are coniferous trees and shrubs in the genus Juniperus. Juniperus species are found from sea level to above timberline. It can grows on sand dunes, granite and sandstone and range from deserts to bogs (Adams R., P., 2014). Essential oil of common juniper is an aromatic liquid accumulated in different parts of plant like cones and needles. The essential oil extracted is commonly used as a traditional medicine and by the pharmaceutical industry and it can be found various applications in the other industries. The needles of *Juniperus communis* produce a strongly smelling smoke used for smoking meat and fish in order to preserve food (Ložienė, K., Venskutonis, P., R., 2016).

The elder (*Sambucus nigra* L.) also known as black elderberry, common elder or European elder, is usually a 4-5 m tall shrub, with vigorous erect shoots and arching branches. It is short-lived, rarely surviving more than 35 years and it is characterized by large white and scented inflorescences and glossy dark purple-black berries (Enescu, C. M. et al. 2016). It grows in Europe from Mediterranean regions to Scandinavia and from Ireland in the west until Russia in the east. It is able to grow in a great diversity of site conditions, having as limited condition drought and

salty soils. It is cultivated all over the world for its fruits, which are used in preparation of artisanal food and medicinal products (Enescu, C. M. et all. 2016).

CONCLUSIONS

Brasov County has a great diversity of forest fruits resulting from its relief and pedo-climate elements which sustain their growth conditions.

The analytical hierarchy process concluded that hazelnut and blueberry are the most requested forest fruits while blackberries are the most important fruits from Brasov County according to AHP hierarchy.

Using the analytic hierarchy process in estimating the importance of fruit species from a certain County proved to be an efficient method to classify them based on the largest quantity of criteria that can be considered.

BIBLIOGRAPHY

ADAMS, R.P., 2014: Junipers of the world: The genus Juniperus. 4th Edition. Trafford publishing CO., Bloomington, IN. p. 417.

BLAGA, T., PLEȘCA, I. M., DINCĂ, L., 2019: Selecting the most promising non-wood forests products for Bacau County using the analytic hierarchy process. Studii și Cercetări Științifice-Biologie, 28(1): 29-33.

BRAGĂ, C., DINCĂ, L., 2019: Forest is not only wood: Evaluating non-timber products from Dambovita County. Current Trends in Natural Sciences, 8(15): 73-78.

CÂNTAR, I.C., DINCĂ, L., 2020: The most important NWFPs from Dambovita County identified through the analytical hierarchy process. Annals of the University of Craiova – Agriculture, Montanology, Cadastre Series, 49(2): 70-73.

CÂNTAR, I.C., ENESCU, C.M., DINCĂ, L., 2018: Application of the analytic hierarchy process in selection of the most important non-wood forest products for Dolj County, Craiova. Annals of the University of Craiova - Agriculture, Montanology, Cadastre Series, 48(2): 50-57.

COUDUN, C., GEGOUT, J. C., 2007: Quantitative prediction of the distribution and abundance of *Vaccinium myrtillus* with climatic and edaphic factors. Journal of Vegetation Science, 18 (4): 517-524.

DE GOMES, M. G., DEL FABBRO, L., GOES, A. T. R., SOUZA, L. C., DONATO, F., BOEIRA, S. P., ... & JESSE, C. R., 2019: Blackberry juice anthocyanidins limit cisplatin-induced renal pathophysiology in mice. Pathophysiology, 26 (2): 137-143.

ENESCU, C.M., DINCĂ, L., CÂNTAR, I, 2018: Which are the most common non-wood forest products in Timis County?, Research Journal of Agricultural Science 50(1):51-56.

ENESCU, C. M., HOUSTON DURRANT, T., CAUDULLO, G., 2016: Sambucus nigra in Europe: distribution, habitat, usage and threats. In: San-Miguel-Ayanz, J., de Rigo, D., Caudullo, G., Houston Durrant, T., Mauri, A. (Eds.), European Atlas of Forest Tree Species. Publ. Off. EU, Luxembourg, pp. e013c0f+

ENESCU, R., DINCĂ, L., 2020: An assessment of forest fruits from Arad County. Annals of the University of Craiova – Agriculture, Montanology, Cadastre Series, 49(2): 107-112.

FAO, 1999 - Towards a harmonized definition of non-wood forest products. Unasylva 198: 63—64.

LOZIENE, K., VENSKUTONIS, P.R., 2016: Essential Oils in Food Preservation, Flavor and Safety, Chapter 56 Juniper (Juniperus communis L.) Oils, p. 495-500, Elsevier Publisher, 930 p., https://doi.org/10.1016/B978-0-12-416641-7.00056-0.

MIKULIC-PETKOVSEK, M., SCHMITZER, V., SLATNAR, A., STAMPAR, F., VEBERIC, R., 2015: A comparison of fruit quality parameters of wild bilberry (*Vaccinium myrtillus* L.) growing at different locations. Journal of the Science of Food and Agriculture, 95(4): 776-785.

PLEȘCA, I.M., BLAGA, T., DINCĂ, L., BREABĂN, I.G., 2019: Prioritizing the potential of non-wood forest products from Arad county by using the analytical hierarchy process. Present Environment and Sustainable Development, 13(2): 225-233.

ROMSILVA - Fructe de padure http://www.rosilva.ro (Accessed May 19, 2020)

SAATY, T.L, 2008: Decision making with the analytic hierarchy process. International Journal of Services Sciences 1(1):83-98.

ȘOFLETEA, N., CURTU, L., 2007 : Dendrologie, Ed. Universității ”Transilvania”, Brașov, 418p.

TUDOR, C., DINCĂ, L., 2019: The main categories of non-wood forest products from Vrancea County. Research Journal of Agricultural Science, 51(4): 211-217.

VASILE, D., DINCĂ, L., VOICULESCU, I, 2016: Wild berries collected in 2016 from national forest fund managed by RNP Romsilva. Revista de Silvicultură și Cinegetică, 21(38):72-76.

VECHIU, E., DINCĂ, L., 2019: Forest fruits from Sibiu County. Research Journal of Agricultural Science, 51 (3): 163-168.

VECHIU, E., DINCĂ, L., ENESCU, C.M., 2018 : Which are the most important forest fruits in Gorj County ? Revista de Silvicultură și Cinegetică, 23(42): 89-93.

www.insse.ro (Accessed May 19, 2020).