FOREST IS NOT ONLY WOOD: EVALUATING NON-TIMBER PRODUCTS FROM DÂMBOVIȚA COUNTY

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Abstract
During the last decades, the global interest towards non-timber products (NTp – forest fruits, medicinal plants, edible mushrooms, game products, etc.) has considerably increased, especially due to their curative qualities. Characterised by a varied geomorphology, Romania has at its disposal, besides its wood resource, a considerable quantity of NTp capitalized especially on the external market. Furthermore, this niche is not capitalized at its existent potential as the main used forest resource is wood production. The aim of this study was to identify the main NTp together with their management efficiency, focusing on Dâmbovița County. In order to determine the most important NTp, a decision analysis process with multiple criteria was used (AHP), which means to assess both quantitative and qualitative criteria and to analyse the production of selected alternatives by mean of pairwise differentiation. Using eight NTp and nineteen criteria, for this region, we found that the NTp with the highest potential was the dog rose (Rosa canina L.) while the lowest potential was recorded by blackthorn (Prunus spinosa L.). This process has offered substantial information regarding the possibility of exploiting forest fruits, as well as how to best manage their harvesting. The obtained results have shown that the methods used for harvesting NTp are complex so that their management can be improved in order to increase their source of income. In conclusion, we consider necessary the adoption of measures in regard with the efficiency of NTp production as a mean of future economic-ecologic advantage. Further, the non-timber forest products can have a favourable impact on the local community (generate profits) and positive effect for biodiversity and forests ecosystem functioning.

Keywords: analysis process, harvesting and management, non-timber products.

1. INTRODUCTION

Approximately 35% of the European Union's surface is occupied by forests that generate assets and services, while over 16 million properties benefit from forest resources, with the possibility of creating new jobs (Nichiforel, 2014).

Even though wood products are considered the most important resources for this sector, accessory or non-wood products (NTp) together with multifunctional purpose forests have a significant importance from an economic (promoting rural competitivity), ecologic (ensuring biodiversity) and cultural point of view (maintaining old traditions), especially at an international level (Belcher and Schreckenberg, 2007, Hernández□Barrios et al., 2015). As a consequence of low productivity forest vegetation from the Mediterranean areas, NTps (mushrooms and truffles) can pose a high economic interest in comparison with wood products (Sainz et al., 2010). In Finland, citizens have ascertained that biodiversity; the landscape and non-wood products should be primary in comparison with the value of wood products (Kangas and Niemeläinen, 1996).

73

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Furthermore, in the context of global preoccupations regarding climatic changes caused by a series of factors, new alternatives with positive effects on the sustainability of forest ecosystems were tried, including the capitalization of NTps (Stanley et al., 2012, Mosquera-Losada et al., 2018). This is considered a valuable niche, constantly growing on the European market and not only. However, the difficulty of creating a long-lasting NTp management in space and time can increase together with the intensification and frequency of their harvesting (Hernández Barrios et al., 2015). During the last years, the capitalization of forest fruits (dog rose, raspberry, blackberry, blueberry, sea buckthorn etc.) has known an exponential increase, especially due to their curative qualities, with beneficial effects on the human body. Moreover, information regarding the NTp production potential are pretty rare, while the instruments for sustaining forest owners in manging them are limited (Huber et al., 2017). In addition, national statistical data concerning the production and management of NTps are incomplete, making difficult a comparative analysis between the participant countries (Vantomme, 2003). At an international level, at least 150 NTps are mentioned and considered as the most important from an international commerce point of view. The most crucial ones are honey, mushrooms, forest fruits, resins, medicinal plants and game (FAO, 2019).

In Romania, according to the silvicultural code (article 58, letter 3), aspects that refer to forest non-wood products are summarily detailed, with the following enumeration: fauna, fish, forest fruits, forest seeds, truffles and eatable mushrooms, medicinal and aromatic plants, resins and other products. It is worth mentioning that the entire technological process is not detailed, only the fact that harvesting and buying NTps is done through authorisations emitted by the forest districts that ensures their administration or silvicultural services. Forest management plans contain some data regarding the presence and capitalization of NTps, but they have more of an informative character.

The present study intends, on one side, to quantify the most important NTps from Dâmbovița County and, on the other side, to analyse the most important measures that can improve their harvesting management.

Figure 1. Study area Dâmbovița County (source: wikipedia.org)

2. MATERIALS AND METHODS

The total surface of Dâmbovița County is of 4054 km^2, being characterised by a relief disposed in three levels that succeed each other from North to South on a level difference of approximately 2400 m. Furthermore, the forest and other vegetation surface was of 121080 ha in 2014, representing 29.8% of the county's total surface. The forests are managed by Dâmbovița Forest District as well as by private forest districts (insse.ro).

The most widespread accessory products (NTps), namely medicinal plants and forest fruits were identified by using databases from forest districts from this county, as well as information offered by speciality ministries. In order to determine the most important NTps, an analysis decision process with more criteria (AHP) was used and presented within the cost 1203 action (European non-wood forest products network). The process was firstly developed by Thomas L. Saaty (2008) and includes the division of "sub problems" that can be independently analysed and resolved. In order to achieve this, 19 specific criteria and 8 different criteria representative for the studied area were analysed (Table 1). A scale from 1 to 8 was used for each criteria as follows: criterion 1- harvesting period (from 1: the shortest harvesting period to 8: the longest harvesting period), criterion 2 - portfolio of derived products (from 1: the smallest number of deriver products to 8: the highest number of derived products); criterion 3 - harvested quantity by one worker in 8 hours (from 1: the lowest quantity to 8: the highest quantity); criterion 4 - harvesting cost (from 1: the lowest cost to 8: the highest cost); criterion 5 - knowledge for recognition (from 1: most recognizable product to 8: hardest recognizable product); criterion 6 - knowledge for harvesting (from 1: the less knowledge necessary to 8: most knowledge necessary); criterion 7 - tools needed for harvesting (from 1: the least to 8: the most); criterion 8 - complexity of harvesting process (from 1: lowest to 8: highest); criterion 9 - distribution range (from 1: lowest to 8: highest); criterion 10 - market potential (from 1: lowest to 8: highest); criterion 11 - the price of raw product (from 1: lowest to 8: highest); criterion 12 - the price of the derived product (from 1: lowest to 8: highest); criterion 13 - transport from the harvesting point to the storage centre (from 1: the most easy to 8: the most complicated); criterion 14 - perishability (from 1: lowest to 8: highest); criterion 15 - "celebrity" of the product on the market (from 1: the least known to 8: the most popular); criterion 16 - market demand (from1: lowest to 8: highest); criterion 17 - biotic threats (from 1: the fewest threats to 8: the most threats); criterion 18 - abiotic threats (from 1: the fewest threats to 8: the most threats) and criterion 19 - development of the harvesting process (from 1: undeveloped to 8: extremely developed). The analyses were obtained by using the Expert Choice Desktop software (v. 11.5.1683).

3. RESULTS AND DISCUSSIONS

The forest fruits selected for AHP are presented based on the analysis's importance as such: raspberry (*Rubus idaeus* L.), wild service tree (*Sorbus torminalis* L.), dog rose (*Rosa canina* L.), wild strawberry (*Fragaria vesca*, L.), hawthorn (*Crateagus monogyna* Jacq.), forest apples (*Malus sylvestris* sp.), elderberry (*Sambucus nigra* L.) and blackthorn (*Prunus spinosa* L.).

This AHP classification was realized based on the opinion of experts (Table 1). Similar with and according to the analysed species, the study carried on by Enescu et al. (2017), who has used the same work methodology in Maramureş County, has situated raspberry on the first classification position. This position is confirmed by the increased market request (criteria 13, 14), being a highly appreciated product with a high potential especially for external consumers. Furthermore, another study realized in Ialomița County (Enescu, 2017) situates dog rose on the highest position on the AHP analysis, even though in the present study the species is situated on the third place (Figure 2).

The harvesting period for forest fruits is important to be acknowledged. If it is not realized at the most opportune moment, the fruits will not be able to be capitalized at their true value. It is widely known that the harvesting of forest fruits is efficient when they reach the maturation moment (Vasile et al., 2016). Moreover, the complexity of the harvesting process differs from one species to another. As such, wild strawberries have the shortest harvesting period, while dog rose have the longest harvesting period (Table 1, Figure 2). The fact that dog rose has the longest harvesting period can be justified by the fact that this plant is a species with large ecological amplitude, resisting very well to frosts and being able to vegetate on soils with different humidity regimes. As such, the species is predisposed to different blooming and fructifications between the harvesting areas, even in the same county or geographic area (Şofletea and Curtu, 2008).

In addition, based on criterion number 3, the highest quantity of harvested forest fruits in 8h is represented by forest apples and blackthorn, while the harvested quantity of wild strawberry and raspberry is much smaller as it requires a longer timeframe and more complex harvesting devices (criterion 5). At the same time, the complexity of the harvesting process (criterion 6, table 1) emphasises the fact that wild strawberries are the fruits with the highest harvesting complexity, in comparison with the wild service tree who has registered the easiest harvesting method.

Table 1. The analytic hierarchy process, alternative ranking for non-timber products from Dâmbovița County: CM- Crateagus monogyna, RI – Rubus ideaus, FV - Fragaria vesca; PS – Prunus spinosa; RC– Rosa canina; SN - Sambucus nigra; ST - Sorbus torminalis: MS – Malus sylvestris

	Criterion	Berries							
		CM	*RI*	*FV*	*PS*	*RC*	*SN*	*ST*	*MS*
1	Harvesting period	7	2	1	6	8	5	4	3
2	Harvested quantity / worker / 8 hours	6	2	1	7	5	3	4	8
3	Harvesting cost	5	2	1	4	8	3	6	7
4	Knowledge for harvesting	4	3	2	6	5	8	7	1
5	Tools needed for harvesting	8	2	1	4	5	3	6	7
6	Complexity of harvesting process	7	2	1	5	6	4	8	3
7	Development of harvesting process	7	4	1	3	6	2	5	8
8	Knowledge for recognition	4	3	2	6	5	7	8	1
9	Distribution range	8	4	3	5	7	2	1	6
10	Biotic threats	3	6	4	1	2	5	7	8
11	Abiotic threats	1	7	8	2	6	3	5	4
12	Perishability	2	8	7	3	1	6	5	4
13	Market potential	2	8	7	1	6	3	5	4
14	Market demand	5	8	7	1	6	4	3	2
15	"Celebrity" of the product on market	5	8	7	1	6	4	3	2
16	The price of raw product	5	6	7	2	3	4	8	1
17	The price of the derived products	5	6	7	2	4	3	8	1
18	Portfolio of derived products	4	8	7	1	6	3	5	2
19	Transport (harvesting - storage center)	4	8	7	2	3	6	5	1

The appreciation quality for the acknowledgement of forest fruits (criterion 8) is assumed by wild service tree fruits that become brown, white pedunculated and with many sclereide at maturity (Dincă and Dincă, 1996, Şofletea and Curtu, 2008). Even though elderberry fruits can be easily recognised, having a similar value with the wild service tree ones for the same discussed criterion (criterion 4), their low quality and request have made them record one of the lowest values in the final AHP analysis, being situated only above the sloe fruits (Figure 2). For the NTps that are perishable, such as wild strawberry, raspberry or sloe, harvesting is done manually, directly from the plant. The *Rubus* Genus fruits are easily detachable from the elongated receptacle that has a cone shape, being delicate due to a short conservation period (1-2 days). As such, they become soft very soon, being very perishable and similar with fruits from the *Fragaria* Genus (criterion 12,

Table 1). Due to this fact, they are harvested before they reach their complete colour. Furthermore, being considered with a high commerce potential (criterion 13-14), raspberry and wild strawberry have registered one of the highest value in regard with their price in a fresh state (criterion 16, Table 1). This fact can lead in the future to an increase interest towards the harvesting, conservation and transport methods. As such, as manual harvesting decreases the production efficiency and increases the workforce cost, the improvement of work productivity by developing mechanized harvesting technologies is necessary.
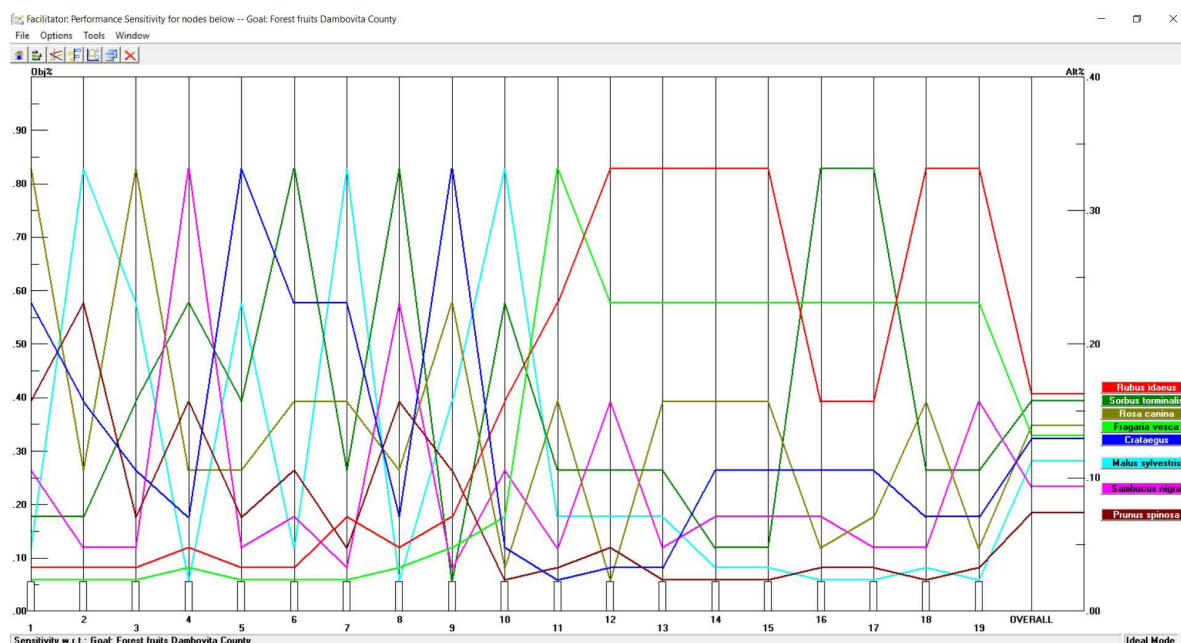

Figure 2. The ranking of the selected non - timber products

4. CONCLUSIONS

The AHP methodology confirms the importance of forest fruits (accessory products) as well as their management from Dâmbovița County. As such, the forest fruits considered as most important for this area are raspberry, wild service tree fruits, dog rose and wild strawberry. The results obtained within the study offer valuable information regarding both the possibility of exploiting forest fruits, as well as the means for their harvesting management. All these aspects have the role of helping future decision factors in implementing strategies concerning the long-lasting economic development from rural areas by capitalizing local workforce resources and with favourable effects on the sustainability of forest ecosystems.

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