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# THE MOST IMPORTANT FOREST FRUITS FROM NEAMȚ COUNTY AND THEIR HARVESTING MANAGEMENT

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***Abstract***

*From an economic and social point of view, the interest for the non-wood forest resources has increased during the last couple of years. Due to its varied landscape, Romania has as its disposal, besides wood as the main forest resource, a large diversity of non-wood resources. As such, the most important non-wood forest products are forest fruits, edible mushrooms, game and medicinal plants. The present study intends to emphasize the most representative forest fruits from Neamț County and to describe their harvesting process management. In order to establish this, an analytical hierarchic process based on certain criteria was created with the help of specialists from the domain. As such, it has been observed that cherries, blueberries and raspberry from Neamț County have a high market potential, while the harvesting process is a complex one, either manually or mechanically.*

***Key words*:** *harvesting, forest fruits, sea buckthorn, Neamț County*

## INTRODUCTION

Over time, the diversity and abundance of forest resources had played a decisive role for the survival, development and revenues of humanity [1].

Non-wood forest products (NWFPs) are the oldest trading objects from the world and play an important role in the worldwide economy. In present times, they represent a main nourishment source for the rural population. According to recent reports, worldwide, there are more than 150 NWFPs that have an important international trading role, such as honey, mushrooms, resins, essential oils or different parts of several plant species used for pharmaceutical products [29]. In the last decades, the marketing of the forest fruits recorded a continuous growth, especially to the fact that more and more people are valuing their high vitamin content and their therapeutically properties [12], [20]. For example, in Romania, approximately 4,000 tonnes of forest fruits are harvested every year, the highest quantities being recorded in the case of dog-rose (*Rosa canina* L.), raspberry (*Rubus idaeus* L.), blueberry (*Vaccinium myrtillus* L.), sea buckthorn (*Hippophaë rhamnoides* L.) and blackberry (*Rubus hirtus* W. et K.) [23].

Currently, the interest shown for NWFPs products has increased also as a consequence of the attention given by the general public to the environmental issues, including the forest ecosystems [3].

The aim of this research was to highlight the most important forest fruits from Neamţ County and to describe their harvesting management.

## MATERIALS AND METHODS

Neamţ County is situated in the Central-East part of Romania (Fig. 1) and it has a total area of 589,614 hectares [26]. The forest fund occupies a surface of 211,042 hectares, most of them being managed by Neamţ Forestry Directorate, through its thirteen forest districts [27]. In the last decade, as a consequence of the application of the restitution laws and due to the changes that occurred in the forestry normative framework, two private-owned forest districts were founded in Neamț County, namely Asociația Ocolul Silvic Privat Bicazul Ardelean and Ocolul Silvic Bisericesc Neamț.

Fig. 1. Location of Neamț County
Source: https://en.wikipedia.org

An analytical hierarchic process (AHP) was used in order to determine the most important forest fruits. This process, which was developed by Thomas L. Saaty, is based on a number of criteria [18]. The following 19 criteria were taken into account: 1) harvesting period, 2) portfolio of derived products, 3) harvested quantity by one worker in 8 hours, 4) harvesting cost, 5) recognition knowledge, 6) harvesting knowledge, 7) tools needed for harvesting, 8) complexity of harvesting process, 9) distribution range, 10) market potential, 11) the price of raw product, 12) the price of the derived product, 13) transport from the harvesting point to the storage centre, 14) perishability, 15) "celebrity" of the product on the market, 16) market demand, 17) biotic threats, 18) abiotic threats and 19) the development of the harvesting process. Expert Choice Desktop (v. 11.5.1683) was used as the main software for analyses.
This methodology was also used for other similar studies realized in the following counties: Ialomița [6], Maramureş [7], Prahova [8], Timiș [9]) and Bihor [22].

## RESULTS AND DISCUSSIONS

The forest fruits that were selected for AHP were: dog-rose (*Rosa canina* L.), raspberry (*Rubus idaeus* L.), blackberry (*Rubus hirtus* W. et K.), bilberry (*Vaccinium* sp.), blackthorn (*Prunus spinosa* L.), cherry (*Prunus avium* L.), cornel tree (*Cornus mas* L.) and sea buckthorn (*Hippophaë rhamnoides* L.). The AHP classification was realized based on the opinion of experts and is given in Table 1.

Table 1. AHP alternative ranking

| Criterion | Berries | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | *Rosa canina* | *Rubus idaeus* | *Rubus hirtus* | *Vaccinium sp.* | *Prunus spinosa* | *Prunus avium* | *Cornus mas* | *Hippophae rhamnoides* |
| 1 | 8 | 3 | 4 | 2 | 7 | 1 | 5 | 6 |
| 2 | 3 | 7 | 6 | 5 | 2 | 4 | 1 | 8 |
| 3 | 4 | 7 | 6 | 2 | 3 | 8 | 5 | 1 |
| 4 | 2 | 4 | 3 | 5 | 7 | 1 | 6 | 8 |
| 5 | 5 | 2 | 4 | 3 | 7 | 1 | 8 | 6 |
| 6 | 4 | 2 | 3 | 5 | 6 | 1 | 7 | 8 |
| 7 | 3 | 1 | 2 | 7 | 6 | 4 | 5 | 8 |
| 8 | 4 | 1 | 2 | 6 | 7 | 3 | 5 | 8 |
| 9 | 4 | 6 | 5 | 2 | 3 | 8 | 1 | 7 |
| 10 | 3 | 7 | 4 | 6 | 2 | 8 | 1 | 5 |
| 11 | 1 | 2 | 6 | 7 | 5 | 3 | 8 | 4 |
| 12 | 7 | 5 | 4 | 6 | 1 | 3 | 2 | 8 |
| 13 | 1 | 7 | 5 | 6 | 4 | 3 | 2 | 8 |
| 14 | 1 | 7 | 2 | 5 | 6 | 8 | 4 | 3 |
| 15 | 3 | 7 | 4 | 5 | 2 | 8 | 1 | 6 |
| 16 | 5 | 7 | 4 | 3 | 2 | 8 | 1 | 6 |
| 17 | 1 | 8 | 7 | 4 | 2 | 5 | 3 | 6 |
| 18 | 1 | 7 | 6 | 5 | 3 | 8 | 4 | 2 |
| 19 | 4 | 3 | 5 | 6 | 2 | 7 | 1 | 8 |

Source: Own determination.

Based on the analytical hierarchic process (AHP), the forest fruits with the highest market potential from Neamț County were: cherries (*Prunus avium* L.), raspberry (*Rubus idaeus* L.) and the *Vaccinium* species, while the least sought out are cornel tree (*Cornus mas* L.) and blackthorn (*Prunus spinosa* L.).
The harvesting process complexity differs from one species to the other. As such, the forest fruits with an ample harvesting process are: sea buckthorn (*Hippophaë rhamnoides* L.), blackthorn (*Prunus spinosa* L.) and *Vaccinium* species, in comparison with raspberry (*Rubus idaeus* L.) and blackberry

(*Rubus hirtus* W. et K), whose harvesting process is much simpler (Fig. 2). Furthermore, the harvesting process is more developed for sea buckthorn and cherries which have a larger distribution range. Based on criterion number 3, the highest quantity of forest fruits harvested in eight hours was recorded in the case of the cherries and raspberry, while the quantity of sea buckthorn and blueberry is much lower as it requires more harvesting devices.

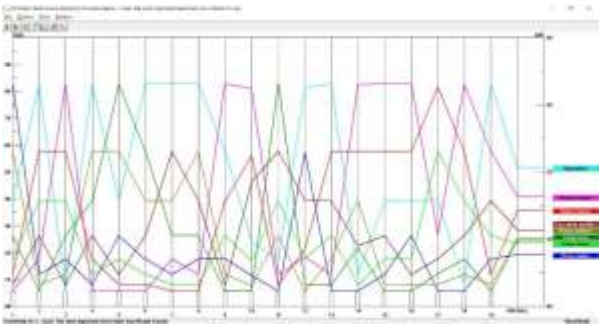

Fig. 2. The ranking of the selected NWFPs
Source: Own determination

The harvesting period of the forest fruit species is essential as knowledge. As such, if the harvesting is not realised at the most opportune moment, the fruits will not be capitalized at their true value. The harvesting of forest fruits is realized when they reach the maturation moment.

Sea buckthorn (*Hippophaë rhamnoides* L.) is a shrub (2-3 m in height) with orange fruits. The plant has an important role in protecting and improving soils [2], [5]. The sea buckthorn fruits are rich in vitamin C, being used both in the food and pharmaceutical industries [4]. The fruit harvesting is realized from August until September [16], [21]. The harvesting process is vaster, and can be achieved through numerous methods. One of these methods is the classical one, namely manual harvesting which requires a large workforce. However, over time, mechanical harvesting methods were also developed. Amongst the specialists who have developed mechanical methods for sea buckthorn fruits we mention: Koch [15] who chose pneumatic shears, Savkin and Mukhamadiev [19], who have designed a pruning machine that organizes sea buckthorn in hedges, which are easier to harvest, Olander [17], who created a harvesting machine that removes branches with fruits and then the fruits themselves by shaking the branches axially, or Wolf and Wegert [24], who have removed entire branches and freeze them during the night at a temperature of –36 °C, after which the frozen fruits were removed by shaking the branches [10], [16].

In the case of perishable forest fruits (wild strawberry, blueberry, raspberry, cornel tree, blackthorn, blackberry etc.), the harvesting must be realized manually: directly from the shrubs or trees, by approaching the branches or through drying with the help of tree stairs [13]. *Rubus* fruits are easy to detach from the elongated receptacle resembling a cone, but they are also very delicate and have a short conservation term (1-2 days) due to the fact that they soften very fast. These fruits must be harvested before they reach their complete colour [11], [14], [28].

Manual harvesting decreases the production efficiency and increases the workforce cost. However, mechanical harvesting can be used only for fruits that are not fallible to bruising and intended to the processing market [25].

In order to improve work productivity, the development of new mechanical harvesting technologies is required.

## CONCLUSIONS

The importance of forest fruits both on a commercial level, as well as an economical level (in the case of Neamţ County) results from the information mentioned above.

The most representative forest fruits for the research area were: sea buckthorn, cherry and raspberry.

The scores obtained within our study offer precise information in regard with the possibility of harvesting forest fruits, as well as for the management of their harvesting.

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