

THE MOST IMPORTANT NON-WOOD FOREST PRODUCTS FROM ARGEȘ COUNTY

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Abstract

Argeș is one of the counties from Romania with the highest potential in terms of harvesting and commercialization of non-wood forest products (NWFPs). Across the county, the distribution of NWFPs is not uniform, being concentrated in north. The goal of this study was to highlight the most important NWFPs from Argeș County. Therefore, four categories of NWFPs (i.e. Mushrooms, Tree products, Understory plants and Animal origin) were selected and ten criteria were used. The Analytic Hierarchy Process (AHP) was used in order to systematically evaluate both quantitative and qualitative criteria and to assess the performance of selected alternatives (i.e. NWFPs) by means of pairwise comparisons. The analyses were carried out with Expert Choice Desktop software. Red deer and wild boar were the most promising NWFPs, while raspberries were the less promising. In the perspective of sustainable development, future integrated management plans should take also into consideration the potential of these specific categories of forest products.

Keywords: AHP, Argeș County, non-wood forest products, NWFPs

1. INTRODUCTION

The concept of Non-wood Forest Products (NWFPs) was introduced almost four decades ago in tropical forestry in order to account all the production generated by the forest sector (Vidale et al., 2014). According to Food and Agriculture Organization of United Nations (FAO, 1999), NWFPs are defined as goods of biological origin other than wood, derived from forests, wooded lands and trees outside forests.

Due to the fact that nowadays it is estimated that more than 150 NWFPs are important within international trade (Schvidenko et al., 2005), NWFPs are gaining more and more attention, being of great interest both for forest owners and the general public (Janse and Ottitsch, 2005; Keča et al., 2013). Particularly, in Europe, as a consequence of developing the bio-economy concept, the forest owners became aware of the potential of these products, especially due to the available resources and the huge portfolio of end-products that can be obtained (Wolfslehner et al., 2014).

In Romania, the main categories of NWFPs consist in forest fruits, mushrooms, honey, medicinal plants and game. According to the project of the Ministerial Order regarding the instructions for harvesting and purchasing the non-wood forest products, specific to national forest fund (MEWF, 2016a), the list of NWFPs of harvesting and commercialization interest consist in 120 mushroom

species and 171 herbaceous, shrub and tree species. A special category of NWFPs consists in game species. According to Law no. 407/2006, in Romania, hunting is permitted for 18 species of mammals and 39 species of birds.

The aim of this research was to highlight the importance of non-wood forest products in Argeş County.

2. MATERIALS AND METHODS

Argeş County is situated in southern-central part of Romania, in Muntenia region, with the capital city at Piteşti (Figure 1a). Nowadays, the active businesses in the field of agriculture, forestry and fisheries developed in this county represent more than 15% of the total businesses from South Muntenia (Nicolescu, 2015). In the last two decades, several economic activities contributed to the current situation. For example, the timber production almost doubled in 2005, compared with 1995 (Turnock and Laawrence, 2007), and increased by 25% from 2000 to 2010 (Rusu and Cojinovschi, 2014).

The climate is very diverse, with an average annual temperature of $-2\text{ }^{\circ}\text{C}$ and an average annual rainfall of 1200-1400 mm in the mountainous region from north of the county to $10\text{ }^{\circ}\text{C}$ and 700 mm in the plain region, in the south. Compared with the situation from 1961-1990, in the 2001-2008 timeframe, both in January and July, the average air temperature in Argeş increased by $1.6\text{ }^{\circ}\text{C}$ (Chitu et al., 2012). The geographical conditions (geographic location, relief, climate, soil) are variable and they cause a corresponding variation in phytocenosis complexes (Mavrodin et al., 2013). The woody vegetation consists in more than 276.000 hectares of forests (NIS, 2016), distributed across the county with the highest share in the north (Figure 1b). Even if Argeş County is ranked in the top seven of the counties with more than 250.000 hectares (Rusu and Cojinovschi, 2014), there is also an estimated area of about 10-20.000 hectares of degraded and unproductive lands (Costea, 2013).

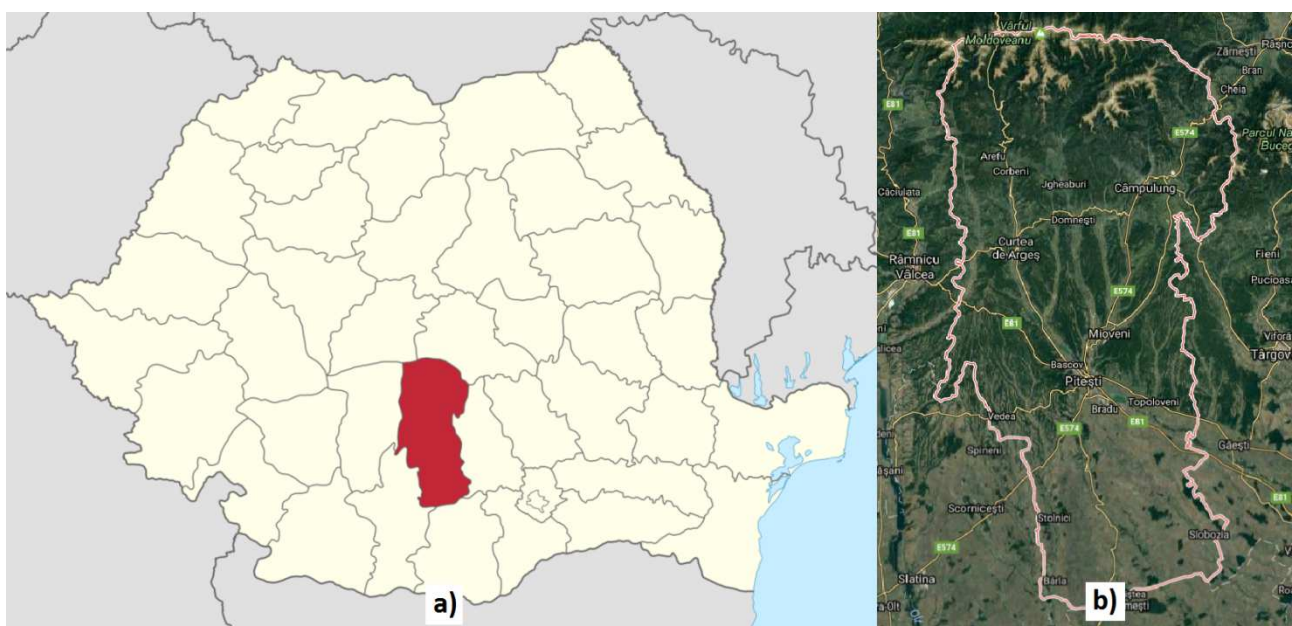


Figure 1. a) Location of Argeş County (Wikipedia); b) Satellite view of Argeş County (Google Maps)

Almost half (*i.e.* 117.212 hectares) of the forest fund from Argeş County is managed by Argeş Forestry Department. The rest, *i.e.* approximately 150.000 hectares is managed by private forest districts. The woody flora is dominated by beech (*Fagus sylvatica* L.), sessile oak (*Quercus petraea* (Matt.) Liebl.), Norway spruce (*Picea abies* (L.) H. Karst) and silver fir (*Abies alba* Mill.) in the high hills and mountainous regions and other representatives of genus *Quercus*, namely Hungarian oak (*Q. frainetto* Ten.), Turkey oak (*Q. cerris* L.) and pedunculate oak (*Q. robur* L.), hornbeam (*Carpinus betulus* L.) and black locust (*Robinia pseudoacacia* L.) in the plain regions.

The abundance and variety of the woody vegetation, on one hand, and site conditions, on another hand, determine favorable conditions for several categories of NWFPs, Argeş County being in the top regarding the yearly harvested and commercialized quantities of forest fruits, mushrooms, medicinal plants and game. For example, from the total quantity of forest fruits harvested by National Forest Administration-ROMSILVA in 2016 (NFA-Romsilva, 2017), *i.e.* 2363.7 tons, almost 4% originated from Argeş County, *i.e.* 91.1 tons (58.3 tons of fruits of dog-rose, 23.9 tons of raspberries and 8.9 tons of blackberries).

According to the same report (NFA-Romsilva, 2017), 47 tons of mushrooms were harvested in 2016 in Argeş County, which represents almost 9% of the total quantity harvested by NFA-Romsilva in 2016. The main mushrooms species consisted in honey fungus (*Armillaria mellea* (Vahl) Kumm) and penny bun (*Boletus edulis* Bull.). Mushrooms' harvesting seems to be an important activity in this region since the name of 13 localities from Argeş County are linked with the Romanian words "ciuperçi" and "bureţi" (Dincă et al., 2016).

Also, in the case of the medicinal plants, large quantities were harvested in 2016. From a total of 624.9 tons collected at national level by NFA-Romsilva, 83.6 tons (13.4%) originated from Argeş County (NFA-Romsilva, 2017).

In terms of hunting, in 2016, 7 tons of game meat were commercialized (3.2% of the total quantity harvested by Romsilva (NFA-Romsilva, 2017). The main game species were represented by red deer (*Cervus elaphus* L.) and wild boar (*Sus scrofa* L.). These species occur also in Mozacu, Vlăşcuţa and Bălăceanca hunting funds, which sum up for more than 1.000 hectares (MEWF, 2016b).

In order to determine the most promising NWFPs for Argeş County, a selection of the most important NWFPs was made based on the above-mentioned data and an Analytic Hierarchy Process (AHP), in various scenarios, was performed. AHP is a multi-criteria decision analysis that was developed more than 40 years ago by Professor Thomas L. Saaty (Saaty, 2008). Within AHP, the decision problem (*i.e.* the aim of this study) is decomposed into a hierarchy sub-problem (*i.e.* the 10 criteria) that can be independently and deeply analyzed (Figure 2).

The next step consist in systematically evaluation of the elements (*i.e.* the 8 selected NWFPs) by comparing them to each other two at the time, by taking into consideration their impact on an element above them in the constructed hierarchy (*i.e.* the 10 criteria).

Four NWFPs categories designed in the European project COST Action FP1203: *European Non-Wood Forest Products (NWFPs) Network* were used, namely Mushrooms, Understory plants, Tree products and Animal origin and for each category the most promising two NWFPs were selected.

In order to achieve the goal of this study, the following 10 criteria were taken into consideration: Criterion 1: **Harvesting period** (1: the shortest harvesting period ... 8: the longest harvesting period), Criterion 2: **Portfolio of end-products** (1: the smallest number of end-products ... 8: the highest number of end-products), Criterion 3: **Harvested quantity by one worker in 8 hours** (1: the

lowest quantity ... 8: the highest quantity), Criterion 4: *Knowledge for harvesting* (1: the less knowledge necessary ... 8: most knowledge necessary), Criterion 5: *Complexity of harvesting process* (1: lowest ... 8: highest), Criterion 6: *Distribution range* (1: lowest ... 8: highest), Criterion 7: *Market potential* (1: low ... 8: high), Criterion 8: *The price of the end-product* (1: lowest ... 8: highest), Criterion 9: *Perishability* (1: lowest ... 8: highest) and Criterion 10: *Biotic and abiotic threats* (1: the fewest threats ... 8: the most threats).

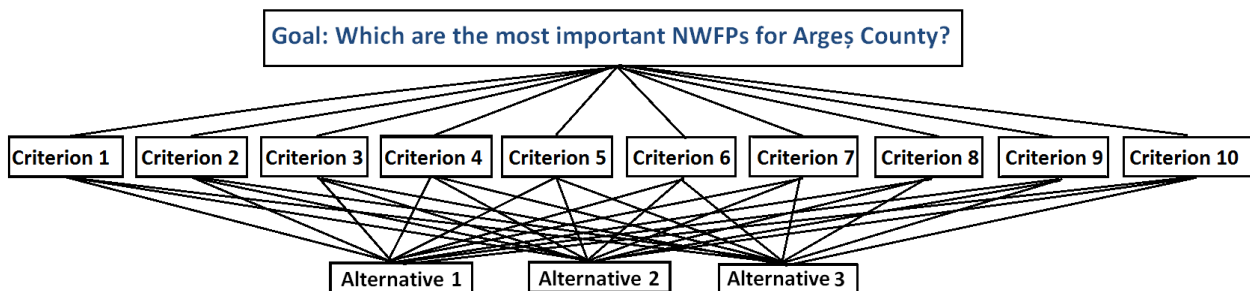


Figure 2. AHP hierarchy

The following three scenarios (alternatives) were taken into consideration: Scenario 1: all 10 criteria have equal importance (10%); Scenario 2: Criteria *Market potential*, *The price of the end-product* and *Harvested quantity by one worker in 8 hours* had the highest importance (Figure 4); Scenario 3: Criteria *Harvesting period*, *Perishability* and *Biotic and abiotic threats* had the highest importance (Figure 5). The analyses were conducted by the aid of Expert Choice Desktop (v. 11.5.1683).

3. RESULTS AND DISCUSSIONS

The selected 8 NWFPs, two for each of the four categories are the following: honey fungus (*Armillaria mellea* (Vahl) Kumm) and penny bun (*Boletus edulis* Bull.) for *Mushrooms* category; seeds of Norway spruce (*Picea abies* (L.) H. Karst) and acorns of sessile oak (*Quercus petraea* (Matt.) Liebl.) for *Tree products* category; fruits of dog-rose (*Rosa canina* L.) and raspberry (*Rubus idaeus* L.) for *Understory plants* category; red deer (*Cervus elaphus* L.) and wild boar (*Sus scrofa* L.) for *Animal origin* category. The AHP alternative ranking is present in Table 1.

Results in scenario 1

In the case when all ten criteria had an equal importance/share, the most promising NWFPs for Argeş County were represented by red deer, which recorded a value of 21%, followed by wild boar, with 19.2% and Honey fungus, with 13.4% (Figure 3).

Results in scenario 2

In this scenario, the most promising two NWFPs were the same like in previous case, namely red deer and wild boar. Acorns of sessile oak ranked third, followed by the seeds of Norway spruce (Figure 4).

Results in scenario 3

As in previous two scenarios, red deer and wild boar were placed on the first two positions, while raspberries ranked last (Figure 5).

Table 1. AHP alternative ranking

Criterion	Mushrooms		Tree products		Understory plants		Animal origin	
	Honey fungus	Penny bun	Seeds of Norway spruce	Acorns of sessile oak	Fruits of dog-rose	Fruits of raspberry	Red deer	Wild boar
1	2	3	6	5	4	1	7	8
2	6	5	1	2	8	7	4	3
3	6	5	1	2	4	3	8	7
4	8	7	4	3	2	1	6	5
5	1	2	6	5	4	3	8	7
6	8	6	1	2	5	4	3	7
7	1	2	6	7	4	3	8	5
8	1	2	5	6	4	3	8	7
9	6	5	1	2	3	4	7	8
10	5	6	7	8	1	2	3	4

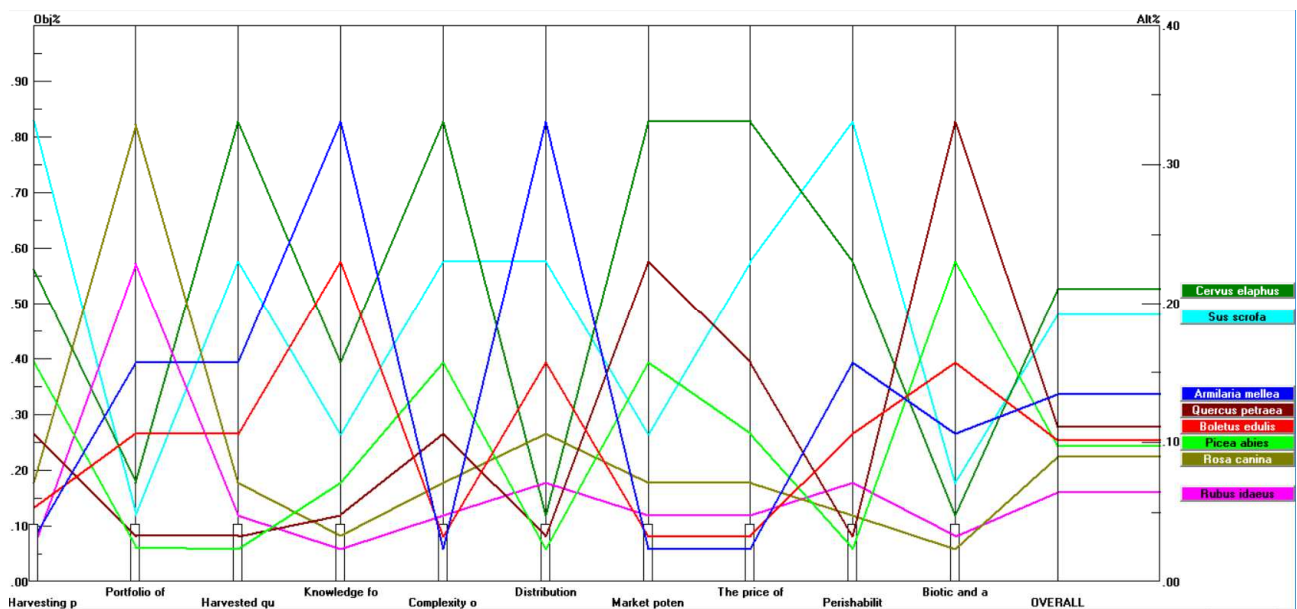


Figure 3. The ranking of the eight non-wood forest products in scenario 1

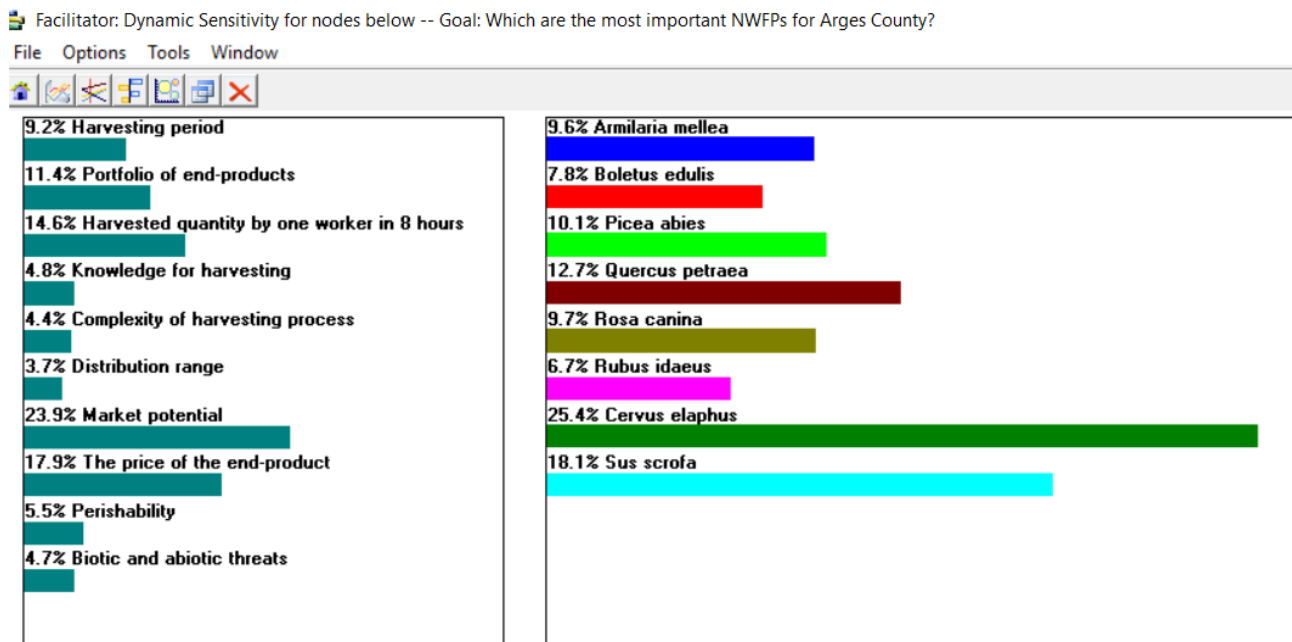


Figure 4. The ranking of the eight non-wood forest products in scenario 2

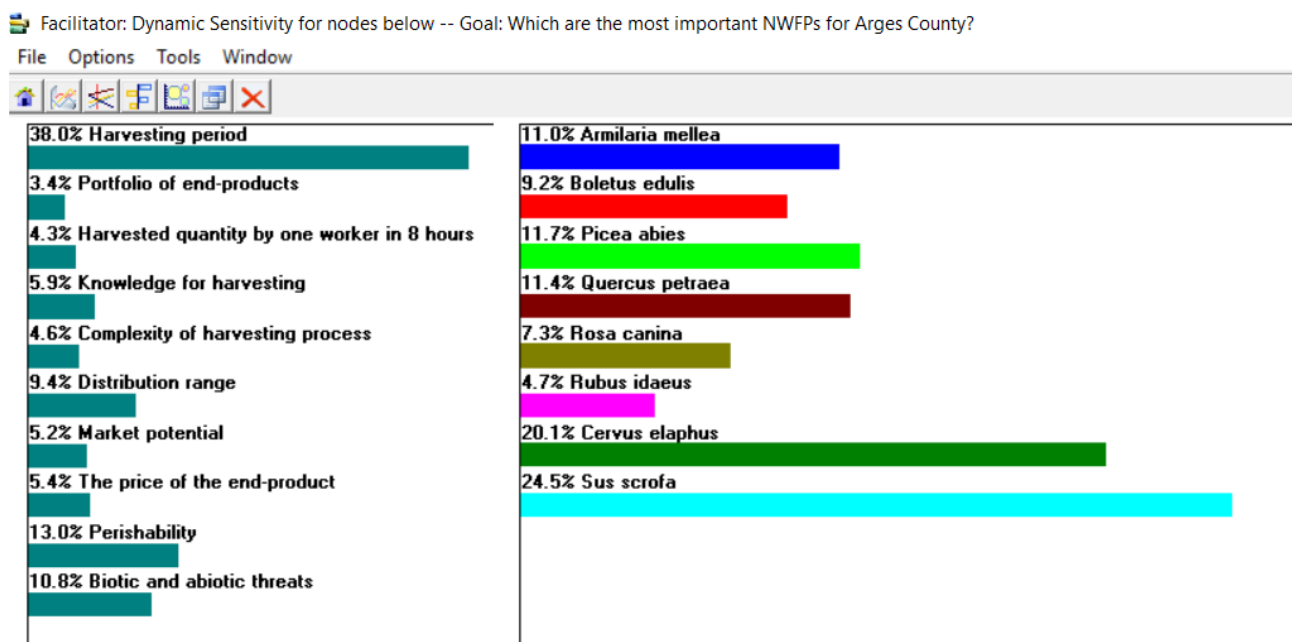


Figure 5. The ranking of the eight non-wood forest products in scenario 3

The completed results in the case of the three scenarios are given in Table 2. The most promising two NWFPs were red deer and wild boar (mainly meat).

Table 2. Ranking of selected NWFPs in the case of the three scenarios

NWFPs	Scenario		
	1	2	3
<i>Armillaria mellea</i>	3	6	5
<i>Boletus edulis</i>	5	7	6
<i>Picea abies</i> (seeds)	6	4	3
<i>Quercus petraea</i> (acorns)	4	3	4
<i>Rosa canina</i> (fruits)	7	5	7
<i>Rubus idaeus</i> (fruits)	8	8	8
<i>Cervus elaphus</i> (mainly meat)	1	1	2
<i>Sus scrofa</i> (mainly meat)	2	2	1

4. CONCLUSIONS

Conclusions based on the data collected from national reports and other papers

The diversity of non-wood forest products in Argeş County is high. Even so, the quantities harvested and commercialized decreased in recent years.

At regional level, like the case of Argeş County, little importance is given to the analyzing of the situation of these products and their potential.

In the perspective of decreasing the pressure on wood harvesting, forest owners and forest managers should take into account the potential of NWFPs as revenue. Special attention should be given to the NWFPs that have a broad distribution range, a high potential and also a large variety of end-products.

Conclusions regarding the AHP results

Red deer and wild boar (mainly meat) were the most promising non-wood forest products for Argeş County when all the 10 selected criteria received an equal importance. In other words, in the context of the selected 10 criteria, these products represent the main NWFPs on which forest owners and forest managers should focus their management plans and measures more in the future.

The raspberries were the lowest ranked NWFPs, which is easily explained mainly due to their more limited distribution range and a higher degree of perishability compared with the other non-wood forest products selected in this study.

General conclusions

In the current context of forest management in Romania, mainly characterized by wood-harvesting management goals and the difficulty to have a more or less homogenous approach, since there are more than 800.000 forest owners, at a small-scale the harvesting of NWFPs it is expected to increase. Also, since a large number of forest owners who have their forests included in several categories of protected areas, hence they have restrictions in terms of wood harvesting, they could find the commercialization of NWFPs as a sustainable solution. By doing this, the forest owners and forest managers will have benefits and the conservation of the forest ecosystems will be guaranteed.

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