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Forstwesen**The value of non-wood forest products for the Croatian bioeconomy****Der Wert von Nichtholz-Waldprodukten für die kroatische Bioökonomie**Stjepan Posavec^{1*}, Anton Brenko², Karlo Beljan¹**Keywords:** non-wood forest products, forest values, bioeconomy, forest policy**Schlüsselbegriffe:** Nichtholz-Waldprodukte, Waldwerte, Bioökonomie, Waldpolitik**Abstract**

Economic importance of non-wood forest products (NWFP) has been increasing over the last decades, and is now holding a respectable share in the global bioeconomy. The importance of bioeconomy is not yet fully recognized in many country policies, therefore, a well-defined and sustainably managed forest and wood industry could play an important role in implementing and boosting bioeconomy aims, especially in rural areas. The aim of the paper is to present recent research on characteristics of NWFP's and their value for Croatian bioeconomy. Data obtained from collectors and processors (1001 respondents April-May 2018) was analyzed using descriptive statistics tools on the value of the most common products (mushrooms, medical and aromatic plants, berries and other fruits). The average road distance that respondents cross between their home and the forest is about 10.5 kilometers. They spend 14 days per year collecting, and collect around 2 kg per day. The average prices that non-wood forest products achieve on Croatian, and even on the international market (5.3 EUR/kg) are higher than expected. Medicinal, aromatic and edible herbs achieve the highest price (6.24 EUR/kg mostly influenced by immortelle prices in the last few years), as well as mushrooms whose prices are higher than average (5.90 EUR/kg, mostly

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influenced by the price of white and black truffle). Sustainable forest management with focus on NWFPs could have a positive influence on employment, creation of added values and the share of forestry in national bioeconomy.

Zusammenfassung

Die wirtschaftliche Bedeutung von Nichtholz-Waldprodukten (NWFP) hat in den letzten Jahrzehnten zugenommen und hält nun einen respektablen Anteil an der globalen Bioökonomie. Die Bedeutung der Bioökonomie wird von der Politik vieler Länder noch nicht vollständig berücksichtigt. Daher könnte eine klar definierte und nachhaltig bewirtschaftete Forst- und Holzindustrie eine wichtige Rolle bei der Umsetzung und Förderung der Ziele der Bioökonomie spielen, insbesondere in ländlichen Gebieten. Das Ziel dieser Arbeit ist es, aktuelle Forschungsergebnisse zu den Merkmalen von NWFP und deren Wert für kroatische Bioökonomie vorzustellen. Die von den Sammlern und Verarbeitern erhaltenen Daten (1001 Befragte von April bis Mai 2018) wurden unter Verwendung deskriptiver Statistikinstrumente zum Wert der am häufigsten verwendeten Produkte (Pilze, medizinische und aromatische Pflanzen, Beeren und andere Früchte) analysiert. Die durchschnittliche Entfernung, die die Befragten zwischen ihrem Zuhause und dem Wald zurücklegen, beträgt etwa 10.5 Kilometer. Sie sammeln 14 Tage im Jahr und sammeln etwa 2 kg pro Tag. Die Durchschnittspreise, die Nichtholz-Waldprodukte auf dem kroatischen und sogar auf dem internationalen Markt erzielen (5.3 EUR/kg), sind höher als erwartet. Medizinische, aromatische und essbare Kräuter erzielen den höchsten Preis (6.2 EUR/kg, der hauptsächlich von den Immortelle-Preisen der letzten Jahre beeinflusst wurde) sowie Pilze, deren Preise über dem Durchschnitt liegen (5.9 EUR/kg, die hauptsächlich vom Preis der weißen und schwarzen Trüffeln beeinflusst werden). Eine nachhaltige Waldbewirtschaftung mit Schwerpunkt auf NWFP könnte sich positiv auf die Beschäftigung, die Schaffung von Mehrwert und den Anteil der Forstwirtschaft an der nationalen Bioökonomie auswirken.

1. Introduction

In South-East European countries, mushrooms, medicinal and aromatic herbs and forest fruit have the potential of strongly contributing to the development of national and local economies and bioeconomy (Amici *et al.*, 2020). Their importance is reflected in the possibility of additional income and the development of small and medium-sized enterprises, which can encourage the development of rural areas. Recent research (Lovrić *et al.*, 2020), shows that 26% of European households collect NWFPs and that collected quantities increase from Western to Eastern Europe. In research results from the EU FP7 StarTree project presented in 2017 (Lovrić *et al.*, 2017), the value of collected NWFPs for Croatia was about 5 €/ha. Total value of NWFPs including marketed animal products was 6,075.20 million Euros. According to the FAO-TRAFFIC Expert Consultation Report (FAO, 2010), South-East European countries represent the key area in Europe for collecting non-wood forest products and play an important

role in local, regional and international trade. The NWFPs are also important in pharmaceutical industry, where plants with medicinal properties are used, and in cosmetic industry, for extracting essential oils (needles, leaves). According to the FAO FRA report (2020), in Europe, the main product groups were ornamental plants (39%), edible plants (30%), wild meat (17%) and bee products (8%). The high value of the ornamental plants product group was due mainly (97%) to Christmas trees, where the market was dominated by Germany (51%). NWFPs removals are estimated in Croatia for 1.8 million € in year 2005 (FAO FRA 2010). Most of the data were estimated, because there is no reliable data on quantity and value of removals, like for NWFP categories “food” (mushrooms, honey) and “raw material for medicine and aromatic products” (FAO FRA 2010 Croatia). According to Martinez de Arano *et al.* (2021), in 2015, the economic value of marketed NWFPs in Europe was 4 billion €, nearly 20% the value of marketed roundwood. Moreover, by including informally marketed and self-consumed products, the value of that figure may rise to some 23 billion € yr⁻¹, which exceeds, by far, the revenues from roundwood. Around 85% is used for self-consumption, while the remaining 15% is sold in formal and informal markets, for an estimated 3.5 billion €. Nowadays, no more than 2% of European forests and other wooded land are primarily managed for NWFPs, although probably more than 80% of those areas, actually provide resources other than wood. Over 5 million hectares (Mha) of forests are primarily managed for the production of different NWFPs or for coproduction with timber, pastures or other ecosystem services, including agroforestry systems.

Due to the fact that the NWFPs are a crucial segment of a bioeconomy as a whole (Amici *et al.*, 2020), the national bioeconomy and the economic share, respectively the impact, of NWFPs market should be evaluated. Total bioeconomy in Croatia is assessed at 204,000 employees that made 11.33 billion € of turnover and 3.47 billion € of added value in 2018 (Kulišić, 2020). In 2015, Croatian bioeconomy made 10 billion € turnover and 3 billion € of added value, which was less than 1% of total turnover and about 1% of added value of this sector on EU level. Production of wood and wood products, without furniture, employs 19% of all workers, production of furniture 3% and paper production employs additional 2%. The biggest turnover in bioeconomy sectors is in food production (50.4%), followed by agriculture (21.2%) and wood industry and furniture production (11.1%). Most of employees work in high intensity sectors that are characterized by low productivity, which indicates great potential for development of the bioeconomy sector in Croatia. Croatian total forest and forest land coverage is 2,759,039.05 ha of which 2,097,318.16 ha (76%) are owned by the state, while 661,720.89 hectares (24%) are owned by almost 500,000 private owners, which indicates small size of private forest properties (Forest Management Plan of the Republic of Croatia from 2016 to 2025). Total annual cut amounts to 5.5 mil m³. This renewable resource has high potential for use as biomass, which could play an important role in Croatian bioeconomy sector. The share of forestry in national bioeconomy sector is estimated at 3% looking at trade turnover in 2018 (Kulišić, 2020). According to data by the Croatian Bureau of Statistics (CBS, 2017), in 2016 on the

territory of the entire Croatia there was 1,562,983.00 ha of utilized agricultural land, which makes 27.61% of the total land area of the Republic of Croatia. Almost 4.7% of the total agricultural area is registered as a permanent crop or a vegetable garden, which makes these areas potentially suitable for the cultivation of aromatic and medicinal herbs. In 2016, in the Republic of Croatia there were 72,543.00 ha of vegetable gardens and permanent crops, which represents a decrease of these areas by 1.55% compared to 2013 (Croatian Bureau of Statistics, 2017). According to data by the Croatian Paying Agency for Agriculture, Fisheries and Rural Development, 5977 requests for subsidy payout for the production of aromatic and medicinal herbs were submitted in 2017, out of which 18 requests consider subsidies for the production of aromatic herbs on the total area of 5.04 ha (0.0068% compared to the total agricultural area in 2016), while 5959 requests consider the production of medicinal herbs on the total area of 8,684.91 ha (11.81% compared to the total agricultural area in 2016).

On the other hand, the reliable info on management and the assessment of the yearly quantity and quality of NWFPs are lacking. Exact data on the collected non-wood forest products are not available. There is no comprehensive inventory, but only some estimations of the values of non-wood forest products, while estimation parameters are not coherent. There is a huge number of non-wood forest products and there is no single accepted classification. The quantities and values of the collected forest products cannot be obtained from the Croatian Bureau of Statistics. Due to the fact that there is no single database, it is difficult to obtain the relevant data on the importance and influence of secondary forest products on national economy (bioeconomy). This paper is an attempt to provide some valuable observations regarding this knowledge gap. Legal framework regarding the collection of non-wood forest products regulates that for the collection of native wild species the collectors must obtain a permission of the Ministry of Economy and Sustainable Development pursuant to the Ordinance on Collecting Native Wild Species (OG114/2017). The Ordinance, along with the expert base as appendix, also regulates the amount of products that a single collector can collect, the methods of collecting and the collection periods and restrictions.

The Ordinance on Secondary Forest Products (Croatian Forests Ltd, 2014) defines secondary forest products and their usage, requirements for their collection, repurchase and everything else related to the use of secondary forest products on the entire forest management area. Pursuant to Article 3 of the Ordinance on Secondary Forest Products (Croatian Forests Ltd, 2014), the use of non-wood forest products according to the Ordinance includes: collection and/or organization of collection, as well as exploitation, storage, circulation and other activities related to the use of non-wood forest products by a natural or legal person either for personal use or for processing, trade or other types of exchange. National Strategy for Environmental Protection states that it is necessary to apply integral protection, "along with monitoring of all processes and activities that endanger the conservation and sustainable use of nature" (Croatian Parliament, 2002), but also to inform the public on the "exceptional

biodiversity and the need for its conservation". Within the legal framework for secondary forest products there are many acts and subordinate regulations from different sectors (Forestry Act OG 68/2018, Nature Protection Act OG 127/2019, International Trade and Endangered Species Trade Act OG 14/2019, Ordinance on Collecting Native Wild Species OG 114/2017).

Determination of the maximal quantity of secondary forest products that can be collected from the wild has been defined by the Ministry of Economy and Sustainable Development, which authorizes the permission for the collection of wild plants and their parts for processing, trade or other types of exchange. In addition to the Ministry's permission it is necessary to acquire the owner's or right holder's permission. In accordance with this, in case of state-owned forests managed by Croatian Forests Ltd. it is necessary to acquire permission of the local forest management unit that manages the area of secondary forest products' collection.

The primary aim of this study is to provide an overview of a collection, processing, usage, selling and the market of all NWFP which are present on the domestic free market. Afterwards, the secondary aim is to assess the NWFP's economic footprint regarding the Croatia's bioeconomy. Those two aims will surely help the intensive use to gain insight into the disposable quantities, to plan sustainable management and to protect the endangered species.

Based on the aim which should be fulfilled the two hypotheses were set:

H1: Economic impact of the usage and selling of the NWFPs has a significant effect on the respondent's household budget.

H2: Croatian bioeconomy could benefit by developing NWFPs market, sustainable forest management and forest policy.

2. Material and Methods

The survey was carried out on 1001 respondents during April and May 2018 (Table 1). The data collection is conducted with two quantitative methods: CAWI – Computer Assisted Web Interviewing (30% share in sample) and CATI – Computer Assisted Telephone Interviewing (70% share in sample). Confidence level is 95%, and confidence interval 3.1%. Based on the census conducted in 2011 in the Republic of Croatia (DZS, 2011), the sample evenly covered the area of the whole country, considering the number of respondents according to age, gender and level of education. A total of 1863 telephone calls were made in order to fulfil the intended sample of 1000 respondents. A number of respondents did not collect non-wood forest products, while in some cases the survey was cancelled at the request of the respondents. Table 1 shows the ratio of samples according to regions, and it is important to stress that the smallest number of respondents were from Lika, Kordun and Banija, while the majority of respondents were from the Zagreb region. Data can also be distributed according to each county, but for statistical purposes they were grouped into regions.

Regarding spatial distribution, it is important to stress that the majority of collectors (44.6%) live in villages with less than 2000 inhabitants (other four categories of the place of residence are represented with minor share). The sample includes villages and towns of all sizes, age of the respondents ranges from 15 to 89 years, while the gender structure is 64% female and 36% male. Within the age groups of the respondents the prevailing group of collectors is 35-44 years (23%), followed by age groups of 65< years (19%), 55-64 years (18%), 45-54 years (17%), 25-34 years (15%), and 15-24 years of age (8%).

Table 1: The number and share of the respondents according to regions of the Republic of Croatia.

Tabelle 1: Anzahl und Anteil der Befragten nach Regionen der Republik Kroatien.

Region	Number respondents	%
Zagreb	209	20.9
North Croatia	179	17.9
Slavonia	153	15.3
Lika, Kordun, Banija	103	10.3
Istria, Hrvatsko Primorje, Gorski Kotar	165	16.5
Dalmatia	192	19.2
Total	1.001	100.0

The collection of primary and secondary data and information from the available sources were used in the survey - international and national scientific and specialized literature from the field of forestry economics (Croatian Bureau of Statistics reports, Croatian Forests Ltd. Business reports, FSC web page, Stojanovska *et al.*, 2015; Posavec *et al.*, 2018; Pezdevšek *et al.*, 2019, Brenko *et al.*, 2018). Based on the conducted survey for registered/non-registered collectors and processors, the supply and demand of secondary forest products in the chosen areas was determined, as well as the main actors in the added-value chain. Furthermore, legal and strategic framework and the procedure for obtaining permission for forest product use were analyzed as well. By conducting field work the number and type of products and services in the studied area were determined. Statistical analysis of the collected survey data was conducted by the SPSS software.

3. Results

Research results show that respondents are collecting wild herbs (17.2%), wild forest fruits (23.9%), mushrooms (29.4%) and the most they collect medicinal, aromatic or edible herbs (28.9%). In the distribution according to gender (M, F), it stands out that women among all listed products mostly collect medicinal, aromatic and edible herbs, while men mostly collect mushrooms. When asked about their average monthly household income 25% of the respondents did not want to answer. The only data available is that an average household consists of four members with income ranging from 800 to 1,066 €. In respondent analysis the variable that connects their employment status and collection intensity has also been calculated. Contrary to the expectation prior to the research, the results show that most of the collectors (30%) are employed in the private sector, while least of the collectors are categorized as unemployed (7%). Non-wood forest products are collected during different seasons and with different intensity.

Analysis of the collection according to regions indicated the following results of most common collected products: Zagreb – mushrooms, North Croatia – mushrooms, Slavonia – medicinal, aromatic and edible herbs, Lika, Kordun and Banija – mushrooms, Istria, Hrvatsko primorje and Gorski kotar – edible plants, Dalmatia – equally frequently collected are edible and medicinal herbs. Of course, some non-wood forest products are related to a particular geographical region in which they naturally grow. It can be concluded with certainty that the collectors do not collect products that are financially more valuable, but those that are more easily found in nature (the place of collection may be a forest or a meadow). The relation between the type of a non-wood forest product and the number of inhabitants in a town or village is that all people mostly collect medicinal, aromatic and edible herbs they can find in their immediate surroundings. The collectors most often go to the forest with their family members (57%), and mostly in privately-owned forests (43%), but not necessarily in their own forest. The average distance they cross between their home and the forest is 10.5 kilometers. They spend 14 day collecting per year and collect around 2 kg per day. They mostly collect products for personal use (99%). Out of the sample of 1,001 respondents, 45% of the respondents said they own a private forest. The amount of collected products per day and the fact that they are collected for strictly personal use is the result of the respondents' awareness that for such purposes and amounts they do not have to obtain (*i.e.* pay for) a permit for collecting. It is important to point out that 90% of the respondents have never obtained a permit for collecting. Data from the database show that the rare respondents who obtained a permit come from the North Croatia region and from towns with more than 100,000 inhabitants. The permit was obtained by respondents from the age group of 15-24 years for the purpose of collecting mushrooms and plants for food. More precisely, for collecting blueberries, black trumpets, golden chanterelle mushrooms and Jerusalem artichokes. The place of collecting these species is primarily in state-owned forests, and the collectors for such purposes cross a higher-than-average one-way distance of around

20 kilometers, spending 40 days collecting during the season. However, those who sell the products mostly sell them to households and do not earn a profit that would significantly affect their income. For 54% of respondents the profit earned from selling the products has little or no effect on their household income. Table 2 shows the average prices of products in the last collecting season classified into four basic groups. Some of the collectors who sell products and have a permission for selling usually sell raw or semi-processed products (cleaned, dried, cooked etc.).

Table 2: Selling prices of non-wood forest products.

Tabelle 2: Verkaufspreise von Nichtholz-Waldprodukten.

Product type	Average price (EUR/kg)	Standard deviation
Wild forest fruits	2.20	1.90
Mushrooms	5.90	4.34
Edible plants	4.15	0.85
Medicinal, aromatic and edible herbs	6.24	2.93

The average prices that non-wood forest products achieve on Croatian, and even on the international market (5.3 €/kg) are higher than expected. Medicinal, aromatic and edible herbs achieve the highest price (mostly influenced by immortelle prices in the last few years), as well as mushrooms whose prices are higher than average (mostly influenced by the price of white and black truffle). The respondents who sell products come from the Zagreb region (21%), while other regions are evenly distributed with the share of around 15%. Those are mostly women living in villages up to 2,000 inhabitants, of the age group of 35-44 years. Their amount of sale related to quantity mostly includes chestnut and wild strawberry (forest fruits), cep, golden chanterelle mushroom and parasol mushroom (mushrooms), dandelion, wild garlic, asparagus (wild plants for food), elderberry, chamomile, lavender and mint (medicinal, aromatic and edible herbs). During collection, processing and distribution of products the collectors do not tend to join associations or similar organizations. As much as 90% of the respondents do not even want to become a member of an association which would organize collecting and sale. As the main reason for this the respondents claim that they only collect products for personal use and that joining an association would not offer them any benefits, or that they simply do not have any need for such activities. In the survey, the respondents were asked to evaluate the quality of non-wood forest products which they collected during the previous year. Most of the respon-

dents (56%) gave the highest possible score, while the frequency of the lowest scores is almost insignificant (0.2%). It is important to stress that the sum of scores 4 and 5 in percentage equals around 90% (Table 3). The product quality is without doubt closely related to the habitat where it was collected (Table 4). The respondents who, apart from collecting, also sell the products have almost the same opinion on the quality of non-wood forest products, but there is some statistical difference. The average score by the collectors is 4.47, and by collectors/processors 4.26. Due to subjectivity in providing answers and the scale (1-5), the difference between scores can be considered insignificant. It is interesting how the respondents evaluated the quality of non-wood forest products with high scores despite the high average score of the factors that have a negative effect on sustainable management (shown in Table 5).

Table 3: Quality evaluation of the collected forest products by respondents.

Tabelle 3: Qualitätsbewertung der gesammelten Waldprodukte durch Befragte.

Quality score	Number respondents	%
1 Very poor	2	0.2
2 Poor	7	0.7
3 Neither good nor poor	81	8.1
4 Very good	341	34.1
5 Excellent	561	56.0
"I don't know" / "I cannot evaluate"	9	0.9
Total	1001	100.0

Table 4: Place of collection of non-wood forest products by respondents.

Tabelle 4: Ort der Sammlung von Nichtholz-Waldprodukten durch Befragte.

Ownership type	Number respondents	%
In state-owned forests	321	32.1
In private forests	426	42.6
On agricultural land (or meadows)	203	20.3
In urban, populated area (e.g. forest parks, parks)	33	3.3
In a forest – unaware of the ownership status	10	1.0
Combination of different places (forests, meadows, gardens)	3	0.3
I don't know	5	0.5
Total	1001	100.0

Table 5: The respondents' opinion on negative factors.

Tabelle 5: The respondents' opinion on negative factors.

Negative impact factors on NWFP management	Average score *	STDEV **
Current forest management	3.2	1.2
Excessive collection	2.9	1.9
Clear cutting	3.7	1.6
Climate change	3.7	1.2

*scores vary between 1 (very small threat) to 5 (extremely big threat), ** standard deviation of an average answer

Products are mostly collected in forests, more precisely in private forests (Table 4). Products are also to a great extent collected in state-owned forests. The answers to this question have to be taken with caution because the respondents avoided to give the answer: "I collect in a state-owned forest". Although it is known that a permission

is required for collecting products in a state-owned forest, it can be assumed that the respondents are more likely to answer: "I collect products in a private forest". Almost one fifth of the collectors (20%) collects products on agricultural land (Table 4). This includes only those types of products that grow exclusively on meadows. In the process of collecting they usually do not encounter difficulties (e.g. they state that there are enough forest roads, obtaining a permission is not difficult, the legislation is appropriate etc.). However, when asked about sustainable management of non-wood forest products, they point out the following threats:

The respondents' opinion, in this case the opinion of people who collect non-wood forest products, is that clear cutting and climate change have the most negative impact on sustainable management of non-wood forest products. Climate change is evident and neither the collectors nor forestry experts can influence it to a greater extent.

However, clear cutting has been identified as a huge threat as well. In this regard it has to be considered that clear cutting, or regeneration, occurs every year in a different part of a large forest area. Most of the collectors usually do not change the location of the collection because they chose the closest locations, the most familiar ones, etc. Therefore, it should be expected that the part of forest in which they had been collecting products for years has been regenerated. As part of integral forest management, it has to be emphasized that efficient forest management and the collection of non-wood forest products is possible only in case the collectors are willing to change the location.

Private and legal persons who buy non-wood forest products from the collectors are presented in Table 6. It can be observed that products are mostly sold to private buyers (neighbors, acquaintances etc.), while a smaller amount of products is sold to restaurants and small shops. Business cooperation with Croatian Forests Ltd, *i.e.* with local forest management units, is represented by the repurchase of the collected forest reproductive material. In this view the collectors collect acorns, chestnuts and beechnuts, which are used for forest regeneration.

Table 6: The selling of non-wood forest products by respondents.

Tabelle 6: Der Verkauf von Nichtholz-Waldprodukten durch Befragte.

Buyers	Share*
Private persons	79.2 %
Small companies	29.2 %
Restaurants	20.8 %
Grocery shops	8.3 %
Local forest office	8.3%

***Since a particular respondent can sell his/her products on different locations, the total share of sale in the table can exceeds the value of 100%**

Based on the obtained data, an assessment of the annual amount of the collected non-wood forest products has been made. Table 7 in segments shows the assessment for two groups of collectors. The first group are the collectors oriented solely towards personal use of the collected products. They make up a large majority (90%), but on average they collect multiple times less non-wood forest products per year (11 times less than the collectors oriented only towards selling). It is evident that an average collector oriented towards personal use of non-wood forest products collects a smaller amount per year, but since most of the collectors collect for personal use, in total they collect the largest amount of products.

Considering that the average purchase price of all non-wood forest products on the Croatian market is 5.3 €/kg, as well as data from Table 7, the difference between the financial incomes between the collectors can be calculated. A collector for personal use annually collects and consumes (alone or with family) non-wood forest products valued at 97.7 €. A collector who sells the collected products earns 1,100 € per year.

But the income has a different influence on the respondent's household budget. For the 12.5% respondents, who sells the NWFP's, this kind of earning is very important (it represents 50%< of the household budget). For the 20.8% of them it has semi important influence (11-50% of the household budget), and for the 37.5% of respondents it has low importance (10%> of the household budget). Other respondents could not estimate the level of importance. Accordant to this finding we can say that hypothesis 1 is accepted.

Table 7: Assessment of the collected quantities of NWFP (kg) in the period of 1 year.

Tabelle 7: Bewertung der gesammelten Mengen an NWFP (kg) im Zeitraum von 1 Jahr.

	Personal use *	Selling **
Average	18.43	205.85
Standard deviation	57.2	479.8
Median	5.00	35.00
Minimum	0.10	3.00
Maximum	1,000.00	2,000.00
Number of pickers	981	20

*collectors oriented towards personal use of NWFP, **collectors who only sell the collected NWFP

4. Discussion

For South-East Europe, the marketed value of NWFPs in year 2015 was around 43,3 million €. The economic value of animal products is estimated on 48 million €, what could end up with 91,3 million € worth NWFPs used in SEE. The estimated value on European level of 4 billion € economic value of marketed NWFPs represents an increase of 76% of gross value worth of NWFPs (comparing to previous State of European's Forests Report) and a decrease of 15% for South-East Europe. The reported values cover only the marketed NWFPs and for reasons of consistency, although they could represent a substantial share, the values of NWFPs harvested for self-consumption and informal use at the local level are excluded from the analysis (State of Europe's Forests Report, 2015 and 2020). Since the market of non-wood forest products in Croatia is not organized, the prices of repurchase depend on the buyer and vary depending on the current supply and demand, which largely depends on the weather conditions and season as well (Posavec *et al.*, 2014). Due to different reasons and issues in added value chain, grey market has been growing, while the overview of the production and collection of aromatic and medicinal herbs and mushrooms has to be taken with caution, especially due to a huge disproportion between the number of issued permits and the number of reports on realized amount of collection. The main source of information were secondary data from the records by the Ministry of Environmental Protection and Energy from May 2018 (Figure 1). However, according to the policy documentation analysis and assessment of economic impact of the, at the moment, undeveloped market of the NWFPs, the hypothesis 2 can be conditionally accepted. Informal market in the coun-

try is much bigger than the formal one, like in other SEE countries (Keča *et al.*, 2017). Also, the self-consumption and consumption within the collecting household is several times larger than the marketed part (Lovric *et al.*, 2020). Market analysis for non-wood forest products in conducted research showed that on average the collectors during the season spend 14 days collecting and collect around 2 kg of any type of product per day. Out of 10% of the respondents who have a permit, the majority of them stated that the procedure and cost of obtaining a permit poses a moderate problem. Other respondents stated that they collect non-wood forest products only for personal use and therefore were not legally obligated to obtain a permit. Furthermore, before collecting, the collector must obtain the land owner's permission (by the Ministry of Economy and Sustainable Development for state-owned land or by private land owners for privately-owned land), and after the collecting the collector must deliver a report on the realized quantities to the appropriate authority. Since a lot of private agricultural and forest land in Croatia do not have resolved property rights, obtaining a permission in many cases is not possible. However, some processors in the region, starting to create innovative products and businesses (Živojinović *et al.*, 2017). For that purpose, the Ministry of Agriculture, together with the European Agricultural Fund for Rural Development and the Rural Development Program of the Republic of Croatia publish a tender for "Marketing of wood and non-wood forest products". Eligible beneficiaries are forest owners, forest owners' associations, micro, small and medium enterprises and local government units and their associations. The funds could be used for packaging and labeling equipment of forest products, the cost of obtaining certificates for the ecological area or forest products and other certificates.

A new EU bioeconomy strategy was published in 2018 (A sustainable Bioeconomy for Europe: Strengthening the connection between economy, society and the environment), with aim to increase sustainable resources according to the EU Agenda 2030., and Sustainable Development Goals – SDG, as well as Paris Agreement (EU Comision, 2019, Katila *et al.*, 2019). The bioeconomic strategy of the Republic of Croatia, it has not yet been adopted, but bioeconomy is defined in the Draft Proposal of the Energy Development Strategy of the Republic of Croatia until 2030 with a view to 2050 (2019) as "production of renewable biological resources and conversion of these resources, together with waste, into value-added products, as what are food, feed, biological products and bioenergy ". New initiative among 11 EU member countries, agreed about Central European bioeconomy strategy called BIOEAST (EC, 2018), to strengthen knowledge based bioeconomy in forestry, aquaculture and agricultural sectors. The development of bioeconomy concept also helps to identify the drivers of bioeconomy development and contributes to green growth and circular economy (OECD, 2019). The obtained results of the conducted research should help clarify the role and importance of forestry for the economy, society and the environment, which are the main goals of the strategy. The relevance of NWFPs is not recognized in national statistical reports (CBS, 2019), in national classification NACE A02 (forestry and wood production) or C10 (production of food products), what should be changed in the future. The share of agriculture, forestry and fisheries in the Republic of Croatia

in total gross domestic product (GDP) for the period 2000–2017 is about 4% (Grgić *et al.*, 2019). Considering the conducted research, the share of forestry in GDP would certainly increase significantly with the inclusion of NWFPs and biomass products.

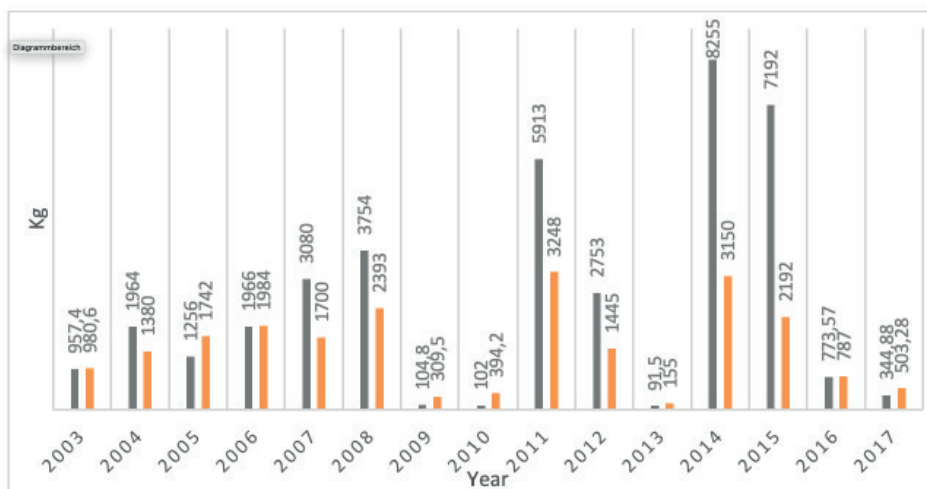


Figure 1: Quantities of truffles, 'white truffles' (orange) and 'black truffles' (dark grey), reported as picked from the wild to the Ministry of Nature Protection and Energy, in kg, from 2003 to 2017 (Source: Brenko *et al.*, 2018).

Abbildung 1: Mengen von Trüffeln, „weißen Trüffeln“ (orange) und „schwarzen Trüffeln“ (dunkelgrau), die dem Ministerium für Naturschutz und Energie von 2003 bis 2017 in kg als in Nature gesammelt gemeldet wurden (Quelle: Brenko *et al.*, 2018).

5. Conclusions

The situation on the Croatia's NWFPs market could be improved by the organized certification, joint appearances of the sellers and by the Government/EU financial support for the private persons and companies dealing with NWFPs. Research results have shown that trade of these products between neighboring countries is most efficient. Due to transport prices, non-wood forest products do not achieve high market prices, so transport to more distant countries would not be cost-effective. Of course, there are some exceptions, such as products from truffles and immortelle.

Organized certification of small and medium-sized forest owners is a prerequisite for more efficient use of non-wood forest products, lowering the certification costs and creating new products and services. Joint appearances on the market through fairs and ecological products' trade enable better recognition of products and brand re-

cognition on the Croatian or international market. Although strategies of sustainable development emphasize the importance of products and services offered by forest ecosystems (e.g. health, eco- and agritourism), more effort and assets are needed to achieve these goals, especially in a situation when financial support is available from the EU and national funds. Integration of sustainable management of NWFP in Croatia, could shift a traditional timber-oriented management paradigm towards an inclusive ecosystem forest management approach (Shepard *et al.*, 2020). According to the research results (Rodrigues de Mello *et al.*, 2020), the best way to enhance the sustainability of NTFP use and/or commercialization, include improved forest management and increasing the resource base what lead to ecological sustainability. Only new and innovative products and services offered by forests can create the added value in the development of national bioeconomy. This will strengthen and increase biomass-based sectors like forestry, open up investments and markets.

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