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Assessment of Forest Certification as a Tool to Support Forest Ecosystem Services

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Abstract: Certification provides a way to demonstrate the positive impacts of sustainable forest management (SFM) on ecosystem services. Ecosystem services provide society with a wide range of benefits, from clean water and carbon sequestration to the production of wood and non-wood products. This study evaluates forest owners' and managers' perceptions of forest certification as a tool to support SFM and forest ecosystem services in Slovakia. The questionnaire survey focused on the understanding of the concept of SFM, the objectives of forest certification schemes, and especially on the examination of the perceptions of 288 PEFC- and FSC-certified forest owners and managers on how forest certification helps to support individual ecosystem services. Among the important factors influencing the level of understanding of forest certification and its role in ensuring forest ecosystem services is the size of the managed forest area and the implemented certification scheme. The results of this study indicate that forest certification is positively perceived as a supporting tool for ecosystem services, and certified forest owners are sufficiently aware of the objectives of SFM. Regardless of the size of the managed forest area and the type of the implemented certification scheme, forest certification is mainly perceived as a tool which improves the company image and represents a commitment to environmental responsibility while promoting SFM. Certified companies managing large forest areas see the role of certification as being more significant in ensuring selected ecosystem services, in particular, the provision of woody biomass and water. However, in general, forest certification is mainly perceived as a supporting tool for the ecosystem services related to the control of erosion, soil formation, and natural composition, as well as the function of species and ecosystem diversity, followed by the provision of aesthetic, scientific, and educational values.

Keywords: forest ecosystem services; forest certification; sustainability; sustainable forest management

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1. Introduction

1.1. Forest Ecosystem Services and Forest Certification

Forest ecosystems provide a wide range of services that society uses and is dependent on. These services include tangible goods such as timber and timber products; carbon sequestration; soil retention; and cultural, recreational, and spiritual values [1] that are essential for human health, livelihoods, and survival [2]. There are several definitions of ecosystem services, in which they are referred to as the benefits that people derive from ecosystems [3], but also as the direct and indirect contributions of ecosystems to human well-being [4]. The concept of ecosystem services is a widely used framework that has many different perspectives with different aims and manners, and is therefore increasingly being applied in policy as well as in practice [5]. The commonly used approaches include the most well-known classifications implemented within the project Millennium Ecosystem Assessment (MEA) [3], The Economics of Ecosystems and Biodiversity (TEEB) [5] based on MEA, and the Common International Classification of Ecosystem Services (CICES) [6]. The CICES classification describes ecosystem services in more detail in comparison with the other mentioned concepts. The aim is to enable people to obtain an easier overview of the

classification of ecosystem services, and a clearer understanding of how people measure and analyse the obtained information [6].

In general, it is necessary to plan and make decisions in the areas of biodiversity, ecosystem protection, restoration, and sustainable development due to the growing intensity of human activities and their associated impacts [7]. Therefore, in order to ensure the continuous provision of forest services, the forest landscape needs to be managed in a way that pays attention to the various functions of forests, and at the same time ensures their sustainability [8]. The first idea of sustainable forestry was born in the 18th century in Germany as an incentive for degraded forests and a lack of timber supply [9], but the concept of sustainable development was popularized in the Brundtland report [10]. Later, this concept was developed at the United Nations Conference on Environment and Development in Rio, 1992 [11]. The conference identified the economic, environmental and social areas that are important as the pillars of sustainable development [12]. Besides this, a non-binding statement on forest principles was drawn up, consisting of 17 points. They outlined guidelines and resources for the protection of the world's forests. However, within the context of sustainable management, there were two basic resolutions defining priorities in forest management, containing six criteria and indicators for sustainable forest management adopted at the Lisbon Conference in 1998, which were accepted within the Pan-European context [13]. Together with another regional intergovernmental process that developed different documents, policies, criteria and indicators for sustainable forest management, they formed the basis for the creation of forest certification schemes.

Currently, forestry faces many sustainability issues that are partly in a conflict of interest which requires the weighing of different objectives and the seeking of a compromise, such as ecosystem services, timber provision, adaptation to climate change, or maintaining carbon stocks in forests [14]. The vision of sustainable forest management (SFM) represents the use and management of forests based on the satisfaction of ecological, economic and social values. However, this vision can vary considerably among countries and regions due to different socioeconomic settings and ecosystems [15]. Siry et al. [16] mention that countries around the world are striving toward the goals of sustainable management. Therefore, it is still important to put in place a mixture of effective public policies and a private market for the achievement of global sustainable forest management.

As sustainable forest management has evolved, new forest certification systems have emerged to focus on forest ecosystem management [17,18]. There are currently several forest certification systems that operate worldwide. Most of them consist of organizations of which the goal is to promote SFM by defining the basic requirements that are placed on forest owners and managers [19]. There are two main internationally-recognized forest certification schemes: the Programme for the Endorsement of Forest Certification (PEFC) and the Forest Stewardship Council (FSC); both are currently applied across Europe. Although the aim of both schemes is the sustainable use of resources, the primary differences between them are their origins and specific rules for responsible forest management. The FSC builds on 10 international principles and 70 criteria for responsible forest management [20]. Furthermore, International Generic Indicators have been developed to supportthe national standard setting process. The PEFC relies on six Pan-European criteria for SFM defined by the Ministerial Conference on the Protection of Forests in Europe [21], which were integrated and partially amended in the recent PEFC SFM requirements [22]. These systems contribute to a degree of standardization by establishing internationally-recognized sets of SFM principles [23]. Rametsteiner and Simula [24] deal with forest certification, criteria and the indicators of SFM as a tool to support the SFM objectives. Furthermore, they mention that the criteria and indicators of SFM evolved mainly at a national level in order to describe and monitor the state and trends in forests and forest management. These criteria and indicators provide an essential reference basis for forest certification standards, which set performance targets to be applied to a defined area. Forest certification represents a voluntary tool for independently-verified SFM [25], which is in line with specific ecological, economic and social standards [26]. Many authors identified a range

of benefits following from certification, in particular, some economic benefits in terms of increased sales, penetration of new markets, and potential price premiums [27–31]. Kalonga et al. [32] state that forest certification standards and their implementation processes have a positive effect on biodiversity protection, such that adoption is considered to be an appropriate political choice. In some cases, forest certification has proven to be a tool capable of operating without the intervention of the public forestry administration or the support of market management. However, it is necessary to implement other public policy instruments, such as ensuring an appropriate regulatory framework, targeted support, and incentives for certified forest managers, and to support the promotion of the market for certified products [33]. A particular contribution to the certification of forest ecosystem services was made by FSC, which introduced specific procedures to demonstrate a positive impact of responsible forest management on ecosystem services. The resulting standard and accompanying documents outline the compliance requirements for ecosystem services within FSC certification, as voluntary additions to FSC Forest Management Certification. The objectives of the FSC Ecosystem Services Procedure are to set out the requirements for certified forest managers to credibly demonstrate the impact of their activities on the maintenance, conservation, restoration, or enhancement of ecosystem services. Another objective is to provide certified forest managers with improved access to emerging ecosystem services markets, and to improve the access to finance for validated ecosystem service restoration or enhancement impacts [34]. In particular, the considered procedures could not only reflect a positive impact on recreational services but also for carbon sequestration and storage, biodiversity conservation, watershed services, and soil conservation [35].

The adoption and effectiveness of non-state market-driven instruments, such as forest certification, could positively enhance the conservation of ecosystem services [36]. There are several studies pointing out the relationship between forest certification and the provision of forest ecosystem services. Savilaakso and Guariguata [37] define the certification of forest ecosystem services as a market mechanism involving activities such as a guarantee that a given forest stand is explicitly managed in a way that maintains or enhances the provision of a specific ecosystem service. Jaung et al. [38], in their study, contribute to filling the knowledge gap by evaluating and comparing key FSC stakeholders' adaptability to the incorporation of various forest ecosystem services into the certification. They conclude that there is a link between the FSC certification and forest ecosystem services. Moreover, their results contribute to understandings of the potential scope to test the FSC system's expansion to forest ecosystem services. They identify that key stakeholders' adaptability to include services is high for biodiversity conservation, carbon storage, and the provision of non-timber forest products, while it has a medium impact on watershed protection services. However, the lowest adaptability is represented by ecotourism and agricultural products. Meijaard et al. [39] examine whether the certification of ecosystem services supports the management and conservation of forests. Moreover, this study analyses ecosystem services such as water regulation, carbon sequestration, and pollination, and evaluates the opportunities and constraints for the development of certification systems. The findings prove that opportunities for the large-scale commercial viability of certified forest ecosystem services are limited because of the insufficient demand for multiple services, high biophysical service complexity, and elevated monitoring costs. Duchelle et al. [40] state that the certification of non-timber forest products has the potential to promote a sustainable harvest and bolster rural livelihoods. Jaung et al. [41] conducted a study to test the market demand for a potential certification scheme for the watershed services, assessed potential business values of certification, and suggested that the preferred business values obtained credible information disclosure on improved water quality, reduced flood risk, and environmental or social safeguards of the upstream forests.

1.2. Forestry and Forest Certification in Slovakia

The forests in Slovakia cover an area of 1.95 million ha of land (41% forest cover). In 2019, state-owned forests accounted for 40% of this area. The remaining 60% are owned

by non-state forest entities, including private, municipal, community, and church forests. As some non-state owners rent their forests to the state, state forest enterprises manage 51.3% of the total area of forests. In the forests in Slovakia with the total standing volume of 483 mil. m^3, the total increment was 11.9 million m^3, and the volume of felled timber reached 9.22 million m^3 [42]. All Slovak forest owners, regardless of their ownership type, are equally entitled to manage their forests in accordance with the respective legal provisions of the Forest Act [43] under the supervision of the forestry state administration bodies. These provisions relate to obligatory forest management plans, the allowable cut, and the stand reforestation requirements, ensuring SFM by the authorized professional foresters with required education and experience, etc. In total, there are almost 9000 forest owners in Slovakia whose forest holding areas range from less than one hectare to several tens of thousands of hectares. The largest state forest enterprise manages a network of regional forest districts with an average area of 7000 ha. The average area of non-state forest owners is approximately 200 ha [44].

In Slovakia, forest certification started to develop in 2001 when the first forest area of 40,000 ha managed by the state forest enterprise, LESY SR, š. p., became FSC certified. In 2003, the national FSC initiative launched the development of the national FSC forest management standards. However, the process of the development of national FSC standards was never completed, and recently the national initiative was cancelled. As a result, FSC forest certification in Slovakia is still based on the international FSC principles and criteria adopted for Slovakia by the interim standards of individual certification bodies [45]. By the end of 2020, there were 16 valid individual and group FSC sustainable forest management certificates covering an area of 303,818 ha [46], which represents 15.5% of the total forest area in Slovakia. The main expectations of forest owners and managers entering the FSC certification were linked to the improvement of their external image, commitment to environmental issues, and possibilities to seek profit margins. Among the main benefits are the penetration of new markets and a price premium related to timber sales. On the other hand, the key problems identified by the FSC certificate holders in Slovakia are linked to the high certification cost and the administrative burden associated with the certification record keeping [47].

In 2002, the Slovak Forest Certification Association—later renamed PEFC Slovakia—was established, aiming at the development of the national forest certification system. Two years later, in 2004, the Slovak Forest Certification System (SFCS) was internationally endorsed by the PEFC Council for the first time, and by the end of 2020, there were 1,224,530 ha of forests (nearly 63% of the total forest area) certified under this scheme, covering 269 forest owners and managers [48]. In the middle of 2020, the area of double forest certified forests was 78,254 ha. The PEFC certification system is dominant in Slovakia. It reflects the system of institutional arrangements, the best practice in forestry operations at a national level, and the local natural, social, and economic conditions. It invites representatives of all stakeholder groups—as defined by Agenda 21 of the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro in 1992 [49]—to participate in the process of the development of the national certification criteria, and—through the PEFC national governing body—it permanently maintains the information, education, and communication channels with certified entities [19]. Recent findings showed that the main motivation for PEFC certificate holders to enter the certification process was to improve their external image, to demonstrate SFM practices, and a commitment to environmental issues. Apart from the possibility to demonstrate SFM practices through PEFC forest certification, forest owners benefit from a better understanding of forest management concepts, and an improvement of administration issues, such as records keeping. The main challenges relate to the requirement to ensure compliance with certification criteria by contractors [47].

The organisational arrangements of forest certification in Slovakia differ between the two main certification systems. While the implementation of the requirements of the global FSC certification standard is organised on a group or individual level and directly

targets forest owners through an FSC-accredited certification body, the national PEFC system, governed by the national governing body, allows for the creation of regional organisations managed by regional entities (regional applicants). Thus, the overall forest certification decisions are taken at the regional level, whereas the fulfilment of certification criteria is audited on the level of individual forest owners and managers. Apart from these differences, some previously published studies focusing on forest certification in Slovakia demonstrated that the awareness, understanding, and perception of forest certification by certified entities and consumers are influenced by a range of other factors, among which are, e.g., the ownership type or the forest area. [27,47,50–53].

1.3. Objectives and Rationale for the Research

In European countries, there is an increasing demand for a wide range of services provided by forests. In order to respond to these new challenges, the European Commission—in the proposal of its new EU forest strategy [54]—set the SFM and the multifunctional role of forests, delivering multiple goods and services in a balanced way, ensuring forest protection as one of the guiding principles. It builds on existing legislation frameworks, considers the special situation of forest owners, and addresses market-based private-sector tools, such as certification. In Slovakia, the constantly-evolving public opinion and the public demands for the protection and, at the same time, multifunctional use of forest resources are gradually being reflected into the national legislation. Recently, in 2019, the latest amendment of the Act on Forests [43] adopted a definition of close-to-nature forest management as a concept of the application of more environmentally-friendly forest management methods. At the same time, it states that the forest certification systems can be used in connection with ensuring the professional knowledge based and sustainable management of the forests. Additionally, it recognizes the implementation of certification systems as being eligible for financing from state budget resources. As certification schemes comply with the national legislation, there is an indication that actual legislative requirements are being taken into consideration, at least during the ongoing process of the revision of the national Slovak Forest Certification System [48]. All of these legislative and voluntary requirements can strengthen the role of forest certification in supporting SFM and the provision of forest ecosystem services for the society. Its contribution can be also assessed by the certificate holders themselves, as they represent the key stakeholders whose participation is the certification process is critical to the outcome of the certification standard requirements.

Therefore, the main objective of this study is to evaluate the perception of forest certificate holders regarding forest certification as a tool to support SFM and the provision of forest ecosystem services in Slovakia. In spite of several studies carried out in the field of forest certification in Slovakia, the relationship between forest certification and the provision of forest ecosystem services has not been studied yet. Whether certification is perceived positively in this context, and to what extent, also depends on the degree to which it is understood, as perception and understanding are very closely linked, and the relationship between them is almost certainly a two-way one [55]. Therefore, we first examine the level of understanding of the concept of SFM and forest certification by certified forest owners and managers, and later, we focus on the evaluation of the influence of selected factors on the perception of forest certification in supporting the provision of forest ecosystem services.

2. Materials and Methods

The intention was to obtain data by conducting a survey applying systematic sampling with a list of the entire population of certificate holders in Slovakia. The forest owners and managers selected for the survey were identified from the national PEFC database [56] and the international FSC database [46] of SFM certificate holders. A database of entities holding a valid SFM certificate with available email addresses was constructed and checked for the presence of doubly-certified users, resulting in a total number of 309 forest owners

and managers to be contacted in the survey. The study was carried out using a mail questionnaire survey. The survey's development and implementation were based on the modified methods recommended by Dillman [57], including an informative phone call, a pre-notification email, and a first and second mailing in order to maximize the response rates. The data were collected in September and October 2020. In total, 288 (93.2%) responses were received and were suitable for further analysis.

The survey was carried out using Google Forms. The questionnaire consisted of several sections, including an introduction explaining the objectives and contents of the survey. Overall, the survey consisted of 41 closed-ended questions. The first section contained questions regarding the demographic profile of the certified forest owners and managers in terms of the size of their forest area, region, ownership type, and implemented certification scheme. These characteristics were supplemented by information on the respondent's position within a forest holding. Additionally, information on the number of years since the first issuing of the certificate was required. The second section was aimed at the examination of the respondents' level of understanding of the concept of SFM, the objectives of the examined forest certification schemes, and the determination of the level of agreement with the basic certification statements referring to the main certification objectives and purposes, e.g., SFM promotion, environmental commitment, image improvement, timber legality, economic aspects (market access, profit margin, communication), and management efficiency, etc. These statements were determined in line with the previously-published studies by Vlosky et al. [58] and Paluš et al. [27,47]. As the forest ecosystem services represent the benefits provided by forests to humans, the aim of the last section was to examine the ways in which certified forests' owners and managers perceive the role of forest certification in securing forest ecosystem services. For this purpose, three groups of forest ecosystem services—provisioning, regulating and cultural—were distinguished on the basis of the CICES classification [6], and within these groups, 16 ecosystem services were identified in total.

In order to examine the extent to which certificate holders understood the certification concept, agreed with the principal certification statements, and associated certification with the provision of ecosystem services, a five-point Likert scale was used, where 1 corresponded to "strongly disagree" or "do not understand at all", and 5 corresponded to "strongly agree" or "completely understand". In order to assess the internal consistency of the questionnaire, Cronbach's alpha was used. A reliability coefficient of 0.7 and above was considered the acceptable consistency level [59].

As demonstrated by previous studies—e.g., [27,47]—the perception of forest certification is influenced by a range of factors, among which are the forest holding size, type of ownership, and implemented certification scheme, etc. In order to examine the effect of different factors on the perception of the role of certification in securing forest ecosystem services, we focused on several factors, namely the region of the registered office, ownership type, forest area size, implemented certification scheme, time of being certified, main competitive advantage, and position of the respondent filling in the questionnaire. As only the forest area size and applied certification scheme proved to be statistically significant, we refer only to these two factors further in this study. For these purposes, six forest area size categories were determined, ranging from less than 100 ha to over 50,000 ha. Considering the two represented certification schemes in the country, the forest owners were classified as PEFC, FSC or double (both PEFC and FSC) certified.

SPSS was used for the statistical analyses of the collected data. The nonparametric Mann–Whitney U test was applied to determine the differences in the distribution of the categorical variables, in particular, the differences between the certification schemes. In order to determine the influence of the certification scheme on the responses, two categories of certificate holders were considered (PEFC and FSC). The double-certified entities were assigned to one or the other categories, depending on which certification they gained the first. Moreover, a Chi-square test was used to identify the differences between the respondents belonging to different forest size categories. In order to reduce the number of

forest area size categories with the aim to eliminate the occurrence of empty cells in the analysis, four main categories were created: up to 100 ha, 501–2000 ha, 2001–10,000 and over 10,001 ha.

3. Results

The questionnaire survey focused on evaluating the benefits of forest certification as a tool to support SFM and ecosystem services among forest owners and managers in Slovakia. Reflecting the actual management structure of forests in Slovakia, more than half of the respondents were from the state forest enterprises (57.2%), and the remaining 42.8% respondents represented non-state ownership.

The area of the managed forest land served as an identifier to determine the size of the company. Based on the answers from the respondents, the most represented category is the one of owners with a large area, in the range of 2001–10,000 ha (57.7%), followed by respondents managing a medium area of 501–2000 ha (19.6%), then a very large area of over than 10,001 ha (11.3%), and finally respondents with a small forest land area of up to 500 ha (11.4%).

As for the two certification schemes, PEFC was the most frequently reported (77.8%). Holders of double certification represented 16% of the respondents, and only 6.20% of the questionnaires were answered by holders of the FSC certification scheme. The period during which the companies held the certificate ranged from 1 to 23 years. Up to 80.9% of them held a certificate from 6 to 15 years.

Lastly, the respondents had the opportunity to identify their position within the company. More than half of the respondents were in the position of the head of forest administration in public forests (50.5%), and over 16.0% were professional forest managers.

Based on the respondent's profile, the statistically significant differences between the size of the managed forest area and the certification scheme were tested. The reliability of the examined factors using the Cronbach's alpha coefficient was 0.944. Table 1 describes the level of the respondent's understanding of the SFM concept, and PEFC and FSC objectives, where the respondents are divided into four groups based on the ownership area. Despite a high understanding of the SFM concept, the forest area is not an important factor affecting the understanding of certification objectives. In any case, the highest level of understanding of the SFM concept is expressed by forest owners managing medium and large forest areas (over 2001 ha and more). In general, regardless of the size of the managed forests, the PEFC objectives are understood better than the objectives of FSC certification by certified scheme users.

Statistically significant differences were found within the owners identifying certification as a means of promoting learning and facilitating the exchange of experience in ensuring SFM ($\chi 2 = 14.634$, $\alpha = 0.023$). Of this, the highest level of agreement was expressed by owners with a large area of forest (3.91). Furthermore, the significant differences in the expressions of the respondents with an average score of 3.38 coincide with the fact that certification helps to improve communication with customers ($\chi 2 = 14.097$, $\alpha = 0.029$) and increases the sale of forest products ($\chi 2 = 21.045$, $\alpha = 0.002$). In this case, the respondents managing large forest areas agree the most that certification helps to increase the sale of forest products (3.64), and owners managing average forest areas agree the least (2.79). The last statistically significant difference is in the level of agreement, in which the respondents describe certification as a tool that increases the company's profit ($\chi 2 = 18.916$, $\alpha = 0.004$). In this case, the owners with a very large area agree the most (3.18) compared to the respondents with the smallest area (2.09).

Table 1. Influence of the forest area size and certification scheme on the understanding and role of certification.

			Area					Certification Scheme		
	Mean	**SD**	**Up to 500 ha**	**501–2000 ha**	**2001–10,000 ha**	**Over 10,001 ha**	**χ2 Test**	**PEFC**	**FSC**	**U Test**
Understanding of . . .										
SFM concept	4.56	0.667	3.95	4.45	4.67	4.77	24.491	4.50	4.77	3042.0
PEFC objectives	4.40	0.803	4.00	4.24	4.53	4.41	24.165	4.42	4.33	2940.5
FSC objectives	3.47	1.332	2.82	3.79	3.46	3.59	8.883	3.15	4.60	1405.5 **
Certification . . .										
Improves external company image	4.24	0.996	3.32	4.3	4.46	4.45	28.601	4.19	4.44	2977.5
Represents a commitment to environmental responsibility	4.21	1.057	3.68	4.21	4.31	4.18	7.252	4.17	4.33	3200.0
Promotes sustainable utilization of forest resources	4.10	1.092	3.50	4.16	4.20	4.14	12.213	4.6	4.26	3149.0
Improves forest management practices	3.85	1.123	3.32	3.79	3.96	3.86	10.165	3.85	3.81	3236.5
Improves market access	3.77	1.144	3.14	3.37	3.96	4.9	13.446	3.69	4.5	2606.0 *
Supports learning and facilitate the exchange of experiences	3.70	1.079	3.41	3.61	3.75	3.91	14.634 *	3.67	3.81	3063.5
Prevents from illegal logging	3.61	1.343	3.9	3.68	3.70	3.55	9.626	3.65	3.47	3066.0
Ensures compliance with forest policy objectives	3.60	1.107	3.18	3.11	3.84	3.68	12.532	3.55	3.79	2795.5
Enables participation of forestry policy interest groups	3.46	1.003	3.55	3.16	3.55	3.41	12.053	3.42	3.58	2883.5
Improves communication with customers	3.38	1.151	3.5	3.3	3.49	3.77	14.097 *	3.30	3.65	2708.5
Increases sales of forest products	3.36	1.153	3.00	2.79	3.57	3.64	21.045 *	3.28	3.63	2754.5
Improves management efficiency	3.32	1.126	3.5	3.24	3.39	3.41	4.293	3.33	3.30	3129.5
Improves multi-level governance	3.12	1.073	2.64	2.97	3.21	3.36	10.957	3.5	3.35	2832.0
Increases profit margins	2.88	1.139	2.9	2.53	3.10	3.18	18.916 *	2.79	3.21	2795.0

Scale of agreement: (1, strongly disagree; 3, neither disagree nor agree; 5, strongly agree); * $p < 0.05$; ** $p < 0.01$.

The next area was to determine the understanding of the SFM concept, and PEFC and FSC objectives depending on the applied certification scheme. Both the PEFC- and FSC-certified forest owners understand the concept of SFM and the objectives of PEFC certification at the same level. However, there are differences in understanding FSC certification objectives (U = 1405.5, p = 0.000) between the PEFC- (3.15) and FSC-certified forest owners (4.60).

Based on non-parametric testing, there was only one statistically significant difference, in which FSC certified respondents agreed more (4.05) that certification helps to improve market access (U = 2606.0, p = 0.022) compared to PEFC respondents (3.69).

The respondents also identified their levels of agreement with the areas where certification helps to support ecosystem services and functions. The reliability of the examined factors using the Cronbach's alpha coefficient was 0.976. The overall assessment (mean values of all reported answers) illustrated in Figure 1 shows that the respondents agree the most in the field of provision services in the production of biomass (3.55), and the least in the provision of non-wood forest products (3.21). In the field of regulating and maintenance ecosystem services, the respondents express a high level of agreement that certification supports the regulation of erosion and other natural hazards (3.80), and agree less that it helps climate regulation (3.37). In the last examined area, in which certification helps to promote cultural ecosystem services, aesthetic (3.68), scientific, and educational values (3.68) appear to gain the highest levels of agreement.

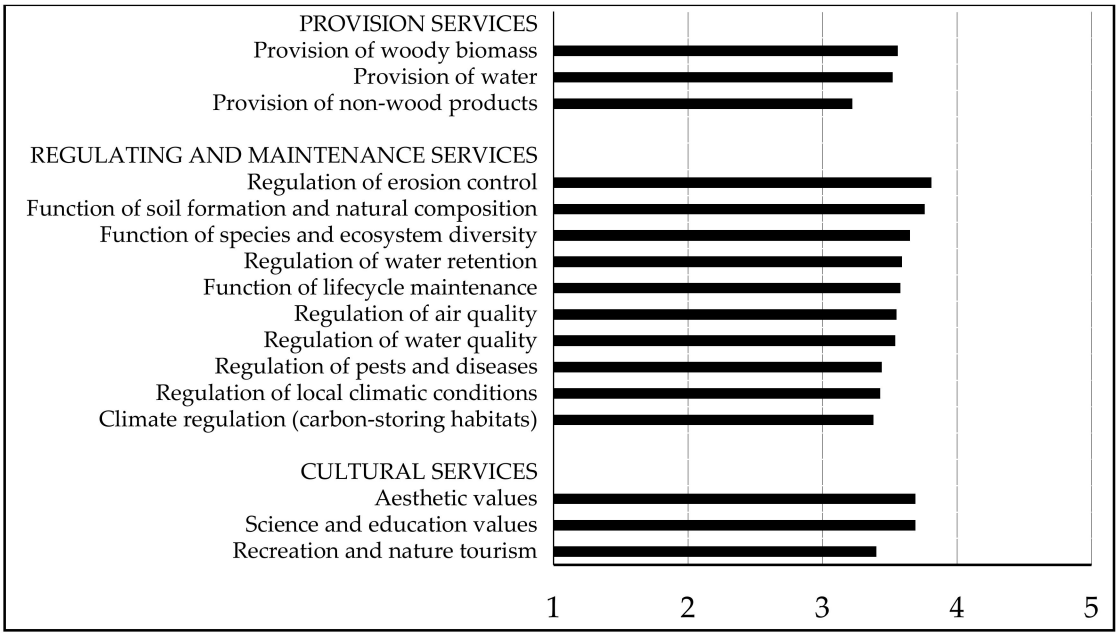

Figure 1. The perception of certification as a tool to support ecosystem services and functions.

Based on the determination of whether the certification helps to support forest ecosystem services, statistically, significant differences were also found when considering the size of the area, namely in the support of provisioning ecosystem services (Table 2). The Pearson chi-square test revealed differences in the cases in which the ecosystem services support producing wood biomass ($\chi 2$ = 20.894, α = 0.002). Of these, the respondents managing medium areas (3.71) and large areas (3.70) expressed the highest level of agreement, but owners with small areas of forest agreed the least (2.50). Another significant difference occurred in the expression of the agreement that certification helps to support and provide quality water ($\chi 2$ = 16.817, α = 0.010), in which owners with a medium area (3.66) agreed almost equally, and respondents with an area of less than 500 ha (2.77) agreed the least. However, despite the relatively high level of owners' agreement, there was no other statis-

tically significant difference following from the different area sizes in the regulation and maintenance ecosystem services, or in cultural ecosystem services.

Similar dependencies were tested in relation to the certification scheme used by respondents. The FSC respondents, compared to the PEFC respondents, were more likely to believe that the certification helps to support the functions of species and ecosystem diversity (U = 2548.5, p = 0.017), the function of life cycles and processes (U = 2458.0, p = 0.007), and the regulation of the global climate and carbon sequestration (U = 2532, p = 0.023).

4. Discussion

In Europe, organizations primarily use two major internationally-recognized forest certification systems to ensure SFM: the Program for the Endorsement of Forest Certification (PEFC) and the Forest Stewardship Council (FSC). These systems contribute to a certain degree of standardization by introducing internationally-recognized sets of principles and criteria of SFM [23]. It is also essential to be able to recognize the differences and understand the objectives of these certification schemes on the national level. The research findings point out a high level of understanding of the SFM concept among the certified forest owners in Slovakia. The SFM concept was better understood by forest owners and managers managing large forest areas, which are principally linked to the state forest enterprises in Slovakia, and those forest owners and managers that are FSC certified. At the same time, the same level of understanding of PEFC certification objectives is detected regardless of the certification scheme according to which the certificate holder is certified. Except for the fact that a high proportion of FSC-certified forests are also double certified (originally PEFC only), a rational explanation for this is that large state forest district enterprises act in a position of the regional applicant for certification [60], and the PEFC national governing body regularly organizes training for the holders of PEFC confirmation on regional certification [40], which enables them to disseminate information and learn about the approaches, goals, and current state of SFM and certification objectives. Concurrently, the similar level of understanding of PEFC certification objective could also be explained by the fact that some of these objectives are valid for both schemes. All of the findings related to the understanding of the SFM concepts and objectives of both certification schemes can help potential applicants for certification to make a preferential decision when choosing a particular scheme.

Forest certification serves as a voluntary tool for the independent verification of SFM [25]. At the same time, the certification standards cover, to a varying extent, many ecological, economic, and social issues [26]. Several authors pointed out the role of forest certification, and a range of benefits for forest managers resulting from the implementation of certification standards [27–31,61]. It follows from our survey that certified forest owners and managers in Slovakia associate certification with the improvement of their external image. This role of certification is mainly emphasized by large—and thus state—forest managers, as well as FSC–certified companies. At the same time, the respondents linked certification to their commitment to environmental responsibility, similarly to what was mentioned by Paluš et al. [27]. Furthermore, this research shows that a high level of agreement with environmental commitment is expressed by middle-sized forest owners (501–2000 ha) and those certified by the FSC. The respondents also see the certification as an important tool for the promotion of the sustainable utilisation of forest resources, improving SFM practices, and assisting them to penetrate new markets. FSC-certified forest owners identified more with the fact that certification helps to improve market access and increase profit margins. We assume that, in Slovakia, this is due to the demand for FSC-certified wood that is driven by wood processing companies operating within the chain supplying multinational furniture industry plants based in the country. This motivates forest owners to gain certification and thus new customers. To strengthen the role of certification as a tool to assist certificate holders to penetrate new markets is one of the aims of the FSC Ecosystem Services Strategy [62]. Our results also confirmed the

validity of the use of certification to achieve these strategic goals, so that certification has the potential to be useful for the development of the tools mentioned in this strategy to assist certificate holders. It is worth mentioning that the certification is also seen as a tool for the promotion of learning and the facilitation of the exchange of experiences in ensuring sustainable forest management and ensuring compliance with the objectives of forestry-related policies and improving their functioning. Similar statements are mentioned in the research of Šálka et al. [63]. The respondents expressed the lowest level of agreement that the certification increases the company profit as, undoubtedly, certification is associated with various kinds of costs [64].

Some studies [32,38] emphasise a positive impact of the implementation of forest certification standards on biodiversity, and proved a link between the certification and ensuring forest ecosystem services. These statements are also supported by the results of our research. Within the provisioning ecosystem services, the respondents expressed a high level of agreement with the fact that certification helps to support the production of wood biomass and water. Regarding the production of non-wood products, the respondents expressed moderate agreement. This is a reasonable finding as, according to Green Report [65], timber has the highest share in the structure of the revenues of forest managers, which together account for up to 79.2% of market production. The rest of the revenue is represented by revenues from the sale of non-timber forest products (NTFP) such as seedlings, and a range of services including hunting, tourism, and other business activities. Even if the potential for the provision of NTFPs is high, its importance is not significant in association with forest certification compared to other countries such as Brazil [40] or Italy [66,67].

Within the regulating and maintaining ecosystem services of forests, certification is perceived as a tool supporting mainly the regulation of erosion and other natural hazards. Similarly, the role of certification is acknowledged in supporting the function of soil formation and natural composition, as well as the improvement of species and ecosystem diversity. In particular, the latter is valid for FSC-certified forest owners. Similar results were found by Jaunga et al. [38], indicating the high level of adaptability of the stakeholders to cover forest ecosystem services related to biodiversity conservation by certification. Regarding cultural services, the weakest association was indicated between forest certification and the provision of recreational and tourism services. The new FSC strategy seeks to bridge this gap by improving the concept of ecosystem services. FSC certification raises the ecosystem services concept, demonstrating that conservation and restoration activities positively impact the provision of ecosystem services [36]. Recently, one of the key concepts that has been applied is the 'theory of change', which is behind the FSC Procedure for ecosystem services. From this point of view, the certification should promote the adoption of improved management solutions that ensure better impacts [68].

Table 2. Influence of the forest area size and certification scheme on the perception of certification as a support to forest ecosystem services.

			Area					Certification Scheme		
Certification Helps to Support . . .	**Mean**	**SD**	**Up to 500 ha**	**501–2000 ha**	**2001–10,000 ha**	**Over 10,001 ha**	**χ2 Test**	**PEFC**	**FSC**	**U Test**
Provision services										
Provision of woody biomass	3.55	1.255	2.50	3.71	3.70	3.59	20.894 *	3.50	3.74	2930.0
Provision of water	3.51	1.289	2.64	3.66	3.63	3.50	16.817 *	3.46	3.65	3008.5
Provision of non-wood products	3.21	1.243	2.77	3.21	3.31	3.14	5.869	3.17	3.35	2907.5
Regulating and maintenance services										
Regulation of erosion control	3.80	1.148	3.41	4.05	3.77	3.95	9.964	3.74	2.20	2793.5
Function of soil formation and natural composition	3.75	1.206	3.14	3.20	3.78	3.73	12.910	3.68	3.98	2836.5
Function of species and ecosystem diversity	3.64	1.140	3.23	3.68	3.70	3.68	6.427	3.55	3.95	2548.5 *
Regulation of water retention	3.58	1.211	3.18	3.79	3.58	3.64	4.485	3.54	3.72	2993.5
Function of lifecycle maintenance	3.57	1.238	3.27	3.55	3.59	3.77	2.989	3.42	4.09	2458.0*
Regulation of air quality	3.54	1.231	3.00	3.55	3.61	3.68	9.377	3.50	3.65	2980.0
Regulation of water quality	3.53	1.243	3.00	3.68	3.56	3.64	7.300	3.50	3.63	3153.0
Regulation of pests and diseases	3.43	1.270	3.23	3.37	3.43	3.73	4.581	3.38	3.60	2894.5
Regulation of local climatic conditions	3.42	1.190	2.95	3.45	3.46	3.68	9.365	3.38	3.58	2838.0
Climate regulation (carbon-storing habitats)	3.37	1.215	2.95	3.47	3.38	3.50	6.061	3.28	3.65	2532.5 *
Cultural services										
Aesthetic values	3.68	1.174	3.55	3.74	3.68	3.73	1.00	3.67	3.72	3037.0
Science and education values	3.68	1.180	3.32	3.58	3.75	3.82	1.00	3.60	3.95	2783.0
Recreation and nature tourism	3.39	1.192	3.00	3.45	3.46	3.36	6.263	3.31	3.67	2762.0

Scale of agreement: 1, strongly disagree; 3, neither disagree nor agree; 5, strongly agree; * $p < 0.05$.

As follows from the overall evaluation of the results of this study, the adoption and effectiveness of voluntary non-state market-based instruments, such as certification, can positively contribute to the provision of forest ecosystem services. Similarly, as reported by Ningsih et al. [36], it can increase their protection and the need for linking certification with the forest ecosystem services as the SFM tool in the process to the uptake of policy innovations. Future developments will create pressures to interlink the certification and support for ecosystem services, which are still underestimated. At the same time, the tools to assist certified forest owners to evaluate the impact of forest certification on ecosystem services are currently under development. Our results indicate that certificate holders perceive a strong relationship between certification and its contribution to the provision of ecosystem services. Therefore, policy makers should concentrate on the promotion of certification through various tools, e.g., financial and informational, etc., to fulfill the intentions of the Forest Act, in which certification is considered one of the tools to support SFM. Nevertheless, because the survey was carried out in Slovakia, some limitations of this research may follow from the traditional perception of the role of managed forests by the society, and may reflect the actual scope of discussion related to the opportunities and challenges regarding the implementation of new EU strategies in the area of biodiversity protection and SFM promotion. At the level of individual forest owners and managers, the perception of the role of certification can be also associated with the particular ecosystem services that are provided by particular certified forest stands within the managed forest area. This is also valid for the certification of forest ecosystem services [37].

5. Conclusions

This study focused on the evaluation of the perception of forest certification as a tool supporting SFM and ecosystem services by forest owners and managers in Slovakia. The research concentrated on the area of the understanding of the concept of SFM, the objectives of PEFC- and FSC-certification schemes, and especially on examining the perceptions of forest owners and managers of the ways in which forest certification helps to support individual ecosystem services in Slovakia. The main findings can be summarised as follows:

- In general, the results show that certificate holders perceive a strong relationship between certification and its contribution to the provision of ecosystem services and the assurance of SFM.
- Forest owners and managers have a good level of understanding of the concept of SFM and the objectives of individual forest certification schemes; this is particularly valid for large forest owners.
- Regardless of the size of the managed forest area and the type of implemented certification standards, forest certification is mainly perceived as a marketing tool within the larger framework of Corporate Social and Environmental Responsibility tools while promoting the sustainable utilization of forest resources and improving forest management practices.
- More 'quantifiable and measurable' elements, such as an increase in the sales of forest products, the improvement of management efficiency, or the increase in profit margins are of lesser importance in association with the role of certification.
- Forest certification is mainly perceived as a supporting tool for the ecosystem services related to the control of erosion, soil formation, and natural composition, as well as the function of species and ecosystem diversity, followed by the provision of aesthetic, scientific, and educational values.
- Certified forest owners and managers managing large forest areas compared to small forest owners see the role of certification as being more significant in supporting provisioning ecosystem services, in particular, the provision of woody biomass and water.
- For FSC-certified entities, the certification is more important for ensuring regulating ecosystem services, such as species and ecosystem diversity, lifecycle maintenance and climate regulation in terms of carbon storage.

The results of this study enabled us to identify the role of certification in ensuring forest ecosystem services. Although the survey was realized at a regional level, the results confirmed several well-known claims. In particular, they provided a deeper insight into the perceptions of forest owners and managers certified by different certification schemes, and they contribute to filling the gap by formulating recommendations for policy makers, building on the responses of the key participants in forest certification. In the future, it would be interesting to carry out similar research in other EU countries in order to identify any regional differences.

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