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# Will cultural and regulatory forest services provide enough balance to provisioning services in forest enterprise portfolios in future? Marketing case studies of selected forest enterprises in Slovakia

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**Abstract:** The study aims to identify the difference between the current and future strategic management of forest ecosystem services (FES) portfolios in public enterprises of Slovakia. The case studies focus on forest enterprises in Košice, Banská Štiavnica, Kremnica, and Bratislava, representing the best practice examples of providing cultural services in the country. A marketing decision-making model, Boston Consulting Group (BCG) matrix, was used to analyse each company's current FES portfolio. Content analysis assessed the data collected from interviews with managers of the public forest enterprises. Duncker's forest management approaches classification was applied to evaluate the future strategic management of the FES portfolio, and a horizon of 10 years was set. According to the results, the urban forest enterprise in Bratislava is an example of receiving a subsidy from the capital for building and reconstructing recreational facilities. Therefore, this FES portfolio is and will be the most balanced. The portfolio of the forest enterprises in Košice, Kremnica, and Banská Štiavnica will remain unchanged for the next decade, and they plan to use a combination management approach that caters to economic, ecological, and social needs and objectives. Urban forests in Bratislava will focus even more on close-to-nature forestry.

**Keywords:** business strategy; forest ecosystem services; forest management; interviews; qualitative research

Approximately 80% of the sales and income of forest managers comes from the sale of wood as the most important source of income for preserving forest functions and maintaining employment in the forestry sector. The area of forests and wood stocks has been increasing for a long time, which creates prerequisites for increasing the logging workforce in the coming decades (MARD 2018). From a marketing point of view, however, forest enterprises are too concentrated on income from selling raw wood assortments. Their portfolios are, therefore, quite unbalanced and, from the point of view of the increasing adverse impacts of climate change, very risky. Moreover, this, although po-

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tentially increasing income from the sale of wood, is insufficient to manage all forest functions. Free use of facilities in environmental and recreational areas causes high costs for forest enterprises. On the other hand, prices of raw wood assortments are inadequate considering the care coverage for other forest functions. The situation is further aggravated by political restrictions, as the economic freedom of decision-making of forest enterprises is increasingly limited (Mantau et al. 2001).

With the increasing focus on the monetary value of ecosystem services in the 21st century, there has been a growing interest in market-oriented tools. This has led to markets for ecosystem services, which were expected to result in more efficient utilisation (Duraiappah 2006; Svobodová, Hlaváčková 2023). In the forestry sector, these markets can be referred to as the wood and wild game markets, each with unique characteristics.

In general, the wood market still sees minimal differentiation of wood raw material as a product, with access mostly restricted to the ownership or use of forest land. The wood stock limits the supply, and various entities on both the sellers' and buyers' sides can significantly impact the price (Hansen, Juslin 2018).

Currently, the wild game market is underdeveloped. This is due to low game purchase prices, the inability to account for the rising costs of hunters in the price of primary production, and an underdeveloped processing and distribution chain (Němec et al. 2023).

The markets for cultural, regulatory, and maintenance ecosystem services need to be better developed or, in some cases, do not exist. Consequently, forest management enterprises make little revenue from selling these services compared to the revenue generated from wood production. According to Section 30 of Act 326/2005, forests are accessible to everyone. Therefore, under current legislation, forest companies mainly generate revenue from recreational activities such as payments for accommodation in recreational facilities or hunting fees. These activities primarily serve recreational purposes. Additionally, the collection of non-wood forest products, such as mushrooms and forest fruits, is currently not regulated in any way in Slovakia.

In 2020, the demand for recreational activities in forested areas significantly increased due to the COVID-19 pandemic. The High Tatras saw a substantial rise in visitor statistics, with 30 223 visitors counted at the entrances to the valleys on a selected day in August 2020, compared to 18 624 in 2019. This surge can be attributed to the positive impact of forests on human psychological health (Ohe 2017; Rajoo et al. 2019), as well as government measures.

Implementing curfew and travel restrictions between districts resulted in higher attendance, especially at the regional level (Pichlerová et al. 2021), as residents were primarily confined to travelling within their district. This increased the pressure to use forests for non-productive purposes, not only from the public but also due to the European Union's aims to improve biodiversity and reduce greenhouse gas emissions (EC 2020). These efforts aim to address the management of national parks in Slovakia. The transfer of the administration of national parks to the Ministry of the Environment has led to increased costs for mining, employees, and investments (Gális et al. 2022). It has been confirmed by national park managers that the management of cultural services will be unsustainable or impossible without subsidies and funding from European Union projects.

Some of the following long-term trends lead to the assumption that the demand for production, as well as other ecosystem services of the forest, will continue and strengthen, e.g.:

– The requirements are to apply the principles of the green economy in forestry, harmonise ecological and economic approaches, implement a social strategy to mitigate the consequences of climate change, and use scarce natural resources.
– Increasing requirements for providing and using non-wood products and public services.
– There is an expected increase in production and consumption of all wood products (paper and cardboard, lumber, industrial wood) between 2005 and 2030 (FAO 2009).
– According to EC (2016), the determined share of energy from renewable sources consumed in the EU will increase from 20% to 27% of the average of EU countries by 2030.

Within the recent trends and situation in the global forestry sector, we were interested in the current state of selected urban forests as examples of best practices in Slovakia with the expectation of a balanced portfolio of forest ecosystem services. At the same time, we compared the forest management approaches and decision-making in the

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present and on the horizon of the next ten years to explore the opinions of forest managers and the implementation rate of the global trends in Slovak forestry conditions.

## MATERIAL AND METHODS

**Theoretical background.** The marketing decision-making model was one of the theoretical backgrounds for developing the analysis of business portfolios of individual forest enterprises. Specifically, it was the implementation of the modified BCG (Boston Consulting Group) matrix (Kotler, Armstrong 2004), the so-called portfolio growth-share matrix (Šulek 2004). In general, it is a strategic management tool that helps companies analyse their business portfolios (Stern, Deimler 2006). This assists the company in allocating resources and is used as an analytical tool in brand marketing, product management, strategic management, and portfolio analysis. The matrix is divided into strategic business units (SBUs) within the four main quadrants: stars, question marks, cash cows, and dogs (Figure 1A, B). The distribution of SBUs is based on their two parameters, namely the relative market share (relative share on the total revenues, $x$-axis) and the growth rate of the sales market (growth index, $y$-axis).

The portfolio growth-share matrix is illustrated in Figure 1B, showcasing its revised format for evaluating strategic business units (SBUs) within the company's internal portfolio. The following interpretations pertain to each quadrant of this version. Question marks (upper right quadrant) represent SBU with a low share of sales. With the use of appropriate marketing tools, their share in the company's portfolio can increase. Stars (upper left quadrant) have the highest future potential for SBU company. They have a high growth index, which can lead to a significant future profit source. On the other hand, currently, the most important SBUs for the company are the so-called cash cows in the lower left quadrant. They generate the primary source of profit (cash flow). Therefore, their active management is considered the company's main strategic goal. They are used for support or financing of other SBUs in the company portfolio (mostly question marks or dogs). The last SBUs are dogs (lower right quadrant) with low relative share and growth potential, making them candidates for removal from the portfolio. To realise their potential, they need investment and can be placed among the question marks and stars. By categorising SBUs, we can evaluate the health of the business portfolio. An unbalanced portfolio has too many dogs and question marks.

Another theoretical basis of the scientific work was the structure of forest management approaches elaborated by Duncker et al. (2012). This characteristic was applied to compare the decision-making approach and the overall management method of selected forest enterprises at present and in the next ten years. The characteristics of individual management approaches are presented in Table 1.

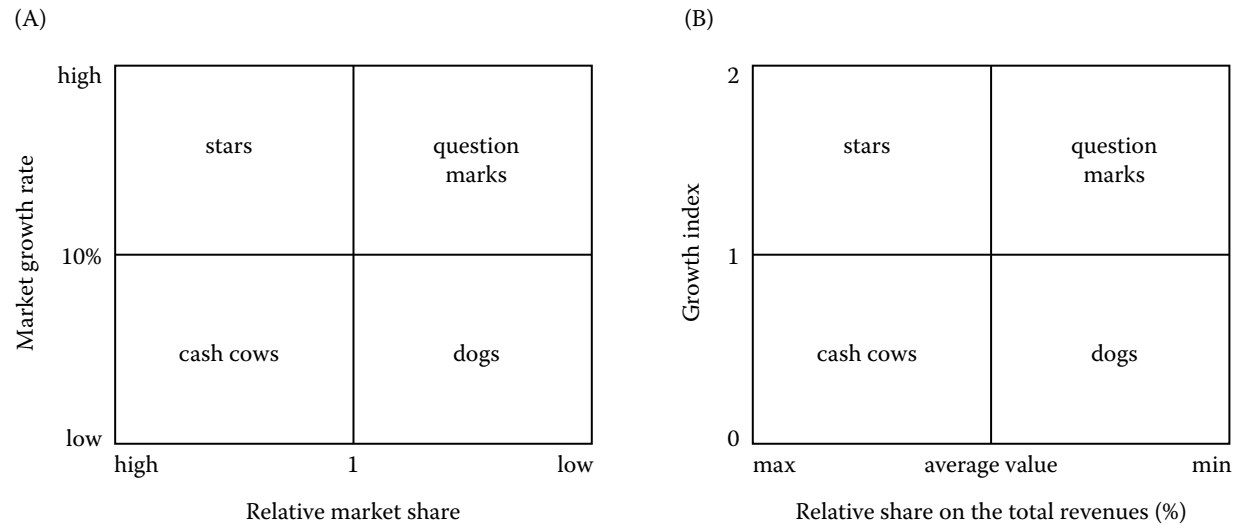


Figure 1. (A) BCG (Boston Consulting Group) growth-share matrix (Kotler, Keller 2021); (B) the portfolio growth-share matrix (Šulek 2004)

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Table 1. A list of the major decisions and the basic principles of the five forest management approaches

| Decision | | Forest management approaches | | | | |
|---|---|---|---|---|---|---|
| | | non-intervention | close-to-nature management | combined forest management | intensive even-aged forestry | intensive management with a short rotation |
| 1 | tree species composition | species characteristic of the given locality | native species | species suitable for the given location | species suitable for the given location | any species (except invasive) |
| 2 | tree improvement | no | non-genetically modified or non-breed trees | seedlings can be grown but not genetically modified | seedlings can be grown but not genetically modified | seedlings can be grown or genetically modified |
| 3 | forest restoration | natural regeneration | natural regeneration | natural regeneration, planting and sowing | natural regeneration, planting and sowing | planting and sowing |
| 4 | successional elements | yes | yes | temporarily | no | no |
| 5 | machine operation | no | extensive | medium | intensive | most intensive |
| 6 | soil cultivation | no | no (only to introduce natural regeneration) | yes | yes | yes |
| 7 | fertilisation/ liming | no | no (only if devastated soil) | no | yes | yes |
| 8 | application of chemical agents | no | no | yes (only in extreme cases) | yes | yes |
| 9 | integration of nature protection | high | high | high | medium | low |
| 10 | tree removals | no | trunk | trunk and crown | whole tree (also roots) | whole tree (also roots) |
| 11 | final harvest (and main silvicultural) system | no | selection system | shelterwood system | clearcut | clearcut |
| 12 | maturity | non-intervention | long rotation | optimal rotation period | short rotation | short rotation |

Source: Duncker et al. (2012)

Following Table 1, we distinguish five management approaches based on their assumed method of forest land management according to Duncker et al. (2012).

(*i*) Non-intervention management (unmanaged forest): In non-intervention management, ecological and social goals are given priority over other considerations. The goal is to preserve biotopes and the biodiversity that depends on them. The territory is mainly used for recreation or applied research. No operations that could change the area's character are allowed (e.g. sidewalk construction is allowed).

(*ii*) Close-to-nature management (CTNFM): The principle of CTNFM must be upheld in any intervention to maintain or improve ecological functions, with logging depending more on tree quality and thickness than age.

(*iii*) Combined forest management: This approach satisfies diverse needs, and individual goals are maximised in separate areas. The most important are economic and ecological concerns. In addition to production, the objectives include protecting habitats, water, and soil, producing non-timber products, wildlife management, and recreation.

(*iv*) Intensive even-aged forestry: Small age differences exist in the forest stands (often monocultures). The main goal is wood production.

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(*v*) Intensive management with a short rotation: It aims to produce the largest possible amount of marketable wood or biomass. Economic goals are prioritised, and ecological ones play only a secondary role.

Several authors have developed and presented different conceptual frameworks and typologies for describing and classifying ecosystem services as another necessary theoretical framework, e.g. Costanza et al. (1997), Daily (1999), De Groot et al. (2002), MEA (2005), Sekot and Schwarzbauer (1995), Merlo and Croitoru (2005), Mantau et al. (2001) etc. However, not a single classification scheme is universal, and they all have advantages and disadvantages depending on the content of their application (Báliková et al. 2018). A general classification for all ecosystem types was proposed first through a project called the Millennium Ecosystem Assessment (MEA 2005). This classification offers the following forest products and services: natural resources, ecological, biospheric, social and cultural. It was later supplemented with an economic classification approach and the latest CICES (Common International Classification of Ecosystem Services) classification (Haines-Young, Potschin 2018). These and other theoretical frameworks impacted the formation of new European and national policies, national strategies and guidelines, which gradually began to be applied in practice. The latest CICES classification, according to the authors Haines-Young and Potschin (2018) distinguishes three groups of services, namely: (*i*) supply (production) services, (*ii*) regulatory and support services and (*iii*) cultural services.

**Research methodology.** The study's primary objective is to predict the future utilisation of forest ecosystem services (FES) in selected forest enterprises in Slovakia over ten years. Four research questions were formulated as part of the study:

$RQ_1$: Will there be significant changes in the use of forest ecosystem services?

$RQ_2$: Will sales for provisioning services be the primary source of income for forest enterprises in the future?

$RQ_3$: What kind of forest management will prevail in 10 years or be the most applied in selected forest enterprises?

$RQ_4$: Did the pandemic period positively impact revenues from cultural forest services due to the increasing number of visits to forests?

For our survey, we chose urban forestry enterprises operating in the forestry sector within individual regions of Slovakia, for which individual case studies were carried out (Yin 2009). Enterprises represent good practices (so-called best practices) (Bretschneider et al. 2004) in managing forest cultural services. We have chosen Mestské lesy Košice a.s. (Urban Forests of Košice, Inc.) located in eastern Slovakia. The forestry enterprise in Košice manages forest property with an area of 19 432 ha. It is the second-largest forest property in Central Europe. The company's sales primarily consist of the sale of wood (98%).

On the other hand, the company provides a wide range of cultural services. It manages a forest park, the locations of which (e.g. Čermeľské údolie, Alpínka, etc.) provide excellent conditions for recreation. It also has a developed network of cycle paths and nature trails (www.meleskosice.sk). Selected companies from central Slovakia, i.e. Mestské lesy Kremnica, s.r.o. (Kremnica Urban Forests, Ltd.) and Mestské lesy Banská Štiavnica, spol. s r.o. (Banská Štiavnica Urban Forests, Ltd.) are in a similar situation. The urban forests in Kremnica manage an area of 9 701.5 ha (www.mslkca.sk), and the urban forests in Banská Štiavnica 4 200 ha (www.mlbs.sk). Wood production has the largest share of the company's total sales, but providing cultural services to the public is also very important.

The latter company manages forests owned by the city of Bratislava (Mestské lesy v Bratislave – Urban Forests in Bratislava). This enterprise has a specific mission: to provide a high-quality environment for the recreation of the residents. This is reflected in the sales for provisioning (65% of sales) and cultural services (35% of sales). Of the total forest land area (3 133.13 ha), up to 98% is categorised as 'special purpose forests'. The public from the capital enjoys using these forests for relaxation, regeneration, and sports activities (www.lesy.bratislava.sk).

The methodological framework is based on the classification of ecosystem services by CICES (2018). FES are divided into three sections: provisioning services (the production and sale of raw wood or forest fruits), cultural services (recreation and tourism), and regulatory and maintenance services (e.g. anti-erosion and water retention forest function) (Haines-Young, Potschin 2018). An analysis of forest enterprise annual reports was used to identify currently used FES (Hendl 2005). We searched annual reports for FES's sales or earn-

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ings for the past three years. The chosen three-year period was to ensure the identification of as many FES as possible. As part of provisioning services, companies have revenues from the sale of wood, small forest production, seed production, nurseries and meat sales. Regulatory and maintenance services constituted income in the form of financial compensation for the restriction of economic activity, state support for the fulfilment of non-production functions of forests, forestry-environmental and climate services and forest protection (LEKS) and in the form of uniform payments per area (SAPS). Businesses achieve revenues for cultural services through accommodation facilities or fee-based game shooting.

The central part of the survey focused on the perception of the use of FES on the horizon of the next ten years. The basis was qualitative data collection through a structured interview (Puvenesvary et al. 2020), which contained 16 open questions to predict the future use of FES based on expert estimates from forest enterprise managers. The next ten years are the most distant suitable horizon for managerial decision-making in forestry (Hoogstra-Klein, Schanz 2009). The duration of the interview was from 20 to 25 minutes. Answers were recorded and transcribed into text using Microsoft Word (Version 16.93, 2024). The data thus obtained were subjected to content analysis (Drisko, Maschi 2015). With the help of content analysis, we forecasted future use and determined why companies use FES in terms of volume and quality.

Subsequently, we compared the results with different management approaches to forest management, the theoretical framework being the classification according to Duncker et al. (2012). The comparison aimed to match the responses of company managers to 12 basic parameters of forest management (Table 1).

The methodological framework is based on the latest classification of ecosystem services by CICES (2018). In the data collection phase, we analysed the available annual reports of companies (Hendl 2005) to find FES sales as necessary input data for the portfolio analysis. We identified two types of quantitative data crucial for our research. The first type was the number of sales for individual ecosystem services of the forest, achieved by forest enterprises through selling their products and services. The second type was the income of enterprises from sources other than their performance, such as compensation for the limitation of ordinary economic activity according to Section 61 of Act No. 543/2002 Coll. on nature and landscape protection as amended.

In our research, we gathered data on sales related to provisioning services (wood sales, small-scale forest production, seed production, nurseries, meat sales), regulatory and maintenance services (financial compensation for restricting economic activities, support for non-production services), and cultural services (recreational facilities, hunting accommodation services, paid shooting activities, hunter membership fees, and land leasing for hunting purposes). The sales structure for individual FES is based on the available annual reports of enterprises. The research time frame was from 2019 to 2022, reflecting the immediate pre-pandemic, pandemic and post-pandemic period.

We used the modified BCG matrix (the portfolio growth-share matrix), a marketing decision-making model, to analyse the position of individual strategic business units (SBU) in company portfolios (Šulek 2004; Blažková 2007). These SBUs represent the forest ecosystem services. The BCG matrix is based on two key parameters: the relative share of SBUs on total revenues ($x$-axis), see Equation (1), and the revenues growth index ($y$-axis), see Equation (2); we calculated them using Microsoft Excel (Version 16.93.1, 2024) for each SBU:

$$Relative\ share_n = \frac{revenues\ \mathrm{SBU}_n}{total\ revenues} \times 100 \quad (1)$$

where:

$relative\ share_n$ – the share of $n$-product on the total revenues (%);

$revenues\ \mathrm{SBU}_n$ – revenues of $n$-product ($\mathrm{SBU}_n$) in the current period;

$total\ revenues$ – revenues from all products (SBU) in the current period.

$$i = \frac{\mathrm{SBU}_n\ current\ year}{\mathrm{SBU}_n\ previous\ year} \quad (2)$$

where:

$\mathrm{SBU}_n\ current\ year$ – revenues of $n$-product SBU in the current period;

$\mathrm{SBU}_n\ previous\ year$ – revenues of $n$-product SBU in the previous period.

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To construct the BCG matrix, we used the so-called bubble chart in Microsoft Excel, in which we identified the individual positions of SBU (FES) in the portfolios of selected urban forestry enterprises.

Mallya (2007) explains that the *y*-axis, which represents the growth index, ranges from 0 to 2. The midpoint of this axis is 1, indicating that FES revenues are stable, neither increasing nor decreasing from year to year. In some cases (Figures 2, 3, and 4), we had to consider FES's significant annual revenue increases when calculating the mean value of the *y*-axis to accurately depict FES's positions within the matrix. The *x*-axis represents the share of each strategic business unit (SBU) in the total revenues. Both values determine the coordinates of the SBU centre (bubble), with its size reflecting the absolute value of the revenues achieved each year.

The BCG matrix has been adapted from market analysis to business portfolio analysis, particularly in the context of forest enterprises. For instance, Šulek (2004) applied this methodology to assess the attractiveness of customers for raw wood within the company's portfolio. In this framework, strategic business units (SBUs) represent the customers of the forest enterprises. Additionally, adjustments to the BCG matrix are utilised in financial management. As noted by Haltofová and Štepánková (2014), this approach helps evaluate the position of individual SBUs, often by examining their cash flow.

The application of the BCG matrix for the analysis of the business portfolio has the advantage of not demanding input data, a quick picture of the so-called health condition of the portfolio, i.e. whether the company is not too tied to any SBU, leads to the optimisation of the portfolio, leads the company to diversification strategies, which is one of the most recommended in view of the globalised market of wood products and adverse natural factors. The use of the BCG matrix to analyse a business portfolio has the advantage of not requiring extensive input data. It provides a quick overview of the

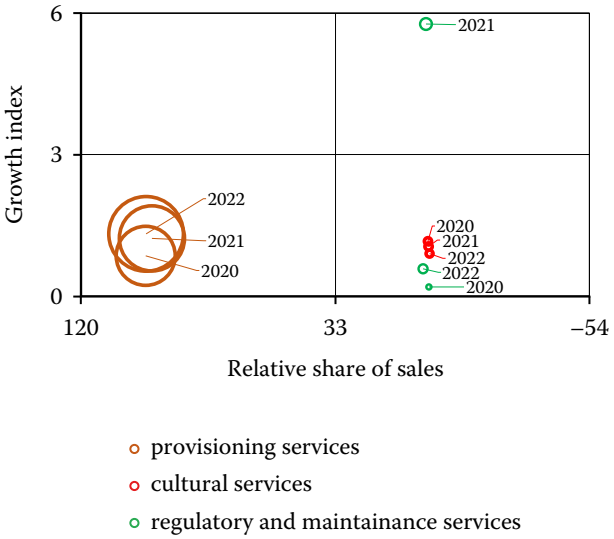


Figure 2. FES portfolio, Urban Forests of Košice, Inc.

Source: The authors

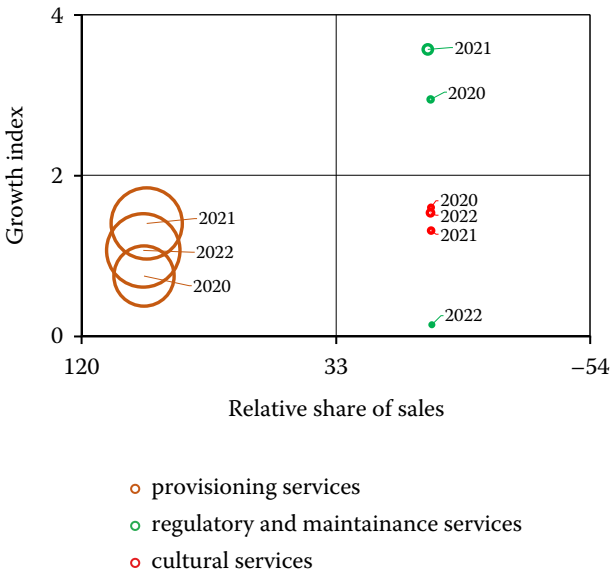


Figure 3. FES portfolio of Kremnica Urban Forests, Ltd.

Source: The authors

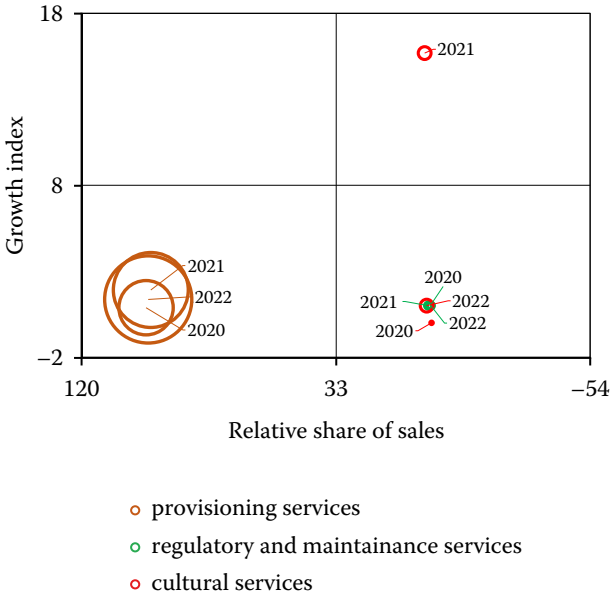


Figure 4. FES portfolio of Banská Štiavnica Urban Forests, Ltd.

Source: The authors

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portfolio's health, helping determine whether the company is overly reliant on any particular strategic business unit (SBU). This insight aids in optimising the portfolio and suggests mostly a diversification strategy. Such a strategy is especially recommended in the context of the globalised wood products market and various adverse natural factors.

Considering that supply services, specifically wood production, account for up to 90% of total revenues in the portfolios of most forest companies in Slovakia, we propose a 10% increase in the share of cultural and regulatory forest ecosystem services in total revenues over a 10-year period. This increase is identified as the threshold for significant change ($RQ_1$).

## RESULTS AND DISCUSSION

The current portfolios of forest ecosystem services (FES) in selected urban forest enterprises are unbalanced, and the use of individual FES is essentially the same (Figures 2–5). Sales of provisioning services, which make up 96–99% of the total FES sales, hold a dominant position in all companies. The only exception is the urban forests in Bratislava, where this proportion is lower (67–73%) but still relatively high (Figure 5). As part of provisioning services, companies primarily achieve sales from wood production. Seed production, small-scale forest production, or the sale of wild game are almost insignificant in terms of sales for these companies.

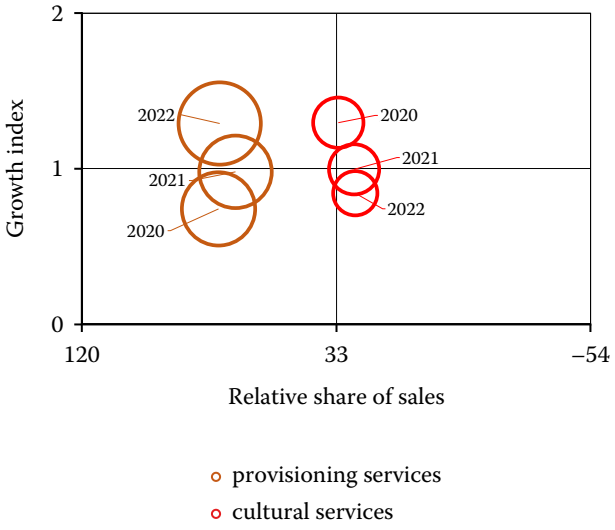


Figure 5. FES portfolio of Urban Forests in Bratislava, allowance forests organisation

Source: The authors

The financial compensation for restricting everyday economic activities or supporting the non-production functions of the forest (regulatory and maintenance services) makes up a tiny portion of the portfolios. This ranges from 0% in the urban forests in Bratislava to 1.84% in the urban forests in Košice. The revenue from cultural services is negligible, ranging from 0.33% to 2.7% in the selected enterprises. The situation is quite different in the urban forests of Bratislava, where the sales for cultural services made up 26.58% to 32.40% of the total sales over the past three years.

The portfolio variation is due to the specific requirements placed on forest enterprises and the opportunities available to them. According to the heads of urban forest enterprises, they have traditionally focused on wood production while contributing to city revenues and serving as an additional source of income for cities (such as urban forests in Košice). In some cases (like urban forests in Kremnica), this financial contribution is essential for cities when preparing their budgets. Although none of the companies harvest timber full-time, they maintain a 10–20% reserve. This strategy is a reaction to fluctuations in timber market prices (Zemaník 2021), the threat of the bark beetle, and the impact of climate change, which has caused some forest stands, particularly spruce stands in drier areas and lower altitudes, to stagnate. As a result, these stands are typically harvested earlier, around the 80–90-year mark of the forest stand's age.

Compared to provisioning services, the lack of revenue for cultural services reflects the current business limitations to generate income in this area (as stated in Section 30 of Act No. 326/2005). Accommodation revenues are minimal, as enterprises primarily use these facilities for hosting hunting guests, and they are often tailored for this specific purpose. Additionally, a portion of the revenue from cultural services comes from hunting fees, which are restricted by the annual hunting plan. However, the low income from cultural services does not indicate low interest in urban forestry enterprises.

They understand that cultural services do not generate significant income, but they aim to meet the community's need for leisure activities. Businesses offer a range of tourist and educational trails and recreational facilities such as pavilions, information boards, cycle routes, and lookouts, which are popular among the public. The funding

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for constructing and providing recreational facilities comes from wood harvesting revenue, as the businesses do not make money from recreational activities. They only incur costs for construction, maintenance, and reconstruction. In contrast, municipal forests in Bratislava receive subsidies from the city, part of which is used for building and renovating recreational facilities. This is reflected in the cultural services revenue (30% share). Such a use of funds is unique in Slovakia. However, other businesses find it challenging to implement without support from the city, state subsidies, or changes in legislation (Gális et al. 2022).

Based on the content analysis of interviews, it was found that provisioning services will continue to hold a dominant position in the future. According to the managers of the forest enterprises interviewed, wood sales will once again comprise the majority of total sales. This is mainly because the enterprises were established and are focused on wood production. They also make significant contributions to city finances; in some cases, these funds are crucial for city budgeting. On the other hand, urban forests in Bratislava primarily focus on contributing to the city and receiving financial support for their operations, especially in recreation.

Consequently, logging is of secondary importance in this enterprise. In addition to wood production, urban enterprises are responsible for wildlife management, including hunting rights and regulating the number of animals. Wildlife management plays a vital role in protecting forest stands from damage caused by wildlife, especially as enterprises transition to a more nature-focused approach to forest management.

Companies actively support and ensure regulatory services to the best of their abilities. All businesses have areas dedicated to protective purposes, where no economic activities occur. These areas primarily contribute to preserving biodiversity and protecting essential species of plants and animals. Meanwhile, companies receive financial compensation for this under Section 61 of Act No. 543/2002 Coll. on nature and landscape protection, as amended. Forestry-environmental and climate services and forest protection are supported financially through uniform payments per area. However, these compensations and supports do not contribute significantly to companies' income. It is also not expected that there will be an increase in the level of nature protection and related compensation mechanisms in urban forest enterprises in the future.

Providing cultural services is a crucial aspect of the economic activity of forest enterprises. The main challenge lies in financing these services, as companies cannot generate revenue from their provision due to existing legislation and infrastructure. As a result, all costs related to building and renovating recreational facilities are covered by timber sales. Company leaders do not anticipate any changes in funding in this area over the next decade, following the example of other states and their PES (Payment for Ecosystem Services) schemes (Gatto et al. 2009). For instance, the head of the forest enterprise in Kremnica cannot fathom charging people for accessing the forest in their managed territory. He adds, 'People are happy that it is made available in this way, and they also expect it to be provided to them annually and free of charge.' The heads of forest enterprises see providing cultural services as a necessary part of managing urban forest properties. In the future, they plan to focus on developing and maintaining the current services to meet the recreational and health needs of the community. The cultural services in Bratislava's urban forests are funded by a contribution from the city, which will become even more critical as wood felling decreases and the need for recreational space grows.

The study by Min et al. (2024) confirmed and offered answers to our findings that coordinating policies between the forest and urban sectors enhances the cultural services of forests. This is achieved through collaborative efforts in planning and managing forests and green spaces in urban areas. Additionally, collaboration between the forest and environmental sectors helps support and regulate services related to habitat preservation, wildlife protection, and soil conservation. The study demonstrates that coordinated structural policies effectively manage multiple ecosystem services across both forest and non-forest sectors.

Regarding forest management approaches, the heads of forest enterprises in Kremnica, Banská Štiavnica, and Košice have agreed to apply a combined management approach. However, certain activities will follow the principles of close-to-nature forestry or no intervention, as indicated in Figure 6. The businesses aim to satisfy economic (profit), ecological (nature conservation),

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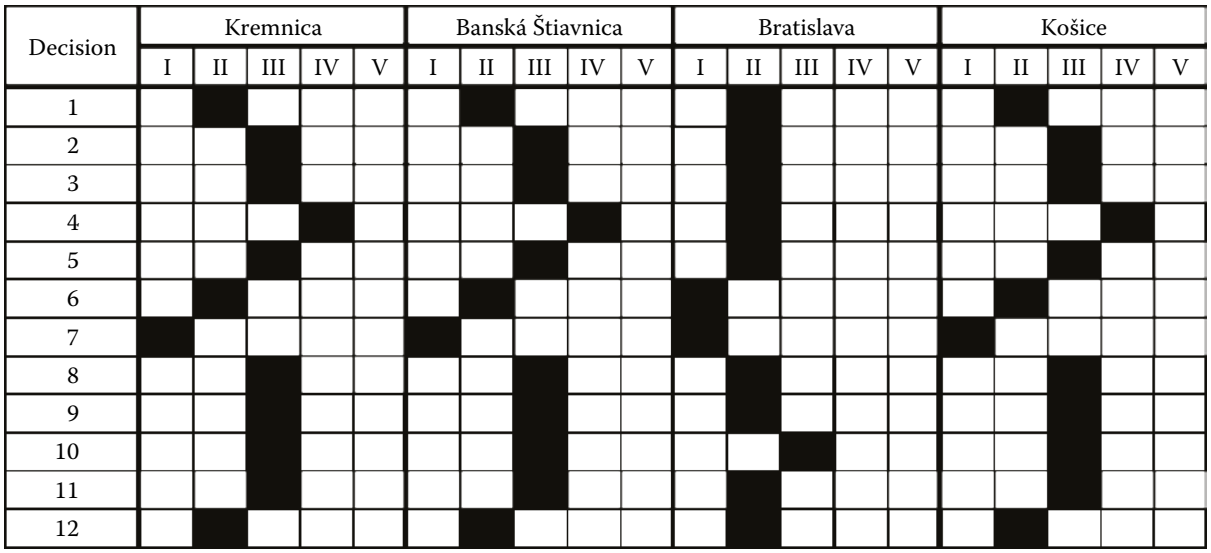


Figure 6. Evaluation of future forest management approaches at the selected urban forest enterprises in Slovakia (Source: The authors)

and social (recreation) needs and goals (Dunker et al. 2012). These findings are also documented by Simončič et al. (2024), underlining that urban forests must integrate coordinated efforts in silviculture, recreation, protection, harvesting, and communication.

Emphasising the original composition of forest land, companies will primarily rely on natural regeneration for re-planting after logging or natural disasters, supplemented by planting seedlings. Forest enterprises currently do not cultivate the soil, use fertilisation, or employ chemical preparations against pests, and they plan to continue this practice. In rare cases, they may apply a repellent coating to the shoot terminals of young trees to protect them from animal bites. Logging activities will be carried out in the undergrowth using forest-wheeled tractors, cable cars, horses, and harvesters where the terrain allows. With technological advancement, harvesters are expected to increase, partly due to declining interest and emigration of young people seeking better salaries (Čarný 2022). Current climate changes significantly impact spruce stands, especially in drier areas and lower altitudes, leading to deterioration, at least within the Carpathian Arc (Popa et al. 2024). However, the impacts of climate change on economically important tree species such as Norway spruce are global, e.g. in western and central North America (Lesven et al. 2024; McMonagle et al. 2024).

Consequently, these stands are sometimes harvested earlier, as was seen in the 1980s and 1990s. According to the head of urban forests in Košice, beech trees, which dominate the area, are less impacted by climate change. In fact, these stands may strengthen their position and expand to higher altitudes. This is supported by Bosela et al. (2023), which indicates that empirical and process-based models predict increased beech growth in European mountains under various climate change scenarios.

Close-to-nature forestry is another management approach mostly applied to urban forests in Bratislava (Duncker et al. 2012). In the future, the aim is to adopt a management approach that minimises intervention. Forest interventions will be limited to safety measures, maintaining current forest infrastructure (such as tourist paths and cycle paths), and constructing additional recreational facilities. However, this forest management approach can be considered as short-sighted. A study by Trummer and Hegetschweiler (2023) from Switzerland shows that people prefer even-aged and continuous forest management when visiting urban forests. Therefore, addressing visitors with targeted communication strategies can enhance understanding and acceptance of various interventions, thus supporting the implementation process in recreational forests.

Based on the results obtained, we can answer the research questions as follows:

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$RQ_1$: Will there be significant changes in the use of forest ecosystem services?

Considering the interview results, the share of represented ecosystem services in the portfolios of the selected companies will be similar to the current one. This means there will be no significant changes on the part of the forest enterprises. On the other hand, there will be increasing demand for regulatory and cultural services due to climate change and changes in customer behaviour.

$RQ_2$: Will sales for provisioning services be the primary source of income for forest enterprises in the future?

Suppose the method of any support for regulatory and cultural services of the forest remains the same. In that case, forest companies will be forced to subsidise all other ecosystem services of the forest from provisioning services. At the same time, setting a legislative framework for financial support in the form of subsidies or creating a fund to support the regulatory and cultural services of the forest does not mean a positive change in the support of these services. However, a broader discussion about the possibility of systemically introducing payments for ecosystem services has yet to emerge. This means that the state and quality of the services offered will need to be revised to the demand for these services, with some exceptions, such as Urban Forests in Bratislava.

$RQ_3$: What kind of forest management will prevail in 10 years or be the most applied in selected forest enterprises?

The urban forests Košice, Kremnica and Banská Štiavnica plan to use a combined forest management approach that caters to economic, ecological, and social needs and objectives. Urban Forests in Bratislava will continue with the close-to-nature forest management approach.

$RQ_4$: Did the pandemic period positively impact revenues from cultural forest services due to the increasing number of visits to forests?

We can conclude that the pandemic period had no impact on the position of forest ecosystem services in the business portfolio of the chosen companies. Specifically, increased attendance in forests had a negligible effect on sales of cultural services, that is, in the number of overnight stays and other related services, which is also documented by the need for more equipment in selected urban forests.

## CONCLUSION

The FES portfolios of selected urban forestry enterprises need to be more balanced, with sales for provisioning services (96–99%) dominating. Revenues for other FES (cultural, regulatory, and maintenance) have no meaning for the companies, and achieving a balanced portfolio is impossible for companies in the current situation.

The 2020–2022 pandemic period did not affect the positions of the investigated FES, specifically the cultural forest services, nor their volume in the business portfolios of the selected urban forests.

Over the next decade, forest enterprise managers expect that the sales of provisioning services will be the primary revenue driver for their companies. This is due to their company's objectives and the current sales opportunities for other forest ecosystem services. The number of protected areas will likely remain unchanged. Still, the level of nature protection within the areas managed by these companies is expected to be high, according to heads of urban forests. Forest enterprises provide a wide range of cultural services, such as observatory towers, forest parks, educational trails, cycle paths, etc., all built to a high standard. In the future, these companies will continue to expand on this trend by not only constructing more recreational facilities but also paying close attention to the upkeep of existing ones.

Urban forest enterprises in Košice, Kremnica, and Banská Štiavnica will adopt a combined management approach to forest management. The only exception is the organisation managing urban forests in Bratislava, which currently follows the principles of close-to-nature forestry (Duncker et al. 2012). Their future goal is to gradually reduce wood extraction and minimise their interference with forest stands, moving towards a non-interventional forest management approach while modernising the provision of cultural services to the general public.

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