Interreg CENTRAL EUROPE

Co-funded by the European Union

HealthyForestRegions

D.2.1.3 Regional strategies for prioritisation of forest ecosystem services

Slovak pilot site

Zuzana Sarvašová, National Forest Centre
Vlastimil Murgaš, National Forest Centre
Lucia Zacharová, National Forest Centre

19.05.2025

Introduction

Within the Interreg *HealthyForestRegions*, the work package 2 (WP2) explores new funding opportunities and development of reimbursement systems for forest ecosystem services.

This strategy for the prioritization of forest-based ecosystem services (FES) has been developed to support the overarching goal of the project: to identify and promote sustainable, nature-compatible alternatives to timber and fuelwood harvesting for local and regional forest owners. Apart from timber harvesting, the strategy aims to create new income opportunities by recognizing and enhancing the diverse ecosystem services provided by forests—such as recreation, biodiversity conservation, and carbon storage.

The strategy was developed with cooperation of local forest stakeholders, forest owners and *HFR Poloniny* management as a result of several workshops and following the previous working activities in the frame of the INTERREG *HealthyForestRegions* (HFR) project (deliverables *D.2.1.1* and *D.2.1.2*):

- Development of methodology for ecosystem services quantification regionally adjusted by each target area
- Producing maps for each ecosystem service (scale 1:10.000)
- Regional workshop for prioritizing the forest related ecosystem services

Each of the three target regions has identified the most important ecosystem services based on workshops (see *D.2.1.2*).

The project team developed a methodology to quantify and assess the status of forest-related ecosystem services: timber production, protection from natural hazards, biodiversity, carbon sequestration, recreation and tourism for each target area (Austria, Slovenia and Slovakia).

Each FES was presented in the framework of the Common Classification Ecosystem Services (CICES) classification and described in general terms based on published scientific literature. The methodology was presented with a list of criteria and indicators for the quantification of ecosystem services, which were presented to the relevant stakeholders in each pilot region. The list served as a basis for quantification - each pilot region could add or remove some criteria and indicators based on the local context and legal framework.

The strategy is intended to serve as a decision support dataset for the future management planning of the pilot site that can be integrated into broader conservation and regional development objectives. The national park committee will serve as the facilitator of the strategy. In this role, it coordinates implementation by working closely with the regional government, local municipalities, forest owner associations, and relevant stakeholders. Its responsibilities include guiding participatory processes, integrating FES priorities into the management planning, and ensuring that proposed measures are ecologically sound and economically viable.

The objective of the strategy is to ensure or enhance the provision of the highly rated ecosystem services in each of the regions (Austria, Slovakia and Slovenia).

The document includes the following **chapters**:

- General vision (identifying the most important ecosystem services)
- Mission (defining how to successfully achieve the vision)
- Goals and milestones (setting measurable target values and timeframes)
- Situation analysis (conducting a SWOT analysis for the target regions of the status quo in relation to the ecosystem services)

The development and definition of action plans, implementation and operational planning, as well as performance monitoring, will be developed in a later stage of the project and will be included in the deliverable *D.2.2.2*.

A. Vision

For *HFR Poloniny*, the comprehensive vision developed under WP2 sets out a long-term strategy for selected forest ecosystem services. The project proposal originally focused on biodiversity, carbon sequestration, and timber production. However, due to the adopted methodology, recreation was also considered for evaluation. All ecosystem services were prioritised during a regional workshop with relevant stakeholders under the *Activity 2.1* (see **Fehler! Verweisquelle konnte nicht gefunden werden.**).

"Forest management in HFR Poloniny ensures a resilient and multifunctional forest landscape that safeguards biodiversity, enhances carbon sequestration, and supports sustainable timber production for balanced regional development."

This vision expresses the ambition to transform forest management in *HFR Poloniny* into a holistic, ecosystem-based approach. It aims to conserve natural heritage while supporting climate change mitigation, economic well-being, and community resilience aligning with all three pillars of sustainable forest management: social, ecological, and economic.

Table 1: Results of the survey for prioritisation of forest-related ecosystem services (dark green - high, red - low)

Slovakia	Social aspect	Ecological aspect	Economic aspect	Mean
Biodiversity	2.1	2.9	2.1	2.4
Carbon sequestration	1.9	2.8	2.0	2.2
Natural hazards protection	2.5	2.3	2.2	2.3
Recreation and tourism	2.1	1.5	2.1	1.9
Wood	2.7	1.5	2.5	2.2

B. Mission

To achieve this goal, a detailed roadmap will be developed in the form of an action plan (Activity 2.2). This plan will involve all relevant stakeholders, coordinate policies at the regional level, incorporate innovative services, and ensure a long-term impact on future forest management through continuous evaluation.

Key instruments to promote ecosystem services (ES) at the regional level include governance mechanisms, financial incentives, and community-led initiatives. Additionally, the development and effective implementation of legal instruments, along with the integration of traditional knowledge can enhance the capacity of forests to sequester carbon, support sustainable wood production, and enrich biodiversity.

Various market-based mechanisms could be introduced, such as carbon credits, payments for ecosystem services (PES), and green finance incentives. These mechanisms encourage companies and landowners to adopt forest-friendly practices. Promoting different management practices to improve priority ES would require the introduction of payment systems, which is planned under Activity 2.3 (*D.2.3.1* and *D.2.3.2*).

The capacity of forests to deliver these benefits depends on several key factors related to forest management, available infrastructure, and landscape characteristics:

1. Timber harvest and rotation time

The intensity and frequency of timber harvesting significantly impact forest ecosystem services. High harvesting rates can reduce carbon storage capacity, disrupt habitats, and alter nutrient cycles. Shorter rotation periods — where trees are harvested at a younger age — limit biomass accumulation and deadwood availability, thereby reducing long-term carbon storage potential. Conversely, longer rotation periods allow forests to store more carbon, support mature habitats, and enhance biodiversity.

2. Composition of tree species

The proportion of key tree species affects forest resilience and the diversity of ecosystem services. Monocultures, especially fast-growing species planted for timber production, often have low structural and species diversity, making them more susceptible to pests, diseases, and climate change. In contrast, mixed forests promote biodiversity, increase carbon storage, and improve soil stability, enhancing resilience to disturbances such as storms and forest fires.

3. Stand structure and availability of deadwood

The vertical and horizontal structure of a forest — such as the presence of multiple canopy layers and deadwood — plays a crucial role in ecosystem function. Forests with different vertical layers provide habitat for a variety of species, and promote biodiversity and ecological stability. Deadwood, often removed in managed forests, is essential for nutrient cycling and as a habitat for fungi, insects, and cavity-nesting birds. Maintaining complex stand structures increases resilience and promotes important services such as pollination and soil fertility.

4. Density of forest paths and infrastructure

The construction of forest roads is necessary for timber extraction and forest management. However, they also serve recreational purposes, supporting activities like hiking and cycling. Despite these benefits, high road density can negatively impact ecosystem services by fragmenting habitats, disrupting wildlife movement, and accelerating soil erosion. Additionally, roads can facilitate the spread of invasive species and increase human disturbances such as illegal logging and poaching. Sustainable road network planning — minimizing unnecessary road expansion and implementing erosion control measures — helps to reduce these impacts.

5. Protection status and conservation measures

The proportion of strictly protected areas within forest landscapes directly influences their ability to provide ecosystem services. Protected areas serve as biodiversity refuges, allowing forests to develop naturally and store carbon over extended periods. They also act as buffers against climate change, preserve genetic diversity, and support ecological connectivity. The expansion and effective management of protected areas strengthens the long-term ecosystem service provision, balancing conservation and sustainable use.

The following table (**Fehler! Verweisquelle konnte nicht gefunden werden.**) presents the forest indicators influencing the selected forest ecosystem services evaluated in *HFR Poloniny*. It lists various indicators that may be affected by forest management. A direct relationship between each indicators and the assessed ecosystem service is marked with an “x”. The ten indicators highlighted in bold in Table 2 were used during the WS on forest ecosystem services and management scenarios specific to *HFR Poloniny*.

Table 2: Key forest management indicators influencing forest ecosystem services

Forest environment attributes manageable through intervention / indicator (units)*	Recreation	Biodiversity	Carbon sequestr.	Wood production
Age differentiation /**Average age of stands (year)**	x	x		
Thickness variability / number of layers / vertical diversity **Number of layers (pcs)**	x	x		
Diversity of tree species composition / number of tree species / seasonal variability **Number of tree species (pcs)**	x	x		
Stand illuminating, transparency / height, stocking	x			
Unobtrusiveness of the logging area/ logging invisibility	x			
Biomass of logging residues	x	x		
Occurrence of undergrowth	x	x		
Variability of stands on the area / existence of stands groups	x	x		
Naturalness of tree species composition **Degree of naturalness of the tree composition (1-3)**	x	x		
Permanent presence of trees with thickness over 50 cm	x	x	x	x
Presence of coarse dead wood **Percentage of dead wood (%)**	x	x	x	
Occurrence of invasive trees and herbs	x	x		
Occurrence of trees of interests to bees, insects and birds **Percentage of trees of interest to bees, birds, etc. (%)**	x	x		
Proportion of damaged trees Trees damage (%)	x	x		
Amount of standing timber			x	x
Quantity / logging intensity **Annual wood production (m^3)** **Annual fuelwood production (m^3)** **Logging intensity (%)**	x		x	x
Wood increment			x	x

** Indicators highlighted in bold were assessed in the scenario workshop.*

C. Goals and milestones

To ensure the long-term sustainability of forest ecosystems, clear targets with specific, achievable measures and milestones must be set to provide key ecosystem services (ES). Although the targets are not yet fully SMART (specific, measurable, achievable, relevant and time-bound), they provide a roadmap for improving forests' contribution to the balanced development of HFR Poloniny.

Assessing the current provision of forest ecosystem services and their future potential is crucial for setting meaningful targets:

- **Carbon sequestration:**
    - Short-term goal (5-10 years): Reduce logging in the Poloniny National Park (NP) area, with a target of 75% of the area remaining without intervention. NP area is managed in line with **Close-to-nature silvicultural practices.**

- **Indicator:** The primary measure of FES is the volume of timber (increment) calculated per forest stand in cubic meters (m^3) using a national methodology adapted for the HFR project (see Table 2).
- **Milestones**:
  - **Baseline data and trends for carbon sequestration completed by the end of 2025.**
  - **Close-to-nature silvicultural practices implemented and communicated to most forest owners in relevant areas by 2030.**

- **Biodiversity conservation**:
  - Mid-term goal (10-50 years): Improve natural tree species composition (ecosystem-specific according to local site conditions), and maintain deadwood volume on 20%.
  - **Indicator:** Biodiversity is evaluated using structural indicators such as growing stock, deadwood volume, tree species diversity, habitat trees, and very large trees. The proportion of strictly protected areas is also considered when assessing biodiversity conservation status.
  - **Milestones**
    - **Baseline data and trends for biodiversity conservation finalised by the end of 2025.**
    - **Research-driven participation in the NP committee and decision support for the ongoing NP zonation are ensured as part of the ongoing process.**
- **Recreation**:
  - Mid-term goal (10-50 years): **Promote and secure soft tourism in healthy, biodiversity-rich forests.**
  - **Indicator:** A recreation index is calculated based on forest stand characteristics, available infrastructure, and forest management attributes.
  - **Milestones**
    - **Baseline data for recreation and scenario-based calculations completed by the end of 2025.**

General structure for milestones and progress tracking

While long-term success depends on adaptive management, key milestones will help track progress across different timeframes:

Short-term goals (1-10 years):

- Establish baseline measurements for selected FES in *HFR Poloniny*.
- Design incentive programs and information measures.
- Initiate pilot projects for alternative FES provision support.

Medium-term goals (10-50 years):

- Enhance forest management practices to promote tree species adapted to climate change.
- Implement actions/policies for reduced-impact logging and deadwood retention.

- Monitor and report progress on biodiversity indicators and carbon sequestration improvements.
- Strengthen research-driven decision-making to support sustainable forestry practices on an ongoing basis.

Long-term goals (50+ years):

- Achieve balanced regional development by improving landscape resilience while preserving FES supply (biodiversity, carbon sequestration, sustainable recreation, and wood production).

D. Situation analysis (SWOT)

Achieving long-term milestones for improving selected forest ecosystem services in *HFR Poloniny* requires a clear understanding of the internal and external factors that influence success. By analysing strengths, weaknesses, opportunities and threats, a strategic approach can be developed that builds on existing assets while addressing challenges and mitigating risks.

Strengths	Weaknesses
• High proportion of forest ecosystems (70%) - mainly beech and fir-beech forests • The highest concentration of natural and pristine forests in Slovakia • Extraordinary natural values of the area (concentration of rare preserved primeval forests; endangered species of plants and animals; part of the UNESCO International Biosphere Reserve; protected bird areas, National Park, dark site area without light smog). • Presence of skilled experts and professionals	• Unfinished zonation of the National Park • Marginalized region, depopulation • Fragmentation around settlements • Nature protection restrictions and their negative economic impact on the region • Insufficient infrastructure for tourism development • Dependence of local people on forests resources and income, without alternatives • Flysch subsoil, soils prone to landslides and erosion
Opportunities	**Threats**
• Funding programmes and meeting the EU objectives and national policy objectives • Part of the UNESCO International biosphere Reserve • Research and development projects on site • Potential/attractiveness of the area in terms of recreation and tourism	• Climate change impact • Legal uncertainty and weak law enforcement • Social tension between actors with different interests • Instability in the strategic direction of the region caused by frequent personal changes • Lack of the state financial sources • War in Ukraine

Figure 1: Draft SWOT table

Strengths

Forest ecosystems in *HFR Poloniny*, especially beech and fir-beech forests, are the dominant natural feature, covering more than 70% of the area. This region holds the highest concentration of natural and pristine forests, as well as primeval forest communities in Slovakia. *Poloniny National Park* is renowned for its exceptional biological diversity, hosting numerous protected species as well as rare and endangered plant and animal species. The park is also part of the *East Carpathians Biosphere Reserve (UNESCO)*, the world's first trilateral biosphere reserve, spanning Slovakia, Poland, and Ukraine, making it a globally significant natural treasure. Furthermore, the region benefits from the expertise of *Poloniny National Park* staff, state forest authorities, and private forest managers specializing in conservation, sustainable forestry, and ecosystem management.

Challenges and Weaknesses

Despite these advantages, several weaknesses need to be addressed. Unclear zones of National Park (levels of forest land protection) and depopulation of the region are causing economic marginalization of this border region with already limited economic opportunities. While the region holds great potential for recreation and tourism, the availability of educational and interactive elements such as educational trails, educational sites, information and environmental education centres is insufficient. Many of these facilities are outdated and need to be modernized and better equipped. Additionally, gaps in tourism infrastructure must be filled to support sustainable regional development. However, financial resources from both local and national budgets remain inadequate to meet these needs.

The restrictions on forest management imposed by nature conservation regulations have negative economic implications for the region, presenting challenges for local communities. In terms of biodiversity conservation, significant administrative changes have been made to align national park protection with international (IUCN) standards. These measures aim to expand strictly protected areas within the park and transfer management of state-owned forestland from forestry authorities to nature conservation authorities. However, this shift has led to tensions between forest owners, managers, conservationists, NGOs, municipalities, and private landowners.

Opportunities

Despite these challenges, there are numerous opportunities to strengthen forest ecosystem services in *HFR Poloniny*.

- Financial opportunities: Opportunities in the financial area are mainly based on the possibility of obtaining support from the *CAP* strategic plan and other EU programs to meet the objectives of EU and national policies (e.g. Green deal, Envirostratégia 2030). Based on the experience of other European countries, the use of payments for ecosystem services is also relevant in this context, which represent good financing possibilities.
- Research interest: *HFR Poloniny* serves as a case study location for various projects, not only in environmental sciences but also in social and cultural research.
- Tourism and recreation potential: From a tourism perspective, *HFR Poloniny* is one of Slovakia's most attractive regions. In addition to its exceptional natural values (UNESCO World Heritage site), it is home to significant cultural monuments and archaeological sites. Exploring the natural landscape and promoting recreation are key management priorities for this protected area.
- Cross-border cooperation: The region's location, bordering Poland, creates opportunities for cross-border cooperation in nature conservation, tourism, and education. However, the proximity to Ukraine's border introduces risks due to the ongoing military conflict.

Threats

- Climate change impact: Climate change presents a significant threat to forest ecosystems, with rising temperatures, prolonged droughts, forest fires, and natural disasters all affecting the region’s ability to provide essential services.
- Weak legal framework: Another challenge lies in Slovakia's legal environment, with ineffective enforcement of laws. This inadequacy can contribute to deforestation and habitat destruction. Additionally, legislative processes are often influenced by various interest groups, further complicating effective governance.
- Political instability: The political environment is also uncertain and unstable, which poses risks to the region's strategic direction, particularly due to frequent personnel changes in leadership roles.
- Financial and bureaucratic challenges: A major threat is the lack of sufficient state funding, compounded by bureaucratic procedures that hinder the efficient allocation of resources.