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HealthyForestRegions

D 2.1.3 Regional strategies for prioritisation of forest ecosystem services

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The *HealthyForestRegions Project - Supporting Healthy Forest ecosystems for human well-being in forest regions* (CE0100310) operates under Interreg CENTRAL EUROPE's 2021-2027 funding. It is aligned with Priority 2 '*Cooperating for a greener Central Europe'*, and addressing Objective 2.4, '*Safeguarding the environment in Central Europe*'. The project spans form April 2023 to March 2026, with a budget of €2.78 million, of which 80% are funded by ERDF. Involving nine partners across six Central European countries with six project regions, the project fosters commitment among policy- and decision-makers to maintain and create conditions that support the health of the regional forest ecosystems. Thereby, the *HealthyForestRegions Project* supports the long-term well-being of the people living, working and spending time in the targeted regions.

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REGIONAL STRATEGIES FOR PRIORITISATION OF FOREST ECOSYSTEM SERVICES -AUSTRIAN PILOT SITE

Introduction

Within the Interreg *HealthyForestRegions Project*, 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, carbon storage, and protection from natural hazards.

The strategy was developed with cooperation of local forest stakeholders, forest owners and the Nature Park Eisenwurzen management as a result of several meetings and workshop 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

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 feed directly into the future management planning of the nature park Eisenwurzen that can be integrated into broader conservation and regional development objectives. The nature park administration serves as the central carrier and 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 nature park's broader 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.

The following chapters are included in the document:

- General vision (what are the most important ecosystem services)
- Mission (how to get to a successful realisation of the vision)
- Goals and milestones (measurable target values and timeframes)
- Situation analysis (SWOT analysis for the target regions of the status quo in relation to the ecosystem services)

The development of and definition of action plans, the implementation and operational planning as well as the 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 the Nature- and Geopark Steirische Eisenwurzen, the comprehensive vision developed under WP2 sets out a long-term strategy for prioritizing forest ecosystem services, with a focus on biodiversity, carbon sequestration and protection from natural hazards. These three ecosystem services were prioritized on a regional workshop with the relevant stakeholders under the activity 2.1 (see Table 1).

"The forest management in the Nature- and Geopark Steirische Eisenwurzen ensures a resilient, thriving forest landscape that ensures the protection of forest related biodiversity, optimises carbon storage and protects communities and infrastructure from natural hazards."

This vision expresses the ambition to transform forest management in the Nature and Geopark Eisenwurzen into a holistic, ecosystem-based approach. It aims to conserve natural heritage and also to support climate change mitigation, economic wellbeing and community resilience in the face of increasingly frequent natural disturbances.

Table 1: Results of the survey for prioritization of forest related ecosystem services (dark blue - high, rose - low)

Austria	Social aspect	Ecological aspect	Economical aspect	Mean
Biodiversity	2,5	2,8	1,9	2,4
Carbon sequestration	2,4	2,6	2,0	2,3
Natural hazards protection	2,7	2,3	2,2	2,4
Recreation and tourism	1,7	1,8	2,5	2,0
Tourism	2,4	1,8	2,4	2,2

B. Mission

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

Key instruments to promote ecosystem services (ES) on regional level include policy frameworks, financial incentives and community-led initiatives. In addition, the development and effective implementation of policy and legal instruments and integrating the traditional knowledge can enhance the capacity of forests to sequester carbon, provide protection against natural hazards and enrich biodiversity.

Various market-based mechanisms should be introduced, such as carbon credits, payments for ecosystem services (PES) and green finance incentives, to encourage companies and landowners to adopt forest-friendly practices. The promotion of sustainable certification schemes (e.g. FSC, PEFC) ensures responsible forest management. Promoting different management practices to improve priority ES would require the introduction of payment systems, which is planned in 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 and landscape characteristics:

1. Timber harvest and rotation time

The intensity and frequency of timber harvesting has a considerable influence on the ecosystem services of the forest. 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 the accumulation of biomass and deadwood and thus reduce the long-term carbon storage potential. Conversely, longer rotation periods allow forests to store more carbon, support mature habitats and improve biodiversity.

2. Composition of tree species

The proportion of the most important tree species influences the resilience of the forest 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, which contributes to better 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 the functioning of an ecosystem. Forests with different vertical layers provide habitat for a variety of species and promote biodiversity and ecological stability. Deadwood, which is often removed in managed forests, is essential for nutrient cycling and as a habitat for fungi, insects and birds that nest in cavities. 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, but can have a negative impact on ecosystem services. High road density leads to increased habitat fragmentation, interrupts wildlife movements and accelerates soil erosion. In addition, roads provide pathways for invasive species and increase human disturbance, 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 in forest landscapes has a direct influence on their ability to provide ecosystem services. Protected areas serve as refuges for biodiversity and allow forests to develop naturally and store carbon over longer periods of time. 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 provision of ecosystem services and creates a balance between conservation and sustainable use.

The following graphic (Figure 1) presents the key management factors influencing the forest ecosystem services. It illustrates the relationships between various influencing variables in forest management and key forest ecosystem services. The left side lists different factors, such as forest composition, harvesting practices, and structural characteristics. These variables influence different ecosystem services, represented on the right, including wood production, protection against natural hazards, carbon storage, biodiversity preservation, tourism, and recovery performance.

Green arrows indicate a positive correlation, meaning the variable enhances the respective ecosystem service, while red arrows show a negative correlation, meaning the variable has an adverse effect. Some factors, such as the diversity of tree species and protected area share, positively influence multiple services, particularly biodiversity. Conversely, factors like timber harvesting volume and energy wood share contribute positively to wood production but negatively impact carbon storage and biodiversity. The influence between different ES and their complex interactions shows that through preserving biodiversity a positive effects on both tourism and recovery performance can be achieved, as indicated by the green arrows.

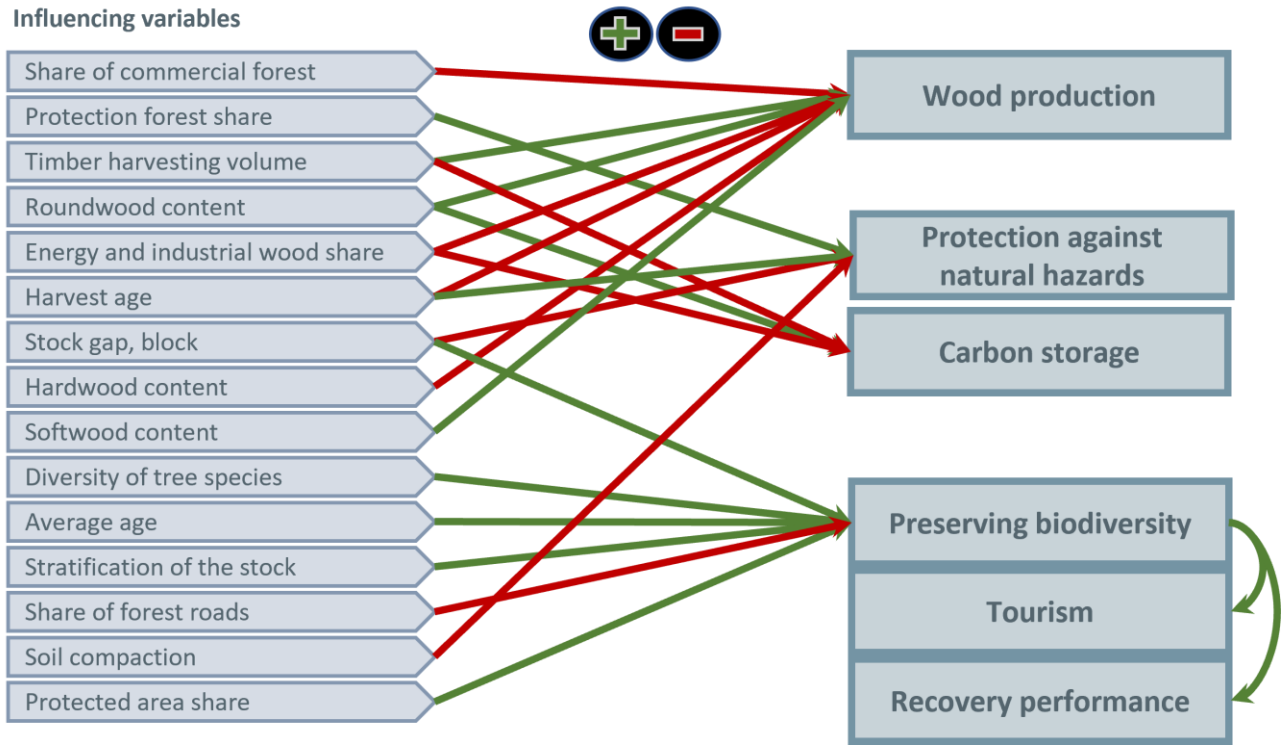

Figure 1: Key management factors influencing forest ecosystem services

C. Goals and milestones

To ensure the long-term sustainability of forest ecosystems, clear targets and milestones must be set for the provision of 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 the contribution of forests to climate regulation, biodiversity conservation and risk reduction.

Understanding the current state of these ecosystem services is crucial for setting meaningful targets:

- **Carbon Sequestration**:
  - Short-term goal (5-10 years): Increase awareness on carbon storage in forest ecosystems (forest management units managing more than two thirds of the forest areas are well informed)
  - Mid-term goal(10-50 years): Increase the carbon stored in forest indicators by 10%
  - **Indicator**: The current growing stock (above ground biomass) is the baseline of the indicator. The volume is categorized by tree species as well as living and dead biomass. These data are currently in calculation phase based on the remote sensing approach in the HFR project.
  - **Milestones**:
    - **Baseline data ready end of 2025**
    - **Detailed action plan approved by the majority local forest managers and regional forest authority by 2028**
    - **Growing stocks assessed in the target area and trends calculated by 2030**
- **Biodiversity Conservation**:
  - Short-term goal (5-10 years): 2 incentive programs established and communicated to forest managers
  - Mid-term goal (10-50 years): Increase the forest biodiversity indicator by 5%
  - **Indicator**: based on structural information (growing stock, dead wood volumes, tree species diversity, habitat trees or very large trees) an index of potential biodiversity (IPB) is calculated. The baseline is calculated 2025 by the remote sensing approach. The woodland bird index (WBI) can be an additional indicator to use bird as umbrella species to evaluate the biodiversity conservation status.
  - **Milestones**
    - **Baseline data ready end of 2025 (IPB and WBI)**
    - **Incentive Programs for biodiversity measures in place and communicated to majority of forest owners by 2028**
    - **Assessment of IBP and WBI repeated to calculate trends in 2035**
- **Natural Hazard Mitigation**:
  - Mid-term goal (10-50 years): Crown cover of forest with protective function for settlements and infrastructure will not decrease
  - **Indicator**: Forest cover calculated from remote sensing sources. The reference areas are derived from the map of gravitational hazards above settlements and infrastructures (result from action 2.1).

- **Milestones**
  - **Baseline data ready end of 2025**
  - **Incentive Programs for transformation of tree species composition and close to nature silvicultural practices in place and communicated to majority of forest owners of relevant forest areas by 2028**
  - **Assessment of crown cover in relevant areas repeated to calculate trends in 2035**

General structure for milestones and progress tracking

While long-term success depends on adaptive management, key milestones will guide progress. For a short-Term (1-10 years) goals, the following activities are proposed:

- Establish baseline measurements for carbon storage, biodiversity, and erosion risk.
- Establish incentive programs and information measures
- Initiate pilot projects for sustainable forest management and protection zones.

For a medium-term (10-50 years), the goals can be achieved through these activities:

- Expand afforestation and reforestation programs in degraded areas.
- Enhance regeneration measures to promote tree species adopted to climate change.
- Implement policies for reduced-impact logging and deadwood retention.
- Monitor and report progress on biodiversity indicators and carbon sequestration improvements.
- Strengthen legal frameworks to support sustainable forestry practices permanently.

Finally as long-term (50+ years) goals, these activities can be envisioned:

- Achieve targeted percentage increases in carbon storage and biodiversity conservation.
- Reduce forest-related natural hazard risks by improving landscape resilience.

D. Situation analysis (SWOT) analysis

Achieving the long-term milestones for improving forest ecosystem services — carbon sequestration, biodiversity conservation and natural hazard mitigation — requires a clear understanding of the internal and external factors that influence success. By analysing strengths, weaknesses, opportunities and threats, we can develop a strategic approach that builds on existing assets while addressing challenges and mitigating risks.

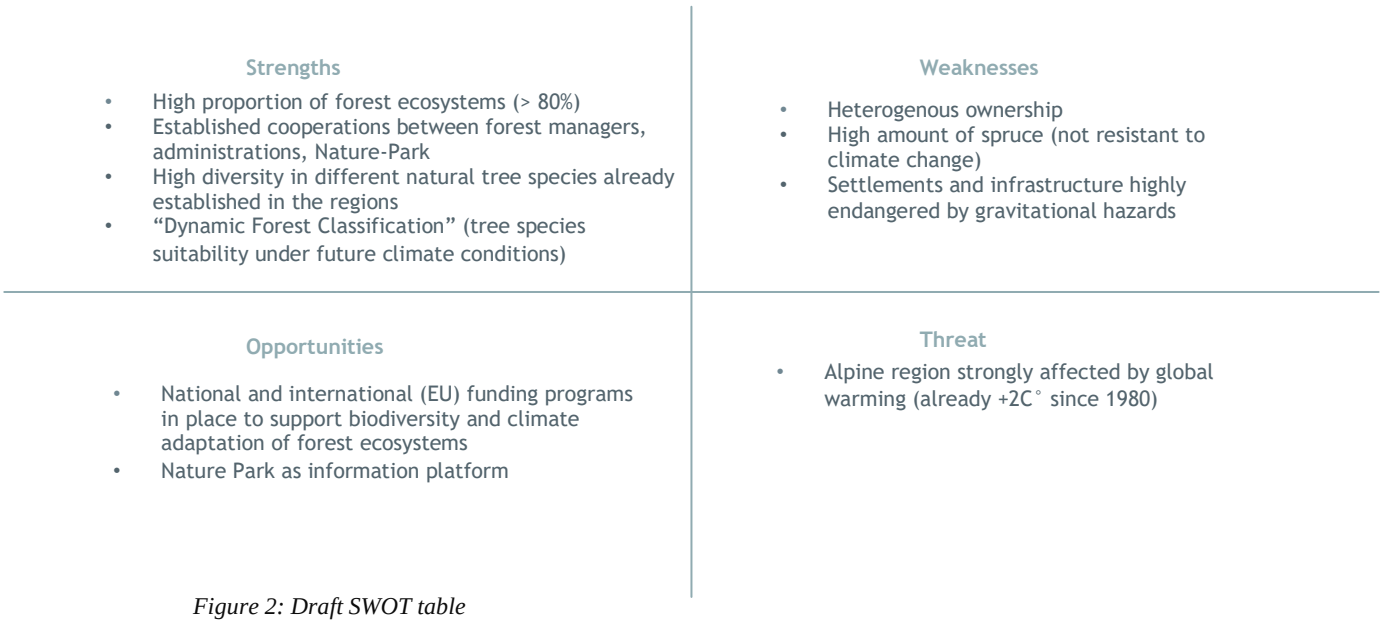

Figure 2: Draft SWOT table

Forests in the Eisenwurzen already provide a solid foundation for improving ecosystem services. The region is highly forested (80% of the area) and have the natural capacity to sequester carbon, promote biodiversity and regulate the water cycle. In addition, the established policy frameworks, conservation programs and regulations for sustainable forest management provide a legal basis for the promotion of ecosystem services. In addition, local communities have extensive ecological knowledge and play a crucial role in managing forests through traditional and participatory management practices.

Despite these advantages, several internal challenges need to be addressed. One important limitation is the lack of comprehensive baseline data and systematic monitoring. Without an accurate assessment of current carbon stocks, biodiversity and risks from natural disasters, it is difficult to set precise targets and measure progress effectively.

Economic pressures also pose a major challenge. Short-term economic interests, such as intensive timber harvesting, often take precedence over the long-term preservation of ecosystem services. In addition, fragmented and small forest ownership makes coordination and decision-making difficult. Financial constraints further hinder sustainable forest management practices. Reforestation, biodiversity conservation and sustainable management require investment, but available funds are often limited or unevenly distributed, slowing implementation.

Despite these challenges, there are numerous external opportunities. Growing global awareness of climate change, biodiversity loss and ecosystem degradation has led to increased political and financial support for nature-based solutions.

The emergence of carbon markets and payment for ecosystem services (PES) schemes provides financial incentives to maintain and enhance forest ecosystem services. Landowners and forest managers can benefit from these mechanisms by adopting sustainable practices that contribute to carbon storage and biodiversity conservation.

Technological progress also offers new opportunities. Remote sensing, satellite imagery and AI-powered data analysis offer more accurate and efficient tools for monitoring the state of forests, carbon storage and biodiversity. These technologies enable better decision-making and more effective conservation strategies.

While there are opportunities, external threats pose a significant risk to the success of forest ecosystem services initiatives. Climate change continues to be a major concern. Rising temperatures, prolonged droughts and increasing wildfires threaten the health and resilience of forests. Extreme weather events

such as storms and floods can further impact forest ecosystems and reduce their ability to provide important services.

Uncertainties in the market and political environment also pose a challenge. Fluctuating timber prices can incentivize unsustainable logging, while weak enforcement of conservation laws can enable continued deforestation and habitat destruction. Political shifts and policy changes at national and regional levels can impact long-term conservation efforts and require adaptive strategies to make progress.