Danube Transnational Programme

URBforDAN

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1 INTRODUCTION

1.1 The objective of strategic plan

The aim of the Strategic part of the IMMP plan is to identify demands towards urban and peri-urban forests (UPF), potential conflicts between different forest uses, to define strategic long-term management objectives in UPF, and to define priorities amongst management objectives and ecosystem services (ES). The strategic part also defines management guidelines that represent the basis for the definition of operational goals and measures.

1.2. The planning process and participation

The planning process was not so extended in time but difficult because of the complex relationships established between the local community and Făget forest as an ecosystem.

The preliminary stage of the strategic analysis included also Tineretului Forest, an area in the eastern part of the city. It is a patch of forest composed out of European hornbeam and sessile oak. Due to the small size and more difficult access this second option was later discarded.

The first part consisted of the identification and mapping of general ES. As a result of these, the first ES maps were obtained.

However after several field visits, the complexity of the area emerged and several other ES services were identified.

As a result, we consider this strategy as only a general step. Further studies and especially time is needed to completely understand the complex relationship developed between nature and humans in the area.

1.3 Legal basis

The national forestry legislation provides a robust framework around the existence, continuity and sustainable development of Romanian forests. The Romanian lawmaker has been regulating this matter and establishing the basic rules according to the concepts of management, conservation and sustainable development of forests. The most important collection of forest legislation includes normative acts which have been edited starting with the 19th century and are still being applied in Romania such as: The Forest Order for Bucovina; The Normative Act issued by the Emperor Joseph II in 1786; the Romanian Forest Codices of 1881; the Romanian Forest Code from 1910; the Forest Code from 1962; the Forestry Code from 1996 and the Forest Code from 2008, that was amended and republished in 2016 and 2018.

Currently, the Forestry Code of 2008 (Law no. 46/2008) updated and republished in 2018, as well as related legislation is the general legal framework for the protection, conservation and sustainable development of the Romanian forests. This forest law aims to set up the general framework rules for the development and sustainable management of the Romanian forests, in order to improve the environmental and living conditions, without regardless of the holder of the ownership of forests.

The main objective is the protection and conservation of forests, precisely judging by the elaboration of this forest law and by the establishment of the forestry regime. This gives the legal norms that make up the forestry regime an imperative nature, at the same time delineating the notion of this term in technical and in forestry terms.

The obligation to comply with the forestry regime is stipulated for all the forest holders, without considering the form of the property right. The new legal provisions in the field of the control and enforcement of the forestry regime are in accordance with the European regulations regarding the obligations of forest owners. The Forest Code provides that all types of activities related to the forests are to be preceded by the precautionary phase and the prevention of forest degradation and destruction, as well as the damage to the integrity of the forest fund.

A novelty that was introduced by the New Forest Code regards the development and sustainable management of forests, and the preservation of the biodiversity of forest ecosystems through sustainable management measures. The introduction of sustainable development and forests management concept expresses the need for a new approach to the development of Romanian forests, by recognizing the importance of the forests' quality and their services, through the awareness of the benefits and of the functions they fulfil.

In the context of sustainable forest management, certain legal provisions regarding the forest management, forest biodiversity conservation, forest regeneration and protection and insurance of forests' integrity are stipulated. Also, the legislation stipulated the main principles underlying sustainable development and the management of Romanian forests, principles that have been formulated and established at a global level.

A distinct aspect regarding the legal protection of the forests is represented by the set of special rules stipulated for their defence, in which the legal norms related to the forests' protection are emphasized, safeguard that is ensured and exercised by the forest owners, according to the legal provisions.

The forests' protection is achieved in a special way, by imposing their guardianship for forest owners, with no distinction being made between the safeguarding of public or of private property forests. It is also established that the forestry staff in the exercise of these attributions is assimilated to the staff with duties involving the exercise of public authority. At the same time, for the purpose of the forests' protection, certain obligations for the prevention and extinguishing of forest fires are stipulated on behalf of forest owners, on behalf of forest institutions (which provide the management and forest services), as well as on behalf of prefects, mayors, local and county councils and competent authorities in the field of civil protection of the environment.

Romania has a long tradition in the forestry domain being one of the richest European countries in forest resources. These forests can have a public or private ownership status and they are all managed under the Forestry Code Law (R.P. 2008).

At national level, Urban and Land planning Law no. 350/2001, and the Urban Green Spaces Law no. 24/2007, and the Forestry Code (2008) are the main regulatory documents influencing the planning of urban forests. Equally important is that applies to all forests.

Urban forests are important elements of the green infrastructure network. Cities are changing under economic development and the planning of open spaces is increasing in their complexity, with a wide range of land uses which need to be managed together. Urban forests are strategic areas providing multiple benefits for the community and enhancing the quality of life.

Forests and green spaces are essential to the urban ecosystem and can mitigate temperature, decrease pollution, soil erosion, increase aesthetics and provide a place for recreation.

Urban forestry is focusing on the biodiversity and green infrastructures including an assessment of urban forests connectivity. The urban planning approach considers urban forest as part of the urban fabric and an essential element to achieve sustainable cities.

One of the designated urban green areas for a city are recreational forests, defined as forests with a specific infrastructure for recreational activities. One can also find forests planned for sanitary protection or for climate improvement purposes. Urban forest connectivity on the other hand is a topic missing from the urban planning process, while only elements of urban green infrastructures such as parks are sometimes designed to create a network and to connect with other areas.

The forest is a public property administered by the National Forest Administration Romsilva, autonomous national interest, under the authority of the state by the central public authority responsible for forestry, Forest Research and Management Institute "Marin Drăcea", and fold forestry established by the Autonomous Administration of State Protocol Patrimony.

The Forestry Code introduces the concept of forest-park. Forests-parks will be established at the request of the owner/manager of the forest, based on studies and the advisory opinion of the Technical Committee on Forestry. The arrangements allowed in forests-parks are hiking paths made from environmentally friendly materials, with a width not exceeding 2m or bike lanes; benches; lighting; information points; ecological toilets; temporary buildings; wooden building area not exceeding 15 square meters.

It allows the construction of protection forest areas, at 50 m from the forest edge; also, the county and local roads serving recreational parks, theme parks and/or education are permitted.

1.4 Terminology

Biodiversity - The variability among living organisms from all sources, including inter alia terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part, this includes diversity within species, between species, and of ecosystems.

Conservation Status - The sum of the influence acting on a habitat and its typical species that may affect its long-term natural distribution, structure and functions as well as the long-term survival of its typical species.

Cost-Benefit Analysis - A technique designed to determine the economic feasibility of a project or plan by quantifying its economic costs and benefits.

Cost-Effectiveness analysis/Approach - Analysis to identify the least cost option that meets a goal.

Critical Natural Capital - That set of environmental resources which performs important environmental functions essential to human well-being, and for which no substitutes in terms of human, manufactured or other natural capital currently exist.

Cultural Ecosystem Service (CES) - All the non-material, and normally non-consumptive, outputs of ecosystems that affect physical and mental states of people. CES are primarily regarded as the physical settings, locations or situations that give rise to changes in the physical or mental states of people, and whose character are fundamentally dependent on living processes; they can involve individual species,

habitats and whole ecosystems. The settings can be semi-natural as well as natural settings (i.e. can include cultural landscapes) providing they are dependent on in situ living processes.

Ecosystem - Dynamic complex of plant, animal, and micro-organisms communities and their non-living environment interacting as a functional unit. Humans may be an integral part of an ecosystem, although 'socio-ecological system' is sometimes used to denote situations in which people play a significant role, or where the character of the ecosystem is heavily influenced by human action

Ecosystem Services - The benefits that people obtain from ecosystems (MA, 2005). The direct and indirect contributions of ecosystems to human well-being (TEEB, 2010). The concept 'ecosystem goods and services' is synonymous with ecosystem services. The service flow in our conceptual framework refers to the used service. The direct and indirect contributions of ecosystems to human well-being.

Governance - The process of formulating decisions and guiding the behaviour of humans, groups and organisations in formally, often hierarchically organised decision-making systems or in networks that cross decision-making levels and sector boundaries.

Green Infrastructure (GI) - A strategically planned network of natural and seminatural areas with other environmental features designed and managed to deliver a wide range of ecosystem services (ES). It incorporates green spaces (or blue if aquatic ecosystems are concerned) and other physical features in terrestrial (including coastal) and marine areas. On land, GI is present in rural and urban settings.

Natural Capital - The elements of nature that directly or indirectly produce value for people, including ecosystems, species, freshwater, land, minerals, air and oceans, as well as natural processes and functions. The term is often used synonymously with natural asset, but in general implies a specific component.

Participatory Approach - Family of approaches and methods to enable (rural) people to share, enhance, and analyse their knowledge of life and conditions, to plan and to act, to monitor and evaluate.

Provisioning Services - Those material and energetic outputs from ecosystems that contribute to human well-being.

Public Good - A good where access to the good cannot be restricted.

Regulating Services - All the ways in which ecosystems and living organisms can mediate or moderate the ambient environment so that human well-being is enhanced. It therefore covers the degradation of wastes and toxic substances by exploiting living processes.

Resilience - A measure of an (eco)system’s ability to recover and retain its structure and processes following an exogenous change or disturbance event. If a stress or disturbance does alter the ecosystem, then it should be able to bounce back quickly to resume its former ability to yield a service or utility rather than transform into a qualitatively different state that is controlled by a different set of processes. For ecosystem resilience to be defined, the ecosystem must have a degree of stability prior to the perturbation. Resilience relates to return to stability following a specified perturbation.

Resistance - The capacity of an ecosystem to with-stand the impacts of drivers without displacement from its present state.

Service-Providing Unit (SPU) - The collection of individuals from a given species and the metrics of trait attributes (e.g., abundance, phenology, distribution) that are necessary for delivery of an ecosystem service at a desired level. The SPU can be quantified in terms of metrics such as abundance, phenology and distribution.

Stakeholder - Any group, organisation or individual who can affect or is affected by the ecosystem's services".

Stakeholder Analysis - Stakeholder analysis can be defined as a process that: i) defines aspects of a social and natural phenomenon affected by a decision or action; ii) identifies individuals, groups and organisations who are affected by or can affect those parts of the phenomenon (this may include nonhuman and nonliving entities and future generations); and iii) prioritises these individuals and groups for involvement in the decision-making process.

Supporting Services - Ecological processes and functions that are necessary to produce final ecosystem services. See also 'intermediate services' and 'ecosystem functions.

Trade-off - ES trade-offs arise from management choices made by humans. Such choices can change the type, magnitude, and relative mix of ES provided by an ecosystem. Trade-offs occur when the provision of one ES is reduced as a consequence of increased use of another ES. In some cases, a trade-off may be an explicit choice, in others, trade-offs arise without awareness that they are taking place.

Urban - Environmental condition linked to high population density, extent of land transformation, or a large energy flow from surrounding area.

Urban forest - a forest or a collection of trees that grow within a city, town or a suburb. In a wider sense it may include any kind of woody plant vegetation growing in and around human settlements. In a narrower sense (also called forest park) it describes areas whose ecosystems are inherited from wilderness leftovers or remnants.

2 ANALYSIS OF THE STATE OF THE ART

2.1 Basic data on the strategic area

The project area is a 40-ha area of the forest "Făget" (hereafter Făget), which is the largest forest in the close vicinity of Cluj-Napoca. Făget is situated in the SE part of the city (Figure 1) and is one of the getaway areas in the proximity of Cluj-Napoca. It has always been a popular retreat and classic destination for people wanting to escape the city during weekends. During the last centuries the area has always been forested, as it can be seen on old maps of the region.

During the communist time in the area there were three huts, similar to the mountain huts, the most visited one being "Cabana Veche" (Old Chalet), the other ones "Cabana Sf. Ioan" and "Cabana Faget-Pădure". Besides those two there were only some old houses, around the two main roads crossing the forest and a camping site. After the housing development boom during the 2000[5], the forest obtained protected status under the European Union`s Habitats Directive, thus becoming a NATURA 2000 site. The build-up areas were excluded from the protected area and also some parts of the forest, including the project area.

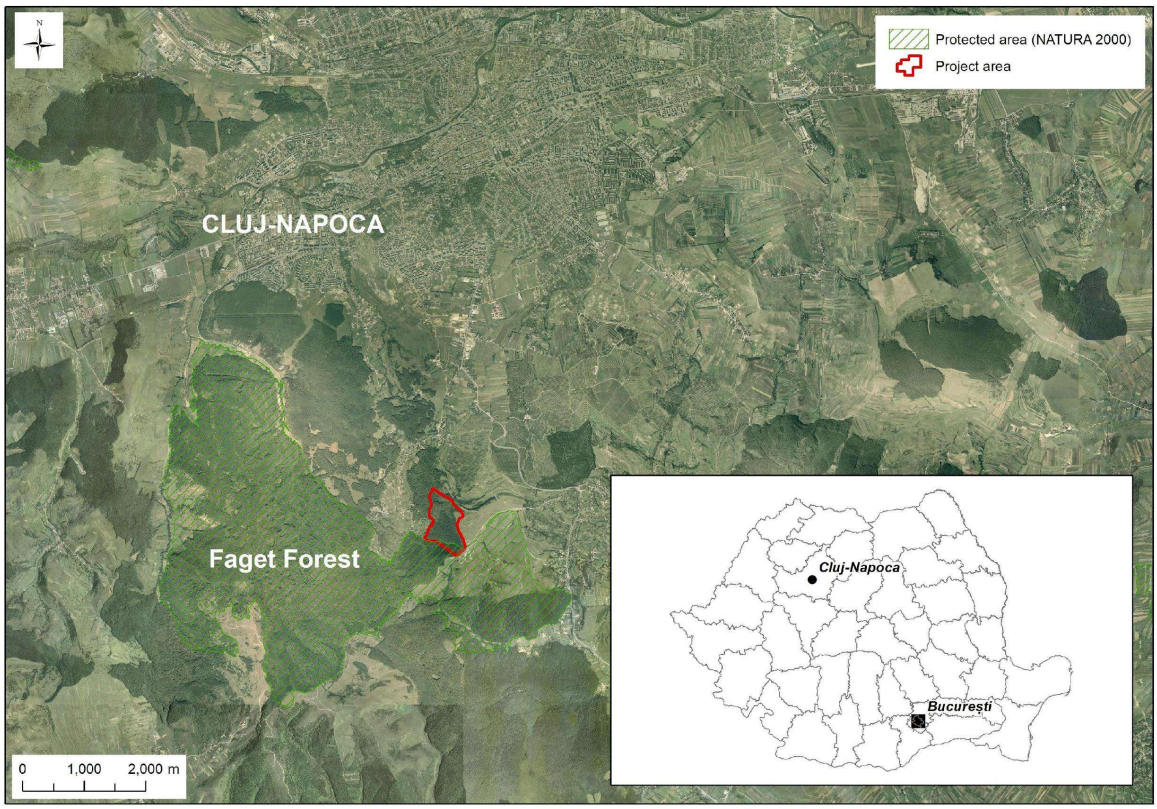


Figure 1. Location of the strategic area

After the collapse of communism one of the chalets (Old Chalet) gradually degraded and does not exist anymore. The other ones survived but are no longer a popular attraction.

The area is managed by the Făget-Chinteni Forest District, which is in the close vicinity of the city of Cluj-Napoca, located in the North-Western part of Romania.

Cluj-Napoca, a city with a population of over 400,000 inhabitants, faces unprecedented expansion of the city limits and population. Within the context of urban sprawl, land is becoming an increasingly difficult resource to manage and preserve, and the local forests are no exception to the constant anthropic interferences.

Făget-Chinteni production unit is located on the Someşan Plateau, the subdivision “Dealurile Clujului” (The Hills of Cluj), on both slopes of the middle course of Someșul Mic River. The forest district Făget-Chinteni production unit is managed by the National Forestry Directorate, the area of the unit is 3055 hectares. The local authorities maintain strict laws concerning the forests, but as a result of the city growth and the rapid construction rate, land began to be occupied up to the forest edge, as well as new roads and bypasses that go through existing forests, damaging the ecosystem and the stability of the soil.

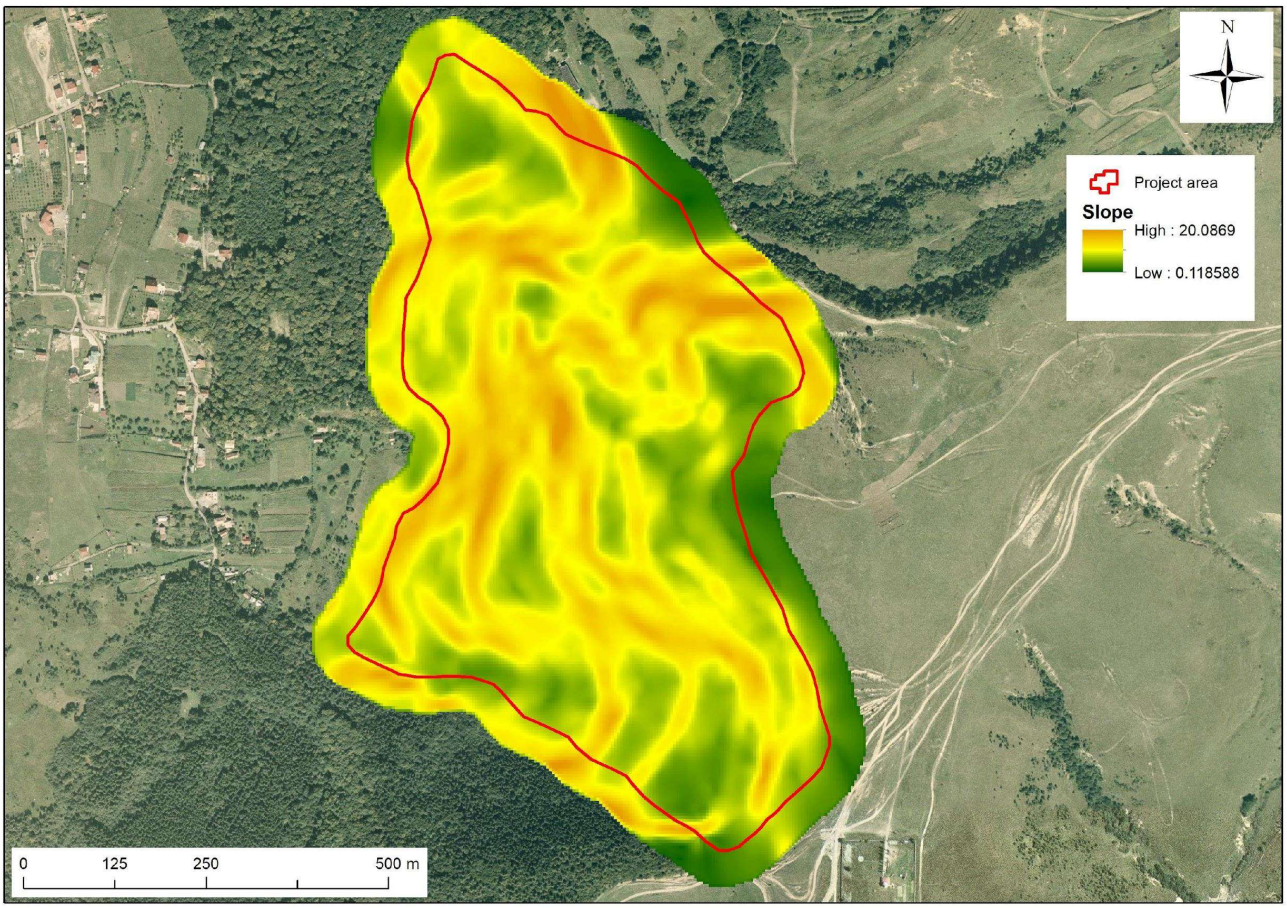


Figure 2. Slope map

Gradually, because of its vicinity to the city, the area became more and more populated and several new development areas with modern houses emerged. Now it is considered to be a part of the city proper and the main open areas (former pastures) were transformed into built-up areas. The project area consists of a sloped hill side between the elevation of 650m and 740m, with an average slope of 9 degrees, facing mainly towards west and south-west (see Figure 2). The main land use is forest with only small patches of open spaces (Figure 3, Table 1). The main native species to be found are hornbeam (*Carpinus betulus*), beech (*Fagus sylvatica*) and sessile oak (*Quercus petraea*). Especially the hornbeam and the beech are uniformly distributed while the oak species are present in clumps in open spaces. The other native species present are *Acer pseudoplatanus*, *Tilia cordata*, *Populus sp*. and *Salix sp*. The project area harbor over 15 native tree species. The non-native species are Douglas fir (*Pseudotsuga menziesii*) and *Larix decidua*. They are found in localized patches and occur in homogenous stands, being plantations.

Being defined as recreational forestry by the forestry documents (until 2018), wood production ES was limited. The forest has not reached the full exploitation phase. Starting with 2019 the forest id included in the forest-park category, thus limiting wood-production.

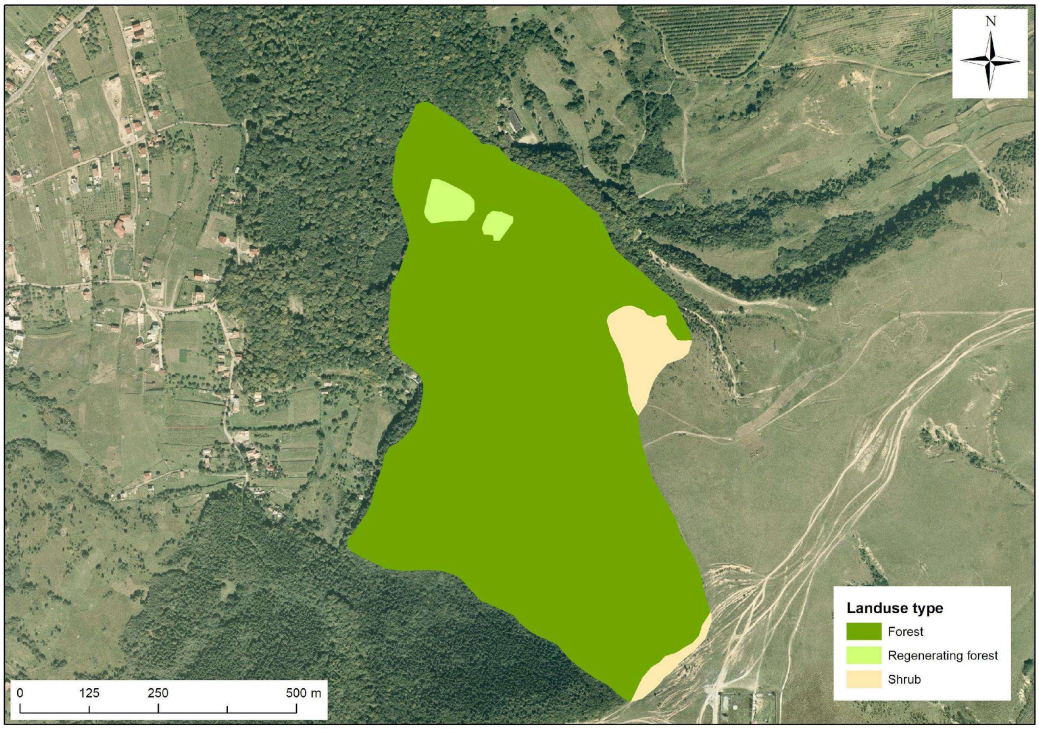


Figure 3. Landuse map

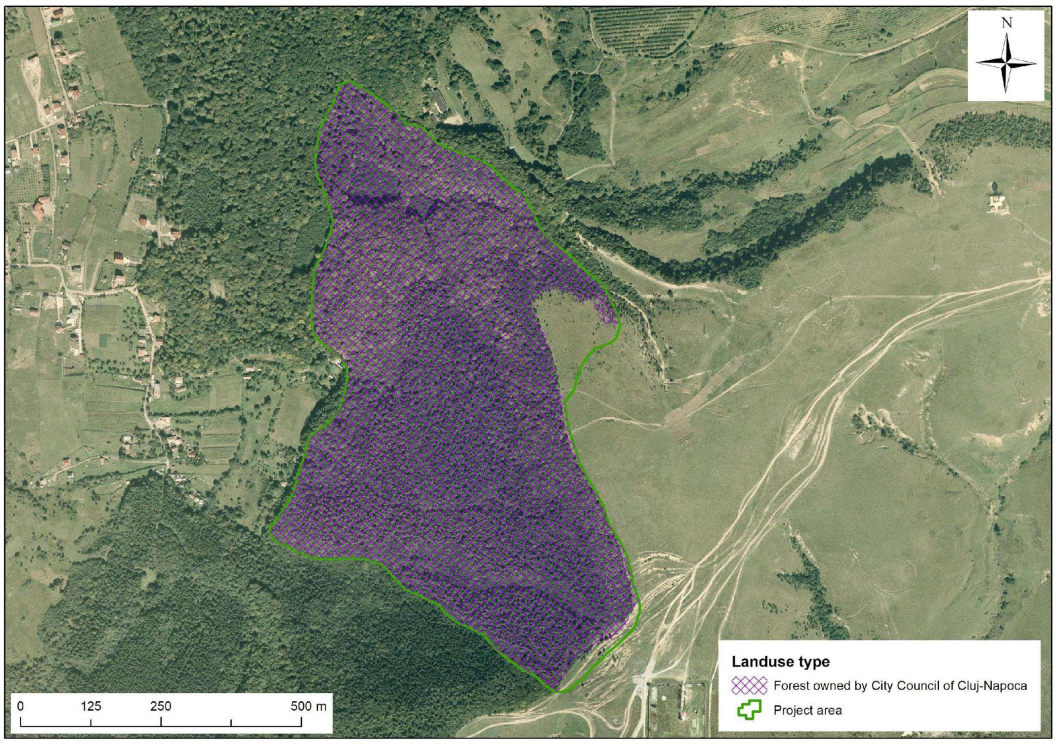


Figure 4. Land ownership in the project area

The forest in the project area is owned by the local council of Cluj-Napoca (Figure 4), which is an important factor in the general implementation of the strategy. A small part of the forest has been cut in the recent years and now is naturally regenerating.

Table 1. Landuse types and covered area

No.	Landuse	Area (hectares)
1	Forest	39.3
2	Regenerating forest	0.75
3	Shrub	1.9

2.2 Ecosystem services in UPF

In this strategy we aim to address all four types of ecosystem services (ES) mentioned in the below table (Table no.2). In the following we will describe these ES and highlight why they are important for our UPF. Before we address the ES, we would like to highlight the specific context and history of the UPF addressed by our project: the forested area developed as a result of centuries-long human-nature interactions. Several and different types of ES addressed below are synergistically maintained by the extensive forestry practices as well as the nature friendly human activities (recreation) currently carried out in that forest. Therefore, in the text below we will often refer to the interconnected nature of human actions and several types of ES.

Some past management actions (i.e. forest grazing) are now forbidden by Romanian law and we cannot currently see the remnants (legacies) of these actions. Other past human activities, however, left their legacies on the trees and can be appreciated nowadays for their cultural, aesthetic and natural values (see e.g. the coppices). Nevertheless, several species of international concern (being protected) depends on the human actions implemented in the past (e.g. traditional forestry, coppicing) as well as present (e.g. the maintenance of temporary ponds along the unpaved roads which are key habitats for endangered amphibians).

Because several ES are strongly interrelated and synergistically maintained by extensive management and human actions in this forest, the conceptual approach to address our system is integrative (rather than segregative). The spatial overlap between some ES can be high. With other words, delineating clear spatial boundaries for various ES within the forest area will over simplify the ES potential of this system and could result in management plans with adverse effects on some ES. Although we will provide ES maps as requested by this project, the reader should interpret them carefully. We will highlight these aspects when addressing the various types of ES below.

Figure 5 presents a contextualized list of ES and nature related values present in the forest site targeted by this project.

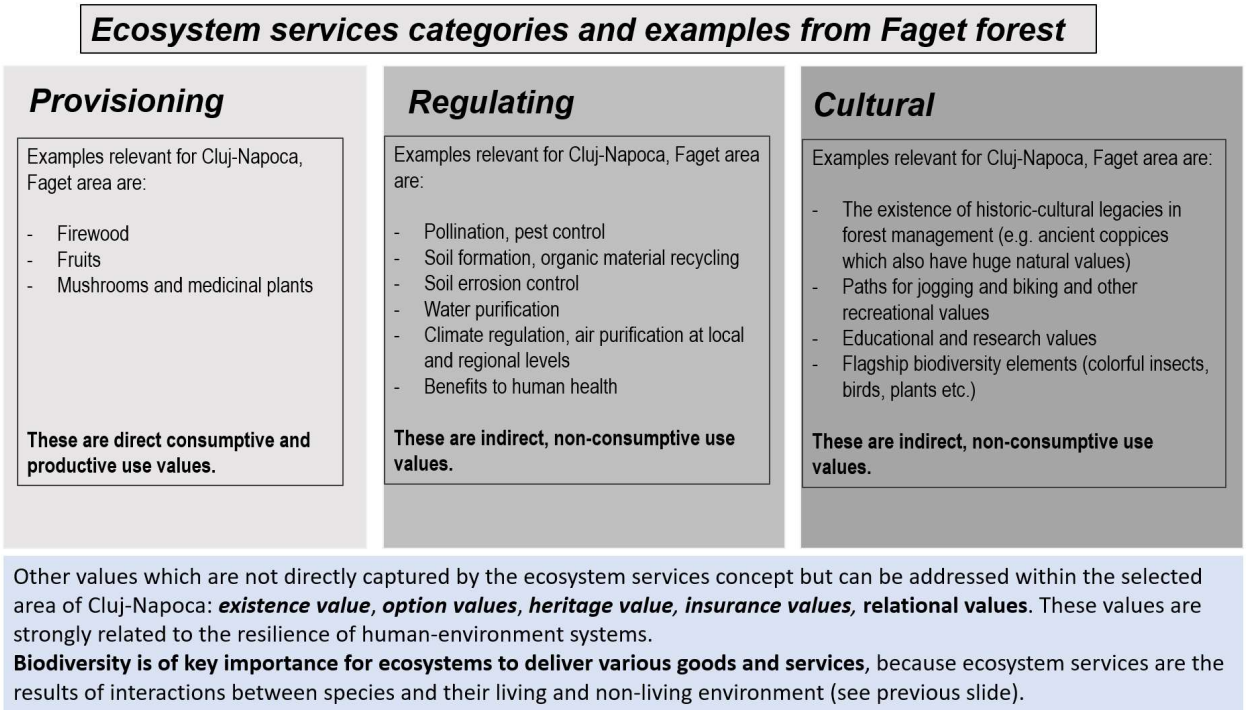


Figure 5. ES examples from Faget forest

Provisioning ES

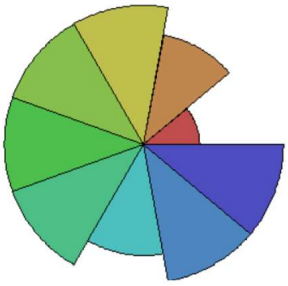
The broad provisioning ES type for which the forest was managed is timber (for firewood or industrial reasons). Besides this ES the local community frequently use the seasonally available non-timber products such as mushrooms and forest fruits. The value of the selected forest for provision of drinking water is potentially high because it is part of a wider native forest network.

While the above-mentioned timber and non-timber products have direct consumptive values, we would like to mention that the extensive (nature friendly) use of these resources during the past century allowed several biodiversity elements and keystone ecosystem structures to persist (these being part of the supporting ES) in the targeted forest parcel. Within this production forest there is a plantation patch (non-native coniferous trees – Douglas fir) for production and there are several forested areas with exceptionally high natural and cultural values with native trees characteristic for this biogeographic region (*Fagus sylvatica, Carpinus betulus, Acer pseudoplatanus, Quercus robur*).

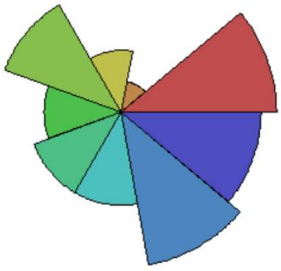
The key take home message for management strategy is to maintain the high multifunctionality of the selected forest (Figure 6 and Figure 7) by carefully identifying those ecosystem components which have high socio-cultural and natural values and maintaining these values while extracting the provisioning ES. The above figure highlights the high socio-economic and natural potential of this production forest and the examples shown point towards the need of further zoning in order to identify those regions where special care should be allocated to not compromise the high natural and cultural values of the forest when extracting timber.

	
Plantation of Douglas fir, a non-native timber tree in the target area. While the economic value of this plantation is high (i.e. provisioning ES), the capacity of this patch to provide diverse ES (except of carbon sequestration as regulating ES) is relative low. Nevertheless the biodiversity and restoration potential of such places can be moderately high and the ES provision potential can be enhanced with environmental friendly forestry.	Forest areas with native trees and natural regeneration in the study system. The project area has several wild or high biodiversity value places. In such cases the native broadleaved forest has a pronounced vertical structure with natural regeneration and open patches with intense light. These features provide high biodiversity, resilience and aesthetic values to the ecosystems, hence simultaneously enhancing several ES, including provisioning (mushroom, fruit), aesthetic/cultural (beauty, colourful flagship species), regulating (carbon sequestration and soil formation) and supporting (high biodiversity) ES.

Figure 6. Short characterization of forest stands with high natural and economic potential in the targeted forest.



Natural forest



Fir plantation

Figure 7. The ES delivery potential of natural forest stands versus the douglas fir plantation in our project area. This representation highlights the strengths of ES delivery in the two forest types and also the ES tradeoffs associated with timber extraction. We suggest that managers should use a holistic approach to the management of this system, where the economic and other intangible values as well as the supporting ES are maximized. Forest stands with high natural values should be maintained primarily because of their potential for delivering several ES, while the douglas fir plantation may be managed for timber extraction in an environmentally friendly way.

Regulating ES

The regulating ES such as mentioned in Table 2 are overall strong, although local variations may exist in specific ES due to the structure (biodiversity, age) of the forest stands (see above Figure). Although we did not assess the regulating ES specifically, it is well known from the scientific literature that forests are also carbon stocks (hence they contribute to climate change mitigation), they play a key part in controlling water flow at local level (water retention) as well as soil erosion. Furthermore, reforestation activities are considered key for reducing greenhouse gases and fighting against climate change. The forest site addressed in our study has the profile for a maximal contribution to all of these regulating ES: the tree density overall ranges between cca 150-800 trees ha^{-1}, the overall diversity of the trees (i.e. in terms of species richness) is high (with more than 20 tree species), the vertical stratification of the forest is well pronounced, the natural tree regeneration occurrs in several places of the forest and the well-developed forest litter (which also includes dead trees at various stages of decomposition) is present in a large area of the forest (which indicates soil formation). Management interventions should consider the maintenance of the above-mentioned ecosystem features in order to secure those ecosystem processes which deliver the regulating ES. Most of these ES can be maintained and enhanced by adopting an environment and nature friendly forest management strategy.

Supporting ES (biodiversity and habitats)

The forest strategic area has exceptional natural values. The main reason for its high natural values is related to the ecosystem structure. The forest has high spatial heterogeneity (horizontal and vertical) which allowsa diversity of conditions regarding light and humidity. The diversity of niches translates into a high diversity of wild species. For example, the number of bird species within the target forest parcel is around 38 species while those of vascular plants 100 species and the amphibian and reptile species 6 and 4 species respectively. The number of mammal species is around 24 species, including 6 species of bats. It is also important to mention that the forest site targeted for this project has several old trees which biodiversity surrogates are (one old tree can represent habitat for hundreds of invertebrate and vertebrate species). The temporary ponds across the unpaved roads depends on extensive human activity: these ponds support internationally endangered amphibian species, such as the yellow bellied toad (*Bombina variegata*) (Figure 8). Nevertheless we identified a wild area in the forest (Figure 9) where ecosystem functions are still largely natural. From the perspective of the resilience and ES provision of this ecosystem it is important to mention that besides the *high species diversity*, there is also a high *functional diversity* of the organisms. For example, the insectivorous bats, amphibians and birds contribute to pest control in the forest ecosystems – this being also recognized by the conventional forestry literature. Furthermore, the insect pollinated plants contribute to the maintenance of pollinators. Hotspots for some of these groups are those areas where human activity is more limited and natural processes dominate . The maintenance of high functional diversity as well as high species diversity in the selected ecosystem should be key strategic component of the management of this site.

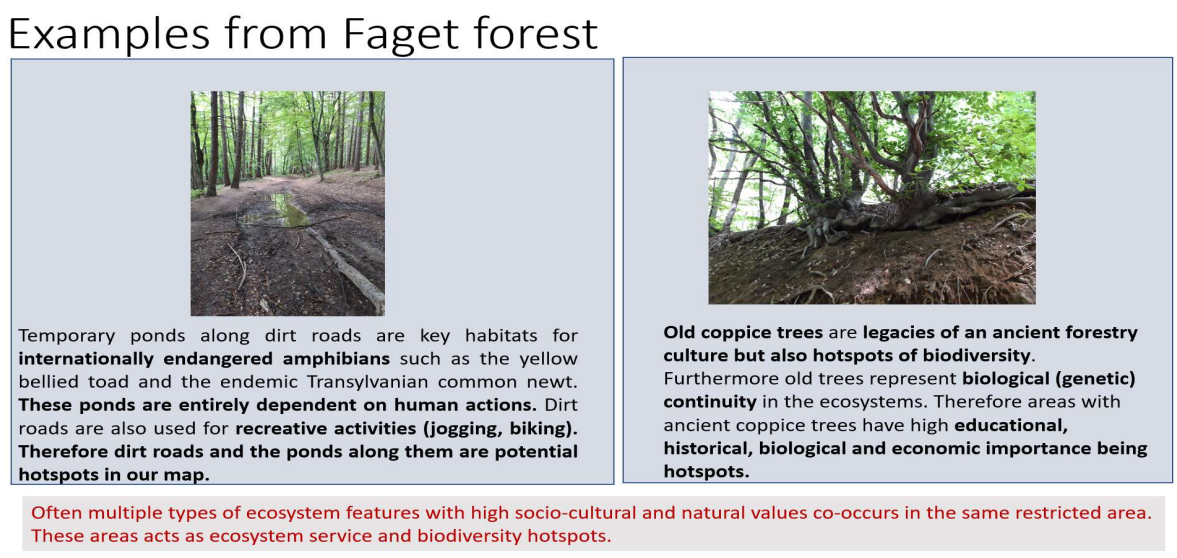


Figure 8 Temporary ponds and old coppice trees are biodiversity as well ES hotspots in the forest addressed within this project. These are ES hotspots because the high habitat value of these structures within the forest is dependent on a specific human management (which was implemented to extract provisioning and other ES).

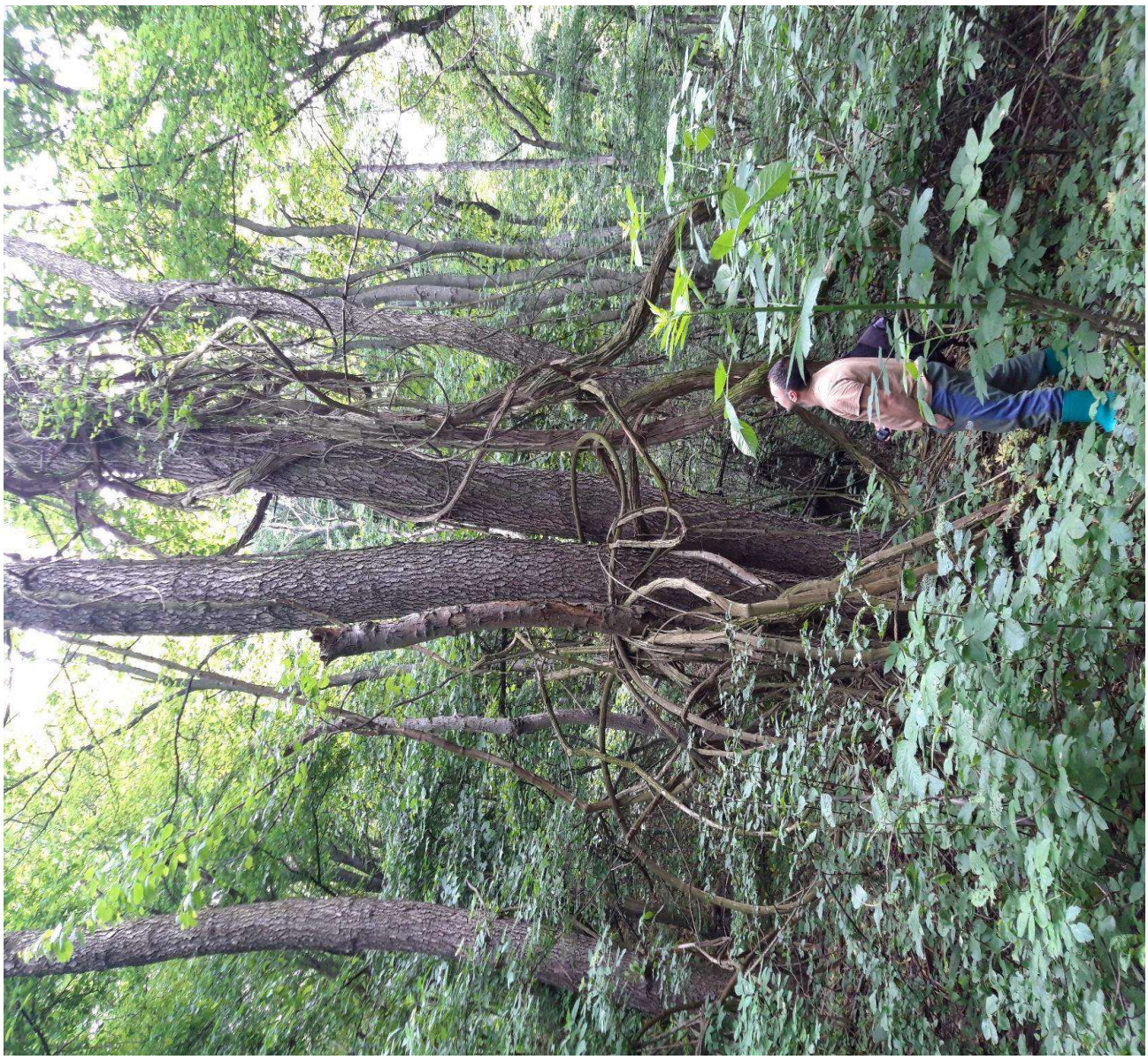


Figure 9 Wild ecosystem area in the forest targeted by the project. We propose the maintenance of this area wild, with human activities restricted to controlled visits and education. This consist cca 1% of the whole area therefore its conservation will not imply high costs.

Cultural ES

As stated above, the forest targeted by the UPF project was used for timber production during centuries, and its cover was constant during this period. By itself this provides an enormous cultural and historical value for this forest. In this project we will highlight and propose the protection of ecosystem structures which were created by human actions and are highly biodiverse and have historical values as well and also, we will emphasize the recreative, educational sports potential of the addressed forest. Some of these values are increasing as the urban society of Cluj-Napoca increasingly recognizes the value of 'nature' for their everyday life. Hotspots of cultural ES are presented in Figure 9 above.

In our study area cultural ES are closely related to the dirt roads, where various activities (jogging, biking) are conducted. Most of the ancient coppice trees as well as the high habitat value temporary ponds are situated across these roads.

The study area provides a great potential to understand how natural/wild processes shape the ecosystems structure. These are also cultural ES and are mostly concentrated on the areas where human impact is low or absent (at least for the past decades).

The educational importance of the area is high in all its parts. By just having a short walk, students and other interested groups can learn about the sustainable forest strategies as well as about the ways how human-nature interactions can result in high socio-cultural and natural value ecosystems.

Table 2: Summary of the most important ES

Ecosystem service (ES) – area (ha) and % of entire forest area – only 1st rank and 2nd rank	**Individual objective/ES**	**Area (ha) and % of entire forest area**
Provisioning ES	11_Timber production	41.88 ha, 100%
	12_Non-timber products	22.09 ha, 52.74 %
	13_Provision of drinking water	
Regulating ES	21_Local climate mitigation	9.13 ha, 21.8%
	22_Local air quality	
	23_Protection against noise pollution	
	24_Regulation of floods	
	25_Protection against erosion	2.33 ha, 5.56%
	26_Waste-water treatment	
Supporting ES	31_Nature protection / habitats for species	41.88 ha, 100%
Cultural ES	41_Recreation and tourism	41.88 ha, 100%
	42_Scientific / educational	2.4 ha, 5.73%
	43_Cultural heritage	

2.3 Target groups

Recreation and tourism users

This is the largest group of users. It is mainly composed of joggers, hikers, cyclist and recreational walkers. These users are local resident who like to practice sports in a nature area. They access the area by using personal car, some of them by bike and a smaller proportion by using public transport.

Forestry

The local forestry administration is a key stakeholder that needs to be involved in the management of the area.

Scientific community

Local scientific knowledge is important so scientists should be involved in all the activities related to the management of Făget forest.

Local NGO

Local environemental NGO's are very interested in the area and usually people from the se groups have a good expertise about the problems of the area.

3 THE STRATEGIC PRIORITIES

Provisioning ES

Timber production

1.A nature friendly forestry for the area

The timber production activities should be harmonized with the high natural, aesthetic, historical and cultural values of the forest. This implies the development and implementation of a nature and intangible value friendly (ES other than provisioning) forestry for the area. Together with the stakeholders (especially forestry sector), develop a nature friendly timber production strategy for the douglas fir plantation.

Non-wood forest products

2.Improve the traditional activities related to mushrooms and forest fruits

Improve the practice of harvesting mushrooms and forest fruits. This practice is linked to Cultural ES. Control the amount, time and species harvested in order to maintain a high diversity of the species. Inform visitors about the mushroom species existing in the forest and their palatability. Rise awareness about the need for sustainable and responsible mushroom and wild fruit collection. Create focal points with other native species (blueberry, blackberry) that are not present in the current moment, as the main group harvested now is composed out of mushroom species

Regulating ES

Local climate mitigation, Erosion prevention

3.Control the erosion and maintain the climate regulating service

Given that the current state of the forest is exceptional, we propose that maintaining the current state would be the ideal way to maintain the forest capacity to mitigate climate change and contribute to regional climate regulation. Control the development of gully erosion by maintaining the shrub species around the gully and creating anti-erosion structures where needed (e.g. small consolidation developed

from wood). This priority is linked to other priorities from the cultural ES. The gully should not be eliminated but controlled. Maintain the small ponds, wetlands that control the water regime in the area. The management practices should aim to maintain as much water as possible in the forest, given that water scarcity will be a main social and environmental issue in Europe and in Romania as well.

Suporting ES

Nature protection

4.Develop an integrated strategy for the protection of species and habitats as they are at the base of all the Ecosystem Services in the area.

Developing a Conservation Strategy for priority Habitats/Species is a key element because all the Ecosystem Services in the project area are based on the natural capital that is to be found in the forest. This strategy will address several issues of high importance:

- Conserving the small ponds created in potholes. Identify optimal disturbance regimes for maintaining these ponds and assuring that they remain optimal habitats for amphibians.
- Maintain the areas with high natural values (including 'wild' areas, where human action was prohibited at least for the past 20 years). Conserving these high biodiversity areas will assure that species will have a refugia and these can act as population sources as well. These areas also include keystone habitat structures, like wetlands, large old trees, hollowing or dead trees (standing or falled). These habitats play not only a key role for biodiversity but they support several other ecosystem services as well.
- Identify and actively promote whenever possible natural ecosystem processes such as tree regeneration and litter formation. This means also the identification and protection of those areas where the litter is well developed. These are key areas for soil formation and will have high educational and scientific importance.
- Maintain high diversity of functional groups (i.e. insectivores, pollinators, decomposers) within the targeted system.

Cultural ES

Recreation and tourism

5.Develop a recreational infrastructure with minimal impact

The infrastructure should include:

- Bike trails and support for nature friendly biking. These trails should be marked and designated for different categories of bike users.
- Walking paths with panels describing the ES, species and habitats
- Organizing events promoting the area and nature in general (nature photography contest, geocaching event). These events should also popularize ecosystem structures with high natural and cultural importance (e.g. large old trees, coppices, pollards).

Scientific/Educational

6.Develop a scientific infrastructure addressing scientists and students

- Organizing/hosting scientific events for scientists or maybe for students/high school children in partnership with educational/scientific institutions (University). These events should also include university field courses.

- Developing educational focal points and scientific focal points. The educational focal points should be locations where different educational activities can be carried out. Target groups are kindergarten children, high school children and students. The Educational points should be also developed to allow individual usage. The scientific focal points are designed for scientists but especially for students in order to be able to have a continuous time series of data about the biodiversity and ecosystem services in the area.

4 THE SPATIAL DEVELOPMENT CONCEPT OF UPF

The strategic map is developed by taking into consideration the priorities identified for the area. Our vision is centred around the recreational, scientific and nature protection ecosystem services.
The relatively small project area does not allow for a lot of priorities to be included so the aim of the map is to accentuate the most relevant ecosystem services. This does not mean that the other ones should be excluded. As previously mentioned, we believe that the ecosystem services act in a synergic way and the spatial delineation is only an artificial construct allowing for the better management of the area.

The prioritised ecosystem services in the area are:

Erosion Prevention

This ES is linked to priority A from the Regulating ES priorities, but it is linked also to Educational and Scientific ES. The management objectives related to this ES aim to control the development of gully erosion by maintaining the shrub species around the gully and creating anti-erosion structures where needed (e,g, small consolidation developed from wood). These practices are also to be presented to the general public and scientists' trough a Scientific Focal Point in the area.

Nature protection

The field research proved that the area is highly biodiverse. There are some "wild" spots that need to be preserved. These are defined as having high natural value. Conserving the biodiversity of the area emerges as a key factor for this strategy. Currently people who visit the area do so mainly for sports and recreational activities. We plan to increase the ecological awareness so that people will focus also on biodiversity and conservation. This is important for the young groups of children but also for university students who could use this natural laboratory.

Recreation and tourism

As already mentioned, recreation and tourism are key ES in the area. Recreational activities are the main current activities and the forest is important for the inhabitants of Cluj-Napoca.

The recreational and tourism activities should be promoted in order to increase the awareness about the area and nature in general.

Scientific ES

Although situated near a big city the forest is preserving a lot of important species. This has happened also because of the strong link between nature and traditional practices. The best example are the potholes created by bikes and carriages that are used by priority amphibian species. All these relationships can be studied by scientists

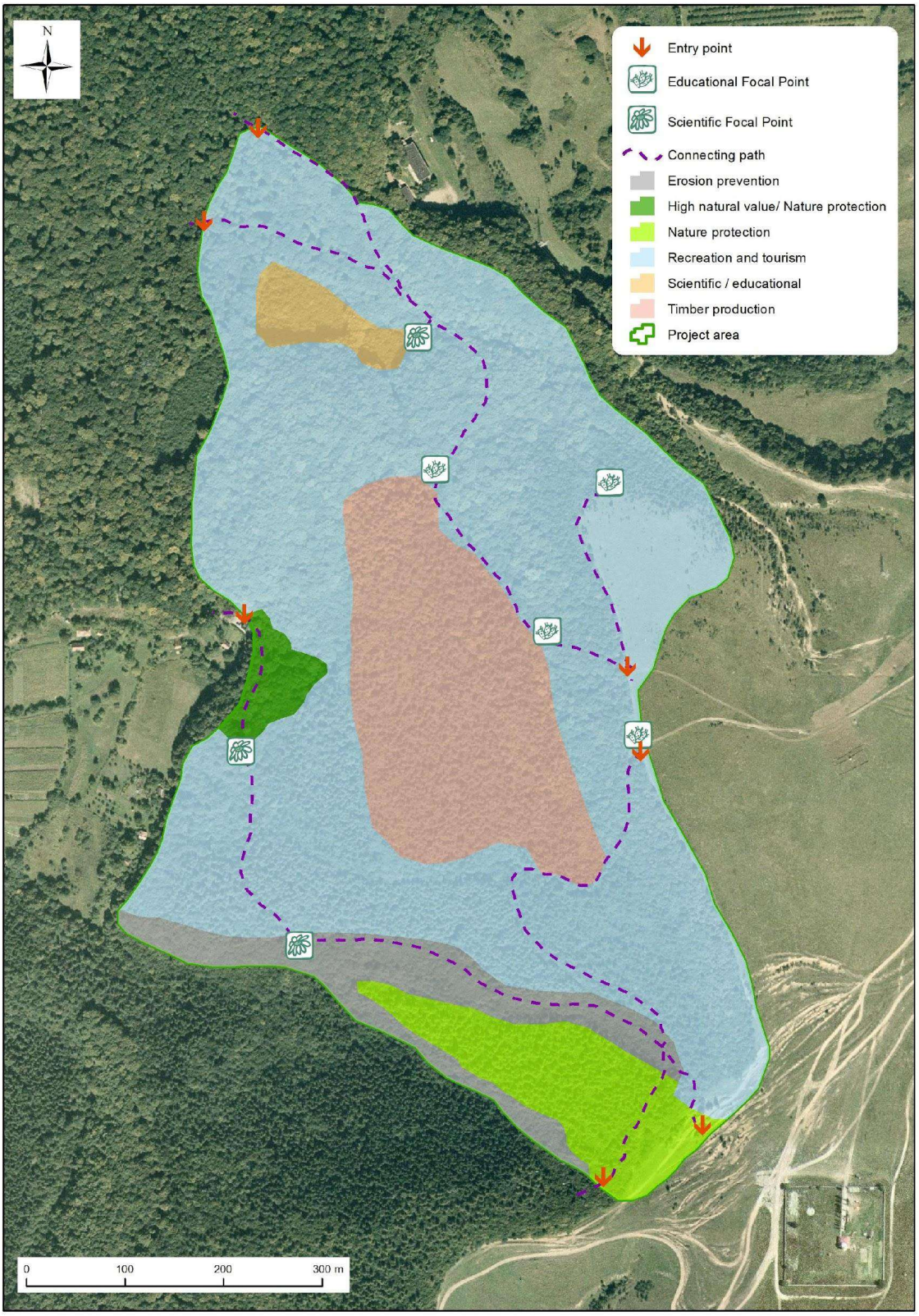


Figure 10. Făget Forest strategic map

Timber production

The aim of this should be to gradually reduce the non-native species like the Douglas fir. However, the time span need to be very long as clearcutting is not an option. Traditional forestry practices should be maintained, and the cutting of non-native trees should be presented as special events to the public.

5 STRATEGIC MANAGEMENT OBJECTIVES AND GUIDELINES

5.1 A nature friendly forestry for the area

All the forestry activities should be harmonized with the natural, aesthetic, historical and cultural values of the forest. These means that the traditional forestry practices should be encouraged. Regarding these forestry activities, a key objective is to prioritize areas where timber production can take place. In this view the timber production is not seen as a commercial activity but as an educational/cultural one. Because of this, the recommendation would be to remove mainly non-native species (Douglas fir) without eliminating it entirely. The cuttings activities could be used also as educational/cultural events.

Strategic objective	A nature friendly forestry for the area
State (SWOT)	*Advantages* The knowledge about traditional forestry practices is maintained; Availability of wood; Large areas with non-native species that can be used for timber without much impact on the local ecosystem
	Weaknesses Low interest about the usage of the traditional practices; Difficulty to integrate timber production with cultural/educational events
	Possibilities The Forestry authorities are helpful; Traditional timber production techniques used; opportunity to present forestry activities as educational/cultural events
	Threats It is considered a threat that responsibilities about the traditional forestry practices are divided
Guideline	**A special forestry strategy should be developed for the area. The strategy will encourage and list the traditional forestry practices. The strategy will address the removal of non-native species by selective cutting over a large period of time.**
Detailed directions:	- Identification of traditional forestry practices - Consider the areas where these practices will be used - Work with the responsible authorities - Designate the number of trees and the frequency for the removal (non-native tree species) - Plan the reforestation of the area were non-native species were removed - List the forestry techniques that must be used - Plan the educational events
Responsible entity:	Cluj Town Hall
Needed	The Forestry authorities, Scientific Community, NGO, Event organizers

participation:	
Coordination with another ES:	Supporting ES, this activity will increase the biodiversity of the forest; Cultural ES
Positive outcomes:	Traditional forestry techniques will improve the biodiversity of the area
Negative outcomes:	No
Legal basis	Low no. 230/2018, updated Forestry Code

5.2 Develop a strategy for collecting mushrooms and forest fruits

Collecting mushrooms and forest fruits is a traditional practice in the area. However, there is no control over this activity and the collected amount. At the current moment the main species that are harvested are mushrooms. However, these are difficult to identify and also dangerous to consume. If there are spots were people can harvest other forest fruit species the general area will attract more people.

Strategic objective	Develop a strategy for collecting mushrooms and forest fruits
State (SWOT)	*Advantages* Richness of mushroom species; Suitable areas, large public involved
	Weaknesses No control over this activity
	Possibilities The number of people involved
	Threats Impossibility to control the activity as access in the area cannot be restricted; some forest fruit species are missing and might be difficult to be introduced
Guideline	**A special mushroom and forest fruit strategy should be developed. The strategy should address issues related to the public involved in the activity, like palatability of the species, the importance of maintaining these species and species richness. Some more species can be plated in order to create special areas where people will find these species**
Detailed directions:	- Identification of all the species of mushrooms and forest fruit - Determine the collectable amount - Inform people about the species and the collectable amount - Raise awareness about the issues involved - Identify the species needed and plant them - Inform people about the introduced species and the collectable amount
Responsible entity:	Cluj Town Hall
Needed participation:	The Forestry authorities, NGO, Scientific community
Coordination with another ES:	Supporting ES by increasing the biodiversity; Cultural and Educational ES by involving the public
Positive outcomes:	Maintaining the mushroom and forest fruit species, Increase the public knowledge about this activity
Negative outcomes:	No
Legal basis	Ministry of Environment Order No. 410/11.04.2008

5.3 Maintain the climate and erosion control

The forest as a whole act in order to regulate the local climate. The erosional processes are present but not developed so much as to constitute a threat for the ES. Just by maintaining the forest, the climate control function is achieved. The evolution of erosional processes, will lead towards the necessity of control measures.

Strategic objective	Maintain the climate and erosion control
State (SWOT)	*Advantages* The climate and erosion control function are already there. There is only the need to maintain them
	Weaknesses Gully erosion is difficult to control
	Possibilities The gully is controlled by local vegetation at this moment
	Threats Losing the climate and erosion control functions by deforestation
Guideline	**The climate function is maintained by simply maintaining the forest. Gully erosion will progress naturally so there is the need to maintaining the shrub species around the gully and create anti-erosion structures. The gully also exposes natural formations (trovanti) that are of geologic and educational importance**
Detailed directions:	- Maintain the forest - Create anti-erosional structures where gully erosion is present - Use these structures during educational and scientific events (as examples)
Responsible entity:	Cluj Town Hall
Needed participation:	Consultant (University), Local soil protection institution (OSPA)
Coordination with another ES:	Cultural ES
Positive outcomes:	Maintaining the climate control and reduce gully erosion
Negative outcomes:	No
Legal basis	No

5.4 Integrated strategy for biodiversity conservation

As the biodiversity in the area is quite high, there is a need for a strategy of conservation. As a result of different activities that are to be carried out there is the possibility that the biodiversity will be impacted, and some species might be lost. The strategy should identify all the species in the area, establish the conservation status for priority species and design conservation measures. There are around 38 bird species while those of vascular plants exceed 100 species. The number of amphibian and reptile species is 6 and 4 species respectively. The number of mammal species is around 24 species, including 6 species of bats.

Potholes are artificial structures that form as bikes and carriages use the dirt roads. These potholes are key elements in the conservation of amphibian species. Being an artificial construct, these potholes are

evolving outside of the natural regime so the identifications of disturbance patterns in these constructed habitats is important in order to maintain the amphibian species.

The strategic area includes “wild” spots where the human intervention has been limited in the last 20 years. The vegetation has evolved according to natural laws, not forestry ones and as a result the human access is limited, and people tend to avoid these areas. They are important biodiversity hotspots and can act as retreat areas. In fact, the deer and wild boar populations use these areas as refuge, to name only some large mammal species. Birds and other groups also use these areas so maintaining them is of key importance. Besides these “wild” areas there are some other important keystone habitat structures, like wetlands, large old trees, hollowing or dead trees (standing or fallen). These habitats are important for amphibians and insects.

The functional groups are actually insect species that play a key role in the ecosystem, worldwide the groups have been reduced with serious impacts at the ecosystem level. They play a key role in the ecosystem by helping the development of plants are recycling organic matter.

Natural ecosystem processes are the base of the food chain and the entire functionality of the ecosystems is depending on them.

Strategic objective	Develop an integrated strategy for biodiversity and ecosystem services
State (SWOT)	*Advantages* The high biodiversity. The high number of species is surprising for the area, especially if one is considering the closeness to a big city. However the biodiversity of the area is a fact and besides the obvious natural part some species are also there because of a human-nature interaction (amphibians being the most obvious example)
	Weaknesses Small area, species are usually found on a much larger area; Potholes are easily eliminated because people tent to fill them up when they become too large; Moving towards more industrial forestry practices; The “wild” areas are small and are easily altered
	Possibilities Key element illustrating the relationship between man and nature; Good scientific expertise in the project area
	Threats In the lack of a biodiversity conserving strategy, the tendency is to loose biodiversity and ecosystem services
Guideline	**The biodiversity strategy should be developed in partnership with relevant scientific organizations. All the species in the area need to be identified. For the priority species, there is the need to design conservation measures. Potholes need to be maintained by identifying the disturbance patterns that create them and by avoiding high maintenance of the roads. The insect species of the area need to be first comprehensively studied and conservation measures should be developed. Identify and actively promote whenever possible natural ecosystem processes such as tree regeneration and litter formation. This means also the identification and protection of those areas where the litter is well developed. These are key areas for soil formation and will have high educational and scientific importance.**
Detailed directions:	- Identification of all the species in the project area/ Create a relationship table between species and ES - Map key elements

	- Prioritize species and groups - Design conservation measures to address key elements: potholes, functional groups, "wild" areas, natural ecosystem processes by conserving species and human activities related to them - Publish the strategy
Responsible entity:	Cluj Town Hall
Needed participation:	Scientific community, NGO, Forestry authority
Coordination with another ES:	This strategy is important for all other ES and can only have a positive impact
Positive outcomes:	Marinating and increasing biodiversity and ecosystem services
Negative outcomes:	No
Legal basis	OUG 5/2007

5.5 Create a network of walking paths

Mountain biking is widely practiced in the area. However, there are no marked paths and bikes move freely within the forest sometimes disturbing the other tourists. By creating special bike trails the activity will be controlled and the impact on the natural system will be limited. The walking paths are not necessarily independent from the bike trails but should be marked differently and the two activities need to be separated.

There are lot of cultural events in Cluj-Napoca so there should be no reason why the Făget UPF could not be linked to one of these events. The town hall is a key factor in order to promote the area and can organize competitions like a nature photo contest, geocaching events and so on.

Strategic objective	Create a network of bike and walking paths
State (SWOT)	*Advantages* Bike trails are already there, also walking paths; A lot of cultural events are organized each year by the Cluj-Napoca municipality
	Weaknesses Biking is practiced without any rule; Trails are not marked; Transport capacity, Weather
	Possibilities Large number of agreement bikers. The area could be included in the biking strategy of the municipality; Large number of people interested in specific events
	Threats Bikers will not follow the regulations as they are habituated to use the entire area. Possible interactions between bikers and walkers; The people attracted to cultural events would not be interested in participating to nature events
Guideline	**The bike trails should be ranked according to the user level. The trails will be colour coded and several facilities for the bikers will be added. A special map for bikers and walkers should be developed. There is the need to mark at least 3 km of walking trails and intersections with existing bike paths.**
Detailed directions:	- Identify the possible bike and walking trails - Rank the trails based on difficulty

	- Mark the trail - Develop a map and information panels for bikers, walkers - Merge cultural events with nature events in the area
Responsible entity:	Cluj Town Hall
Needed participation:	The Forestry authorities, University, Association of bikers, Event organizers
Coordination with another ES:	The trails could impact biodiversity, there is the need to avoid high natural value areas
Positive outcomes:	Biking is a positive tourism activity that also has educational values; The popularity of the area will increase
Negative outcomes:	Possible impact on biodiversity
Legal basis	

5.6 Establish an educational/scientific infrastructure

As UPF's tend to have an important role regarding the education of communities, it is important that this educational role is focused and organised. The administrator of the area should not be directly involved in the educational process but should be able to offer the educational facilities. Other institutions will follow, and it is highly probable that by having the infrastructure in place, educational institutions will be attracted in the area.

Activities that tend to be more educational should be separated from scientific ones, basically dividing the target groups. TThe educational target group is the larger public, while the scientific target group is composed out of students and scientists.

Scientific events are important in order to promote Cluj UPF as a model for other municipalities. Scientific events can be organized in partnership with universities from Cluj-Napoca and the field trip part could be organised in Făget UPF.

Strategic objective	Create an educational/scientific infrastructure
State (SWOT)	*Advantages* A lot of educational institutions in Cluj; Large number of people interested about nature and conservation.
	Weaknesses The infrastructure should be of minimal impact;
	Possibilities A lot of young nature lovers, students and teachers; A scientific community orientated towards nature;
	Threats The infrastructure could be vandalized; Local scientists will be interested only for a limited time span
Guideline	**Focal educational points should be identified. These are areas focused on the forest ecosystem. The first one should address the biodiversity of the area and should be located near a high natural value hotspot. The second one should focus more on socio-cultural activities related to forests; the third one should address the local particularities and traditional forestry techniques. Each year the Cluj-Napoca municipality should develop partnerships with scientific institutions in order to host a scientific event. Create a network of scientific focal points (monitoring network). Each scientific focal point should be marked, and a small list of species and ecosystem services should be provided. Besides the**

	biodiversity there is also an important geological features, respectively the formations called "trovanti". These are found in project area and need to be considered from a scientific and educational point of view.
Detailed directions:	- Identify the locations for educational and scientific focal points - Chose the best infrastructure for these locations; include both passive (panels) and active/ interactive techniques (mobile applications and so on) - Promote these locations by using panels in the entry points to the area - Identify scientific events that are programmed in Cluj-Napoca - Create a partnership with the scientific event organisers - Establish the details about the event - Promote the removal of waste from the area
Responsible entity:	Cluj Town Hall
Needed participation:	The Forestry authorities, Architecture office, NGO, Scientific community
Coordination with another ES:	Supporting ES; The activity will have a positive impact on biodiversity conservation.
Positive outcomes:	Increase the degree of education in people; The knowledge of the area will be improved. There is the possibility that some papers will be published; Increasing the scientific knowledge about the Făget UPF
Negative outcomes:	No
Legal basis	No

6 GOVERNANCE

We consider that, as the actual owner of the forest area is the municipality, the governance should be in the hands of the Local Council of Cluj-Napoca. This does not mean that the Local Council will be the only stakeholder involved; there is the need to establish a strong partnership with the Forestry authority but also with the scientific community and local NGOs. These organisations could also help the City Council in order to obtain the necessary funding for the area.

Financing such an area is difficult and we consider that the financial analysis should be included in a separate study and defined in detail.

The current proposed measures are not money consuming and as a result we are sure that the funding is available.