



Operational part of the Integrated Multi-use Management Plan (IMMP) – Lomb Forest Cluj-Napoca

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Background

OP IMMP (operational part of integrated multi-use management plan) is a basis for management of urban forest. OP IMMP includes elements of tactical and operational plan. The framework for it is a strategic part of integrated multi-use management plan. The perimeter OP IMMP is an individually rounded area within a wider area of urban forests. OP IMMP can be the basis for the direct implementation of the planned measures, but more detailed implementation plans (projects, sketches) for carrying out the activities and objects defined in OP IMMP can be made on the basis of OP IMMP.

OP IMMP is the basis for cooperation with all stakeholders with interests in the area of urban forests. The content of the OP IMMP should therefore be presented in a comprehensible, concise and clear form.

1. INTRODUCTION

1.1 The aim and purpose of OP IMMP

The aim of OP IMMP Lomb is to ensure the implementation of the strategy for the urban forest and to develop a common vision for the sustainable use of urban and peri-urban forests – UPF. As the Cluj-Napoca City hall is the owner of the entire area, the strategic and the focus area are the same.

As a document the OP IMMP is designed as a basic document for Cluj-Napoca Municipality, seen as the main stakeholder in the area. Besides this and in order to ensure the long term sustainability of the UPF concept, the plan needs to address several other relevant stakeholders including the forestry authority, NGO's and educational institutions along with the local community (especially the neighborhoods in the near vicinity of the forest but also the wider community from the town) that will be directly or indirectly influenced by the development of the Lomb project.

At the same time, according to the national regulations regarding forest management, the forest owner is obligated to have an agreement with a forestry authority regarding the management of the forest. Thereby the Cluj-Napoca Municipality has ceded the administration of the Lomb forest to the Cluj Forest District – Canton Baciu. Therefore, to implement the Făget UPF strategy, the OP IMMP needs to be integrated into the official forestry documentations regarding the area. Furthermore, a key challenge is to relax the traditionally strong sectoral authority on the management of the forest in a way that the functionality and ecological identity of the forest is maintained but the social values of the forest are broadened. In this document, we propose a diversity of values which should be integrated into the management of the forest, in a way to fulfil a broad range of social functions while maintaining the natural potential of the forest (see below). The conventional forestry was stopped in the target forest since 2019 (see below). After this integration the operational plan will be considered as the basis for the management of the area, enforced by the Cluj-Napoca municipality along with the Forest District and the relevant stakeholders.

As the only owner in the project area, there are no additional formal stakeholders from the ownership point of view.

Informally, the range of stakeholders is broad, and includes bikers, nature lovers, people who collect mushrooms, or visit the forest for other purposes.

The operational plan is closely linked to the strategic part, basically including the measures needed in order to reach the strategic goals of the UPF:

- Highlight the traditional activities related to mushrooms and forest fruits

- Control erosion and maintenance of the local climate regulating service – recognizing the regulating services of the forest,
- Develop an integrated strategy for the protection of species and habitats as they are form the natural basis of ecosystem service supply for the area
- Develop a network that will facilitate the forest access and experience while respecting the right of the locals for not being disturbed by the suddenly increased social dynamics
- Develop a scientific infrastructure which helps learning about nature in the Lomb forest, including the implementation of citizen science projects, research projects and educational projects (elementary schools, highschoools, universities)
- Develop a valorisation network for trees and shrubs with high natural and cultural values, including large old trees and culturally modified trees

1.2 The design of the plan, obligations and validity of OP IMMP

Currently the strategic area is managed according to the forestry guidelines (“amenajament silvic”), by the Cluj Forest District. This document forms the basis of the forest management activities and it is mandatory both for owners and for the administrators of the forest. In the case of the strategic area the forestry plan was updated in 2018 and it is valid for a period of 10 years.

The strategic area is included in the spatial planning guidelines of the Cluj-Napoca Municipality (Plan Urbanistic General – PUG) as FDL (Forest Designated Land), designated for recreational, educational and sport activities. Any kind of permanent construction, of any nature and for any purpose is prohibited.

As the forest management plan was updated in 2019 and the forest is designated as a recreational and educational area the forestry activities are already limited.

Considering that the forestry planning guidelines are valid for a period of 10 years, we consider that the OP IMMP should also be valid for the same timeframe.

As the only owner in the strategic area the OP IMMP is binding only for the city administration but should be viewed only as a framework that can be updated regularly if necessary. It does not create any legal obligations for the city administration but may be considered by the forestry authorities in order to bridge potential communication and vision gaps between the forestry authorities the administration and various societal demands (e.g. recreation, learning, experiential see above). There is the necessity of a close collaboration between the forestry administration and Cluj-Napoca Townhall.

OP IMMP is also the basis for the participation of the city administration in the preparation of forest management plans. OP IMMPs directly and indirectly affect the work of the forestry service. And thus should be updated in the same time as the forestry regulations.

OP IMMP is the basis for the implementation of the activities of the city administration in the UPF area. It includes guidelines for the implementation of activities, measures and facilities. As the OP IMMP cannot contain all the details for the implementation; therefore, projects that are mentioned in the OP IMMP are in line with the content of OP IMMP or can be prepared during the period of validity of OP IMMP (later, after the end of URBforDAN project).

The strategic area is spatially defined as being comprised of forestry parcels 51,52, 53,54 and 55.

2. THE IMPORTANCE OF URBAN FORESTS (UPF) AND BASIC MANAGEMENT CONCEPTS

2.1 Purpose of UPF

Urban and peri-urban forests (UPF) are essential in ensuring the sustainability of urban environments. The ecosystem services provided by UPF have important contribution to citizens' quality of life, so urban dwellers can enjoy a more diverse, safe and healthy city. Maintaining and even increasing the ES provided by UPF through proper management are essential in safeguarding resistance and resilience both in the present and for the future, especially in the context of global climatic change. The project area (Lomb) is a peri-urban forest with special protection functions (Functional group I and II; **Table 1**),. The present forest composition, structure and usage are the results of historic human-nature interaction through forestry practices and, more recently, the utilisation for recreation, due to the close vicinity of the urbanized areas and facile access. The forest provides ES from all four categories (provisioning, regulating, supporting and cultural), as they are summarized in **Table 2**.

Table 1. Lomb peri-urban forest functions

Parcels	Functional group	Details
51A,53E,54A	1.5H	Forest stands included in the National Catalog of Seminological Reservations, as source area for seeds
51B,51C,52,53A,53B,53C,53D,54B,55	2.1B	This includes trees intended to produce high quality thick wood

The main ecosystem services addressed are presented in the following table:

Table 2. Analysed ecosystem services

Ecosystem services			
Provisioning	Regulating	Supporting	Cultural
Non-timber products (berries, mushrooms, medicinal and edible wild plants)	Climate regulation Air quality Soil formation Protection against erosion Water purification Pollination, pest control	Nature protection/habitat for species	Recreation and tourism Educational and research values Historic-cultural legacies of traditional forest management

Below we will briefly enumerate these ecosystem services (ES). Before we do this, we highlight that the concept of ES aims to highlight the multiple ways in which human societies depend on

ecosystems. The concept was not intended to replace other existing nature related values (such as the intrinsic and relational values), nor to contribute to the commodification of nature (the concept of ES is a tool, and as any tool is as good as its user is, it depends on normative goals and interpretations, intentionality) nor to discredit several other conceptual frameworks which addresses the people and nature systems (such as the social-ecological systems framework, the human-nature connections framework). Nevertheless the newly proposed and increasingly popular concept of Nature's Contributions to People aims to broaden the range of interpretations of the ways how nature can be relevant for people, also allowing local, culturally relevant interpretations of what nature is and making the human-nature relationship conceptually more equitable (i.e. nature not serves people but contribute to people). These being mentioned, we enumerate the ecosystem services identified in the Lomb forest. All these can be also interpreted in the same way as Nature's Contribution to People.

Provisioning ES. The main commercial product of the forest is wood. The level of intervention, quantities and methods used are regulated by an official document ("Amenajament silvic") that sets goals for a period of 10 years. In the project area the last wood harvesting activities took place in 2020 (according to official documents), and are to be stopped from this year. Other forest products, non-wood, are not harvested commercially, but on a small scale, by locals, for personal consumption. These products include berries, mushrooms, edible and medicinal wild plants. According to our knowledge, these activities are limited in the area. A monitoring system for Lomb forest would also include the monitoring of socio-culturally and economically relevant products as well as the societal demand for these products. If these aspects are not well understood, the harvesting can turn into chaotic and detrimental in the future, since there will be no genuine knowledge for regulating these activities.

Regulating ES. Climate regulation ES is achieved by carbon sequestration, a natural output of tree growth, water retention and flow regulation. Carbon sequestration is increased in natural forests, with high diversity of tree and shrub species (more than 20 in the project area), stratified (of different ages) and with diverse density of trees (150-800 trees ha⁻¹). Larger and mature trees tend to sequester and store more carbon than young and small trees. Flow regulation is achieved by intercepting and storing rainfall on tree leaves, which later evaporates, or reaches the ground more slowly. Trees improve rainfall infiltration and retention into soil by channelling the water around the stem and downwards by root channels into soil. The combined effect of intercepting rainfall, greater infiltration of water into soil and the speed reduction of surface water is translated into protection against erosion as well as floods after major rains. The regulating ES value of the peri urban forests such as the Lomb forest will be crucial in the context of extremifying climatic variations. In fact, a large degree of stability for the newly built neighborhoods will come from the genuine natural capital (green infrastructure). Because of this, we strongly recommend considering natural capital explicitly in the establishment of new neighborhoods (as currently the development trends are dramatically eroding genuine natural capital).

Air quality. UPF can improve air quality by air pollution removal. Tree canopy captures particulate pollutants and absorbs them through their leaves, branches and stems. Trees also absorb ozone and nitrogen oxides, deciduous species being more effective than coniferous ones. The close vicinity with a major urban centre such as Cluj-Napoca, that has a population, including the peri-urban areas, exceeding 420,000 residents, highlights the important role of Lomb forest in improving the air quality for its residents although the forested areas are several times smaller than Făget Forest.

Soil formation. Dead trees at various stages of decomposition indicate the soil formation process, as rotten wood and dead leaves are a very important first stage in this process. The litter is often thick,

this also acts as a buffer against extreme droughts, maintaining humidity which is crucial for the wildlife inhabiting the litter layer. The maintenance of litter is essential for the soil formation and functioning, which in turn is essential for the resilience of the whole forest ecosystem and strongly influences its regulatory contributions to the society (i.e. local flood control).

Protection against erosion. The forest acts as a factor controlling erosion: the roots stabilize the soil, the trees foliage regulate the amount and the speed of rain water reaching the soil. The erosional processes already happening have a positive outcome by exposing interesting geomorphological processes. The gullies already formed are well developed but also controlled by the forest and not evolving at a fast rate currently. Sustainable forest management practices, including measures to maintain forest cover on erosion-prone soils and run-off pathways, will help control or reduce the risk of soil erosion and shallow landslides.

Water purification. Forested areas act as a filter on rainwater, removing pollutants before the water reaches rivers and streams. The presence of forests in the watershed has a direct effect on the cost of water treatment for public consumption. The project area, due to its position, impacts the quality of groundwater used by households situated downstream.

Pollination, pest control. The presence of insectivorous bats, amphibians and birds contributes to pest control in the forest ecosystems – this being also recognized by the conventional forestry literature. Furthermore, the high diversity of insect pollinated plants contributes to the maintenance of pollinators. Pollination and pest control are still understudied and not well understood aspects of nature's contributions to people. An intuitive estimation of the potential number of pollinating insects for that area (i.e. forest as well as the surrounding grassland) suggest over 70 species of insect pollinators. However, a detailed research is needed to understand the pollinator communities in this area.

Health benefits. Recent evidence shows that exposure to nature – especially woodlands – have several health benefits for people, including decrease of stress, decrease the incidence of depression and strengthening the immune system. There is a direct link between people's wellbeing and nature. The need to have access to green areas is recognised as a key component of a healthy life. From this perspective we highlight the importance of considering the equity aspects of access to genuine green spaces in Cluj-Napoca as well as Lomb forest. Research shows that human society not only needs the presence of genuine nature in the town as well as the close surroundings of the town, but equally important is the *easy access* and *pleasant access* to these spaces. It was shown that if the access is easy and pleasant, people will visit the green spaces. This in turn will affect their social well being as well as physical and physical well being, and this is especially true for the elderly people. From this perspective *access to genuine green spaces* needs to be explicitly targeted by strategies *in complementation with the maintenance and management of high natural and cultural value green spaces*.

Supporting ES. Nature protection (biodiversity and habitats). The Lomb forest project area has exceptional natural value derived from the complex ecosystem structure, with high spatial heterogeneity (horizontal and vertical) which allows a diversity of conditions regarding light and humidity, translated in a high plant species richness of more than 100 vascular species. The diversity of niches supports a high diversity of animal species, so far being identified 20 mammal species (including bats), 35-40 bird species and at least 4 amphibian and reptile species. The diversity of invertebrate species is also high, supported also by the presence of old and dead trees, both standing and fallen. The diversity of the animal species depends on the quality of the forest edge and the connectivity with the open habitats surrounding the forest, which represents feeding grounds for

birds, herbivorous mammals and for bats, and also provide breeding habitat for amphibians (pond and wells used by livestock). 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.

Cultural ES. The cultural ES are represented by the legacies of the past forestry management (e.g. unpaved roads, old coppice trees), the scenic beauty as well as by the use of the forest for recreation, educational and learning activities.

Participation in defining the importance/ purpose of forests. The project area is owned by the Cluj-Napoca Municipality and, according to the Romanian Forestry Law, it is administered by a Forest District (in this case the Cluj Forest District), part of the National Forest Administration ROMSILVA, a state owned autonomous company under the authority of the Ministry for Water and Forests. The purpose of the Lomb forest has been determined by its owner and the administrator, through an official document that is renewed every 10 years. The forest is defined as a special conservation forest, wood harvesting being forbidden. In the present proposal we highlight that the overall values of the forest goes beyond the economic and recreational values, including cultural values and a high potential for habitat reconstruction along regulating and supporting ecosystem services. Therefore in order to maximize the multifunctional value of this forest, a cross sectoral governance structure is needed (see Chapter 5).

Target groups / users

The Lomb UPF owner is Cluj-Napoca Municipality, which, as a local public administrator, has the main responsibility in satisfying the general interests of the citizens of Cluj-Napoca. In this document we propose that this can be more efficiently achieved if a more inclusive, participatory type of governance structure is developed (see below). The main beneficiaries are the people of Cluj-Napoca, not at all restricted to the immediate neighbourhood, who will benefit by the ES provided by the forest. Although the forest is important for all the inhabitants of Cluj-Napoca, compared to Făget forest here we propose a different approach based on the direct local community of the Baciu neighbourhood. Involving the inhabitants of the area in the management of the forest (local based management measures) which has the aim to create a forest stewardship movement. The largest group of users is composed of recreational walkers (accompanied by pet dogs or not) and mainly local cyclists. Furthermore, the health benefits, educational, learning and philosophical / spiritual types of benefits of this forest for the people should also be recognized. Birdwatching is an activity that slowly gains popularity among urban dwellers, and the project area is very suitable for observing woodpeckers, small passerine birds and also raptors that nest here (ravens and buzzards).

The implementation of the OP IMMP will create the opportunity for other important target groups to use the forest, as follows:

Educational institutions (kindergartens, schools, universities) will use the project area along with the scientific community that will be involved in research and educational activities, with students, using the forest as a natural laboratory for understanding complex processes.

In order to maintain the multiple types of benefits, there is a need for rethinking the ways how the society is involved in the use of this forest (i.e. the problem of social fit) addressed below in Chapter 5. Also, maintaining key ecosystem features of the forest (which also assures their scenic beauty, besides the ecosystem functions) should be recognized. The scientific community will be involved in the design of rehabilitation measures for habitats and reconstruction works.

Currently the visitors of the forest are mainly mushroom pickers and recreational walkers. These users are almost all local residents. Mountain biking is rarely practiced in the area. There are no marked paths, even though there is a great potential for biking. The tourists access the area by personal car, by bike or on foot for those nearby. As more and more people are moving out of the city to the surrounding villages (ex. Popesti), the demand for natural recreational areas in the vicinity is constantly growing.

Nevertheless, one **key stakeholder and beneficiary of the project is the community living in the close vicinity of the Lomb forest**. The local community is entitled to (re)discover the forest, to learn about it and enjoy its many contributions by building several links with the designed forest. In this respect careful management is needed of the way the interactions between the *global population* (of Cluj-Napoca) and the *local population* (people in the very close vicinity of the forest) cascades at local level. These interactions in principle should strengthen the local identity and local sense of place and to not contribute to conflicts between the local population and the global population which uses the forest.

2.2 Fundamental concepts and management objectives

The project area is completely covered by forest. Our goal is to maintain the current land use and to implement forest management practices targeted towards maintaining biodiversity and forest structure and functions. Along with forest maintenance we consider that the functionality of the area will be highly improved if the forested area is complemented by including in the management plan the surrounding pasture area (to the north) and the ecological corridors (riparian vegetation) developed to the south of the forest.

Basic guidelines for the management of forest stands and surrounding area (in short and general terms)

The current function of the forest is for conservation purposes, and it is planned to be managed accordingly, meaning that the conventional forestry activities are limited to maintenance work, some dead wood removal other similar works. This operational plan seeks to harmonize the current forest management with maintaining and improving the ES and human nature connections of the UPF. This requires not only the maintenance of key ecosystem structures (such as large old, dead trees, well developed litter, diversity of native woody vegetation and natural stratification of the forest) but also an active diversification of the ways how the society can experience the forest (see the Faget forest project implementation, available in the scientific publication by Seviãnu et al. (2021 - online form: <https://www.frontiersin.org/articles/10.3389/fenvs.2021.618217/full>). The project area is quite homogenous in terms of age and tree composition and together with the nearby pasture forms an integrated ES area. We propose the integration of forestry management measures with pasture management that will create favourable ecological conditions, but most importantly a functioning ES area in the north of the city of Cluj-Napoca.

Lomb Forest is designated to function as a steppingstone between the two protected areas that are to be found to the east and west but also as an ecological corridor connecting Cluj-Napoca green spaces to the northern forest of Chinteni.

Increasing canopy cover by promoting large, dense canopy, tall (at least 30m) trees will improve regulating the stormwater flow. Tree species with deep roots are better in absorbing rainfall than those with shallow roots.

Wood production is not anymore the main purpose of the project area, as the forest is considered to have a protection role and it is destined for conservation. The wood cuttings are planned to reduce the density of trees and to remove dead wood. The more nature friendly approach will seek to maintain dead wood in the forest and to promote forestry practices that mimic natural processes.

Nature friendly forestry practices help maintain and increase biodiversity. Dead or hollow trees provide nesting sites for birds, arboreal rodents such as dormice, bats and also for a whole array of invertebrates. Temporal ponds will be maintained along active and deserted dirt roads within the forest, as habitats for amphibians. Some of these temporal ponds need to be created and maintained as rehabilitation measures.

3. STATE OF FORESTS AND FOREST USE

3.1 State of forests and forest management

Forest area

The project area is a 95.6-ha area of the forest “Lomb”. The Lomb forest is located in the NV part of the Cluj-Napoca city (Figure 1). Its Hungarian meaning is ‘Leaf’ (translated in Romanian: Frunzar). The forest in the project area is owned by the municipality of Cluj-Napoca, which is an important factor in the general implementation of the strategy. A small part of the forest belongs to other owners. At present the attractivity of the Lomb forest is local, serving the neighbourhood in its close vicinity. This situation also creates opportunities for developing a special forest stewardship, where the local community informally owning and using the Lomb forest is empowered for its socially, environmentally and ecologically sustainable use and care. The causes that led to this special situation of the Lomb forest are multiple:

- its remoteness and overall low accessibility;
- low level of popularization;
- the industrial appearance in the vicinity, with anesthetic farms or car depots;
- the unwelcome reception of the forest due to multiple surrounding illegally deposited wastes;
- presence of some sheepfolds accompanied by sheepdogs.

During the last centuries, the area has always been forested, as it can be seen on old maps of the region. The above causes of the social and cultural isolation of the Lomb forest can be considered (and we suggest to be considered) as opportunities for strengthening the social and ecological linkages / ties between the people inhabiting the nearby vicinity of the forest and the forest.

Although the area is not part of any designated protected area it is an important link between the Natura 2000 sites designated around Cluj-Napoca.

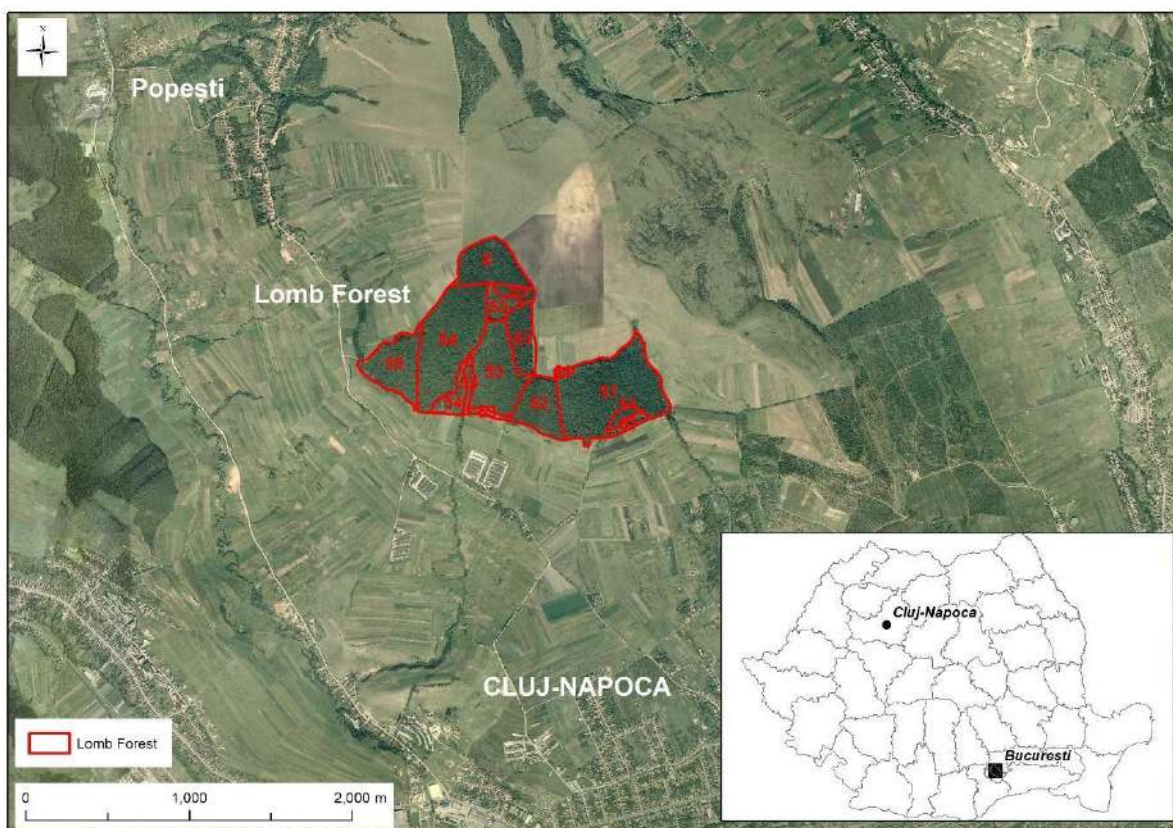


Figure 1. Location of the project area and forest parcels

The Ownership of forests

The forest in the project area is owned by the Cluj-Napoca city City Hall (Figure 2), which is an important factor in the general implementation of the Operational Plan.

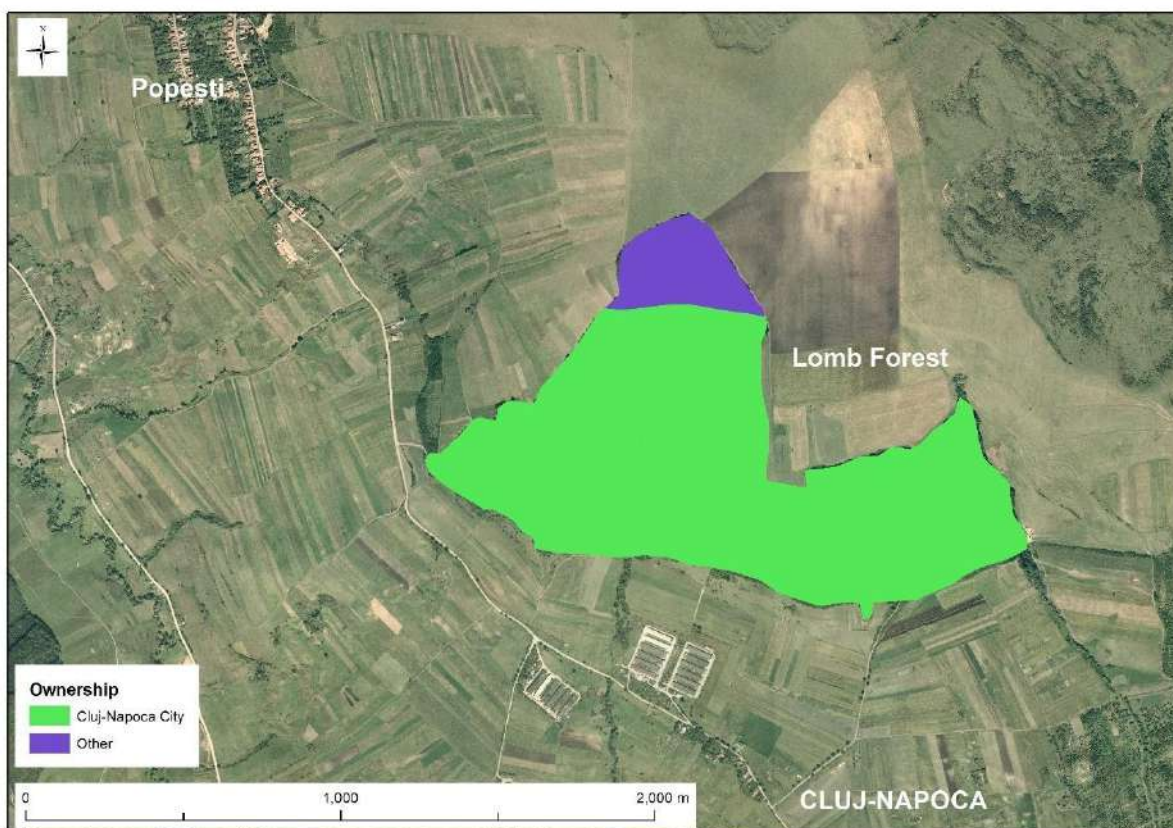


Figure 2. Land ownership in the project area

Forests, site conditions, forest types, stand types

The project area (Lomb) is a peri-urban forest with special protection functions (Functional group I and II; **Table 1**). The present forest composition, structure and usage are the results of historic human-nature interaction through forestry practices and, more recently, the utilisation for recreation, due to the close vicinity of the urbanized areas and facile access.

The tree density overall ranges between cca 150-800 trees/ha while the overall diversity of the trees (i.e. in terms of species richness) is high (with about 20 tree species).

The forest has a well pronounced vertical stratification including a lot of areas with natural tree regeneration. In a large area of the forest, a well-developed forest litter is noticeable, including dead trees at various stages of decomposition which indicates the soil formation process.

The main forestry works proposed are related to conservation measures, like removal of some younger trees in order to promote healthy growth (stands 52, 53C and 54D), conservation specific works (stands 51A and 53E) and other works related to soil rehabilitation.

The main native species to be found in the forest study area are Sessile oak (*Quercus petraea*) (68,9%), English oak (*Quercus robur*) (19.2 %) and Hornbeam (*Carpinus betulus*) (6,3 %). Some native species like Norway maple (*Acer platanoides*) and Silver lime (*Tilia tomentosa*) and non-native ones, like plane (*Platanus sp.*) and black pine (*Pinus nigra*), could be found in localized patches and occurs in homogenous stands, being plantations. The red oak (*Quercus rubra*) is another non-native species that could be found in this forest, but in isolation. Natural regeneration in the forest occurs mainly in case of Hornbeam, being shade tolerant.

Table 3. Tree species in the forest study area

No.	Tree species		Observations
	Scientific name	English common name	
1	<i>Acer campestre</i>	Field maple	Rare
2	<i>Acer platanoides</i>	Norway maple	Rare
3	<i>Acer pseudoplatanus</i>	Sycamore maple	Rare
4	<i>Carpinus betulus</i>	Common hornbeam	
5	<i>Fraxinus excelsior</i>	Common ash	
6	<i>Pinus nigra</i>	Black pine	Rare
7	<i>Platanus sp.</i>	Plane	Rare
8	<i>Populus tremula</i>	Eurasian aspen	
9	<i>Prunus avium</i>	Wild cherry	
10	<i>Quercus petraea</i>	Sessile oak	
11	<i>Quercus robur</i>	English oak	
12	<i>Quercus rubra</i>	Red oak	Rare
13	<i>Robinia pseudoacacia</i>	Black locust	Rare
14	<i>Salix caprea</i>	Goat willow	Rare
15	<i>Tilia cordata</i>	Small-leaved lime	
16	<i>Tilia tomentosa</i>	Silver lime	



Figure 3. The general physiognomy of the forest in the spring season

The total standing volume of trees in the study area is about 14786 m³ (i.e. an average of 154.6 m³/hectare), almost 100 % belonging to native tree species. The sessile oak clearly dominates the ranking in terms of volume per tree species (89 %). The mean productivity is 1.95 m³/ha. The most productive species in the area are Common hornbeam (3.11 m³/ha) followed by Sessile oak (2.28

m³/ha). Usually the average tree height is about 20-23 m, reaching in the case of older specimens at 30 m.

Based on forest stands description, a small part of about 6.5 % of the forest is young (20-35 years), otherwise the tree age exceeds 60-70 years, reaching in some stands 115 years. However, older isolated tree specimens belonging to English Oak, Sessile oak and Wild cherry could be noted in the study area. Except for small areas with young forests of 15-20 years, the average age of the forest is about 40-60 years. However, old tree specimens belonging to European beech, Hornbeam, Sycamore maple and Small-leaved lime were noted in the study area. We highlight the cultural, natural and economical values of the old coppices (beech, hornbeam, lime, sycamore).

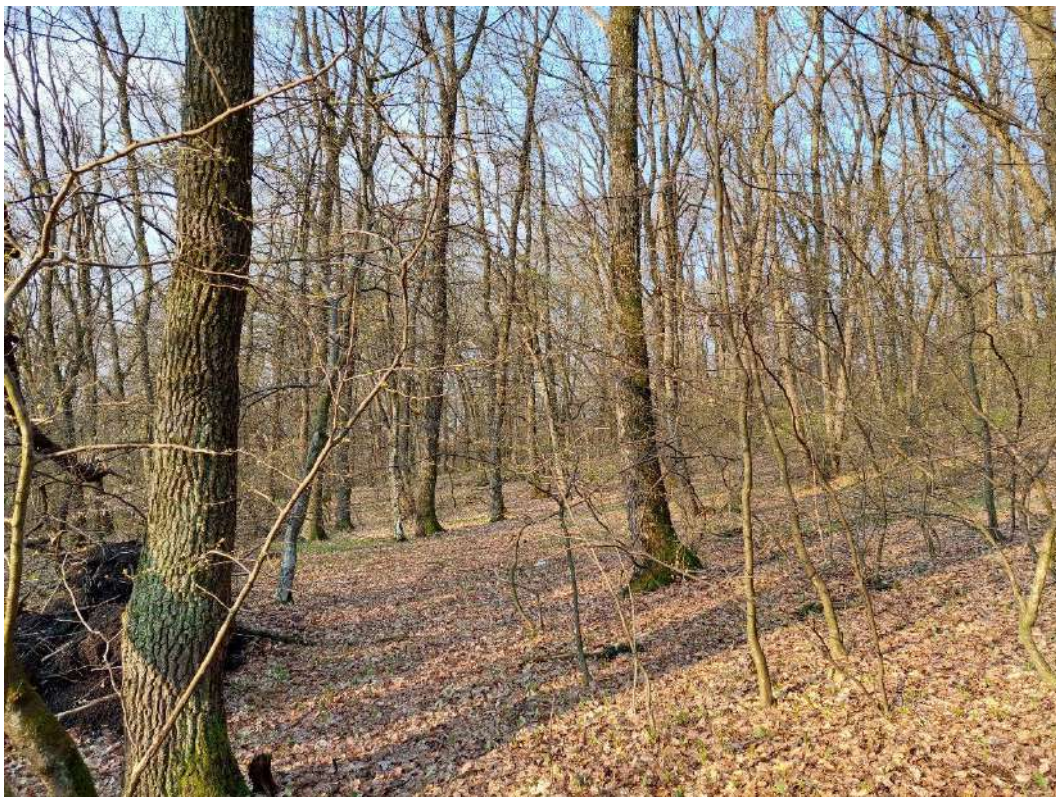


Figure 4. Sessile oak stand from Lomb forest

The average growing stock in the study forest is about 1.42 m³/hectare/year. The maximum growth rate, in some stands, reaches 3.5 m³/hectare/year in case of sessile oak (Figure 4), with values as low as 0.5 m³/hectare/year for Common hornbeam (Figure 5).



Figure 5. Sessile oak and Common hornbeam

Management

In the past, the forest was mainly managed for timber production (for firewood for household or industrial reasons). A small part of the forest (about 4 %) was cut about 25 years ago and around 2 % around 35 years ago, but now is naturally regenerating.

In the last 15 year, only salvage cuts have been carried out, adding only a few accidental cuttings. Thinning is proposed for some stands but the procedure is limited.

Considering the specific parameters of the Lomb Forest, a high number of species with economic potential are to be found. The most important species are: *Crataegus monogyna*, *Prunus spinosa* and *Rosa canina*. Some other species that can be harvested but in limited amounts are *Prunus avium*, *Malus sylvestris*, *Corylus avellana* and so on.

Recently, this spring (i.e. 2021), there were significant tree cuttings on plot 52 (see Table 2 for details regarding the proposed activities). Non-timber products such as forest fruits and especially mushrooms are currently the main resources harvested from the forest. However, there is no control over this activity and the collected amount.

Wood production

Being defined as conservation forest, stands are not to be used for wood production anymore. There are only some rare cuttings designed to maintain the forest health.

Mechanical devices like chainsaws are mainly used for wood harvesting and processing.

In the future perspective and according to the proposed forest strategy, 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 forestry for the area. Together with the stakeholders (especially forestry sector and local community).

Forest accessibility

For the wood harvesting and processing, skidders mechanized vehicles are mainly used.

Impacts, problems

There were some impacts in the forest, mainly associated with other sources than those related to forest management. Being so close to Cluj-Napoca the forest has been impacted by human activities like: illegal garbage disposal, sheep grazing, access with 4x4 motor vehicles and so on.

In the last decade, in the cold season, there have been reports of some tree falls or multiple broken branches (mainly for softwood trees) as a result of the abundant wet snow falls or of frozen rain, the latter having a low frequency. Also, tree falls have accompanied the summer storms (Figure 6). These natural tree falls represent an opportunity for biomass formation, the increase of saproxylic biodiversity creating patches for natural regeneration and providing overall a 'wilded' patch to the forest, where the regulating and supporting ecosystem services are delivered in particular.



Figure 6. Tree felled by the storm

Sheep grazing has been practiced for many years in the eastern and northern neighbourhoods of the forest, the edge of the forest acting as a refuge for animals on hot summer days. In the last period, flocks of sheep were observed crossing the forest, a context that leads to the degradation of litter, soil and thus local biodiversity (Figure 7).



Figure 7. Flocks of sheep crossing the forest

We also highlight that similarly to other peri-urban forests around Cluj-Napoca, in the Lomb forest there are several places with garbage depositions (Figure 8). These depositions not only represent an unpleasant aesthetic structure in the forest, but they pollute and can be dangerous (causing injuries for tourists).



Figure 8. Waste dumped at the edge and in the limit of Lomb forest

Beside the wood production ES has been limited for the past decade, there are traces of recent cutting activities (illegal).

Gradually, because of its vicinity to the city, the area became more and more populated and several new permanent and holiday homes emerged in the southern and western border of the forest, including some access road arrangements (Figure 9).



Figure 9. New access road opened at the southern edge of the forest

3.2 Visits to forests and infrastructure

Visits to forest

The targeted forest is visited every year by some hundreds of people. The visits are made especially during the weekends, or holidays and especially in the hot season, or favourable weather conditions. Cyclists and recreational walkers along with forest fruit gatherers are the main visitors of the forest. These users are local residents who like mainly to practice sports in a nature area. Mountain biking is practiced in the area. However, there are no marked paths and bikes move freely within the forest, sometimes disturbing the other tourists.

Already available infrastructure

In the study area, the already available infrastructure for tourists includes some unmarked bike trails and walking paths, especially along old forest roads.

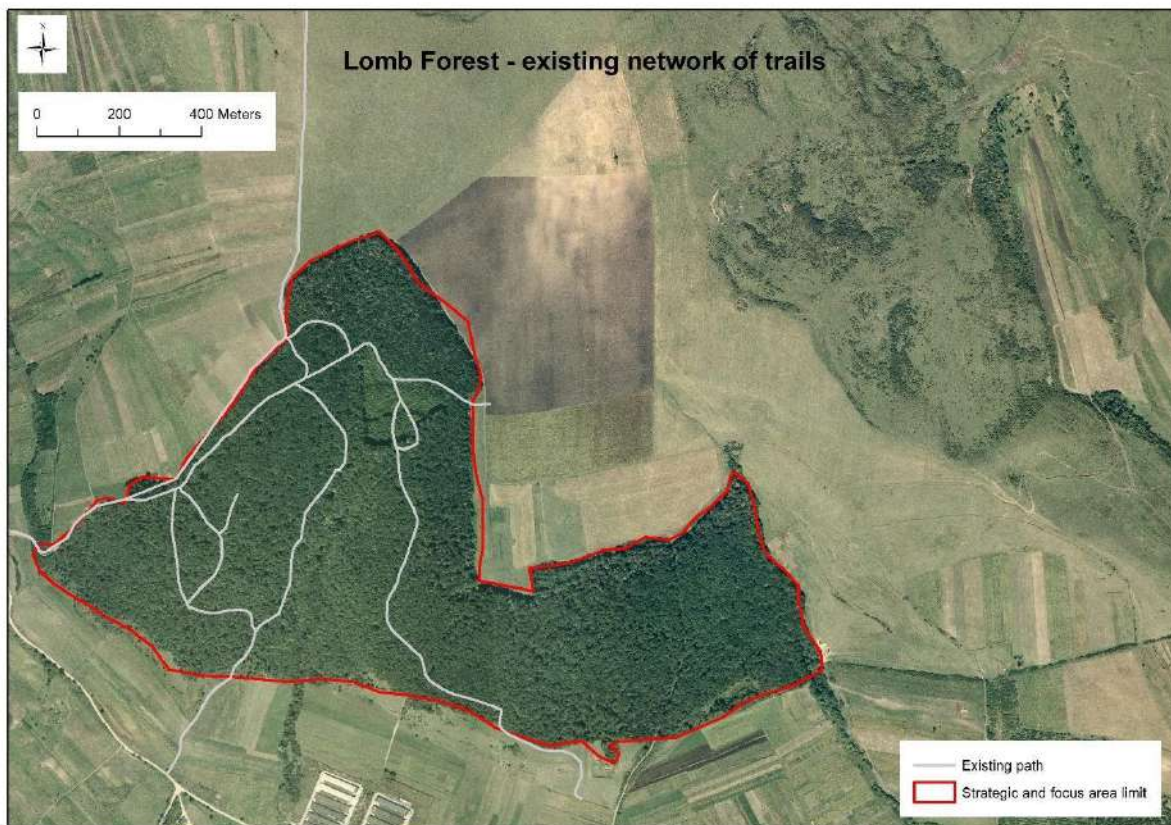


Figure 10. Existing walking and bike tracks in the strategic and focus area

3.3 Important objects in UPF

Nature conservation

The project area includes some biodiversity hotspots and important landmarks. As compared to the Fåget Forest the area has not been so much impacted by human interventions. There are no exotic tree stands and besides shepherders and mushroom gatherers the human presence is limited. Also the remoteness of the forest and its venerable age as a forested area contributed to a more natural character of the area. As a result the entire forest can be considered as being important for nature conservation.

In terms of vertical stratification there are many patches where the brushwood and shrubbery are well developed. The diversity of niches translates into a high diversity of species. For example, the number of bird species within the target forest parcel is around 35-40 species, while those of vascular plants are 100 species, and there are at least 4 species of amphibian and reptile. The number of mammal species is around 20 species, including bats. The diversity of animal species depends on the quality of the forest edge and the connectivity with the open habitats surrounding the forest, which represents feeding grounds for birds, herbivorous mammals and for bats, and also provide breeding habitat for amphibians (pond and wells used for livestock). It is also important to mention that the forest site targeted for this project has several old trees (mainly English oak, but also Wild cherry, Ash and Small-leaved lime), which are biodiversity surrogates (one old tree can represent habitat for hundreds of invertebrate and vertebrate species)



Figure 11. Roe buck in the Lomb Forest

Unfortunately, some other important keystone habitat structures, like wetlands, are missing. The large old trees, hollowing, or dead trees (standing or fallen) are well developed. The forest site targeted for this project has several old trees that are biodiversity surrogates (one old tree can represent habitat for hundreds of invertebrate and vertebrate species). These habitats are important for insects.

Large old trees are to be found in the close vicinity of the forest edge. This is not an uncommon situation for the sessile oak forests around Cluj, as traditional practices included leaving some trees for shadow and seed sources.

Cultural heritage

The forest targeted by the UPF project was used for timber production for centuries, and its cover was constant during this period. By itself this provides an important cultural and historical value. When we also include the large old trees the value increases even more. In this project we will highlight and propose the protection of ecosystem structures which were created by human actions and have high biodiversity and historical values as well.



Figure 12. Coppiced old tree (Common hornbeam and sessile oak)

3.4 Assessment of use, changes and influencing factors

Damages, risks

In this document, we propose that the damages caused by natural disturbances (e.g. weather conditions, wildlife) be capitalized, at least in some key areas (where their ecosystem and educational functions are maximized), for their value for nature as well as for their educational role. For example, the natural damages to trees triggers the hollowing process in the wood, which in turn created optimal habitats for dead wood dependent organisms. Studies showed that several dead wood dependent organisms became rare (and are actually protected) in the European Union because the natural disturbances and their important role for wildlife was cancelled and discredited.

Rethinking natural disturbances as well as addressing the potentially negative human impact requires the involvement of multiple institutions.

Rising air temperature and changes in precipitation patterns are undeniable facts, which may have different impacts on various aspects of nature. The significant rapid increase in air temperature observed particularly in recent decades throughout the world is the most obvious evidence of climate change. Accordingly, with the global pattern, in Cluj-Napoca city also a statistically significant increasing trend of the annual mean air temperature can be noticed. The temperature trend line has a steeper slope compared to the other stations from the central part of Romania, so there are clear evidence that the temperature is influenced by the effect of „urban heat island”. Also, an increasing trend of temperature is expected in the future climate scenarios. Climate change, especially global warming could modify the tree species composition, forcing some species to move to higher altitudes and alter the forest productivity and health. So, forest security should be seen as an explicit part of a coherent long-term climate-change adaptation strategy that will build a more resilient forest in the future.

The proposed arrangement of the forest surely will bring benefits for the local community. On the other hand, the projected increase in the number of visitors will bring additional anthropogenic pressure on the local environment. The potential threat to forest resulting from this scenario would be:

- More visitors, more noise. The higher noise levels could disturb the local animals, but also other visitors;
- More visitors will lead to more waste, because, in Romania, there is a low level of waste management culture, many people usually leave mess behind them. More waste means more sources of pollution and could make the forest less attractive.
- Raising the forest-fire risk resulting from the future favourable context (intensifying human activities in conjunction with global warming);
- The impact on the surrounding area will increase due to the increased number of visitors and new activities (bird watching, walking paths, connecting areas)
- Better access in conjunction with the tourist arrangement of the forest will lead to more visitors, coming into direct impact on local species. Direct impacts can take many forms, like:
 - intensifying of some „traditional” activities: harvesting of some species with economic value (e.g. birch sap, mushrooms, forest fruit etc.) or of spring flowers;
 - some people kill animals that are considered to be dangerous or scary (e.g. some insects, snakes, frogs), or destroy/collect some things that arouse curiosity (e.g. bird nest, frog eggs, big beetle).

From a social side the increasing human impact – including number of visitors and the noise, pollution associated with them – can change the natural environment, decreasing the habitat quality for several organisms. For example species sensitive to noise, soil compaction and the decrease of litter amount are the first affected by these activities. These can be overcome by the formation of an institutional structure which is permanently engaged with the forest as well as with the local community. Again, as opposed to Făget forest we consider that by involving the neighbourhood community, the management of the forest will be improved a lot. The Lomb Forest should be mainly designed to the needs of the residents. This paradigm shift creates the opportunity for the development of a ring of green areas around Cluj, servicing the entire city but mainly the residents in the proximity.

The human impact generated by this approach is lower compared to the previous strategy of creating visitor hotspots. Some of the other advantages are related to the fact that local people tend to be more involved in the management of the area if they feel a connection with the forest.

From the environmental side, climate change, especially global warming could modify the tree species composition. Tree species sensitive to drought and high temperatures are expected to decrease in abundance, while warm dependent trees can establish. This scenario highlights the need for a pro-active management vision, which also includes interventions to maximize the forest ecosystem resilience towards climate changes.

Issues of forest use

The significant issues of forest use could come from increasing anthropogenic pressure on the local ecosystems by increasing the number of visitors. In the long-term, climate-change could significantly affect the viability of some species.

4. GUIDELINES FOR FOREST MANAGEMENT

4.1 Subordinated guidelines

The subordinated guidelines include:

- The forest management plan (parcels 51 to 55)

The forest management plan defines the area as a conservation and production forest with small areas designated for seed production, with limited forestry interventions.

- Urban planning guidelines of Cluj-Napoca

The area is defined as forested area and this status cannot be changed

- Strategic part of the Integrated Multi-use Management Plan (IMMP) – Lomb Forest Cluj-Napoca

4.2 General guidelines for UPF

As defined by Law no. 46/2008 (known as the Forestry Law, Codul Silvic in romanian) and further amendments, Lomb forest is divided into two parts : forest stands part of Group I - Forests with special protection functions, subgroup 1.5H Forests of scientific interest, protection of genofond and forest eco-fund (stands 51A,53E,54A) and forest stands part of Group II Forests intended to produce mainly thick and high quality trees for timber, subgroup 2.1B (stands 51B,51C,52,53A,53B,53C,53D,54B,55).

The extraction of trees is limited only to special interventions and forests can be planted. In order to improve the management of the forest the above group were classified as types (Table 4).

Table 4. Forest types in UPF Lomb

Forest type	Forest subgroup	Area (ha)
T.II	1.5 H	52.2 ha
T.VI	2.1 B	43.4 ha

Type of functional category T.II includes forests with special functions of protection, located in areas with difficult ecological conditions, as well as stands in which it is not possible or allowed to harvest wood, imposing only special conservation works;

Type of functional category T.VI, includes forests with production functions and protection, to which the full range of treatments provided can be applied according to the ecological, socio-economic and technical-organizational conditions.

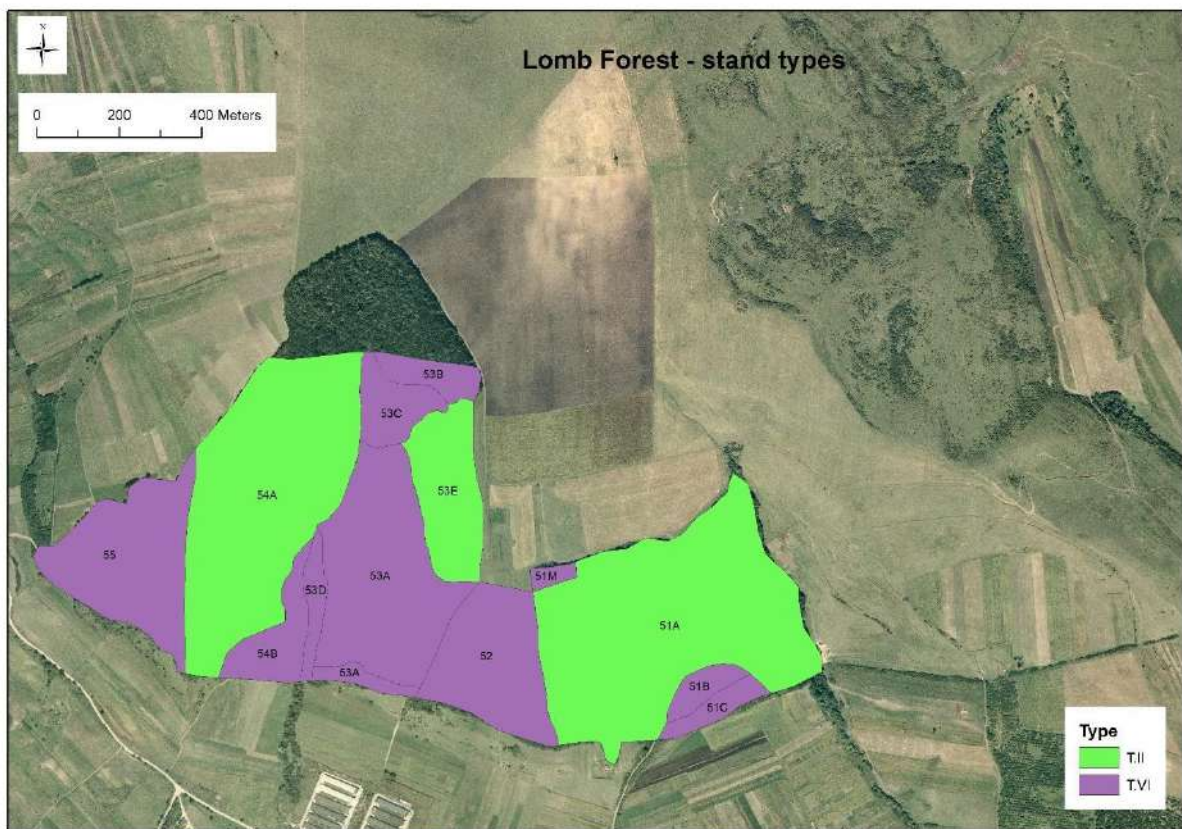


Figure 13. Forest types in Lomb Forest

4.3 Guidelines for specific forest areas (allocations)

Forest cover around 30% of the world's surface and are of key importance for biodiversity conservation, also providing critical ecosystem services (Gustafsson *et al.*, 2012). As a result there are multiple expectations that humans place on forests, with multiple associated conflicts between different stakeholder groups (Freer-Smith and Carnus, 2008). As a result, in many parts of the world this has led to the allocation of forests either for conservation purposes or for intensive production. Currently only about 11% of the total forest area is designated for conservation and only about 4% are plantations (Gustafsson *et al.*, 2012).

It is quite likely that the area covered by forest reserves and plantations is going to increase (Bauhus *et al.* 2010), but for now most of the global forest estate will continue to play a multifunctional role, in which attempts are made to balance human commodity needs with the production of other goods and services (Thompson *et al.*, 2011), along with providing habitat for forest species.

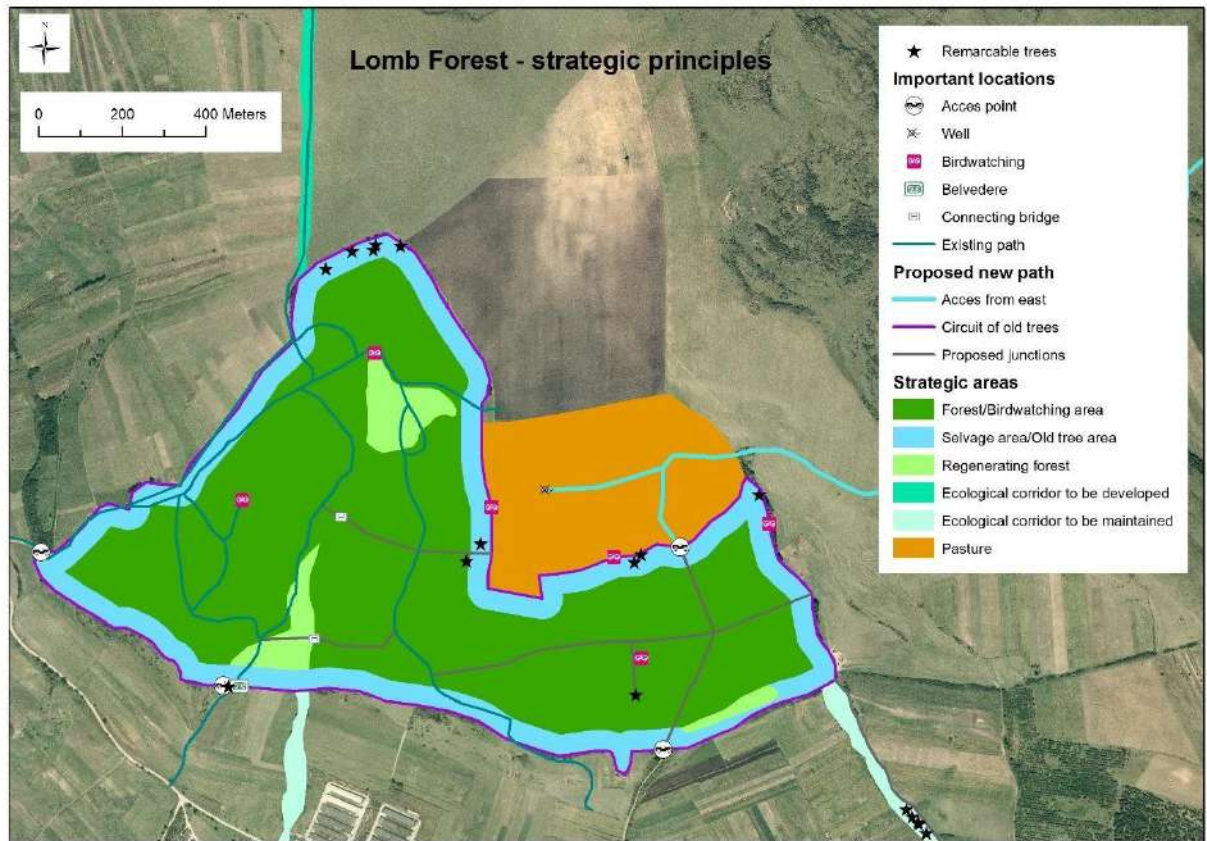


Figure 14. General concept of allocations in the Lomb UPF

The management of the forests has developed more towards a production, agricultural perspective, altering the natural disturbances that play a key role in the forest ecosystem. The man-made disturbances tend to lead towards a simplification of the forest ecosystem, aiming at higher production rates (Gustafsson *et al.*, 2012). The resulting lack of complexity across forest landscapes is a possible problem because it also reduces the ecosystem processes and complexity, thus limiting the provided services (Thompson *et al.*, 2011).

In the view of these multifunctional forests, allocations need to cover as many ecosystem services as possible, trying to maximize the benefits of the forest both for humans and nature.

Considering this we must take into consideration that limiting ES spatially is not a good option. The view for the Lomb UPF is that different ES are constantly overlapping and evolving over time. Having said that it also must be stated that the priority ES identified are supporting ES and cultural ES.

As an area with a more limited number of visitors Lomb Forest is mainly functioning as a natural forest and not as a forest-park like Făget. The character of the surrounding area is also different with sheepfolds and other agricultural activities. There are no marked trails in the forest and the connections with other forested areas are poor. However the functional complex, composed of forested area, pasture and scrubs is very important for the general functioning of the ecosystem.

In this isolated forest, there are several important elements that play a key role for the biodiversity and cultural value of the area around Cluj.

Thus, the allocations towards priority ES have shifted in the favour of Cultural ES and Supporting ES, including here also the recreational value.

4.3.1 Multifunctional forests

Being an isolated forest patch, Lomb Forest is not just a multifunctional forest but also part of a multifunctional system, comprising pastures, agricultural and urban areas in its vicinity. Just from a forestry point of view there are two main functions of forest; if we add here the different ES provided and the fact that Lomb forest is an important stepping stone between the forest situated to the north of Cluj-Napoca the multifunctional character is even more visible.

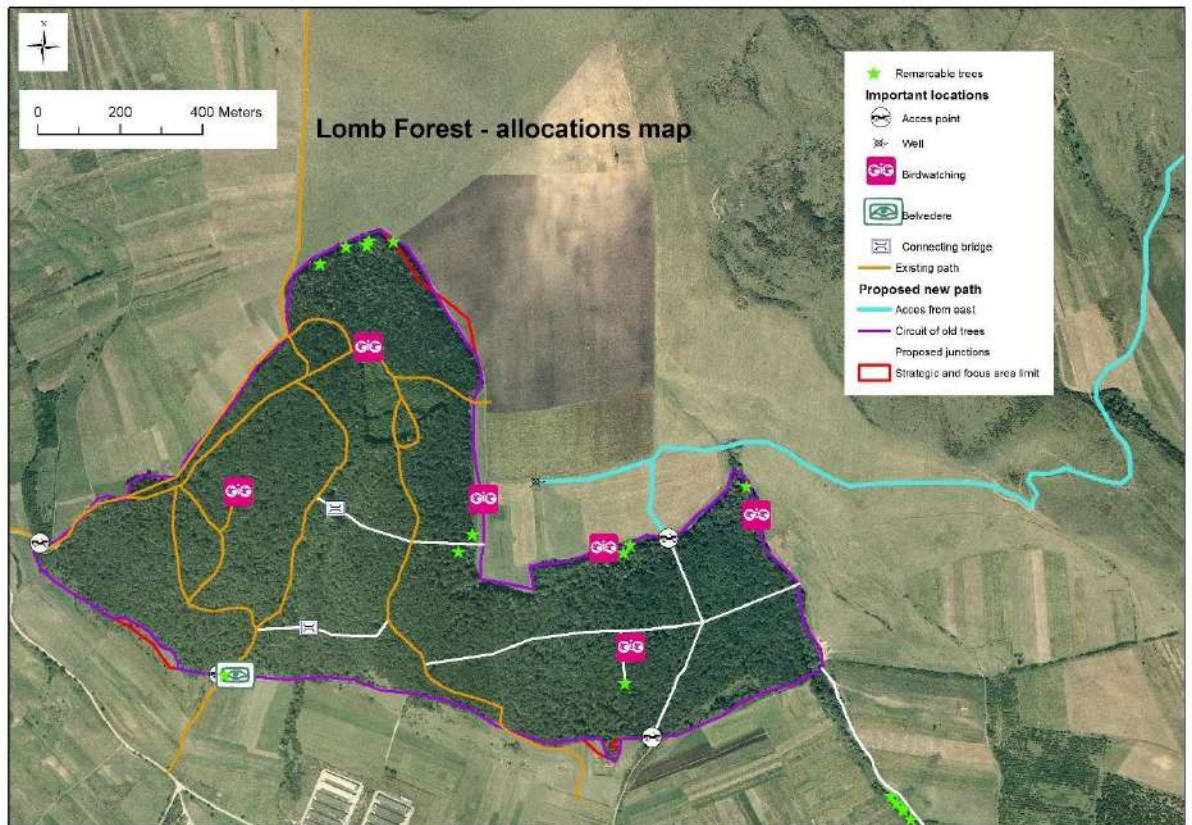


Figure 15. Allocations map

As said the forest and surrounding area are integrated and as such offer a wide range of ES. Important features of this system are:

- forest stands with different functionality
- forest edge area where large old trees are mainly located
- regenerating forest area
- pastures to the north of the forest
- ecological corridors to the south

The point is that the strategic area is just an area where management activities will try to establish a guiding line for development but the entire area surrounding Lomb Forest is important as a multifunctional system.

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.



Figure 16. Forestry stands

As the forest is still included in the Functional group II, although commercial wood harvesting is restricted, wood harvesting can be allowed in the long term. Currently the only allowed interventions are limited to hygiene cuttings. In this aspect they propose that cuttings are organised as educational events where people are involved in order to better understand the forest activities.

In order not to totally eliminate the cuttings we present the following:

Table 5. Proposed forestry activities

No.	Parcel code	Main species	Forestry interventions
1	51A	<i>Quercus petraea</i>	Conservation cut only to help natural regeneration
2	51B	<i>Quercus petraea</i>	Hygiene cut
3	51C	<i>Tilia cordata</i>	Planting
4	51M	-	-
5	52	<i>Quercus petraea</i>	Thinning
6	53A	<i>Quercus petraea</i>	Hygiene cut
7	53B	<i>Quercus petraea</i>	Hygiene cut
8	53C	<i>Quercus petraea</i>	Thinning (regenerating forest)
9	53D	<i>Quercus petraea</i>	Hygiene cut

10	53E	<i>Quercus petraea</i>	Conservation cut only to help natural regeneration
11	54A	<i>Quercus petraea</i>	Hygiene cut
12	54B	<i>Carpinus betulus</i>	Thinning (regenerating forest)
13	55	<i>Quercus petraea</i>	Hygiene cut

Highlight the traditional activities related to mushrooms and forest fruits

Priorities:

- Improve the practice of mushrooms and forest fruits harvesting. This practice is linked to Cultural ES.
- Control the amount, the time and the harvested species in order to maintain a high diversity of the species.
- Inform visitors about the mushroom species existing in the forest and their palatability.

There is a need to raise awareness around these cultural practices in order to develop a sustainable strategy. The importance of this can be highlighted by guiding and informing people who conduct this activity. There are important legal aspects related to that. The collection of forest fruits and mushrooms is regulated by law, but very few people take this into account when harvesting for personal use.

4.3.2 Priority allocations for regulating ES

Local climate mitigation, Erosion prevention, Regulating of floods, Local air quality

Control the erosion and maintain the climate regulating service

Given that the current state of the forest is exceptional, we propose the maintaining of this state, which would be the ideal way to preserve the forest capacity to mitigate climate change and contribute to regional climate regulation. There are two main gullies in the forest and both are quite well developed, but also they are kept in control by the forest vegetation. The management practices should aim to maintain as much water as possible in the forest, given the fact that water scarcity is a main social and environmental issue in Europe and in Romania as well.

The gullies are well developed, and the rate of erosion is reduced. The depth of these gullies sometimes reaches 10m or even more. To better connect the different parts of the forest we propose the build up of suspended bridges over the lower parts of these gullies.

As reduced as it is Lomb Forest can have an important contribution for the local climate. In order to mitigate the climate, forests need to cover extensive areas. Even if Lomb is not a massive body of forest the fact that it is part of a network of forest patches greatly improves the capacity to regulate climate, prevent erosion and contribute to the improvement of local air quality.

Because of the increasing traffic jams, a direct result of the increasing number of cars, local air quality in Cluj-Napoca is poor. The surrounding forests around Cluj are very important for the mitigation of air quality and maintaining a system of protection forests is mandatory.

We consider that mitigation of air quality is, at the moment, the highest priority and one of the most relevant regulating ES.

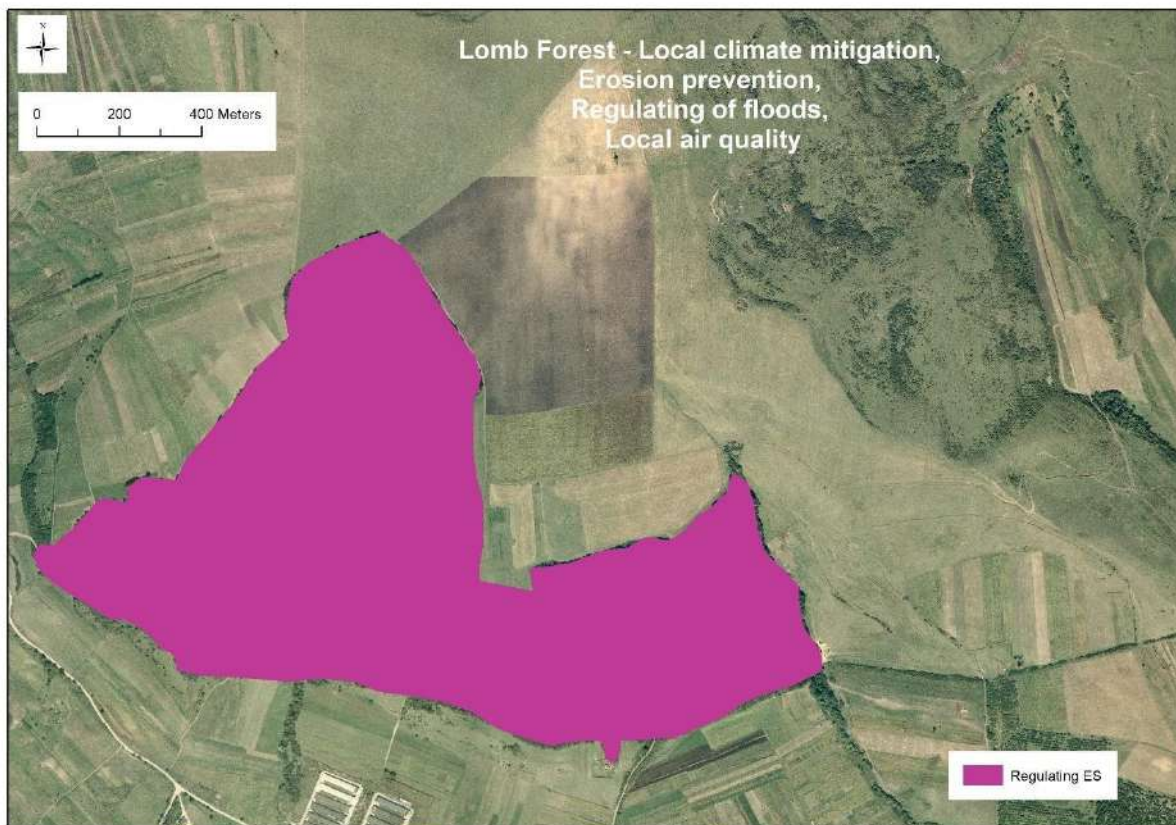


Figure 17. Allocations for regulating ES – Local climate mitigation, Erosion prevention, Regulating of floods, Local air quality

The entire forest is providing regulating ES and as such it is not possible to differentiate between the climate mitigation, erosion prevention, regulating of floods and local air quality.

As several studies have shown air quality is important for human health and wellbeing, this ES needs to be maintained and improved.

4.3.3 Priority allocations for cultural ES

Recreation and tourism

Develop a network that will facilitate the forest access and experience

The network should include:

- Bike trails and support for nature friendly biking
- Walking and running paths
- Birdwatching facilities
- Walking bridges over the major gullies

At the moment forest access and experience is limited by several factors, including the reduced network of walking paths, sheepfolds and dogs and limited facilities.

The allocations for this ES cover the entire Lomb area. The whole forest need to be improved from this point of view.



Figure 18. Allocations for Cultural ES – Recreation and tourism

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.

The cultural and ecological values of the forest can be studied and better assessed through specific scientific studies.

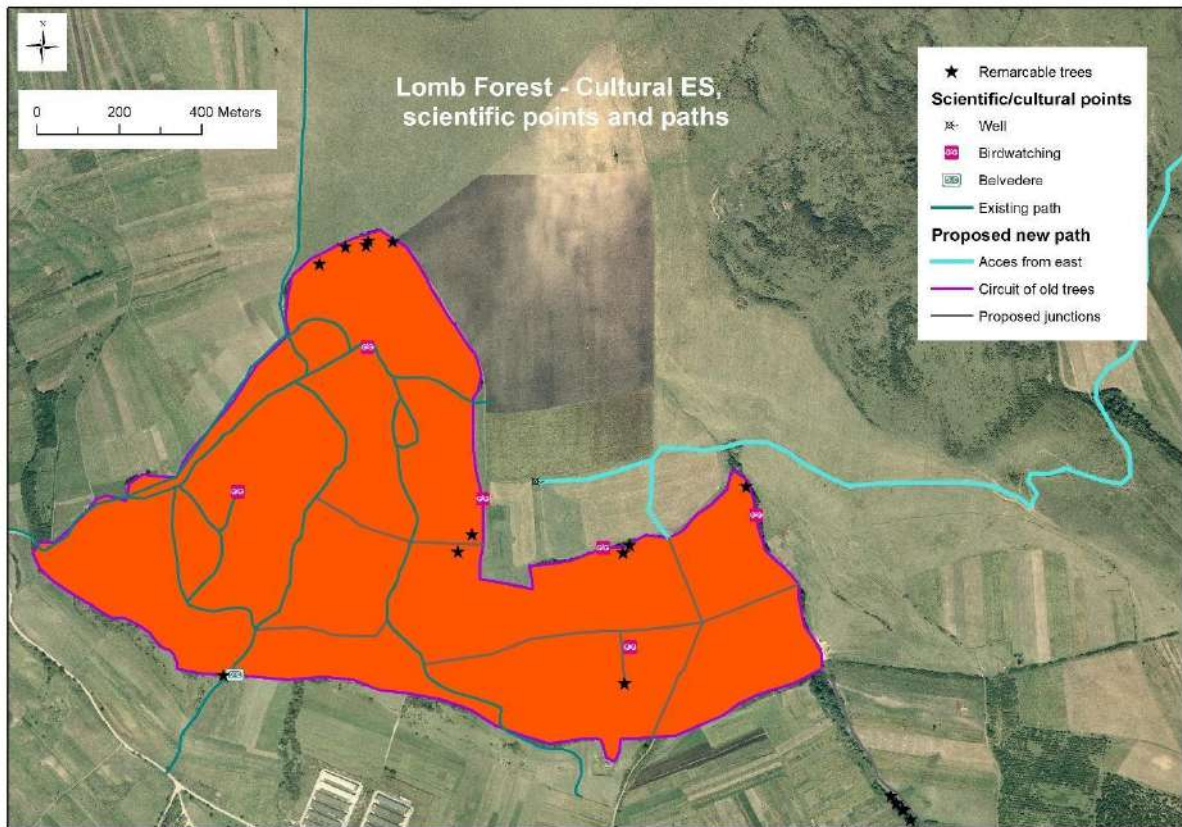


Figure 19. Allocations for Cultural ES – Scientific infrastructure

Develop a valorisation networks for coppice and large old tree

- Consider the development of a large old tree and coppice circuit.

As the density of large old trees is higher compared to the main recreational area around Cluj, which is Făget, we consider that the development of a network of paths and a circuit of large old trees is very important for the Lomb Forest.

The area covered by ES is around 26 ha.

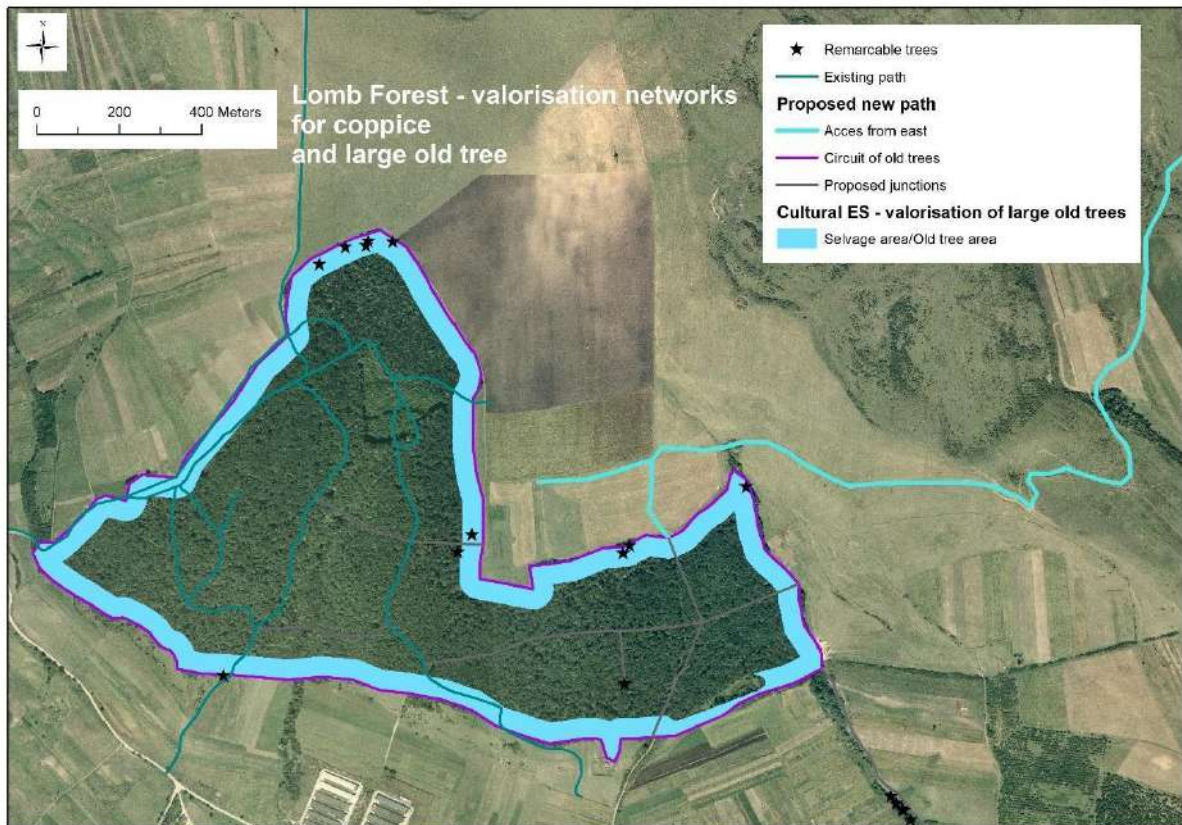


Figure 20. Allocations for Cultural ES – Valorisation networks for coppice and large old tree

4.3.4 Priority allocations for supporting ES

Nature protection

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 found in the forest. This strategy will address several issues of high importance:

- Develop a network of small ponds. Build them up, if necessary, in order to sustain the amphibian populations and provide habitat for the species present in the vicinity, but not inside the forest.
- Maintain the areas with high natural values. Conserving these high biodiversity areas will assure that the species will have a refuge and these areas can act as sources for population growth as well. These areas also include keystone habitat structures, like wetlands, large old trees, hollow or dead trees (standing or felled). 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, the natural ecosystem processes such as tree regeneration and litter formation. This refers also to 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. Include artificial structures to enhance the habitat offer for species dependent on tree hollows (birds, bats, arboreal rodents).
- When considering the area of interest, keep in mind that the functioning of the ecosystem is maintained also by the nearby area, which includes the surrounding pasture, scrub and connections with other natural areas in the close proximity.
- Develop/maintain ecological corridors in the area.

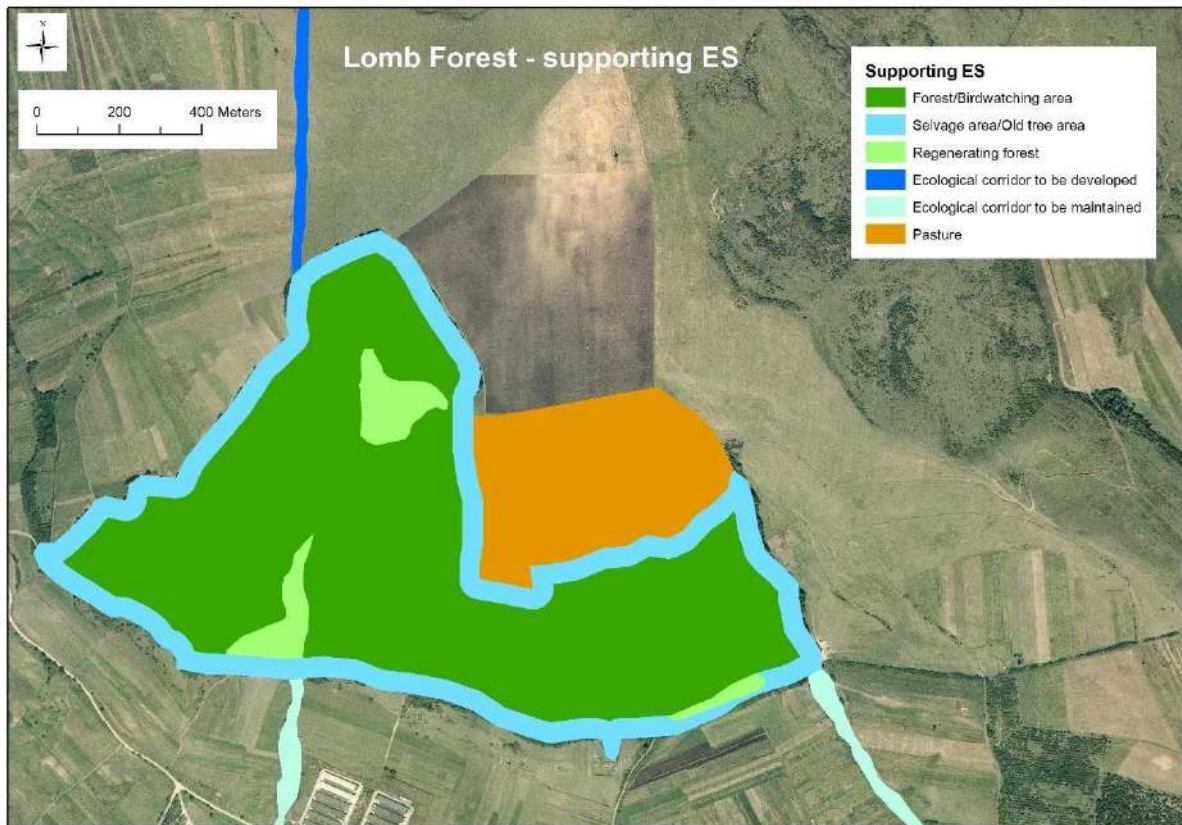


Figure 20. Allocations for Supporting ES – Different conservation and rehabilitation areas

4.4 Forest zoning and identification of projects areas and their location

As stated in the previous sections the strategic area of the project covers approximately 100 hectares of natural forest to the north of Cluj-Napoca. The forest is designated as a conservation forest and wood cutting is limited to mandatory interventions. No commercial wood cutting is allowed.

In accordance to this function, the operational plan is focused mainly on cultural and supporting ES.

Considering that cultural ecosystem services and supporting ecosystem services are spatially homogeneous, it is hard to define specific areas that do not overlap. As such the operational plan will include both clearly delimited spatial allocations for each ES in the form of polygons but also point key locations in the area defined as being allocated to another ES.

The zoning of the strategic area is delineating the priority activities and areas of specific interest in an integrated manner and as such it is not possible to separate different ES spatially.

Considering that we can define sub-zones and locations allocated to different land use. In practice these zones can be overlapped.

Table 6. Areas of regulation/facilities

Name	Type	Area of regulation	
Cultural/Recreational/educational area	A. General cultural/educational B. General Recreational	A. Cultural/educational use B. Recreational use	
Coppice	A Cultural/educational	A.1 Coppice valorisation (3 locations)	
Large old tree	A Cultural/educational	A.2 Large old tree (10 trees)	
Traditional well	A Cultural	A.3 Well	
Belvedere	B Recreational	B.1 Belvedere point	
Birdwatching	B Recreational/educational	B.2 Birdwatching areas	
Bridge	B Recreational	B.3 Bridge (2 locations)	
Network of paths	B Recreational /cultural	B.4 Network of new paths (including Large old tree circuit)	
Nature conservation area	C. General nature conservation area	C. Nature conservation area	
Important trees	C Nature conservation	C.1 Important trees (7 trees designated mainly for nature conservation not for cultural value)	
Ponds	C Nature conservation	C.2 Ponds (5 ponds to be developed)	
Dead tree	C Nature conservation	C.3 Dead tree	
Ecological corridors	C Nature conservation	C.4 Existing ecological corridors to be maintained (outside of Lomb Forest!)	
Ecological corridors	C Nature conservation	C.5 Ecological corridor to be developed (outside of Lomb Forest!)	
Pasture area	C Nature Conservation	C.6 Pasture to be protected and maintained (outside of Lomb Forest!)	

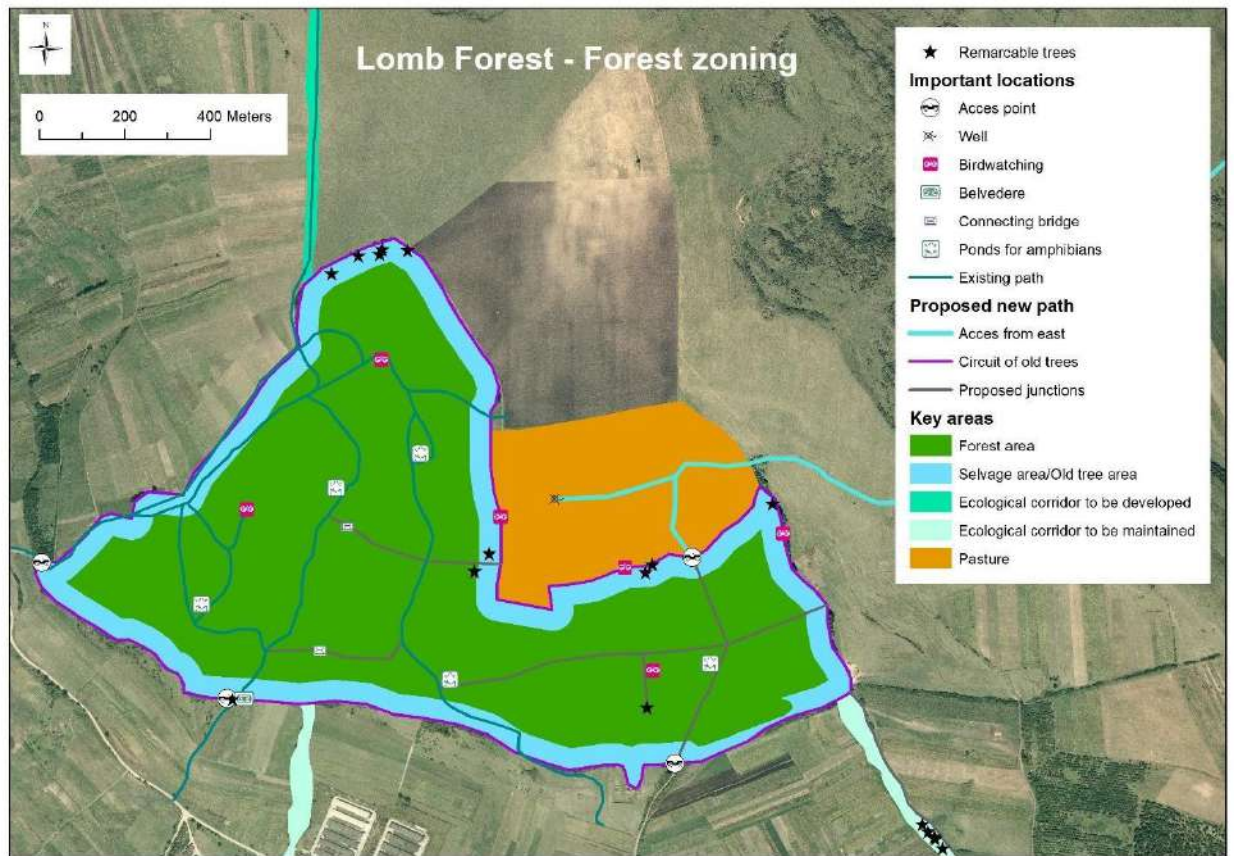


Figure 21. Forest zoning

4.5. Areas of regulation

The general areas of recreational use are to be managed from a forestry point of view as stated in section 4.3.1.

Areas of regulation are presented in the following tables:

Areas	A.1 Coppice
Condition/problems	Coppice trees are quite frequent in the area. They need to be included in the valorisation network, together with large old trees
Target status	Works in order to mark them accordingly (3 locations)
Purpose	Cultural area
Priority	Medium
Most important ES	Cultural/Educational
Possible activities	Walking
Unwanted or prohibited activities	Eating, camping
Silviculture measures	No
Measures for wood extraction	No
Infrastructure measures	Simple wooden signs marking 3 coppice locations
Operational plan	Build up of the facilities

Costs	To be detailed in the annex
Financiers	Project
Coordinators	Cluj City Hall
Stakeholders	Cluj City Hall, General public, Universities
Professional basis	-
Notes	The 3 coppice areas should be used to highlight the traditional forestry practices

Areas	A.2 Large old trees
Condition/problems	Important cultural and natural elements
Target status	To be maintained and not used for timber
Purpose	Conservation of large old trees. Increase awareness about cultural and natural values
Priority	High
Most important ES	Cultural/Supporting
Possible activities	Walking
Unwanted or prohibited activities	Any activity that is impacting the trees
Silviculture measures	Conservation
Measures for wood extraction	No
Infrastructure measures	No
Operational plan	Signs and small panels
Costs	To be detailed in the annex
Financiers	Project
Coordinators	Cluj City Hall
Stakeholders	Cluj City Hall, General public, Universities, Local community
Professional basis	-
Notes	Important natural and cultural elements

Areas	A.3 Old well
Condition/problems	Old shepherds well. It is not in the target area
Target status	To be maintained
Purpose	Cultural/recreational value
Priority	Medium
Most important ES	Cultural
Possible activities	Walking
Unwanted or prohibited activities	NA (not applicable)
Silviculture measures	No
Measures for wood extraction	No
Infrastructure measures	Path toward the well from the forest edge

Operational plan	-
Costs	To be detailed in the annex
Financiers	-
Coordinators	Cluj City Hall
Stakeholders	Cluj City Hall, General public, Universities, Pasture owner
Professional basis	-
Notes	The well is not situated in the target forest but in the pasture to the north

Areas	B.1 Belvedere point
Condition/problems	Currently not marked
Target status	To be developed. A simple sign and a panel describing the view (map)
Purpose	To complement the southern entrance point
Priority	High
Most important ES	Recreational
Possible activities	Walking, Sightseeing
Unwanted or prohibited activities	Camping
Silviculture measures	No
Measures for wood extraction	No
Infrastructure measures	Simple wooden facilities
Operational plan	Build up of the facilities
Costs	To be detailed in the annex
Financiers	Project
Coordinators	Cluj City Hall
Stakeholders	Cluj City Hall, General public, Universities
Professional basis	-
Notes	The spot should be developed as a belvedere spot. Nice view toward the city and to the Western Carpathians

Areas	B.2 Birdwatching hotspots
Condition/problems	There are no birdwatching hotspots. The identification of the locations is necessary
Target status	Identify and sign mark birdwatching hotspots
Purpose	Birdwatching
Priority	High
Most important ES	Recreational/Educational
Possible activities	Birdwatching
Unwanted or prohibited activities	Camping, fire, noise
Silviculture measures	No
Measures for wood extraction	No
Infrastructure measures	Small facilities for bird feeding (temporary and that can be moved)

Operational plan	Build-up of the facilities
Costs	To be detailed in the annex
Financiers	Project
Coordinators	Cluj City Hall
Stakeholders	Cluj City Hall, General public, Universities, Local community
Professional basis	-
Notes	The spots can be changed from year to year/season to season

Areas	B.3 Bridge (2 locations)
Condition/problems	No such facilities
Target status	Works in order to develop two suspended bridges over the gullies
Purpose	To facilitate the forest experience. To better understand gully erosion
Priority	Low
Most important ES	Recreational/Educational
Possible activities	Walking
Unwanted or prohibited activities	Camping
Silviculture measures	No
Measures for wood extraction	No
Infrastructure measures	Two bridges (wooden or suspended)
Operational plan	Build-up of the facilities
Costs	To be detailed in the annex
Financiers	Project
Coordinators	Cluj City Hall
Stakeholders	Cluj City Hall, General public, Universities
Professional basis	-
Notes	

Areas	B.4 Network of new paths
Condition/problems	There is a network of walking paths but it is not covering the entire area.
Target status	Marked walking paths
Purpose	To develop a network of paths
Priority	High
Most important ES	Educational/Recreational
Possible activities	Walking
Unwanted or prohibited	Camping
Silviculture measures	No
Measures for wood extraction	No
Infrastructure measures	Simple paint markings on trees. Panel maps
Operational plan	Build-up of the facilities

Costs	To be detailed in the annex
Financiers	Project
Coordinators	Cluj City Hall
Stakeholders	Cluj City Hall, General public, Universities, NGO
Professional basis	-
Notes	The paint markings will allow the network of paths to develop in a sustainable way. Cycling paths are to be marked differently

Areas	C.1 Important trees
Condition/problems	These are trees important for their ecological value. They just need to be highlighted
Target status	Simple works for the establishment of info panels near the tree
Purpose	Identification of high natural value trees. Add educational value to important trees in the area
Priority	High
Most important ES	Supporting ES, nature conservation
Possible activities	Walking
Unwanted or prohibited activities	Camping
Silviculture measures	No
Measures for wood extraction	Avoid extracting these trees
Infrastructure measures	Simple wooden panels to be placed on trees or in their close vicinity
Operational plan	Build-up of the facilities
Costs	To be detailed in the annex
Financiers	Project
Coordinators	Cluj City Hall
Stakeholders	Cluj City Hall, General public, Universities
Professional basis	-
Notes	The trees need to be highlighted

Areas	C.2 Ponds
Condition/problems	The number of temporary ponds used by amphibians is low
Target status	To improve the conservation status of amphibians by creating and maintaining temporary ponds
Purpose	Increase the population size of priority amphibian species
Priority	High
Most important ES	Natural/Educational
Possible activities	Learning/Walking
Unwanted or prohibited activities	Camping
Silviculture measures	No
Measures for wood extraction	No
Infrastructure	Development of ponds by using natural materials

measures	
Operational plan	Build-up of the facilities
Costs	To be detailed in the annex
Financiers	Project
Coordinators	Cluj City Hall
Stakeholders	Cluj City Hall, General public, Universities
Professional basis	Amphibian expert
Notes	By creating additional man made ponds the conservation status for the amphibian populations will improve. In the development process scientists can offer useful insight and also study the impact of the ponds on the general amphibian population

Areas	C.3 Dead tree
Condition/problems	Dead wood is to be kept in the forest. Currently dead wood is removed
Target status	Standing or fallen dead wood in the forest ecosystem
Purpose	Habitat for insects
Priority	High
Most important ES	Natural/Educational
Possible activities	Learning/Walking
Unwanted or prohibited activities	Camping, fire
Silviculture measures	Do not remove dead wood
Measures for wood extraction	No
Infrastructure measures	-
Operational plan	-
Costs	To be detailed in the annex
Financiers	Project
Coordinators	Cluj City Hall
Stakeholders	Cluj City Hall, Forestry District
Professional basis	-
Notes	

Areas	C.4 Existing ecological corridors to be maintained
Condition/problems	These natural corridors are present in the southern (lower) part of the forest. These ecological corridors are composed out of riparian species, being developed along the drainage line of the two gullies from the forest
Target status	Conservation and development of these areas
Purpose	Increase biodiversity and ecosystem services in the target forest
Priority	High
Most important ES	Natural/Educational
Possible activities	Learning/Walking
Unwanted or prohibited activities	Camping
Silviculture measures	No

Measures for wood extraction	No
Infrastructure measures	No
Operational plan	Involve the local community and authorities
Costs	To be detailed in the annex
Financiers	Project
Coordinators	Cluj City Hall
Stakeholders	Cluj City Hall, General public, Universities
Professional basis	-
Notes	Ecological corridors are very important factors for conservation. Although these corridors are outside the target area, Cluj City Hall is an important stakeholder

Areas	C.5 Ecological corridor to be developed (outside of Lomb Forest!)
Condition/problems	There are no ecological corridors to connect the northern part of the forest with other forests further north
Target status	Simple works for the establishment of the ecological corridor along the path/road to the north of the Lomb Forest (towards Chinteni)
Purpose	Increase connectivity
Priority	High
Most important ES	Natural/Educational
Possible activities	Walking/Cycling
Unwanted or prohibited activities	Camping
Silviculture measures	No
Measures for wood extraction	No
Infrastructure measures	
Operational plan	Plant native trees along the road
Costs	To be detailed in the annex
Financiers	Project
Coordinators	Cluj City Hall
Stakeholders	Cluj City Hall, General public, Universities, Local community
Professional basis	-
Notes	The target action is outside of the target forest area. However Cluj City Hall can have a valuable contribution

Areas	C.6 Pasture to be protected and maintained (outside of Lomb Forest!)
Condition/problems	There is an important pasture to the north of the forest. The forest-pasture system is very important for the conservation of the forest and for providing ecosystem services
Target status	Conservation of the pasture-forest complex
Purpose	Increase biodiversity and ecosystem services
Priority	High
Most important ES	Natural/Educational
Possible activities	Walking/Cycling

Unwanted or prohibited activities	Camping
Silviculture measures	No
Measures for wood extraction	No
Infrastructure measures	
Operational plan	Maintain the pasture, even by purchasing the pasture
Costs	To be detailed in the annex
Financiers	Project
Coordinators	Cluj City Hall
Stakeholders	Cluj City Hall, General public, Universities, Local community
Professional basis	-
Notes	The target action is outside of the target forest area. However Cluj City Hall can have a valuable contribution. If Cluj City Hall decides to purchase the pasture and create an integrated ecosystem service area it will be a first among local authorities in Romania.

5. MANAGEMENT/GOVERNANCE

As mentioned above (Chapter 1), the **governance and management** of the forest targeted by this project is **strongly sectoral**: irrespective to the owner, the forest management should follow the rules, procedures and principles legally described and applied by the forestry authorities. Given that the selected forest area was proposed for the **development of a multifunctional management** strategy for enhancing and integrating multiple societal demands while **enhancing the ecosystem service delivery potential** of the forest, there should be a reconsideration of the classical governance in order to fulfil **multifunctionality demands**. This also means that the current institutions involved in the management of the forest should consider the possibility to **shift from the traditional full control type of forest management** and administration to the inclusion and consideration of **participatory type of management**. The participatory type of management means that the presenters of the society (see above, the potential interest groups with demands for various types of ecosystem services of the forest) are also considered as resources (e.g. knowledge, inspiration, volunteering) and opportunities within a forest management strategy. Scientific evidence shows that addressing the problem of “**social fit**” (i.e. enhancing multifunctionality of forest ecosystems by more effectively connecting multiple societal demands to forest ecosystem service delivery) requires the development of a **pluralistic governance system, i.e. different (traditionally sectoral) institutional structures (old and new) which are capable of integrating multiple perspectives and visions** in the management of the natural resources. The **communities of practice** represent structured

institutional spaces where presenters of different governing institutions, sectors and interest groups (research, policy, practitioners and the civil society) can interact and collaborate. We believe that a community of practice type of engagement provides more benefits for the long term viability of the project than a classical consultative council (present in the most of protected areas). The key difference between the two is that the community of practice means also active and continuous engagement in the knowledge/innovation production and co-creation of management actions while the classical consultative council has the role of overseeing the various economic and other types of initiatives and their engagement is also restricted in time (it happens during pre-defined meetings). The community of practice has several other benefits as well. The collaborative interactions within communities of practice allows **sharing and co-creating actionable knowledge** about multi-faced and multidimensional problems related to common topics of interest (here represented by the forest). Regarding forests, the following themes and topics can be addressed by the communities of practice: **(i) threats to forests (social, environmental), (ii) equity in access to ecosystem services, (iii) developing new tools and methods for sustainable forest management, (iv) increased communication and trust between different institutions regarding forest management, (v) fostering links between forestry, research and practice and finally (vi) fostering the development of new, genuine links between people and forest.** The communities of practice also can promote the development of a **collective identity** and an effective communication of key information. Nevertheless, the communities of practice represents proper institutional design to foster the manifestation of knowledge types which were classically “locked” within various sectors / institutions (hence bridge the knowledge-implementation gap).

5.1 Implementation/responsibility

The project implementation institution mobilised the presenters of **multiple sectors and interest groups** (Table 7) in order to achieve a more holistic perspective of ecosystem service provision and the multifunctional management of the targeted forest. The expertise involved in this project are summarized in the Table 7 below. The partnership between these institutions created the **institutional context for emergence and implementation of a wide diversity of knowledge regarding the socio-cultural and natural values of the forest targeted by this project.** For example, the knowledge regarding the historical legacy and biodiversity values of the ancient coppice trees and the huge habitat value of the extensively used dirt road ponds for amphibians – which are still well represented in the targeted forests – within a strictly sectoral governance would be typically locked within one specific institution (i.e. university knowledge, e.g. Faculties of Biology, Ecology or Environmental Sciences). Furthermore, the NGO sector have a crucial role in identifying creative ways of engaging people with the natural environment represented by the forest, so that various

types of human-nature connections can form. Within a classical sectoral governance, there is little probability that the above knowledge and activities would be transferred into real world management action to sustain these multifunctional values of the targeted forest.

Table 7 Institutions and expertise involved in the development of the present document

Institution	Expertize
Zona Metropolitana	The leader of this project, information flow facilitation between officials of Cluj-Napoca and nine neighbouring communes, the initiator and implementer of several projects relevant for people and the environment
City of Cluj-Napoca	The owner of the forest
Babes-Bolyai University (Faculties of Environmental Sciences, Ecology, Biology)	Taxonomy, conservation biology, ecosystem functioning, ecosystem services assessments, environmental governance
Romsilva	Forestry authority, forest management
Somes Delivery/Atelier Mass	Creative ways to reconnect people and nature through creating favourable and nature-friendly context for educational and cultural activities
Environmental NGO`s	Bridging the decision making-science and society, educational activities in nature

5.2 Forest owners association

The situation regarding the ownership and management was presented earlier (Chapter 1).

6. CONTROL/MONITORING

The monitoring will be implemented on a volunteer basis and below we will provide key indicators of monitoring and control.

6.1 Indicators of monitoring and control

6.1.1 Ecosystem indicators

The diversity and quality of habitats, protected species and their populations, and keystone ecosystem structures, dead trees, culturally modified trees, invasive trees. The reference base for monitoring these indicators consist of a comprehensive survey of key biotic elements such as wetlands, plants, trees, amphibians, reptiles, birds and mammals. Furthermore a rich photo-

documentation exist from the whole surface of the targeted forest in summer and autumn periods, this making possible the implementation of photo monitoring types of activities.

6.1.2. Ecosystem services indicators

Provisioning, regulating, cultural and supporting ecosystem services. These will be assessed either through the number of people visiting the forest for various purposes or indirectly, by assessing the structural and functional properties of ecosystems. PPGIS techniques will be used

6.1.3. Human activity indicators

The number of people visiting the forest in different seasons, the diversity of their motivations.

The number of educational activities organized in the forest.

The number of volunteer based habitat management actions organized.

The number of indicators, educational panels, educational and other marked paths.

The activity and engagement on social media (e.g. Facebook) created for the project area.

6.1.4. Institutional indicators

A community of practice (see below) type of new institutional structure to assure that the decisions are participatory and based on the best available science.

7. COSTS AND FINANCING