



Interreg



EUROPEAN UNION

Danube Transnational Programme

URBforDAN

URBforDAN Mapping of Ecosystem Services

Ljubljana, Slovenia

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1. INTRODUCTION

The strategic area of urban and peri-urban forests of Ljubljana lies within the motorway ring of the city municipality of Ljubljana (Figure 1). The area includes three main forest complexes: Golovec (the focus area), Grajski grič and Rožnik with Šišenski hrib (TRŠ).

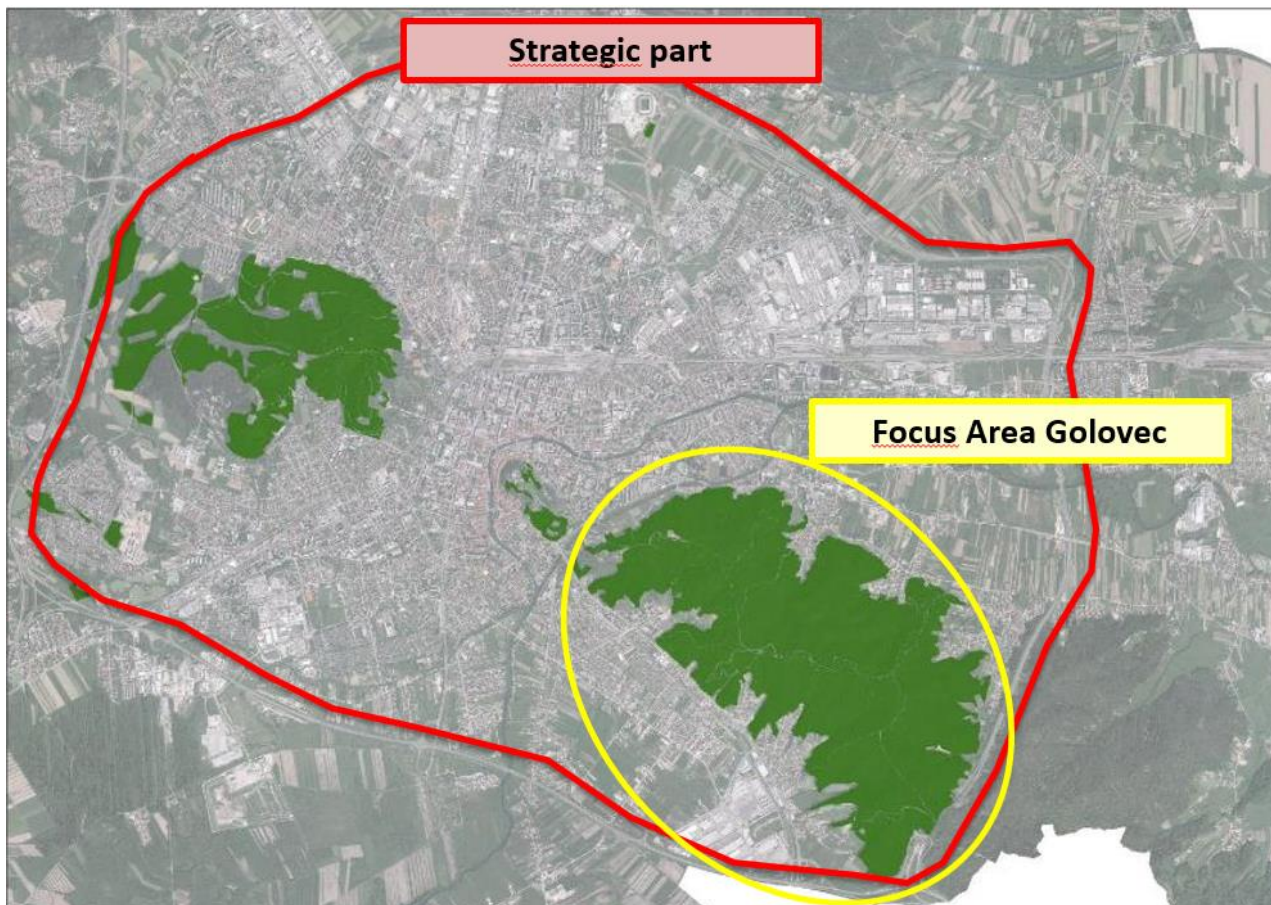


Figure 1: Map of the strategic and focus area

The total area of the strategic part within the motorway ring is 5.530 ha, 1.026 ha (18.5%) of which are forests. The share of urban land use is 64.4%. The surface of the focus area of Golovec is 651 ha, and 637 of which (97.8 %) is forest land use.

Forest property is extremely scattered (Figure 2). Altogether, there are 1.630 forest owners - including republic of Slovenia, different legal entities and 1.529 private forest owners. The majority of forests are privately owned.



Figure 2: Ownership structure of the strategic area

The UPF have high relevancy for the quality of life in Ljubljana. Social/cultural and ecologic functions have high importance and the citizens are well aware of them. They are a little less aware of the fact that forests also have a production function and that most of the forests are privately owned.

2. METHODOLOGY

The main ecosystem services (ES) were selected based on the analysis of the existing forest function maps and data from Forest Management Plan (FMP) of the Forest Management Unit of Ljubljana. The forest functions were transformed in the ES classification of FAO, using expert knowledge and scientific literature (see Methodology for Ecosystem Services Mapping and Valuation).

Existing databases and maps from FMP were used, as well as expert knowledge.

ArcGIS and QGIS software were used for the GIS analysis for each ES map.

3. RESULTS

3.1. Summary of mapped ES

The mapping of ES revealed that regulating and cultural ES have the highest importance in the strategic area, but also provisioning and supporting services are important (Table 1).

Table 1: Area and proportion of mapped ES given ranks of their importance (for the strategic area)

| Ecosystem service | 1st rank (ha) | 1st rank (%) | 2nd rank (ha) | 2nd rank (%) | 3rd rank (ha) | 3rd rank (%) |
|---------------------------------------|---------------|--------------|---------------|--------------|---------------|--------------|
| 11 Timber production | 275.4 | 27.0 | 462.1 | 45.3 | 282.0 | 27.7 |
| 12 Non-timber products | - | - | 586.4 | 57.5 | - | - |
| 13 Production of drinking water | 21.7 | 2.1 | 227.6 | 22.3 | - | - |
| 21 Local climate mitigation | 1019.5 | 100.0 | - | - | - | - |
| 22 Local air quality | 1019.5 | 100.0 | - | - | - | - |
| 23 Protection against noise pollution | 577.2 | 56.6 | 442.3 | 43.4 | - | - |
| 24 Regulation of floods | 2.1 | 0.2 | - | - | - | - |
| 25 Protection against erosion | 2.9 | 0.3 | - | - | - | - |
| 31 Nature conservation | 11.4 | 1.1 | 275.0 | 27.0 | 60.0 | 5.9 |
| 41 Recreation and tourism | 435.8 | 42.7 | 391.7 | 38.4 | 192.0 | 18.8 |
| 42 Education | 1.4 | 0.1 | - | - | - | - |
| 43 Cultural heritage | 57.4 | 5.6 | 362.2 | 35.5 | - | - |

3.2. Timber production

Criteria for mapping:

- 1 – very important (areas where it is possible to harvest more than 7-8 m³ per hectare)
- 2 – important (areas where it is possible to harvest between 5 m³ and 7m³ per hectare)
- 3 – medium importance (areas where it is possible to harvest less than 5 m³ per hectare)

The highest importance of timber production is on the eastern part of the Golovec hill, whereas the least importance is on the majority of the Rožnik hill (Figure 3).

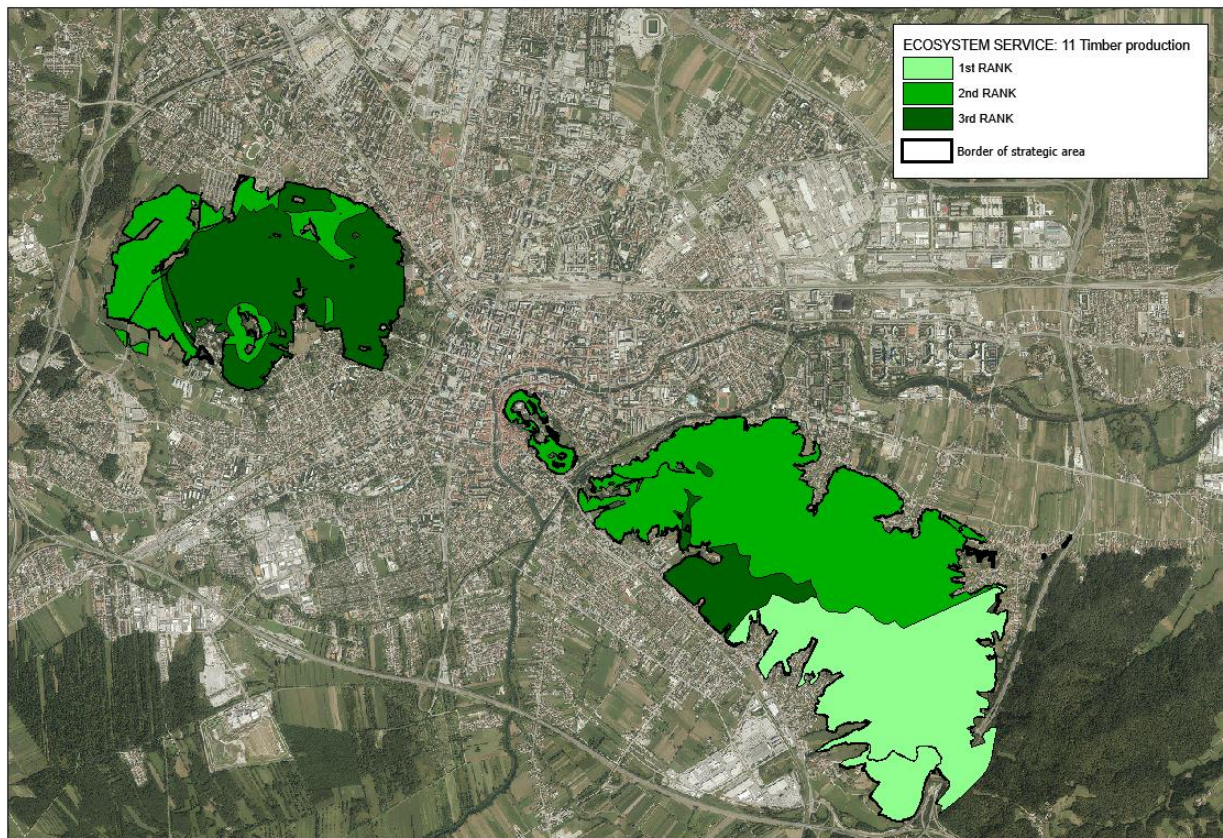


Figure 3: The map of timber production ES

3.3. Non-Timber products

Criteria for mapping:

2 – important (more than 25 % of chestnut in forest; importance for blueberries and mushroom collection)

The importance of non-timber products is mainly on the forests that are closer to the city where the visit of inhabitants is more frequent and where the potential for chestnut production is higher (Figure 4).

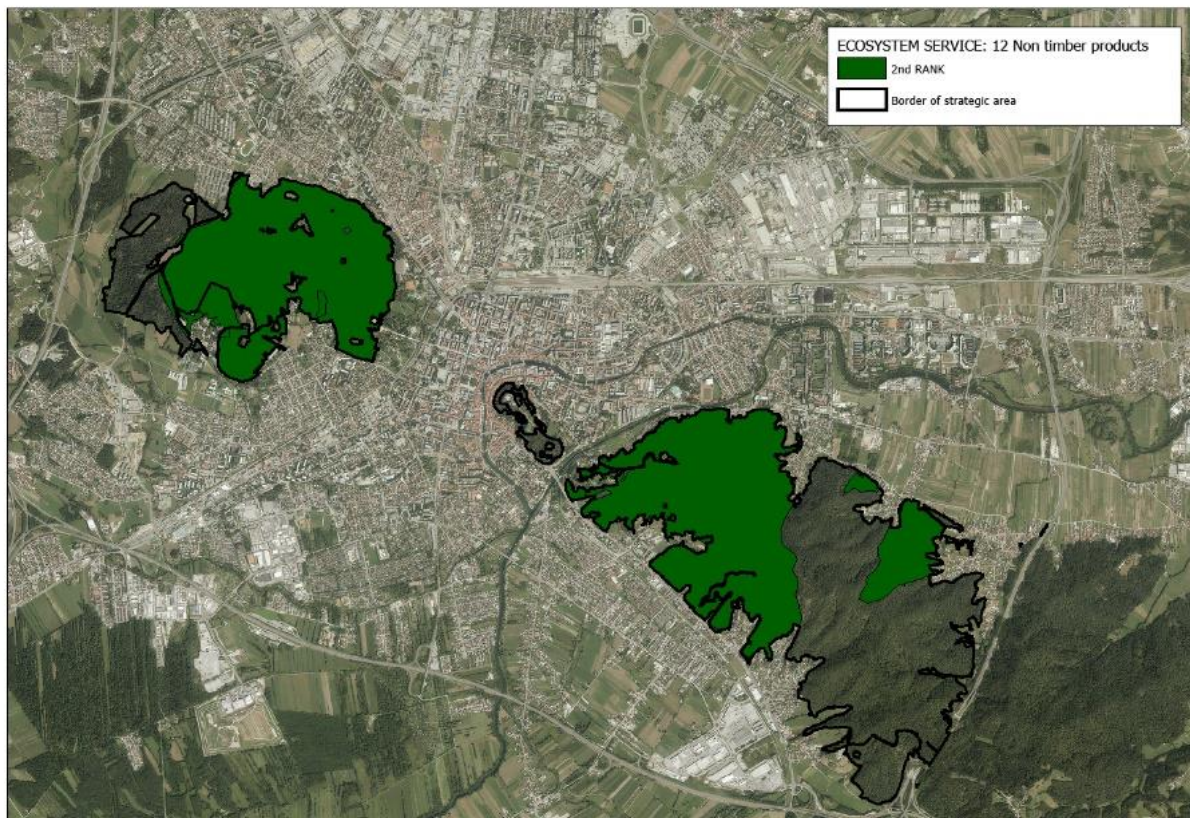


Figure 4: The importance of non-timber forest products

3.4. Provision of drinking water

Criteria for mapping:

According to the water protection regime

1 – inner water protection zones

2 – wider water protection zones

The importance of provision of drinking water is especially on the Rožnik hill, castle hill and some minor areas on Golovec hill (Figure 5).

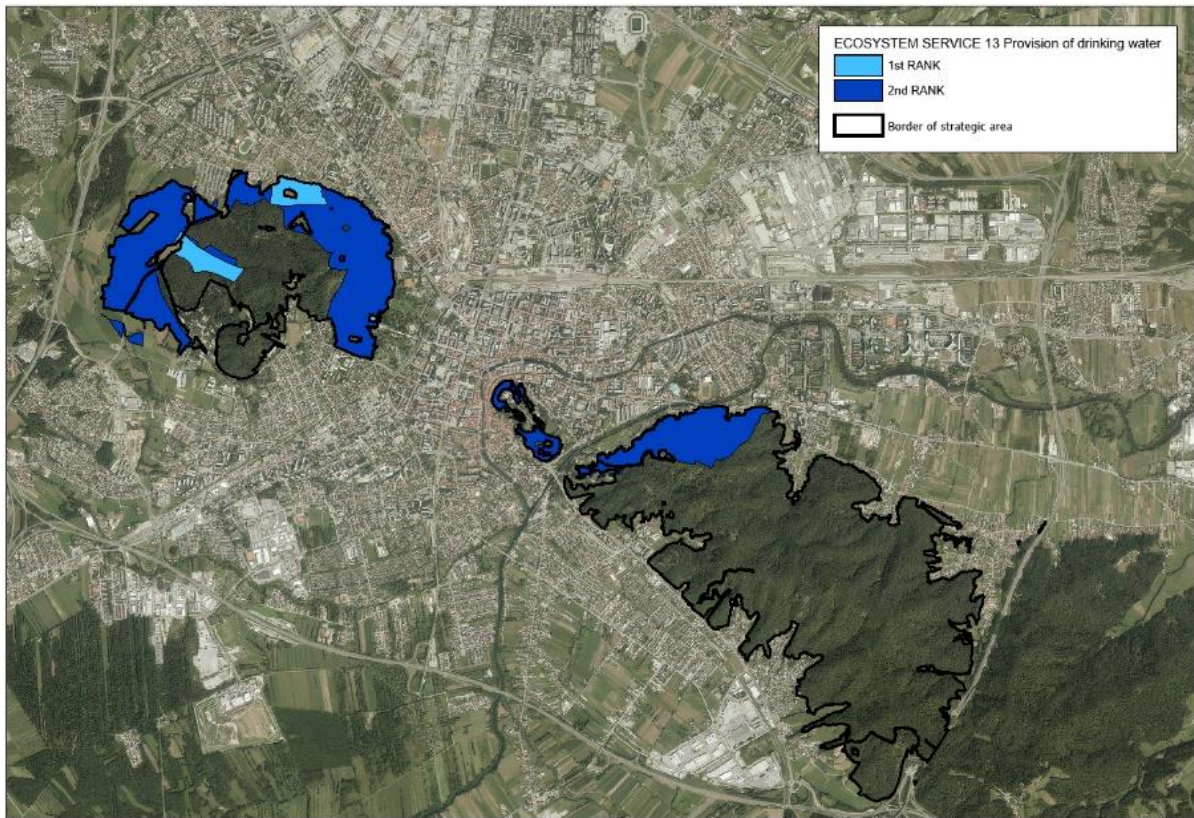


Figure 5: The importance of the provision of drinking water

3.5. Local climate mitigation

Criteria for mapping:

1 – very important (significant contribution to local climate mitigation)

Entire strategic area is extremely important for local climate mitigation due to close proximity of the city and the possibility of the forest missives to positively impact on summer temperatures and other extremes (Figure 6).

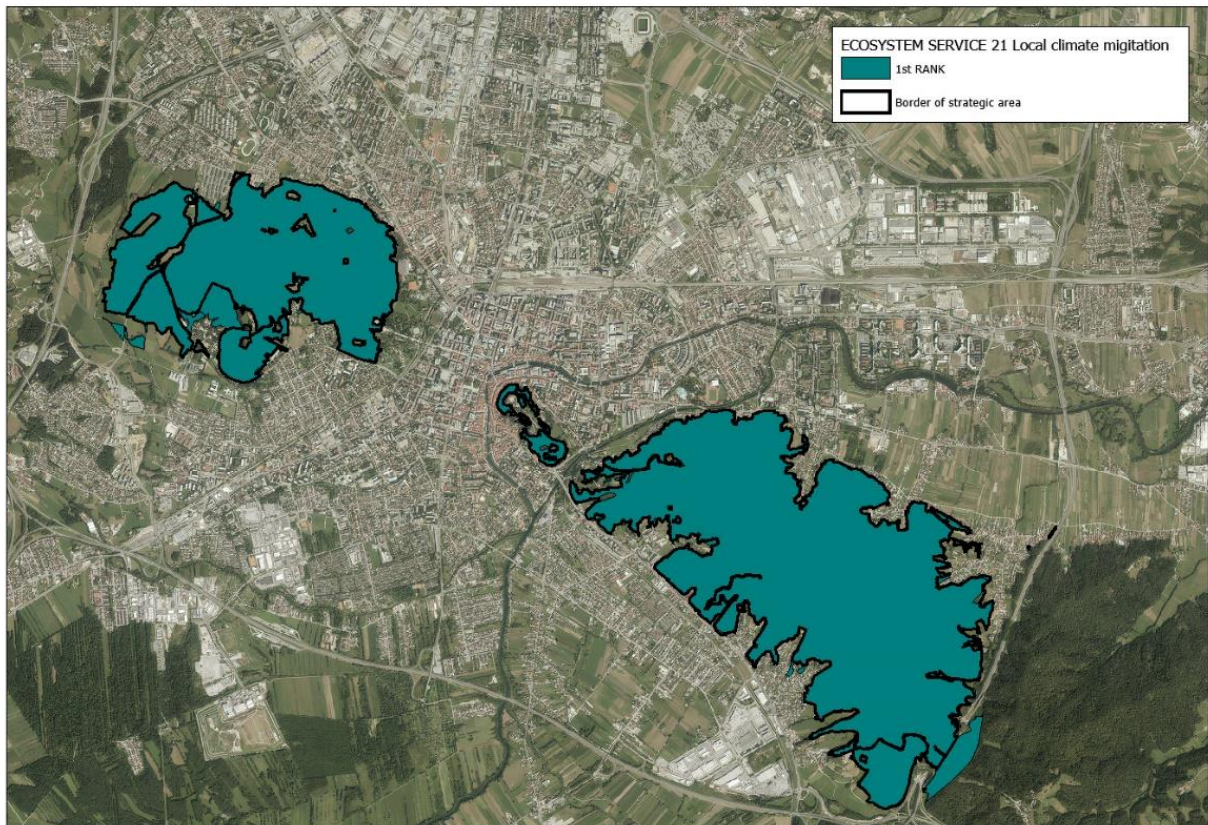


Figure 6: The importance of local climate mitigation

3.6. Local air quality

Criteria for mapping:

1 – very important (significant contribution to quality of air in the city – e.g. forests inside highway wings. forests in the proximity to major roads. forests as inlands in the built areas)

Entire strategic area is extremely important for the impact on local air quality due to close proximity of the major roads and highway and the possibility of the forest missives to decrease the pollution from traffic and other sources of pollution (Figure 7).

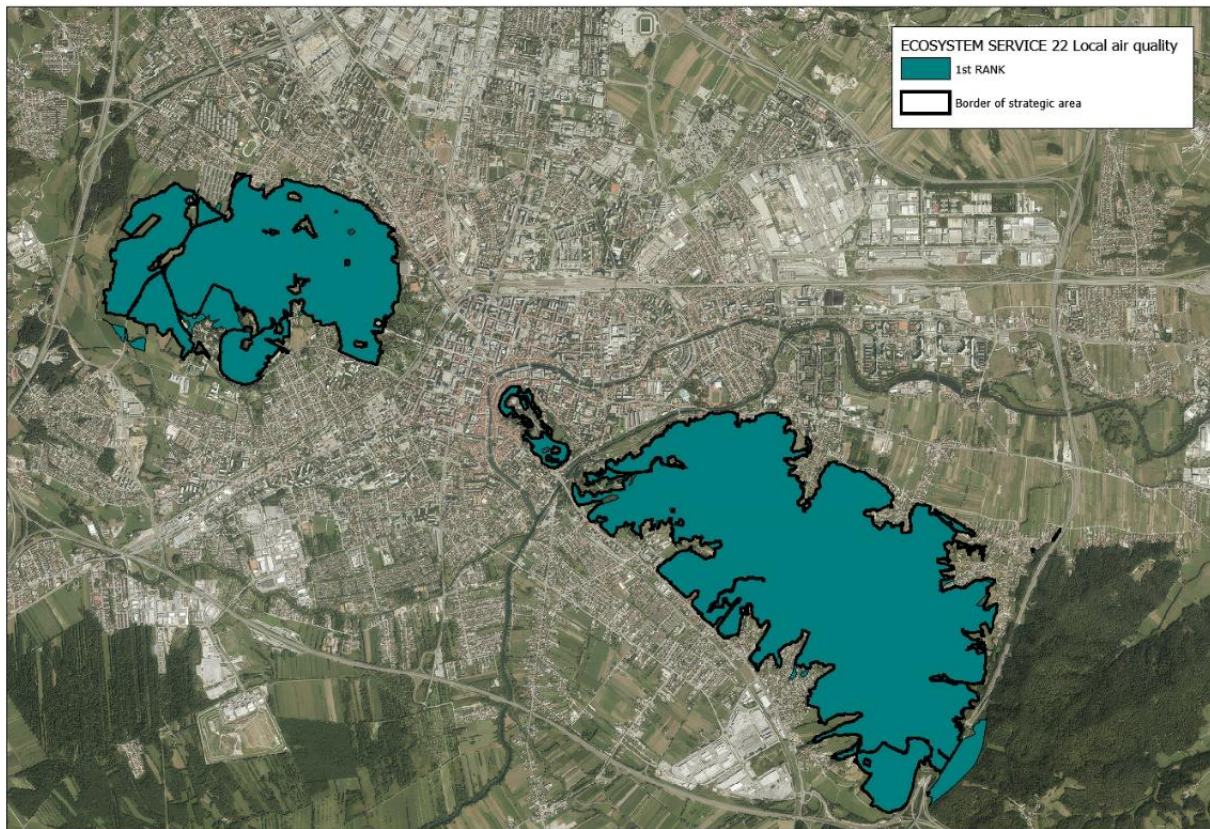


Figure 7: The importance of the impact on local air quality

3.7. Protection against noise pollution

Criteria for mapping:

- 1 – very important (250 m buffer zone from forest edge)
- 2 – important (rest)

Forests in the buffer zone are very important for noise pollution from major roads, and the inner part of the strategic area presents a “quiet zone” within the city where inhabitants can enjoy time without the city noise (Figure 8).

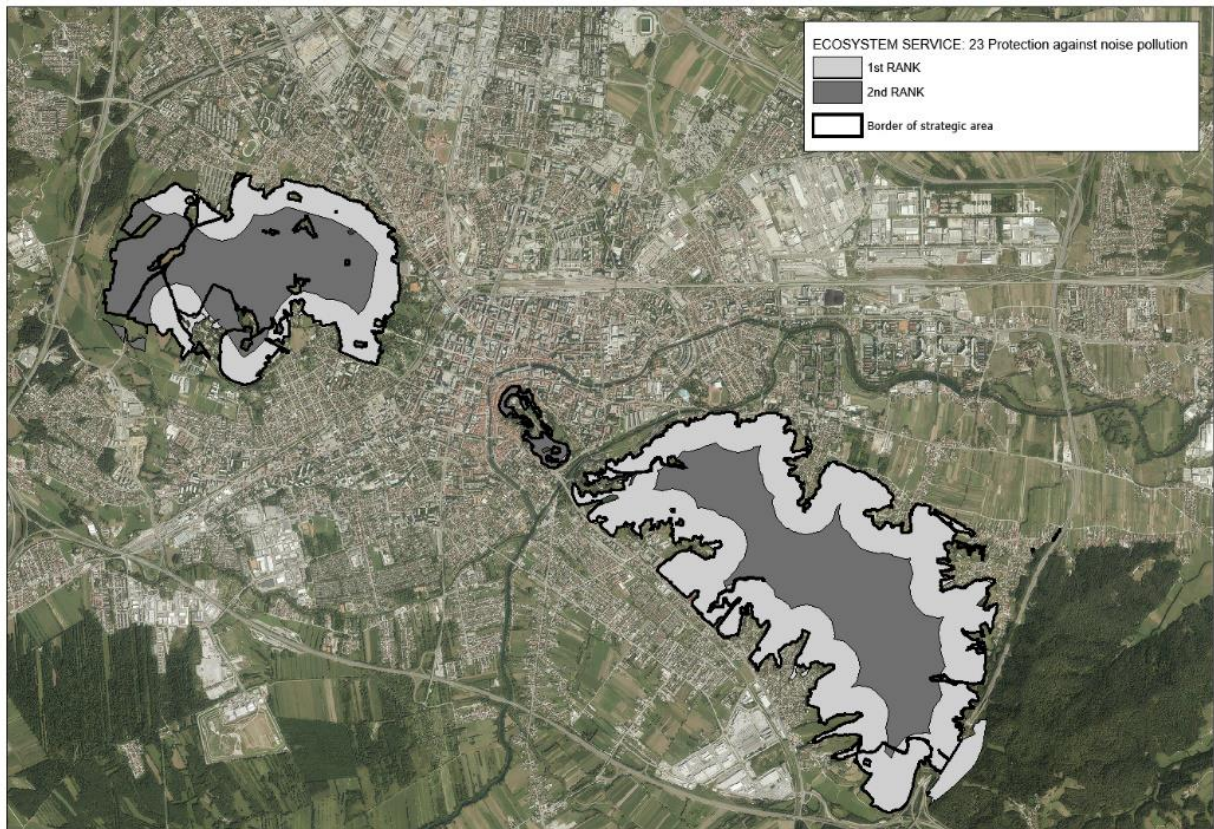


Figure 8: Importance of forests for noise pollution

3.8. Regulation of floods

Criteria for mapping:

Only 1 rank – highly important

On some small places on the Golovec hill, forests are important for protection against floods. Here, water retentions were built to retain the excessive water and protect houses and roads (Figure 9).

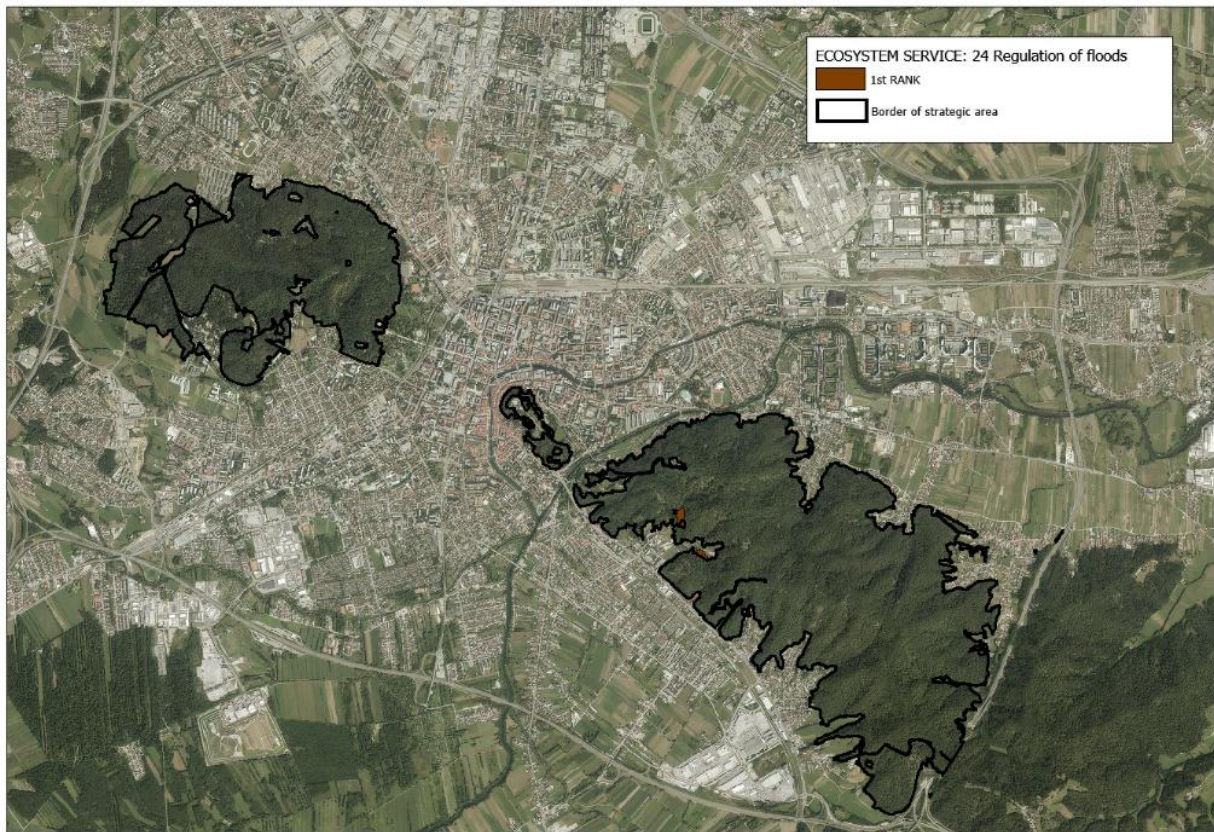


Figure 9: The importance of forests for regulation of floods

3.9. Protection against erosion

Criteria for mapping:

1 – very important (according to the forest function mapping)

On the castle hill, forests are declared as protection forests due to their high relevancy for protecting nearby houses and roads against landslides (Figure 10). These are steep slopes and have higher risk of natural hazards.

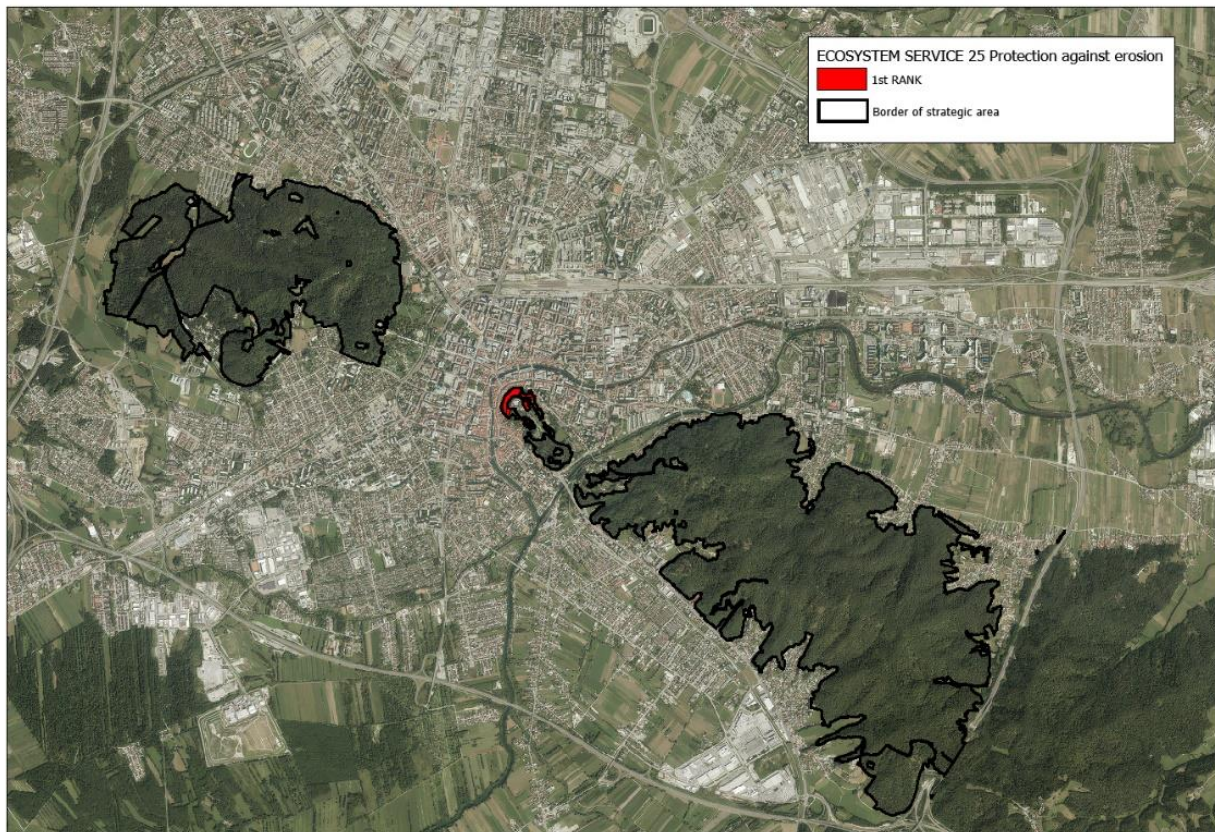


Figure 10: The importance of forests for protection against natural hazards

3.10. Recreation and tourism

Criteria for mapping:

- 1 – very important (highly visited trails, multiple use of trails, trails in the close vicinity of settlements, panoramic trails, trails on ridges etc.)
- 2 – important (the same as for 1. but with a lesser importance)
- 3 – medium importance (less visited recreational trails in more remote areas but still part of UPF, access paths to the main trails)

Most of the strategic area is important for recreation (Figure 11). Very high importance have forests on the vicinity of trails, and the less importance (but still relatively high compared to other forest areas in Slovenia) is on the eastern part of the Golovec hill.

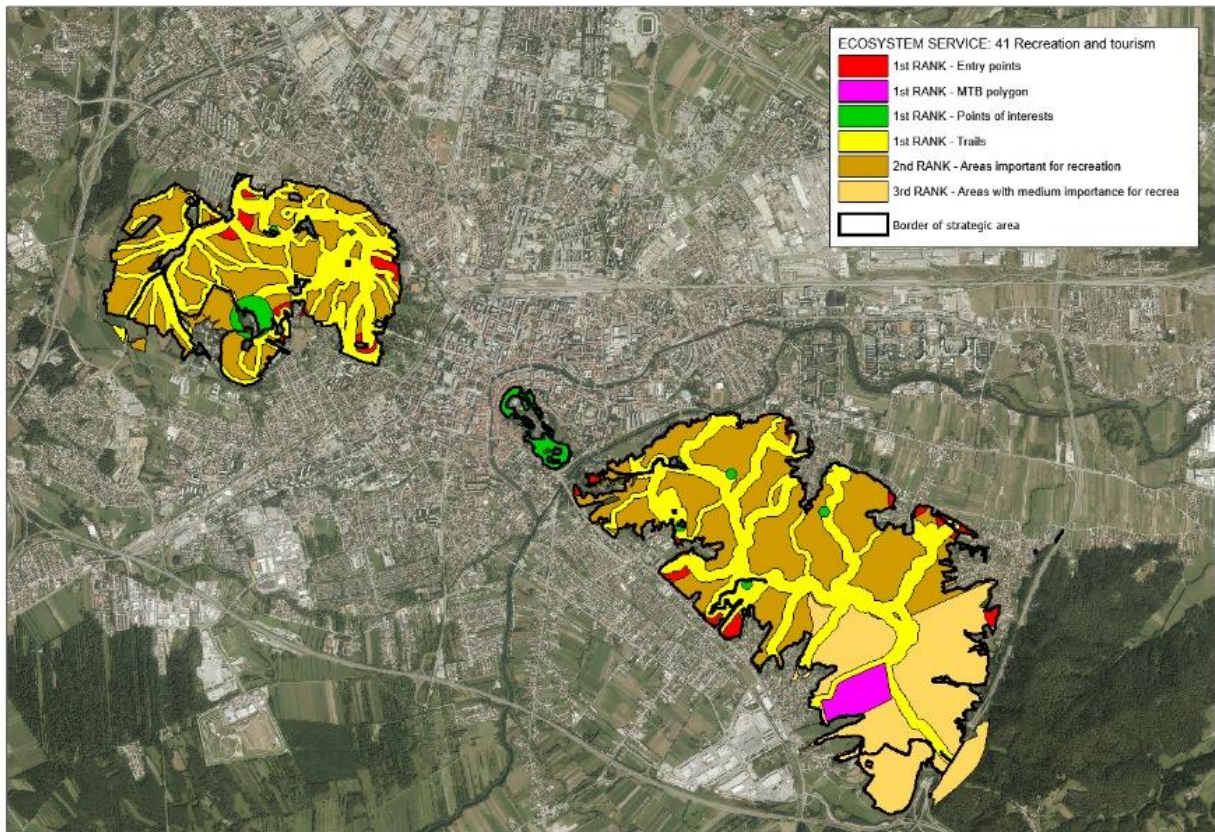


Figure 11: The importance of forests for recreation

3.11. Education

Criteria for mapping:

Only 1 rank – highly important

Education is very important both on Golovec and Rožnik hill on points of interests, special habitats, forest learning trails and all other attractive points in terms of education (Figure 12).

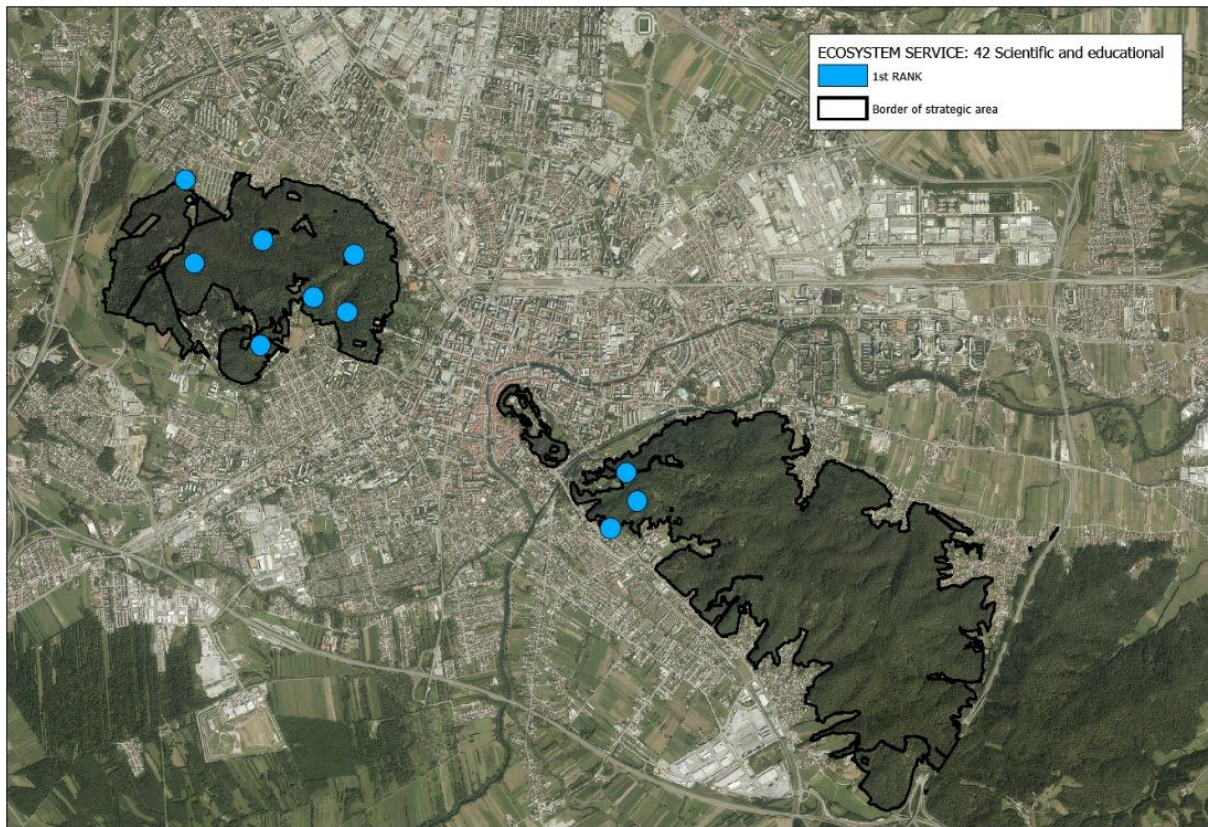


Figure 12: The importance of forests for education

3.12. Cultural heritage

Criteria for mapping:

1 – very important

2 – important

Forests on the castle hill and around the trail of Remembrance are very important for protection of cultural heritage (Figure 13). Also, the entire Rožnik hill declared a landscape part is important for protection of cultural heritage.

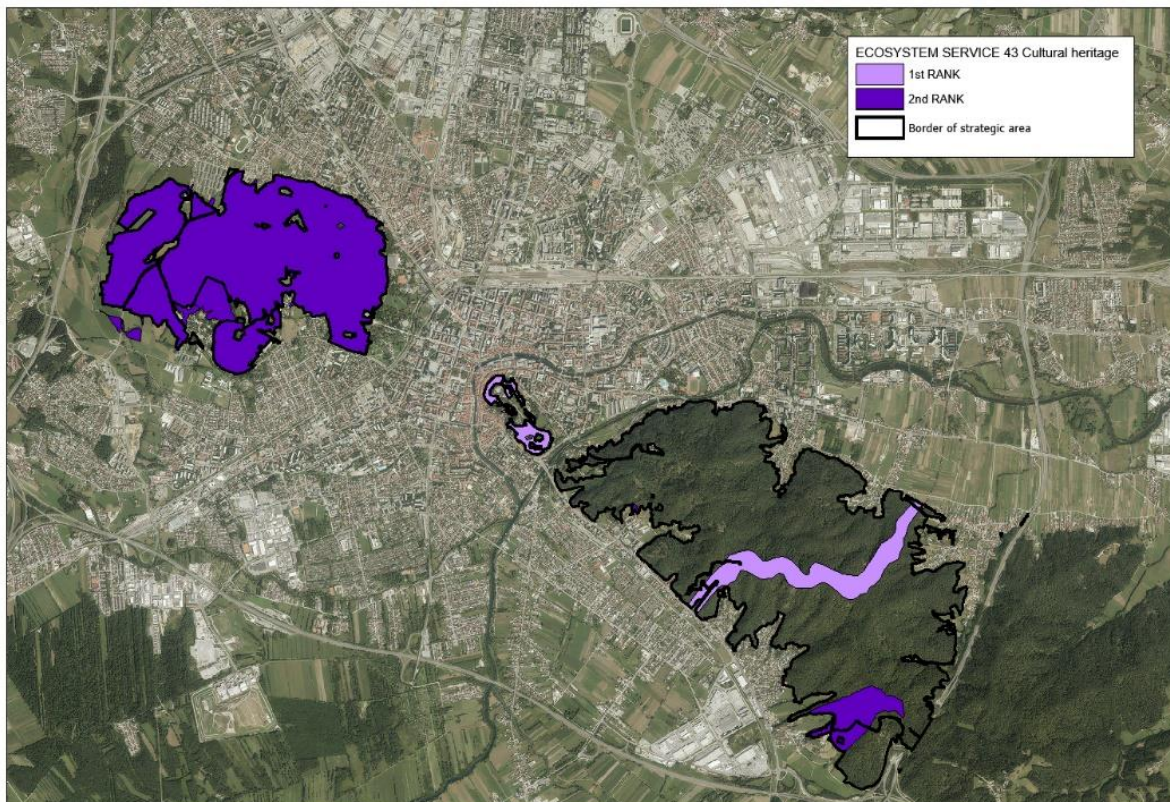


Figure 13: The importance of forests for protection of cultural heritage

4. DISCUSSION

The mapping of ES revealed high multifunctionality of the strategic area of urban forests of the city of Ljubljana. As expected, cultural ES have high importance due to the close proximity of the city. However, these forests also have high importance for regulating ES, since they impact local climate, air quality and consequently have positive effects on the health of the city inhabitants. In addition, which is maybe a unique characteristic for the urban forests, they are also important for the production of timber – and often this ES overlaps with cultural and regulating ES. Finally, even supporting ES have relevancy, which present a great challenge for multifunctional forest management. Especially where nature conservation, intensive recreation and timber production overlap (e.g. on Rožnik hill), appropriate management regime should be set and measures should be implemented with participation of all important stakeholders. Also, on the Golovec hill, overlapping of timber production (more important here compared to Rožnik hill) and recreation is a challenge that needs strong emphasis in the management plan.

The mapping of ES point to the areas in the forests that are more important for particular ES compared to other forest area. In addition, mapping is also a support for forest management – for setting priorities, management objectives and strategies. It shows conflict places where strategies need to be developed to deal with the existing (or potential) conflicts.

We found out that the existing databases were very useful for the mapping of ES, since the Slovenia Forest Service has an extensive database on the forest function mapping. However, in some cases, additional spatial analyses were needed. Sometimes criteria were arbitrary due to the lack of detailed data (small area for data that exist on the national level).