URBforDAN Mapping of Ecosystem Services
Ivano-Frankivsk, Ukraine

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1. INTRODUCTION

The strategic area in Ivano-Frankivsk has a surface of 580.39 ha and includes part of Kozakova Valley and Vovchynets Hill. The area is managed by the State Enterprise "Ivano-Frankivsk Forestry".
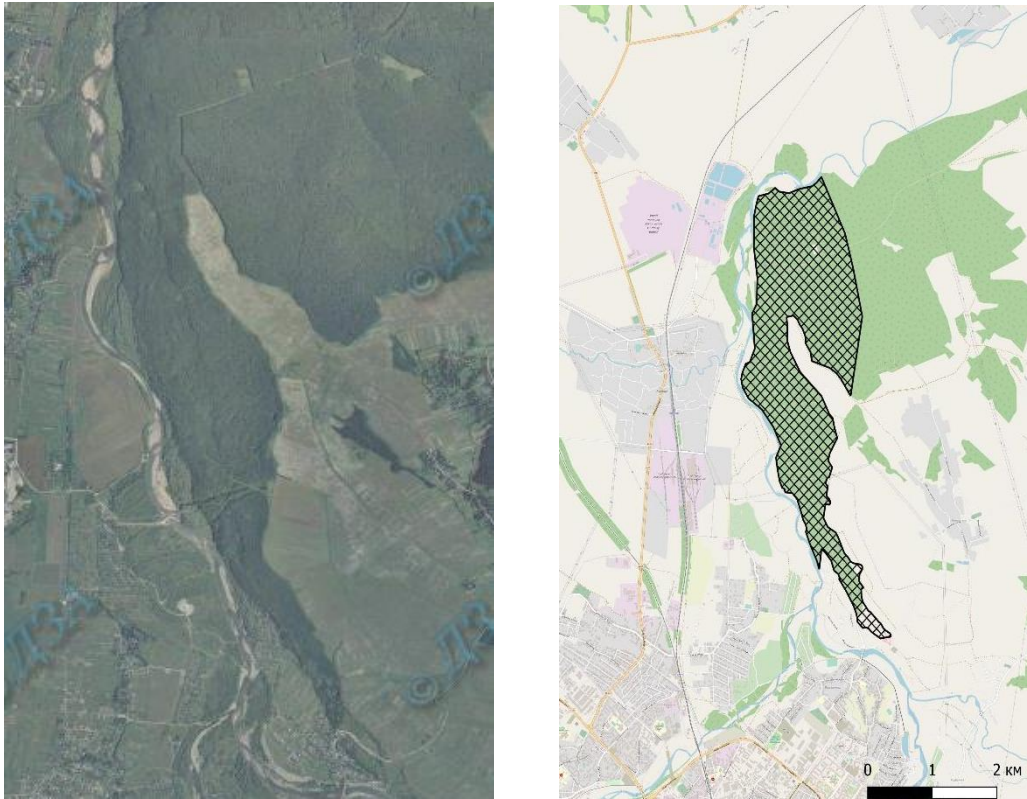
Picture 1 - orthophoto and shape of the border of the strategic area

Kozakova Valley is a landscape reserve of national importance in Ukraine. It is located in the Tysmenytsia district of Ivano-Frankivsk region, north of Ivano-Frankivsk, and south of Ezupiul village. The surface of all area - 953 hectares. Created in 1982. The status is given to preserve the picturesque tract on the right bank of Bystrytsia, dissected by deep beams, with separate outcrops of limestone rocks and small karst caves. The forest occupies 100% of the total area.
The Vovchynets Hill occupies an area of 20 hectares and is the focus area of the project. The peri-urban forest occupies 75.5% of the total area of the hill (15.1 hectares). The area is not protected, but the Hill is a natural monument of local importance

Picture 2 - orthophoto and shape of the border of the focus area

2. METHODOLOGY

ES mapping was prepared through the using of methodology for mapping ecosystem services from urban and peri-urban forests prepared by Dragan Matijašić and Dr. Tina Simončič (Zavod za gozdove Slovenije).

Group of experts that are familiar with the area (forestry managers, experts from the local authority) selected the main ES to be mapped. In addition, the project team checked ES by an on-site visit with the forestry manager and forester responsible for this area.

Moreover, the project team used a participatory approach: data from the survey, workshops, and face-to-face meetings with stakeholders.

Mapping was ensured by the use of the QGIS tool.

3. RESULTS

3.1. Summary of mapped ES

Group of expert together with the project team defined and selected following ES mapping for the strategic area in Ivano-Frankivsk:

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

Type of ES	rank	ha	%
11_Provisioning services	3	560,36	96,55
12_Provisioning services	2	571	98,38
21_Regulating services	3	533 (square of buffer zone)	-
22_Regulating services	1	33 (square of buffer zone)	-
23_Regulating services	3	5,3 (square of buffer zone)	-
31_Supporting services	1	561,55	96,67
41_Cultural services	1	-	-
43_Cultural services	1	-	-

Despite the fact that area is not being used multifunctional, still, it has great potential for developing. Results show the positive impact of ES service providing by forests highlighting the importance of UPF for the population.
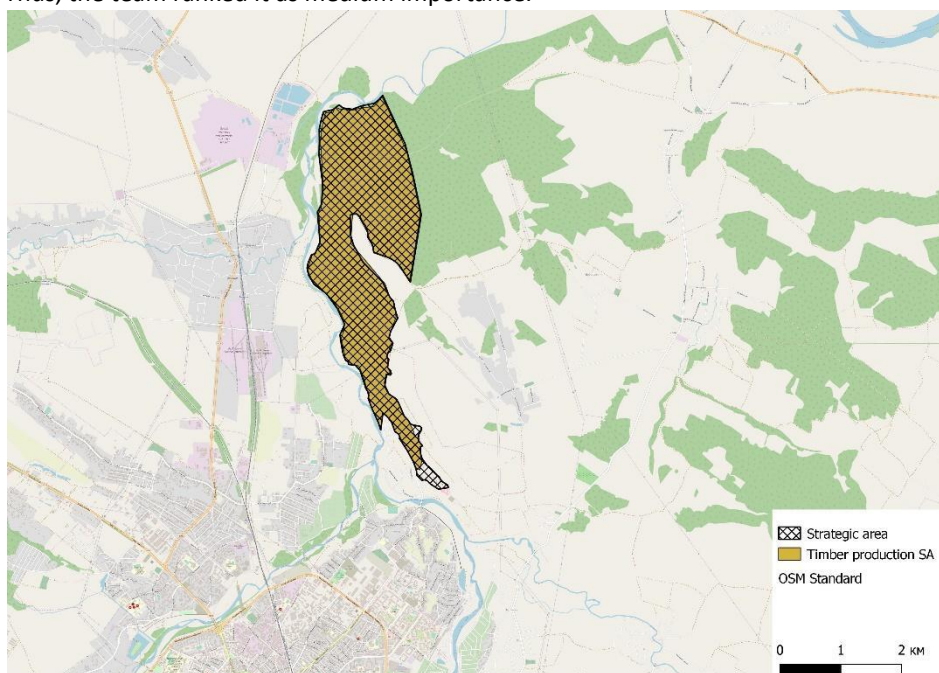
3.2. Timber production

Group used the following criteria for mapping:

Table 2: Criteria for mapping provisioning ES

ES considered	Criteria for mapping	Technical criteria for mapping	Ranking of ES importance
11_Timber production	Long-term high harvesting potential	Existing borders of forest stands/ compartments	According to the amount of possible harvested wood: 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) 0 – harvesting is not permitted/allowed

It is possible to harvest less than 5 m3 per hectare in the focus area and is not permitted in the protected area, but nearly 10 years timber production or agricultural works were not carried out in the area. The area is just maintained and preserved. Thus, the team ranked it as medium importance.

Picture 3 – Shape of the border of the strategic area with timber production potential
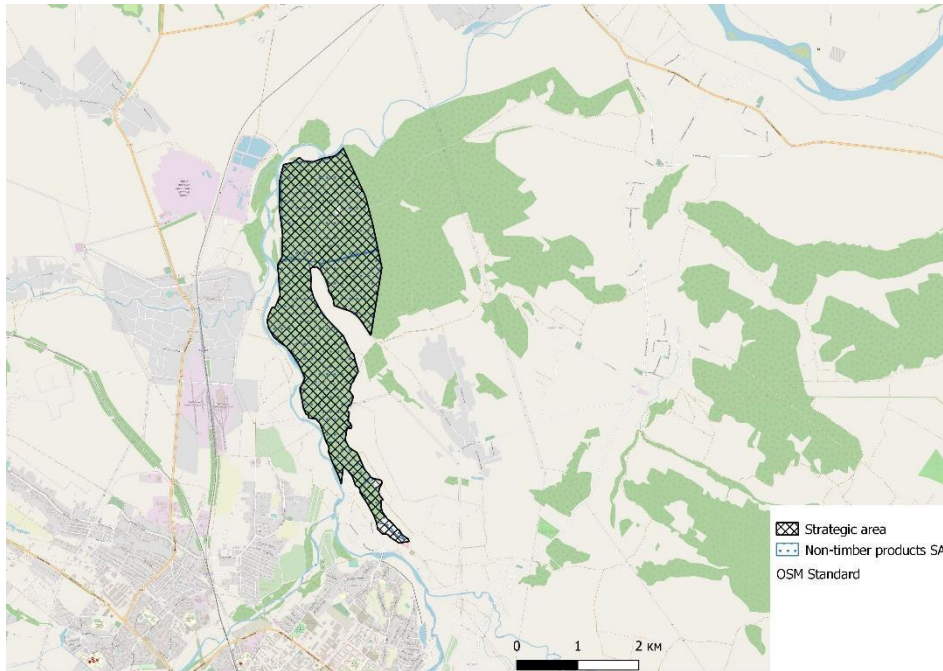
3.3.   Non-timber products

Group used the following criteria for mapping:

Table 3: Criteria for mapping provisioning ES

ES considered	Criteria for mapping	Technical criteria for mapping	Ranking of ES importance
12_Non-timber products	High harvesting potential	Polygons around the gathering area	1 – very important (forests managed exclusively for different forest products - for commercial use) 2 – important (high importance for the gathering of mushrooms, chestnut, medicinal herbs collection, but for personal use only)

There are places for gathering of mushrooms, medicinal herbs collection on the strategic area, but for personal use only. In this case, it`s an important rank of ES importance.

Picture 4 – Shape of the border of the strategic area with –non-timber products potential
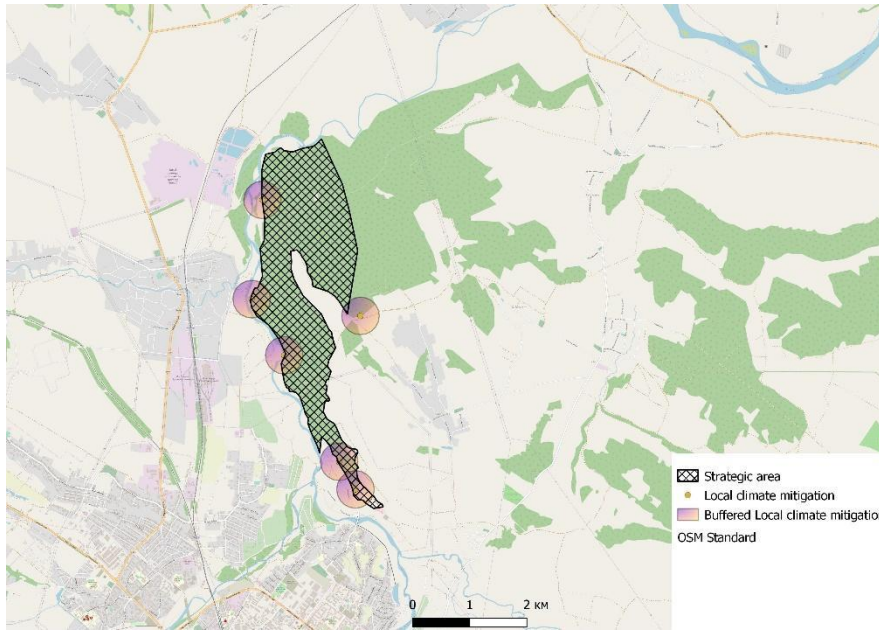
3.3. Local climate mitigation

Group used the following criteria for mapping:

Table 3: Criteria for mapping regulating ES

ES considered	Criteria for mapping	Technical criteria for mapping	Ranking of ES importance
21_Local climate mitigation	Forests that protect settlements from wind, drying, frost; these are mainly forests around exposed settlements and tourist accommodations, forests around large agglomerations, forests around climate resorts	According to expert opinion, studies on local air climate and similar studies – buffer 200 meters from forest to the settlement	1 – very important (the forest is around big settlements, it fully protects from wind, drying, frost) 2 – important (the forest is around medium settlements (towns, big villages), it fully or partly protects from wind, drying, frost) 3 – medium importance (the forest is around small (villages) or near small/medium settlements (towns, big villages), it partly protects from wind, drying, frost)

Forests protect settlements from wind, drying, frost. The rank is "3" as forest only partly protects the small settlements and is located near the areas, not around them.

Picture 5 – Buffer zones between forest and settlements affected by ES on climate mitigation
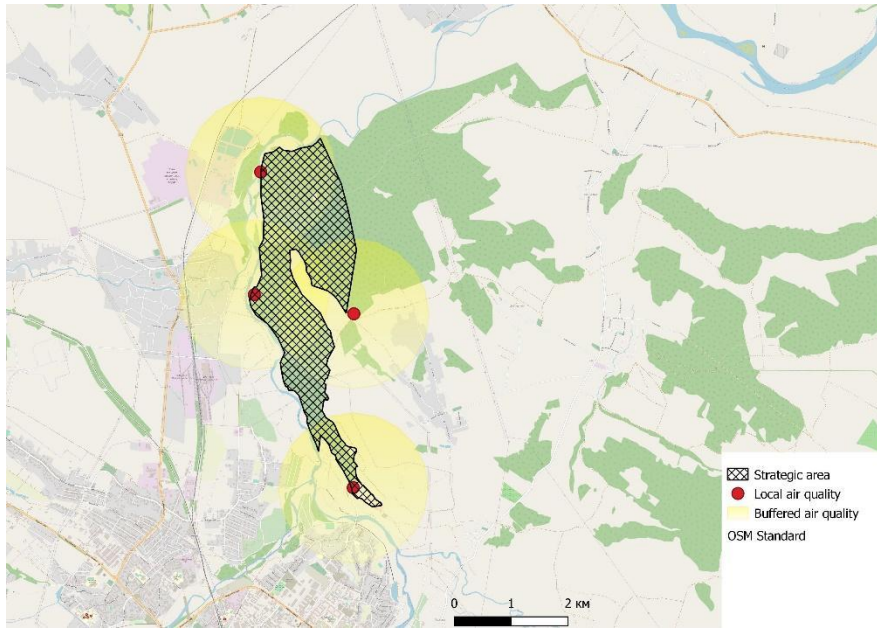
3.4. Local air quality

Group used the following criteria for mapping:

Table 4: Criteria for mapping regulating ES

ES considered	Criteria for mapping	Technical criteria for mapping	Ranking of ES importance
22_Local air quality	Forests that protect settlements from pollution; these are mainly forests around exposed settlements and tourist accommodations, forests around large agglomerations, forests around climate resorts	According to expert opinion, studies on air pollution and similar studies – buffer 2km	1 – very important (significant contribution to the quality of air in the city – e.g. forests inside highway wings, forests in the proximity to major roads, forests as islands in the built areas) 2 – important (forests inside or near the not industrial settlements but with major roads near the forest) 3 – medium importance (forests inside or near the not industrial settlements located far away from major roads)

Forest protects settlements from pollution due to its proximity to major city road, village's roads and factories/companies producing products. Accordingly, for rank is very important.

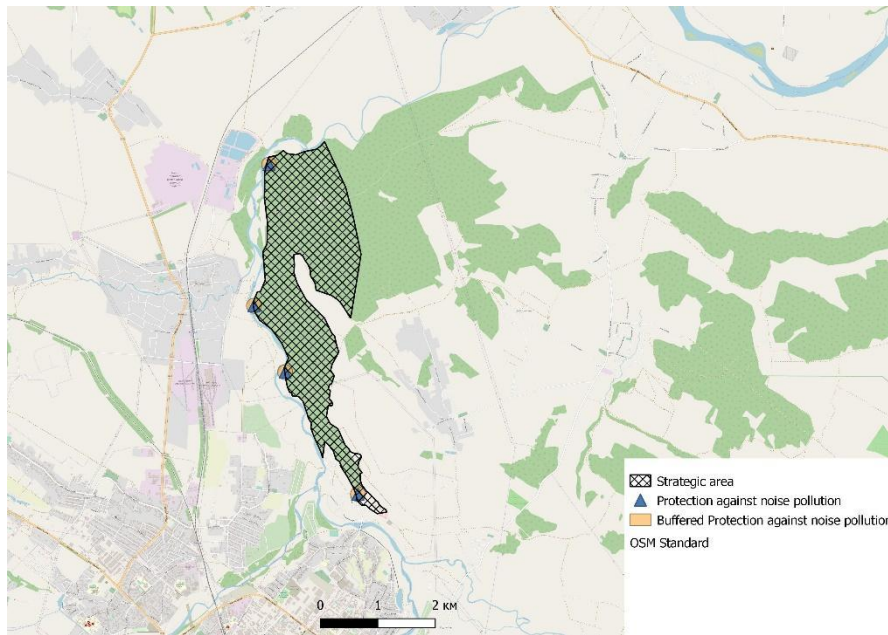Picture 6 – Buffer zones between forest and settlements affected by ES on air quality

3.5. Protection against noise pollution

Group used the following criteria for mapping:

Table 5: Criteria for mapping regulating ES

ES considered	Criteria for mapping	Technical criteria for mapping	Ranking of ES importance
23_Protection against noise pollution	Forests that protect settlements from noise pollution	Buffer around sources of noise according to expert opinion, studies on noise pollution – 200 meters	1 – very important (forest near highways) 2 – important (forest near several major city roads or 1 crowded with cars road) 3 – medium importance (forest near 1 road not crowded with cars)

Forest protects settlements from noise pollution due to its proximity to major city road, but near the forest, the road is not very crowded with cars. Accordingly, for rank is medium importance important.

Picture 7 – Buffer zones between forest and noise pollution producers

3.6. Habitats for species/nature conservation

Group used the following criteria for mapping:

Table 6: Criteria for mapping supporting ES

ES considered	Criteria for mapping	Technical criteria for mapping	Ranking of ES importance*
31_Nature protection/ habitats for species	Legally protected forest areas by regional laws, other relevant habitats and biodiversity hotspots	Local criteria from forest management plans and nature conservation agencies	1 – very important (priority species, endangered species, rare habitats, listed in the Red Book of Ukraine) 2 – important (regional laws) 3 – medium importance (local minutes, plans; ornamental plants)

The vegetation covers about 300 species. Oak-beech virgin forest with rich undergrowth and grass cover grows on wet soils. In addition, rocky oak, as an admixture - a European larch (Larix decidua), elm tree (Ulmus glabra) grow there. Among the herbs, several species are listed in the Red Book of Ukraine: snowdrop (Galanthus nivalis), terrestrial orchid (Neottia ovata), crocus. As for the animal world, there are schnapps, wild boar, stallion, gray hare, badger, tender and others. Such rich flora and fauna mean very important rank for the area.
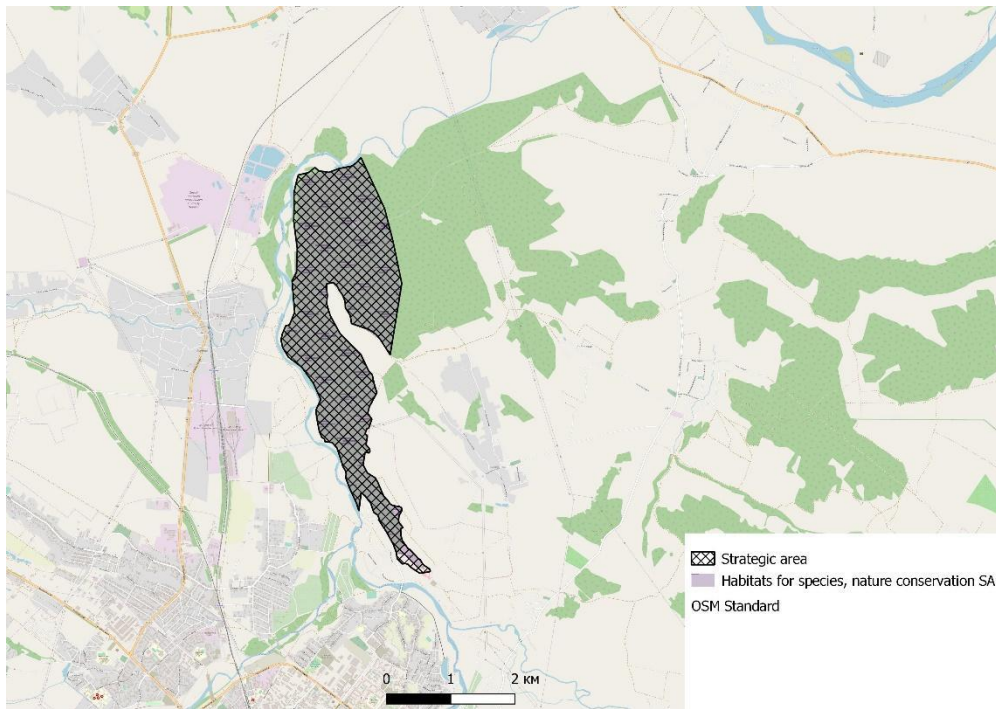
Picture 8 – Shape of the border of the strategic area proving ES on nature protection/ habitats for species
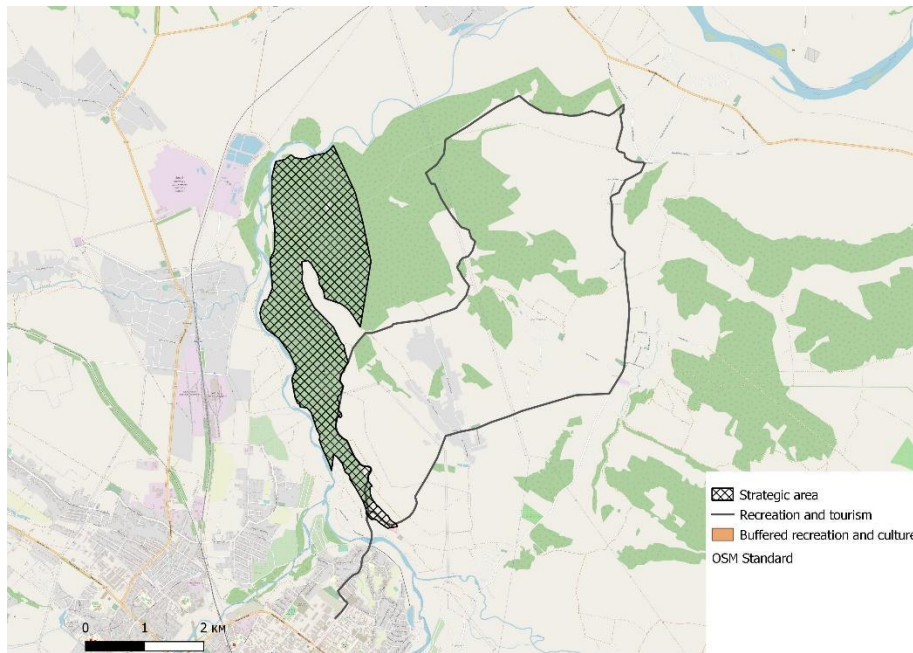
3.7. Recreation and tourism
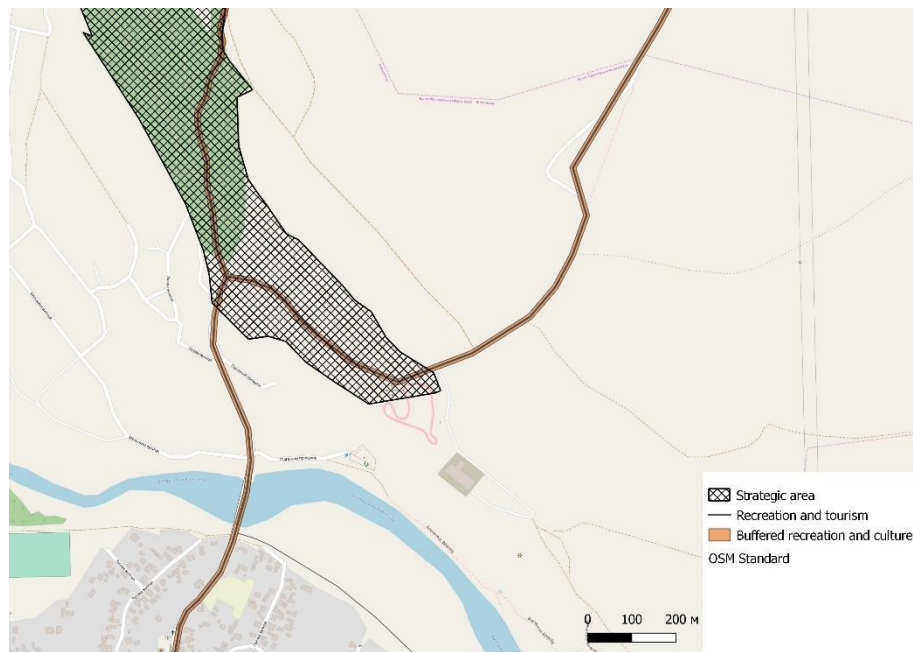
Group used the following criteria for mapping:

Table 7: Criteria for mapping cultural ES

ES considered	Criteria for mapping	Technical criteria for mapping	Ranking of ES importance*
41_Recreation and tourism	Forests in the immediate vicinity of towns and major urban settlements, forests along intensively visited walking, hiking, bicycling, mountain-biking and riding trails, forests along long-distance paths	Buffer 10m of trails Panoramic places – 100 m	Only 1 rank – highly important

Multiple uses of trails (cycling, walking, horse riding, skiing, ATVs riding, motorcycling), panoramic trails, tourist routes to the Landscape Reserve are common for the strategic area. The shown biggest cycling route has the length of nearly 25 km and can be one of tourist attraction due to its significant sightseeing points, historical and cultural values (there some nice legends and mysteries stories that can be interesting for the potential tourists).

Picture 9 – Cycling route near the strategic area

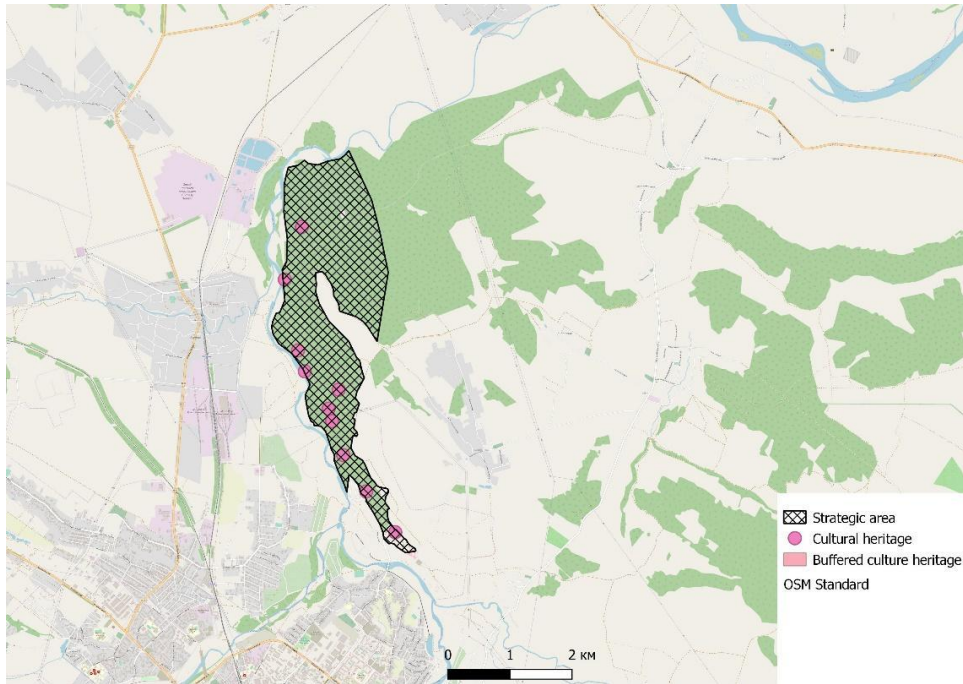Picture 10 – Buffer of cycling paths in the focus area

3.8. Cultural heritage

Group used the following criteria for mapping:

Table 8: Criteria for mapping cultural ES

ES considered	Criteria for mapping	Technical criteria for mapping	Ranking of ES importance*
43_Cultural heritage	Historical and cultural points of interests	Centroid 50-100 m around	Only 1 rank – highly important

Landscape Reserve of the national value "Kozakova Valley" and the complex nature monument of local importance "Vovchynets Hill" have historical and cultural value.

Picture 11 – Historical and cultural points of interests in the strategic area

3.9. Potential ES service

Group used the following criteria for mapping:

Table 9: Criteria for mapping cultural ES

| ES considered	Criteria for mapping	Technical criteria for mapping	Ranking of ES importance*
41_Recreation and tourism	Points of interests such as panoramic towers, entry points	The centroid of 100 m around the point	Only 1 rank – highly important
	Cycling recreational site	Polygon around with small buffer according to expert opinion	Only 1 rank – highly important
	Planned parking place	Polygon around with small buffer according to expert opinion	Only 1 rank – highly important
42_Scientific / educational	Forest teaching rooms, forest playgrounds	Polygon around with small buffer according to expert opinion	Only 1 rank – highly important

Additionally, four more ES services will be created within the project. Consequently, project activities include the improvement of focus area by installing equipment:

- Classroom in nature with forest playground and nature campsite for children
- Equipment for parking and a viewing-point platform
- Equipment for the recreational zone for the cycling community
- Information and education plates for visitors with markings for walking paths and cycling trails
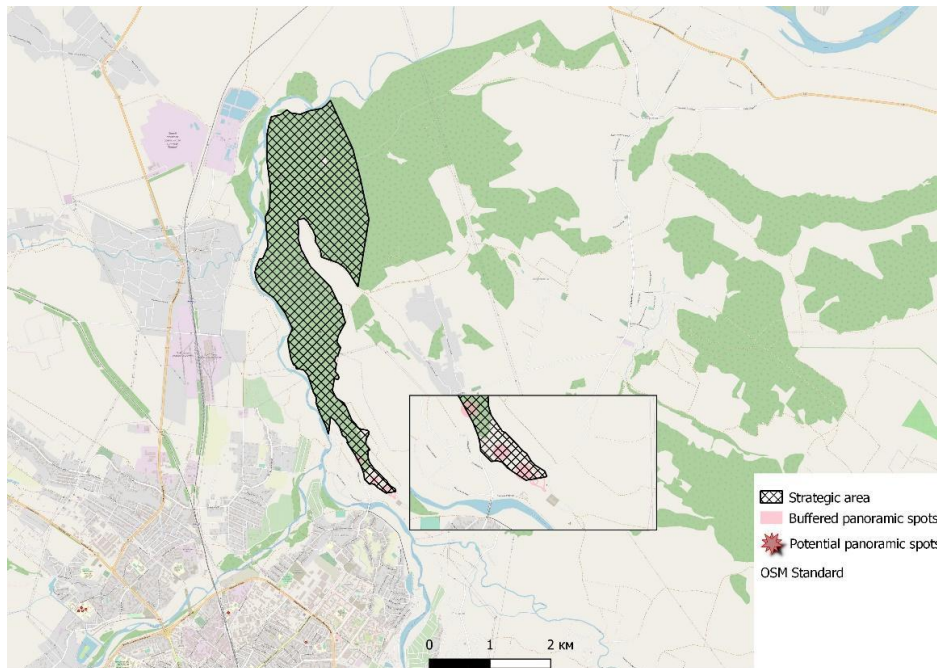- Tables with benches

On the map, the team marked the options for improvements on the locations proposed by participants of workshops.
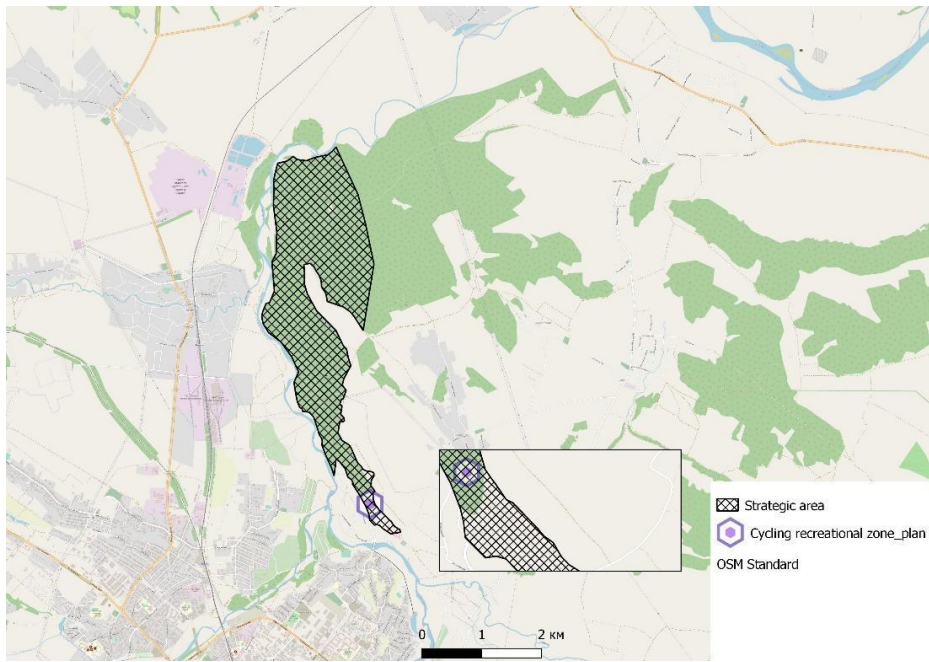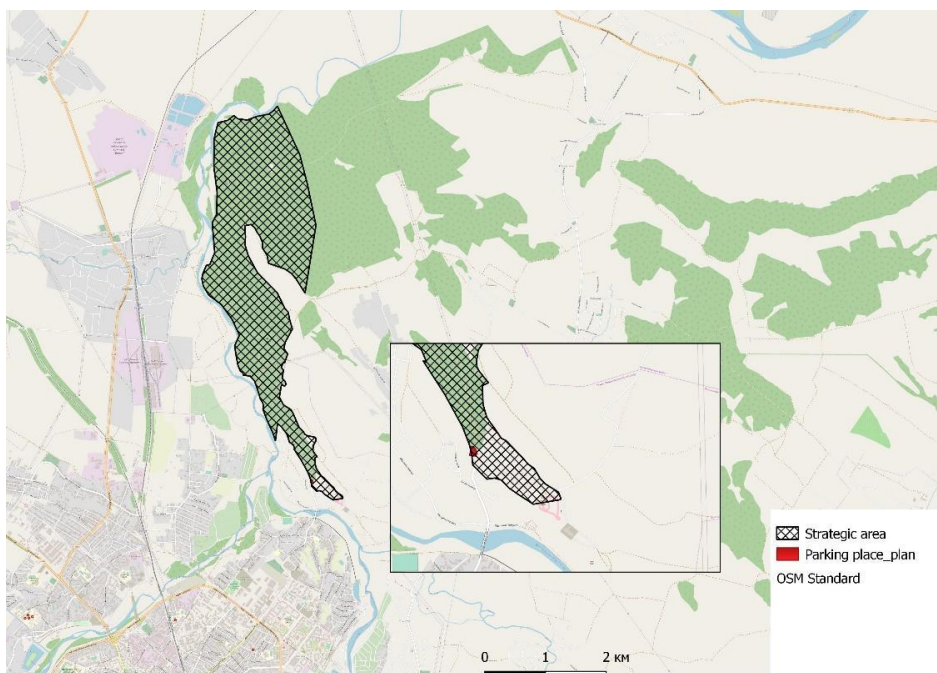
Picture 12 – Planned recreational site for cyclists on the focus area
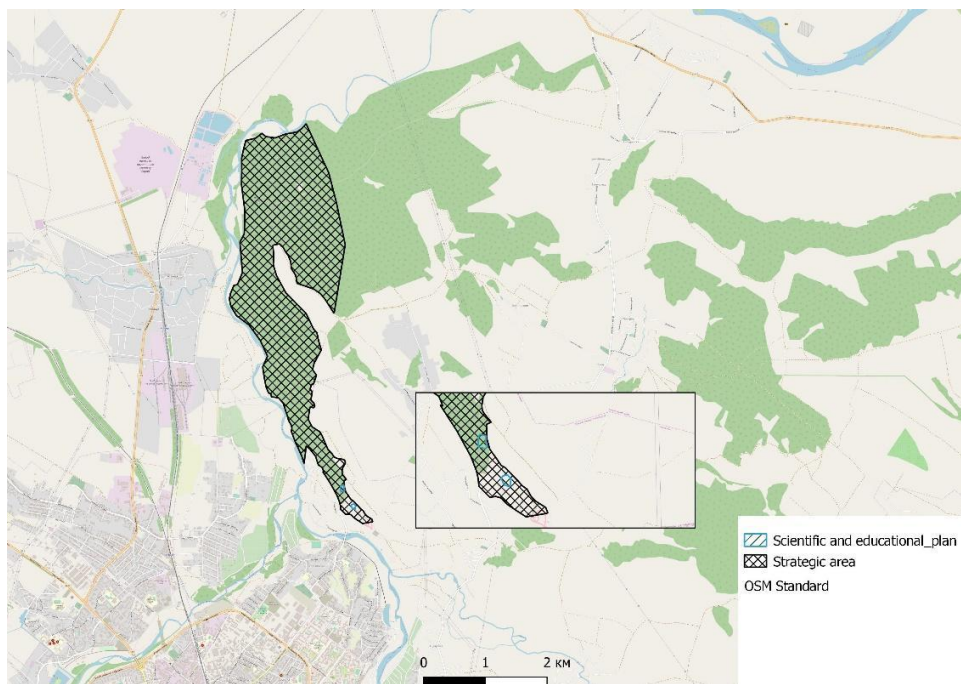
Picture 13 – Options for zones for the planned "open classroom" for kids on the focus area

Picture 14 –Options for zones for the planned observation deck on the focus area

Picture 15 – Option for parking zone and barrier on the focus area

4.   DISCUSSION

In conclusion, the team admitted that the highest multifunctionality of ES is observed in the focus area and areas close to the settlements. Nevertheless, due to the bad transport connections and lack of equipped trails, protection status of the largest part of the area, people use mostly project territory on the Vovchynets hill.

Thanks to the project four new ES service will attract new visitors. At the same time, a new risk of disturbing the protected area will appear. For sure, the project team with experts will find out solutions and recommendations for its minimizing during designing of Integrative Multifunctional Management Plan for the strategic area.

Obviously, the project team and group of experts faced problems as lack of data and maps and free GIS tools for Ukraine for ES mapping. Still, the participatory approach was very useful and communication led to good results.