RFCS RESEARCH PROJECT

Recovery of degraded and transformed ecosystems in coal mining-affected areas

847205-RECOVERY-RFCS-2018

Deliverable 2.9

Assessment of ecosystem services of Chabařovice Mine and Most-Ležáky Mine

European Commission

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Authors

Bc. Vít Kopecký, PKÚ, s. p.
Ing. Dana Prokešová, PKÚ, s. p.

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Executive Summary

Within the Deliverable 2.9, the assessment of ecosystem services of Chabařovice Mine and Most-Ležáky Mine is developed. The GIS aspect of CLC classes in Chabařovice and Most-Ležáky from Deliverable 2.4 was used as a basis.

After analysing CLC classes of the study area, five ecosystem services (at the level of classes) were selected as important/representative for Chabařovice Mine and Most-Ležáky Mine, with indication of the CICES V5.1 code. CICES (The Common International Classification of Ecosystem Services) seeks to classify final ecosystem services, which are defined as the contributions that ecosystems (i.e. living systems) make to human well-being, or the benefits people obtain from ecosystems. These services are final in that they are the outputs of ecosystems (whether natural, semi-natural or highly modified) that most directly affect the well-being of people.

As we selected the most important ES for both study areas, we found out that the selected ES for study areas is identical due to both study areas are in the same region, the methods and the main process of reclamation were same.

1 Introduction

Work Package Nº 2 focuses on mapping and assessing the ecosystems and their services of the project's case studies. Specific objectives are:

1. To identify the adequate boundaries of the different case studies based on existing spatial connectivity and functional cohesion for each coal mining-affected area.
2. To delineate, categorize and map the different ecosystems types of land covers in the study areas, according to CORINE Land Cover classes (Bossard, Feranec, & Otahel, 2000; Barbara, György, Gerard, & Stephan, 2017), although doing detailed field mapping at a higher resolution.
3. To assess the ecosystem services according to the Common International Classification of Ecosystem Services (CICES) V5.1 (Haines-Young & Potschin, 2018), in order to achieve standardization and to avoid any overlapping or redundancy within the different categories.
4. To implement a geographic information system (GIS) web interface for each-case study, allowing constructing user desired information thematic maps for viewing purposes.

As the typology of ecosystems and ecosystem services will provide the analytical frame for the project, in order to operationalize this work package, after Task 2.1 that was focused on the baseline mapping of relevant ecosystems, Task 2.2 will focus on the assessment of ecosystem services.

In order to achieve the higher degree of standardization and to avoid any overlapping or redundancy within the different categories, the hierarchical structure of the Common International Classification of Ecosystem Services (CICES) V5.1 will be used to assess the ecosystem services of each case study, that is "the benefits people obtain from ecosystems" (Millennium Ecosystem Assessment, 2005).

For each relevant land cover the three main section categories (provisioning services, regulating and maintenance services, and cultural services) will be considered, both biotic and abiotic, divided into main types of output or process (Division).

After that, the main types of output or process will be divided into group levels, according to the biological, physical or cultural type or process, and sub-divided into class categories, that are codified in CICES. Class types within class categories will allow to link ecosystem services with identifiable services, suggesting ways of measuring the associated ecosystem services output.

Deliverable 2.6 will undergo the assessment of ecosystem services of Figaredo Mine, property of HUNOSA (Spain).

2 Assessment of representative ecosystem services for Chabařovice Mine and Most-Ležáky Mine

Figure 2-1 presents the GIS aspect of CLC classes in Chabařovice, and Figure 2-2 presents CLC classes in Chabařovice over the Orthoimage of the area.

Figure 2-1. GIS presentation of CLC classes in Chabařovice mine

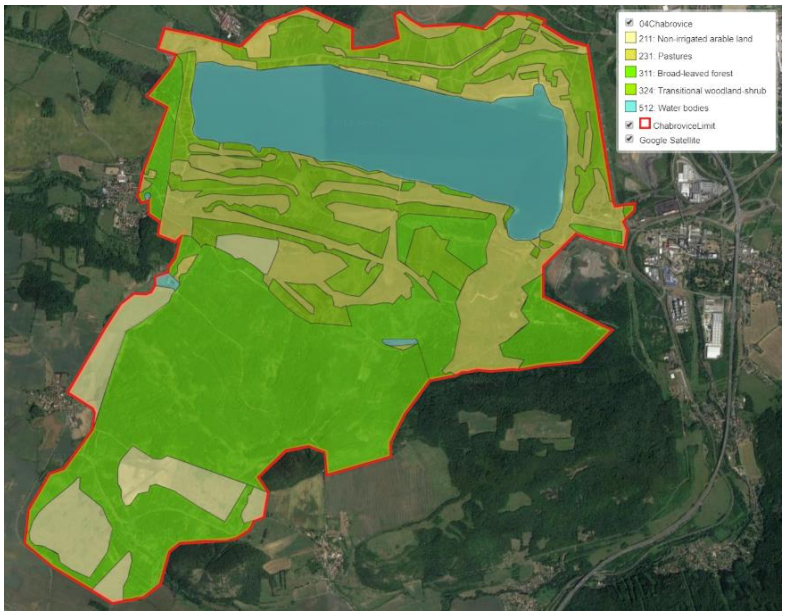

Figure 2-2. GIS presentation of CLC classes in Chabařovice over the orthoimage of the area

Figure 2-3 presents the spider graph of the CLC classes for Chabařovice mine, with a strong projection over the forest and semi natural areas.

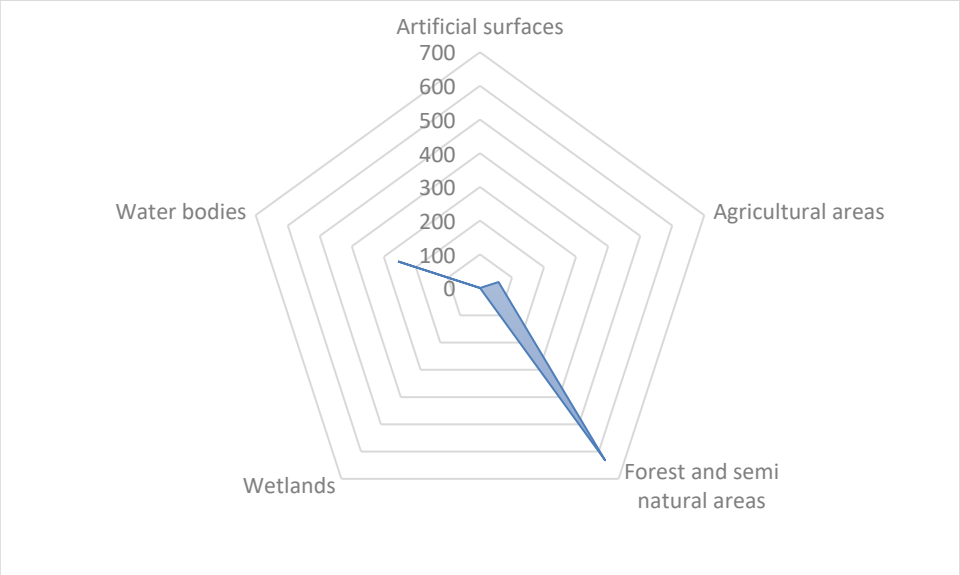

Figure 2-3. Spider graph of CLC classes for Chabařovice mine (ha)

Figure 2-4 presents the GIS aspect of CLC classes in Most-Ležáky, and Figure 2-5 presents CLC classes in Most-Ležáky over the Orthoimage of the area.

Figure 2-4 GIS presentation of CLC

Figure 2-5 GIS presentation of CLC classes in Most-Ležáky over the orthoimage of the area

Figure 2-6 presents the spider graph of the CLC classes for Most-Ležáky mine, with a strong projection over the forest and semi natural areas.

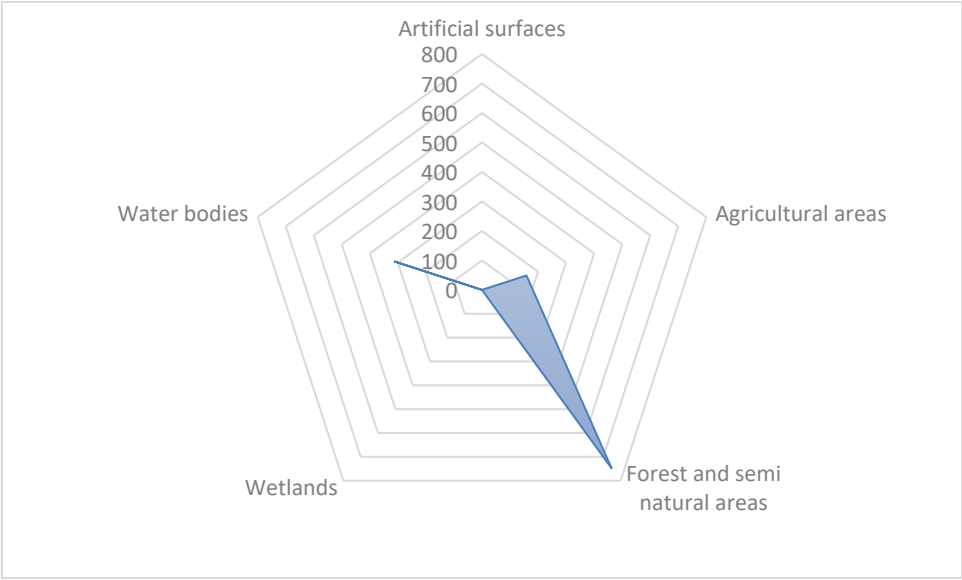

Figure 2-6 Spider graph of CLC classes for Most-Ležáky mine (ha)

After analysing CLC classes of the study area, as well as the topography, the following ecosystem services (at the level of classes) were selected as important/representative

for Chabařovice Mine and Most-Ležáky Mine, with indication of the CICES V5.1 code. As we selected the most important ES for both study areas, we found out that the selected ES for study areas are identical. It is not surprising because both study areas are in the same region, the methods of reclamation are same and the main process of reclamation was same.

2.1 PROVISIONING SERVICES: FOOD PROVISION

Food provision is delivered in the Chabařovice and Most-ležáky study areas only in Non-irrigated arable land.

- Class level: 1.1.1.1 Cultivated terrestrial plants (including fungi, algae) grown for nutritional puroposes
- ES indicator: Agricultural productivity of food crops
- Method: Ap=Area[$ha_{agricultural\ area}$]crop yield potential
- Reference:
  - ✓ Larondelle, N., Haase, D., 2012. Valuing post-mining landscapes using an ecosystem services approach - An example from Germany. Ecological Indicators 18: 567-574.

  https://doi.org/10.1016/j.ecolind.2012.01.008
- Valuation by direct methods (e.g. market prices).
- Sources of uncertainty:
  - ✓ Assessment: seasonal changes depending on weather conditions.
  - ✓ Valuation: changing market prices depending on demand /supply, elasticity of demand/supply, substitution, etc.

2.2 REGULATING SERVICES: EROSION RATES REGULATION

Control of erosion rates is delivered in the Chabařovice and Most-ležáky study areas by Broad-leaved forest and Transitional woodland/shrubs.

- Class level: 2.2.1.1 Control of erosion rates
- ES indicator: Area covered by vegetation (ha)
- Method: USLE (Universal Soil Loss Equation)
- Valuation by indirect methods (e.g. avoided damage cost, repair cost, replacement cost).
- Sources of uncertainty:
  - ✓ Assessment: Differing values in different climatic settings/conditions, Modelling assumptions (reduction of complexity at expense of exactness)
  - ✓ Valuation: Valuation is based on effects of lack of regulating service (assumptions of transformation, reduction of complexity of cause-effect relationships)

2.3 REGULATING SERVICES: CLIMATE REGULATION

Climate regulation is delivered in the Chabařovice and Most-ležáky study areas by Lake Most, Lake Milada, Broad-leaved forests, Transitional woodland/shrubs, Natural grasslands and Pastures.

- Class level: 2.2.6.2 Regulation of temperature and humidity, including ventilation and transpiration.
- ES indicator: Potential evapotranspiration
- Method: LST from Landsat Thermal and Surface Emissivity and fETP or water balance.
- References:
  - ✓ Schwarz, N., Bauer, A., & Haase, D. (2011). Assessing climate impacts of planning policies - An estimation for the urban region of Leipzig (Germany). Environmental Impact Assessment Review, 31(2), 97–111. https://doi.org/10.1016/j.eiar.2010.02.002
- Valuation by indirect methods (e.g. avoided damage cost, repair cost, replacement cost).
- Sources of uncertainty:
  - ✓ Assessment: Differing values in different climatic settings/conditions, Modelling assumptions (reduction of complexity at expense of exactness)
  - ✓ Valuation: Valuation is based on effects of lack of regulating service (assumptions of transformation, reduction of complexity of cause-effect relationships)

2.4 CULTURAL SERVICES: ENVIROMENT FOR SPORT AND RECREATION

The process of resocialization on the Chabařovice and Most-Ležáky study areas is in progress. There are many possibilities to do sports and relax. On the Lake Milada and in the suroundings the activities are possible for few years. For Lake Most and its surroundings should be open to the public in September 2020. That is why we selected this ES even for Most-Ležáky study area. Because it will be very important ES during the project RECOVERY realization.

- Class level: 3.1.1.1 Characteristics of living systems that enable activities promoting health, recuperation or enjoyment through active or immersive interactions
- ES indicator: Recreational areas
- Method: Recreational areas with the distances in a regular raster.
- Reference:
  - ✓ Handley, J., Pauleit, S., Slinn, P., Lindley, S., Baker, M., Barber, A., Jones, C., 2003. Providing Accessible Natural Green Space in Towns and Cities:

A Practical Guide to Assessing the Resource and Implementing Local Standards for Provision.
http://publications.naturalengland.org.uk/publication/65021

- ✓ Kabisch, N., Strohbach, M., Haase, D., Kronenberg, J., 2016. Urban green space availability in European cities. Ecological Indicators 70: 586-596.
https://doi.org/10.1016/j.ecolind.2016.02.029

- Valuation by indirect methods (e.g. stated or revealed preference, etc.).
- Sources of uncertainty:
  - ✓ Assessment: definition of ES is closely connected to cultural values.
  - ✓ Valuation: Valuation is based on cultural values, which are to certain, extend subjective, and based on the cultural background of the stakeholders.

2.5 CULTURAL SERVICES: USING NATURE TO DESTRESS

Chabařovice and Most-Ležáky study areas offer numerous species of animals and plants. Thanks to combination of lakes, transitional woodland/shrubs and forests, there many species of waterfowls, fishes, birds, mammals and amphibians.

- Class level: 3.1.1.2 Characteristics of living systems that enable activities promoting health, recuperation or enjoyment through passive or observational interactions
- ES indicator: Species diversity
- Method: Quantity of species and representatives
- Reference:
  - ✓ Lindemann-Matthias et al., 2010, The influence of plant diversity on people's perception and aesthetic appreciation of grassland vegetation.
https://doi.org/10.1016/j.biocon.2009.10.003
- Valuation by indirect methods (e.g. avoided damage cost, repair cost, replacement cost).
- Sources of uncertainty:
  - ✓ Assessment: definition of ES is closely connected to cultural values.
  - ✓ Valuation: Valuation is based on cultural values, which are to certain, extend subjective, and based on the cultural background of the stakeholders.

3 Conclusion

In deliverable 2.9 Assesment of ecosystem services of Chabařovice Mine and Most-Ležáky Mine there were used data collected in deliverable 2.4 Baseline mapping of relevant ecosystems of Chabařovice Mine and Most-Ležáky Mine. The hiearchical structure of Common International Classification of Ecosystem Services (CICES, 2018) V5.1 was used to assess the ecosystem services for the two case-studies mentioned above.

Ecosystem services are determinative way to show what nature is providing for us. We focused on to select the most important, most valuable ecosystem services for our study areas. Because the perspective, utilization and function of both study areas are the same, we came to conclusion to select five of the same ecosystem services for both study areas. The most important ecosystem services for our study areas are regulating and cultural. This is due to the purposes for which these areas were reclaimed, semi natural recreational areas. Regulating function is very important for the environment because the evapotranspiration from lakes is absorbed by green areas, mainly by forest. In addition, there is a temperature regulation delivering by the study areas. The created environment provide shelter for many species, increasing complexity of the area. On Chabařovice study area the resocialization is working as planned, especially in summer season, many tourists visit the site from surrounding municipalities and it is creating better human-nature relationship. Moreover, the same plan goes for Most-Ležáky study area, which will be opened this year to public. However, in both study areas is non-irrigated arable land, which can potentially expand.

4 Glossary

CICES - Common International Classification of Ecosystem Services

CLC - CORINE Land Cover

CORINE - Coordination of information on the environment

EEA - European Environment Agency

ES – Ecosystem Service

GIS - Geographic information system

SEEA - System of Environmental and Economic Accounting

PKÚ – Palivový kombinát Ústí, s. p.

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