Case study booklet for:
WORKSHOP 3: "Testing the methods across Europe" held in Prague, Czech Republic, 26-29 September 2016

(Picture by Miroslav Hátle)

Czech Republic Pilot National Assessment of ES

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ESMERALDA

Enhancing ES mapping for policy and decision making

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1.1. Case study factsheet and study area description

Pilot National Assessment of ES

WS3_cs2

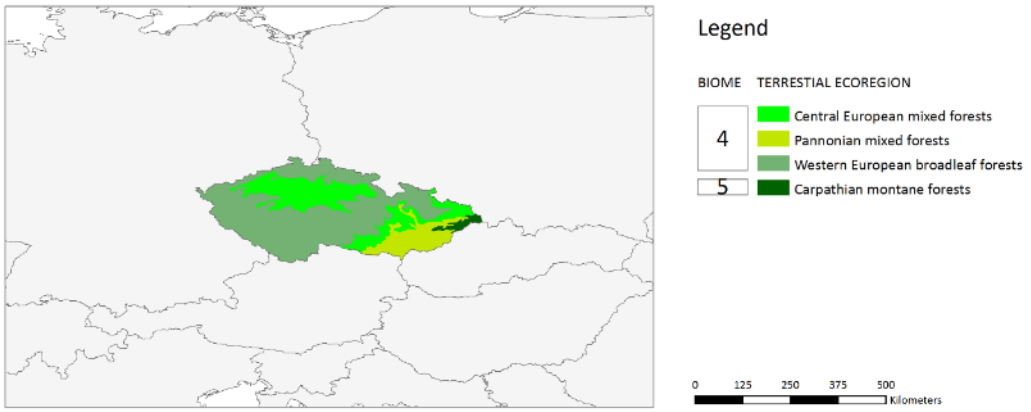
NAME AND LOCATION OF STUDY AREA	Czech Republic
COUNTRY	Czech Republic

STATUS OF MAES IMPLEMENTATION

Stage 1	Stage 2	Stage 3

BIOMES IN COUNTRY

1 Tropical & Subtropical Moist Broadleaf Forests	4 Temperate Broadleaf & Mixed Forests
5 Temperate Conifer Forests	6 Boreal Forests/Taiga
8 Temperate Grasslands, Savannas & Shrublands	11 Tundra
12 Mediterranean Forests, Woodlands & Scrub	13 Deserts and Xeric Shrublands
14 Mangrove	



case study outline

SCALE	national	sub-national	local
AREAL EXTENSION	78 866 km²		

THEMES

nature conservation	climate, water and energy	marine policy	natural risk
urban and spatial planning	green infrastructures	agriculture and forestry	business, industry and tourism
health	ES mapping and assessment		

ECOSYSTEM TYPES

urban	cropland	grassland	woodland and forest
heatland and shrub	sparsely vegetated land	wetlands	rivers and lakes
marine inlets and transitional waters	coastal	shelf	open ocean

Study area description

The study area incorporates the whole of the Czech Republic, an inland state located in central Europe (between latitudes 481 and 511N, and longitudes 121 and 191E) with an area of roughly 78,866 km^2 and 10.6 million inhabitants. Despite its relatively small size (compared to other European countries), the country has an exceptionally variable landscape providing a diversity of habitat types. According to the WWF classification, the following ecoregions are present: Western European broadleaf forests (85%), Carpathian montane conifer forests (9%), Pannonian mixed forests (4%) and Central European mixed forests (2%).

The climate is temperate continental with relatively high seasonal dynamics as well as great variation of temperature and precipitation depending on altitude. The long-term average annual precipitation is 689 mm, and average annual temperature is 7.5 °C. The country overlaps with three main river basins: the Elbe River (western part), the Oder River (northeastern part) and the Danube River (southeastern part). As shown in Figure 0.1, agricultural land use represents more than 53% of the total area of Czech Republic, followed by forests covering about 33%, water bodies and built-up areas (both about 2%) and other areas (9%). Protected areas cover almost 16% of the country.

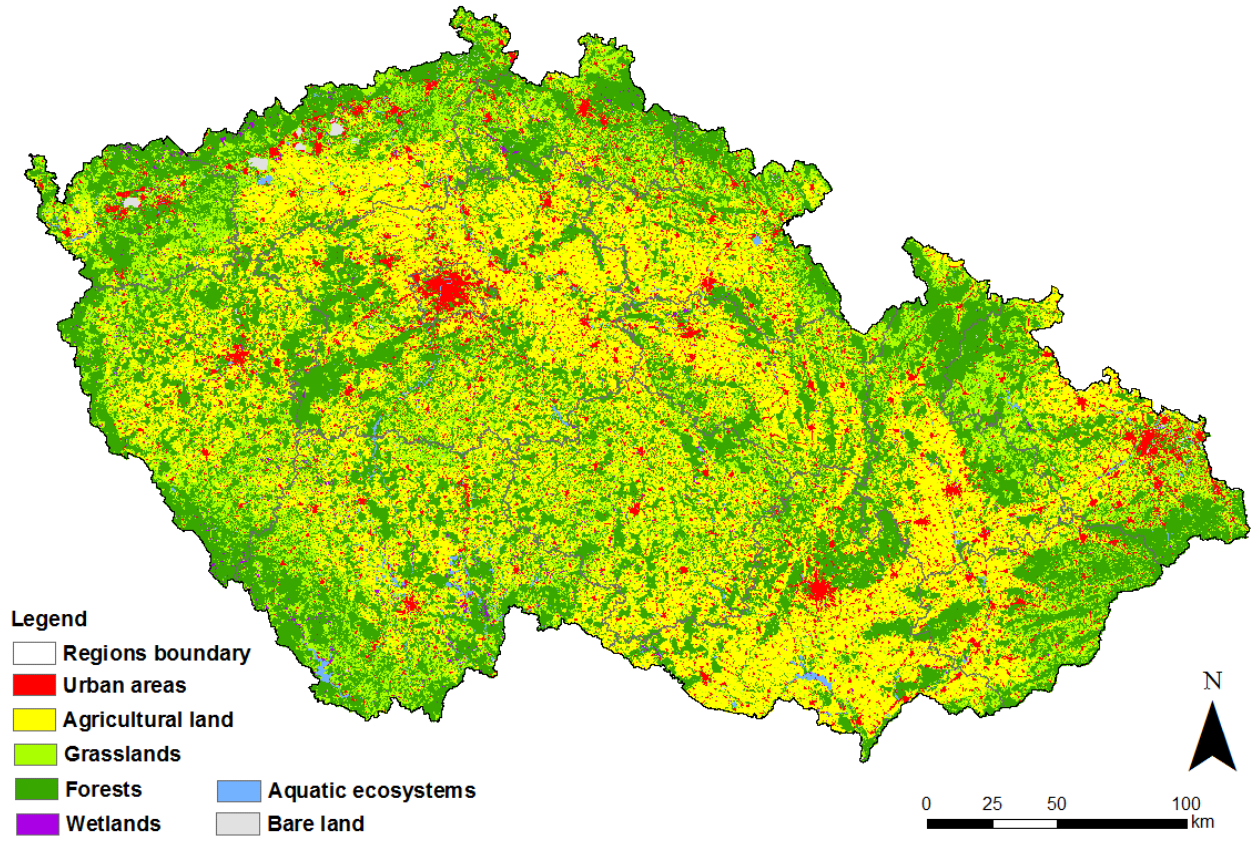


Figure 0.1. Land cover/use map of the Czech Republic (based on the Consolidated Layer of Ecosystems – see below for further source information)

1.2. Main policy question and theme

1.2.1. Objectives of ES mapping and assessment

This Czech pilot ES assessment and mapping followed the worldwide mainstreaming and establishment of global and sub-global assessments within the framework of the Millennium Ecosystem Assessment (MA) in order to substantially contribute to the knowledge on the state of the environment and the sustainable management of natural capital in the Czech Republic. Actual policy demand was driven mainly by the **Aichi Targets (Strategic Goal D) and the EU Biodiversity Strategy to 2020 (Action 5**), which focus on mapping and assessing the state of ecosystems and their services in the national territory, as well as streamlining ES into decision-making and national accounts. Therefore, meeting this goal required us to start with the completion of a national-scale mapping and assessment effort.

The objective of the pilot study was to map ecosystems within the territory of the country and assess the value of ES provided by nature in the Czech Republic. The economic valuation of ES was motivated by the objective to make the value of ES more visible and provide an initial estimate illustrating the importance of ES for society. This captured total value is also aimed to be included in national wealth and accounting, to further emphasize the benefits provided by ecosystems in the Czech Republic.

A preceding pilot study conducted for the government-based Nature Conservation Agency and the European Topic Centre on Biodiversity, focused on the benefits provided by grasslands in the Czech Republic. This is considered a complementary study where some of the methodological approaches were tested. The pilot assessment presented in this case study however, was the first inclusive assessment of ES provided by the diverse ecosystem types across the country.

Individual ES were identified and assessed. This was done with respect to local conditions, and applicable methodologies were prepared for both national and regional scales to further enable application into effective policy responses aimed at halting future ES degradation.

1.2.2. Role of stakeholders

Creating the main land cover GIS data layer (called the Consolidated Layer of Ecosystems of the Czech Republic, CLES) involved cooperation with the Nature Conservation Agency of the Czech Republic (AOPK ČR) (For more information see the link[1]). Overall, they provided insight and help in terms of habitat mapping, acquiring some of the national data and harmonization of different spatial land cover data in the initial phase of creating this GIS layer.

The Ministry of the Environment was also involved at a later stage. Their role was mainly in reviewing and certificating the final methodology for the wider and more detailed national assessment.

[1] http://www.ecosystemservices.cz/en/consolidated-layer-of-ecosystems-of-the-czech-republic

1.3. Ecosystem Types and Conditions

1.3.1. Identification and mapping of ecosystem type(s)

The Consolidated Layer of Ecosystems of the Czech Republic (CLES) was created, because existing spatial data sources were not suitable for national level assessment. As its main data source, the CLES used a Habitat Mapping Layer initially produced to provide Natura 2000 site identification. It was then further combined with Corine Land Cover 2006, Urban Atlas, the Czech ZABAGED data (Fundamental Base of Geographic Data) and other specific data on waters (DIBAVOD). The final polygon layer is therefore based on data from varying temporal resolutions. This approach enabled coverage of all different ecosystem/habitat types in the Czech Republic in order to have the complete picture for further value transfer (see Frélichová et al. 2014 for more information). The final layer consisted of 41 individual habitat categories at four hierarchical levels (See Table 0.2). The most general land cover categories consisted of agricultural land, grasslands, forests, urban areas, aquatic ecosystems and wetlands (e.g. Figure 0.2). Values for the evaluation were made first at the highest level and then for the lower land cover levels.

These ecosystems types were covered (according to ESMERALDA coding):

A.1. Urban ecosystems,	**A.3.** Grasslands,	**A.5.** Heathland,	**A.7.**Inland wetlands,
A.2. Croplands,	**A.4.** Woodlands,	**A.6.** Sparsely vegetated land,	**B.1.** Rivers and lakes

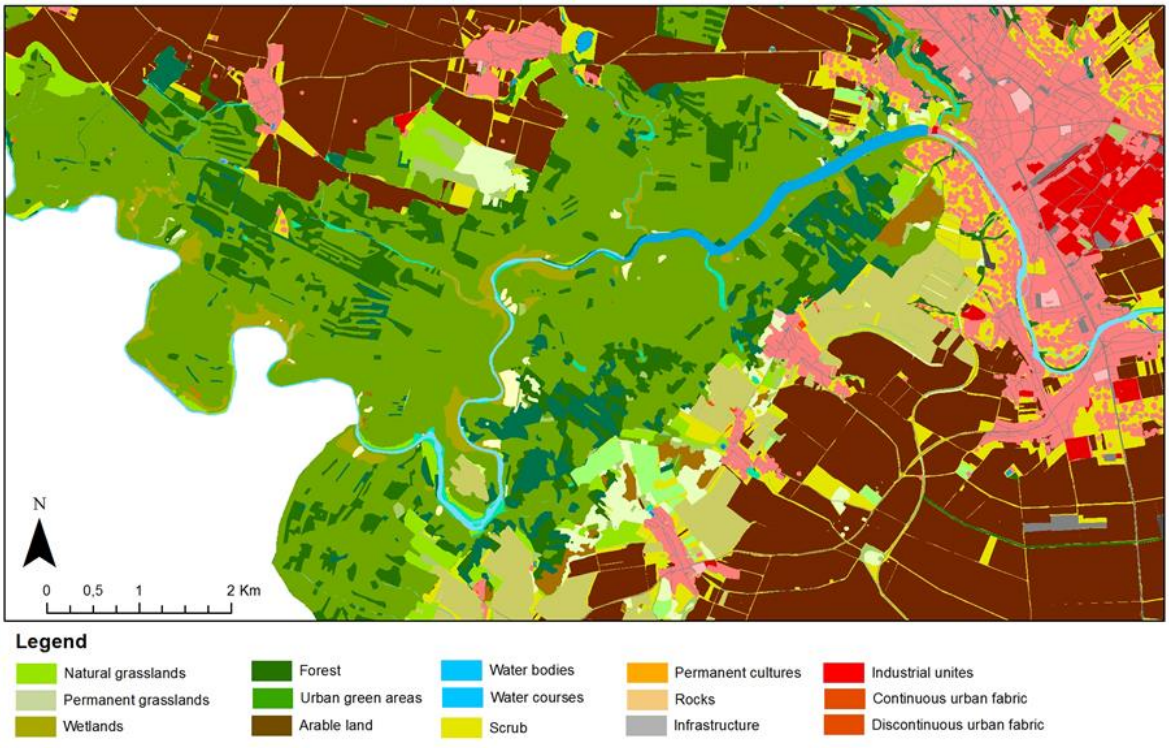


Figure 0.2. Example of consolidated layer of ecosystems for the national assessment and mapping of ES at the hierarchical level 4.

1.3.2. Assessment of ecosystem conditions

The ecosystem conditions were not assessed in this study.

1.4. Mapping and assessment of ES

1.4.1. Identification of ES

The ES were selected based on their relevance to the identified habitat categories, the significance of such services for people and a preliminary assumption that it is theoretically possible to acquire data for their quantification. More details are provided in Annex: Table 0.3. Supporting services were not included in the assessment, as they are assumed conditional for the availability of the other three types of services (de Groot et al., 2002; MA, 2005).

In relation to the aim of mapping all the services provided by ecosystems in the Czech Republic, the study and final assessment was limited by reliable data availability for the database and subsequent value transfer. For more details on the number of values in the database, see Annex: Table 0.4 and Table 0.5.

Table 0.1 shows the classification of ES according to the CICES, although the classification adopted within the MA (2005) was originally used in this case study.

Table 0.1. Overview of the ES and related mapping and assessment methods in the Czech Republic case study

Ecosystem Service selected for mapping and assessment	B	S	E
1.1.1.1 Cultivated crops			X
1.1.1.3 Wild plants, algae and their outputs			X
1.1.1.4 Wild animals and their outputs			X
1.1.2.1 Surface water for drinking*			X
1.1.2.2 Ground water for drinking			X
2.1.1.2 Filtration/sequestration/storage/accumulation by micro-organisms, algae, plants,			X
2.1.2.1 Filtration/sequestration/storage/accumulation by ecosystems	X		X
2.1.2.2 Dilution by atmosphere, freshwater and marine ecosystems			X
2.2.1.1 Mass stabilization and control of erosion rates	X		X
2.2.2.1 Hydrological cycle and water flow maintenance	X		X
2.2.2.2 Flood protection			X
2.3.1.1 Pollination and seed dispersal			X
2.3.4.1 Chemical condition of freshwaters			X
2.3.5.1 Global climate regulation by reduction of greenhouse gas concentrations*	X		X
2.3.5.2 Micro and regional climate regulation			X
3.1.2.4 Entertainment*	X		X
3.1.2.5 Aesthetic			X

* ES selected for further discussion during ESMERALDA workshops 3 in Prague
B = biophysical methods; S = socio-cultural methods; E = economic methods.

1.4.2. ES mapping and assessment: biophysical methods

Biophysical methods for mapping and assessment of ES were used in studies complementing the pilot national assessment, and represented Tier 2 and Tier 3 methods. For grassland ecosystems, the approach corresponded to the bookkeeping model developed for long-term carbon accounting for instance (e.g. see Hönigová et al., 2011). The final biophysical measure was a product of per unit intensity of the ES and

the total area of the ecosystems category where the service is provided. Data were up-scaled from a review of studies, transferred from available estimates or based on original calculations.

ES assessed biophysically included livestock provision capacity, carbon sequestration, erosion control, invasion regulation, water flow regulation, waste treatment and recreation/aesthetic quality.

For example, water regulation was mapped based on combined indicators and values of soil water holding capacity, slope and land cover/use (Figure 0.3). This was done in GIS by combining the layer of soil water holding capacity with slope and land cover data layers, which were reclassified based on their ability to retain water (relative scale).

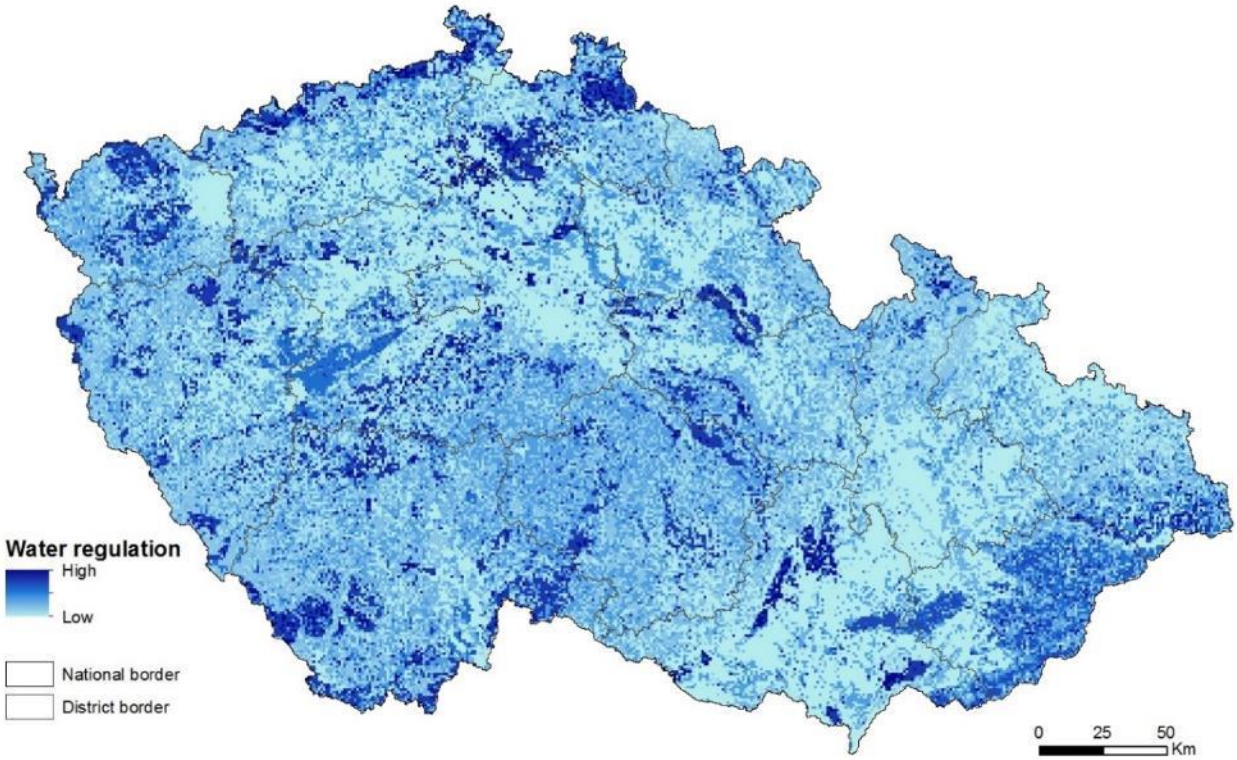


Figure 0.3. Map of water regulation potential based on biophysical mapping of soil water retention capacity.

The recreation was mapped using the ESTIMAP approach and the carbon sequestration by InVEST model based on the available data.

We also used the InVEST modelling suite to model some of the ES delivered across the Czech Republic, especially carbon storage. Other modules have been applied in regional case studies.

1.4.3. ES mapping and assessment: socio cultural methods

No socio-cultural mapping and assessment methods were applied in this case study

1.4.4. ES mapping and assessment: economic

The value transfer method was selected because of its time- and cost-effectiveness as well as the potential to substitute the primary data when specific data was not available. The methodological framework consisted of four individual steps: (1) systematic review of the literature, (2) database construction, (3) value transfer, (4) analysis and subsequent data interpretation (see Frélichová et al. 2014 for details).

The literature search was conducted in *Web of Science* and *Scopus* journal databases for a combination of keywords. Example for grassland land cover: "**Ecosystem service*** AND **valuation** AND **grassland***" and "**Ecosystem service*** AND **assessment** AND **grassland***". For other ecosystems the "grassland*" keyword was replaced by another topmost hierarchical land cover class. Documents published from 01/01/2000 to 31/12/2012 were considered. Google Scholar was checked as well, but with no additional results.

Criteria for data selection were defined similarly to those applied in the case of the ES Valuation Database (Van der Ploeg & de Groot, 2010). In order to ensure the applicability of the transferred data to Czech conditions, the intention was to ensure similarity in socio-economic factors by an application of these conditions. Because most of the studies selected for the transfer had been conducted in Europe (90%), we decided to narrow our initial geographical zone and focus on European studies only. As another criterion, studies needed to provide either original data or data properly referenced to the source. Another requirement was that studies needed to provide a biophysical or economic value of an ES with a reference to a particular ecosystem type/habitat.

Next, the basic value transfer was applied. Therefore, values were converted into common metrics and, in case of monetary values, were standardized to EUR per hectares per year using 2012 as the base year. Once the values were standardized, the average values of individual ES were estimated as well as a total value per hectare of selected ecosystems. In addition, a matrix of ES were assembled to see expected services in particular ecosystem types. A total value per hectare of ecosystem was counted as a sum of the means of available services values. Next, the values of all Czech ecosystems were generated by attributing total values to each individual land use. For more details, see Annex: Table 0.6.

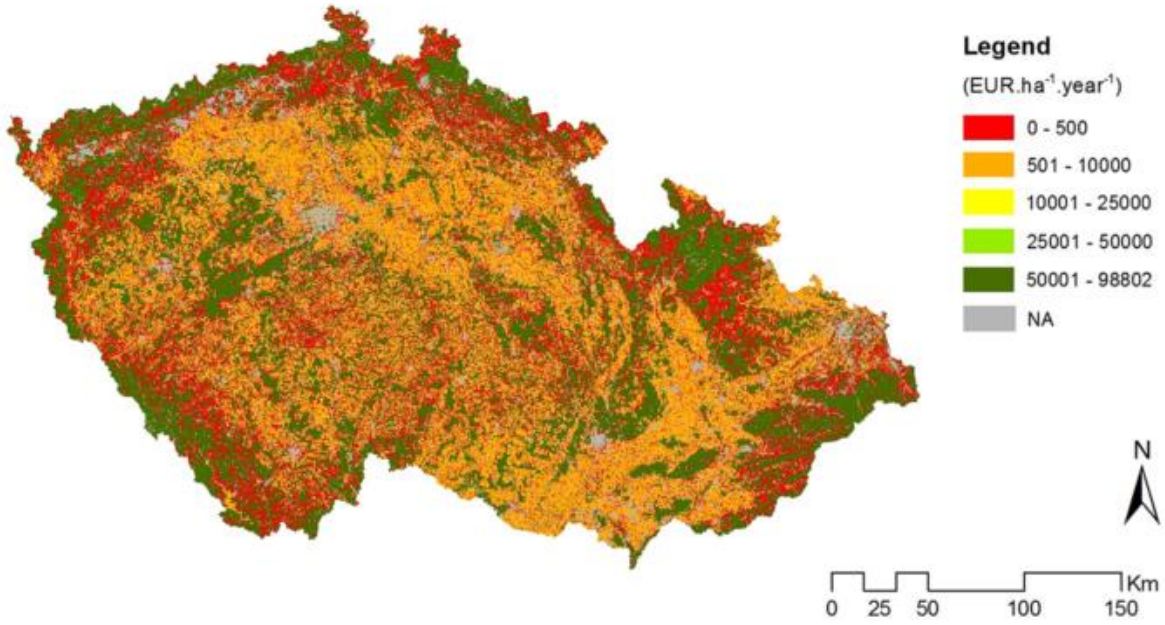


Figure 0.4. Final valuation map of ES in the Czech Republic.

1.5. Use and integration of ES mapping and assessment results

1.5.1. Addressing the policy question

The results of the assessment have not yet been integrated within socio-economic system components. However, there is an ongoing project on the development and testing of environmental accounting in the Czech Republic led by CzechGlobe, which aims to develop experimental pilot ecosystem accounts based on the results from this assessment. We envision this project will provide the opportunity to integrate the results of this assessment as a means of real-life application.

The pilot study also served as an initiation for the discussion on conducting National Ecosystem Assessment in the Czech Republic.

1.5.2. Results communication and dissemination

Communication and dissemination of results were made through regular meetings with the Nature Conservation Agency of the Czech Republic and the Ministry of Environment, from the start of project implementation until its completion. At the end of the process, a summarizing article was also published for a Czech scientific journal, Nature Protection, as well as another paper published in the international journal, ES. The resulting Consolidated Layer of Ecosystems with ecosystems services values and methodology are also available online through a web-based map application (http://envisec.cenia.cz) and website (www.ecosystemservices.cz). Results of the study, especially the Consolidated Layer of Ecosystems, have been distributed by the Nature Conservation Agency and are available for all interested partners.

In general, however, the ES concept is still not widely used and valued among the majority of policy-makers, beneficiaries and practitioners in the Czech Republic, so further dissemination and communication would be recommended.

1.6. References & Annexes

Reference

*De Groot R.S, Wilson M.A, Boumans R.M.J. (2002) A typology for the classification, description and valuation of ES, goods and services. Ecol. Econ, **41** (2002), pp. 393–408*

*Frélichová J, Vackar D, Partl A, Louckova B, Harmackova Z, Lorencova E (2014) Integrated assessment of ES in the Czech Republic, ES **8**:110-117*

Millennium Ecosystem Assessment, 2005. Ecosystems and Human Well-Being: A Framework for Assessment. Report of the Conceptual Framework WG of the Millennium Ecosystem Assessment. Island Press, Washington, DC.

Van der Ploeg, S. and R.S. de Groot (2010) The TEEB Valuation Database – a searchable database of 1310 estimates of monetary values of ES. Foundation for Sustainable Development, Wageningen, The Netherlands.

Annexes

Additional information based on the article by Frelichova J. et al., (2014).

Table 0.2. Hierarchical classification of the Consolidated Layer of Ecosystems

Level 1	Level 2	Level 3	Level 4
Urban areas	Continuous urban fabric	Continuous urban fabric	Continuous urban fabric
	Discontinuous urban fabric	Discontinuous urban fabric	Discontinuous urban fabric
	Industrial and commercial	Industrial and commercial units	Industrial and commercial units
	Transport units	Transport units	Transport units
	Dump and construction units	Dump and construction units	Dump and construction units
	Green urban areas	Natural urban green areas	Urban nature
		Artificial urban green areas	Parks, gardens, cemeteries
			Recreation and sport areas
Agricultural land	Arable land	Arable land	Arable land
	Permanent cultures	Orchards and gardens	Orchards and gardens
		Hop fields	Hop fields
		Vineyards	Vineyards
	Permanent grasslands	Intensive grasslands	Intensive grasslands
Grasslands	Natural grasslands	Natural meadows	Alluvial meadows
			Dry grasslands
			Mesic meadows
			Alpine grasslands
			Heaths
Forests	Forested areas	Intensive forests	Intensive mixed forests
			Intensive broad-leaved forests
			Intensive coniferous forests
		Natural forests	Alluvial forests
			Oak and oak-hornbeam forests
			Ravine forests
			Beech forests
			Dry pine forests
			Spruce forests
			Bog forests
	Scrub	Areas with no forest cover naturally	Natural *Pinus mugo* scrub
		Areas with introduced no forest cover	Introduced *Pinus mugo* scrub
			Introduced shrub vegetation
Wetlands	Wetlands	Natural wetlands	Wetlands and litoral vegetation
		Natural peatbogs	Peatbogs and springs
		Anthropogenic swamps	Swamps
Aquatic ecosystems	Water bodies	Natural water bodies	Lakes
		Anthropogenic water bodies	Ponds
	Water courses	Natural water courses	Natural water courses
		Anthropogenically influenced water	Anthropogenically influenced water

Table 0.3. An overview of ES in the scope of the study

Service	Services	Ecosystem	Valuation methods	
			Biophysical	Economic
Provisioning	Crop	A		NP
	Biomass	A, F, G, W, WET	Modeling productivity	DMP, NVA
	Fish	W, WET	No. of professional fishermen	MA, DMP, NVA
	Game	F	Gross animal weight	DMP
	Non-timber	F	Non-timber production	DMP
	Timber	F	Timber production	DMP, LEV
	Water	W, WET	Extraction, infiltration	AC, CV, MA, NVA
Regulating	Air quality	F	Average dry deposition of PM_{10}	AC
	Climate	A, F, G, U, WET	Carbon sequestration	AC, BT, CV, ET, MAC, DMP, SCC
	Disturbance	W, WET	-	DC, CV
	Erosion	A, F, G, WET	Model of erosion risk control,	AC, BT, MA, RC
	Nutrient	A, G, W, WET	Review	BT
	Pest control	A, F, G, WET	-	BT, CV
	Pollination	A	-	BT, IPEV
	Water cycle	A, F, G, U, WET	Run-off, modelling	AC, BT, MA, RC
	Water quality	G, F, WET	Review	AC, BT, CV, MA, PES, RC
Cultural	Aesthetic	A, F, W, WET	-	BT, PV, CV, MA
	Recreation	A, F, G, U, W, WET	No. of visitors/visits	BT, CPS, DV, DMP, FI, MA, MAC, NVA, TCM

Acronyms for ecosystems: A – agricultural, F – forests, G – grasslands, U – urban, W – water, WET – wetlands.
Acronyms for the valuation methods: AC – avoided costs, BT – benefit transfer, CV – contingent valuation, ET – emission trading scheme, IPEV – insect pollination economic value, LEV – land expectation value, MA – meta-analysis, MAC – marginal abatement costs, DMP – direst market pricing, NP – net production, NVA – net value added, SCC – social costs of carbon, DC – damage costs, RC – replacement costs, PES – payment for ES, PV – property value, CPS – consumer and producer surplus, TCM – travel cost.

Table 0.4. An overview of data used within the database

	Total no. of records	No. of standardized values (per hectare)	Character of values
Biophysical values	55	51	-
Economic values	142	121	Strong values: 102 Weak values: 19 ESVD values: 40

Table 0.5. Frequency of valuation records according to ecosystem types and ES categories in the final database for value transfer

Ecosystem type	Biophysical values	Economic values
Agricultural	16	30
Forests	19	45
Grasslands	4	9
Urban	2	4
Aquatic	6	9
Wetlands	8	45
Ecosystem Services		
Provisioning	9	24
Regulating	42	72
Cultural	4	46

Table 0.6. Final ES values employed

Ecosystem Service category	Service	Average value (in EUR per ha)
Provisioning	Biomass provision	421.39
	Fish provision	107.54
	Game provision	9.91
	Non-timber provision	57.23
	Timber provision	6912.09
	Water provision	32.43
Regulating	Air quality regulation	266.33
	Climate regulation	4015.78
	Disturbance regulation	8456.19
	Erosion regulation	5766.57
	Nutrient regulation	200.10
	Pest control	7.31
	Pollination	1378.76
	Water cycle regulation	1373.14
	Water quality regulation	1210.67
Cultural	Aesthetic value	5971.94
	Recreation	2190.52