

Environmental Information Centre UNEP/GRID-Warsaw

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Mapping and assessment of ecosystems and their services in Poland

SYNTHESIS

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Summary

The expert report being the subject of this work, i.e. **Mapping and assessment of ecosystems and their services in Poland** fits within mainstream activities compatible with the *EU Biodiversity Strategy to 2020* and the national *Programme for conservation and sustainable use of biological diversity*.

The goal of this work was adaptation to national conditions of recommendations included in the European Environment Agency (EEA) report entitled **Mapping and Assessment of Ecosystems and their Services (2013, 2014)**, as well as in **Common International Classification of Ecosystem Services (CICES ver. 4.3)**. The executors were thereby commissioned to use in their work methodology elaborated pursuant to EEA initiatives (EC, MAES WG 2013, 2014) for the purpose of mapping and assessment of ecosystems and their services:

- Common International Classification of Ecosystem Services (CICES 4.3 - Haines-Young, Potschin 2013),
- ecosystem typology elaborated by EUNIS (European Nature Information System).

Except the recommendations listed above, taken into account was also diversification of categories and characteristics of ecosystems with respect to their components and both biotic and abiotic elements and in relation to eco-landscapes zones, physiogeographical regions, and administrative division. Therefore, the scope of this work comprises:

- transposition to the national scale of EU guidelines related to recommended approaches to ecosystem typology and mapping, with consideration to available source data;
- cross-relating ecosystem typology with adopted classification of ecosystem services (CICES);
- selection of indicators characterizing potential of ecosystems to deliver ecosystem services and level of this delivery (production, supply).

This work did not entail valuation of ecosystem services, but assessment of ecosystems and their services do take into account aspects related to their future potential valuation.

Work was carried out using GIS (geographic information systems) tools and methods, in particular multi-criterial analyses of available spatial data, as well as statistical and descriptive data.

The work was divided into the following stages:

- 1) analysis of **land cover forms** defined according to CORINE Land Cover (CLC level 3) classification with respect to their occurrence on the territory of Poland;
- 2) defining **types of ecosystems** occurring in Poland based on EUNIS ecosystem classification at level 2 and 3;
- 3) defining and delimiting of the **basic assessment unit (BAU)**: basic typological unit representing a given ecosystem type (defined based on EUNIS classification) and taking into account land cover features (according to CLC). The BAU is simultaneously the basic spatial operational unit for detailed analyses, including assessment of ecosystem services based on thematic data;
- 4) elaboration, based on adopted ecosystem typology and on CICES v. 4.3 adapted to national conditions, a characteristic (for a given ecosystem type) **set of ecosystem services**:
 - division into basic groups of services: provisioning – regulating and maintenance – cultural;

- assessment of potential of respective types of ecosystems to deliver respective ecosystem services in a 5-point scale (plus a zero – for services absent or insignificant in a given ecosystem type).

The above activities took into account guidelines and recommendations included in *Mapping and Assessment of Ecosystems and their Services - An analytical framework for ecosystem assessments under Action 5 of the EU Biodiversity Strategy to 2020 (Discussion paper - Final, April 2013)* as well as *Mapping and Assessment of Ecosystems and their Services - Indicators for ecosystem assessments under Action 5 of the EU Biodiversity Strategy to 2020 (2nd Report - Final, February 2014)*, *Developing conceptual framework for ecosystem mapping "Draft internal Report" (July 2014)* as well as in other documents, scientific and expert reports, included in Bibliography at the end of the main, full-version of this report.

Resulting from the above stage of work is the 2-dimensional **matrix of ecosystem services**, presenting ecosystem services in the arrangement proposed based on CICES 4.3 and related to the adopted ecosystem typology. One axis of the matrix contains types of ecosystems occurring in Poland (defined based on EUNIS classification) and taking into account the additional parameter of land cover CLC class at level 3 (so, in fact these are basic typological units, or BAU's), while the other axis contains sets of ecosystem services attributed to these ecosystems. At crossings, potential of respective types of ecosystems to deliver respective ecosystem services was characterized by ranks ranging from 0 to 5.

- 5) selection of indicators enabling characterization and quantification of respective services within the defined sets of ecosystem services;
- 6) conducting **selected detailed analyses** aiming at characterization of:
 - a) state of an ecosystems;
 - b) connectivity of ecosystems;
 - c) potential of ecosystems to provide specific ecosystem services, and their actual delivery.

The basis for such detailed analyses were available resources of auxiliary thematic data for a given area, such as hydrographic data, protected areas, data on natural habitats, selected environment monitoring data, etc. – which, according to the recommended methodology, can be merged with CLC data and related to plots of defined ecosystem types (that is, the BAU's), or whole physiogeographical regions, or administration units (communes).

Obviously, the ultimate scope of used data was dependent upon national contingencies determining their availability in both formal and in technical or thematic aspect (continuous coverage of the country's area, appropriate scale/resolution, up-to-dateness, temporal and thematic scope, spatial correctness, etc.). Availability and quality of data is of paramount significance in practical implementation of results of this work. Acquisition of thematic data (detailed list – including sources and copyright information – can be found in the main, full version of this report) was an extremely important element and time-consuming stage of the work.

This expert assessment produced the following outputs:

1) **Spatial database of basic assessment units (BAU)**

The database is elaborated at the resolution corresponding to scale 1:100 000. The thematic contents of the database includes:

- a) information on types of ecosystems according to the classification adopted in this assignment and based on EUNIS level 2,
- b) characteristics of BAU's related to the relief, land cover, tree density, impermeable surfaces and meso-regions according to physio-geographical regionalisation by J. Kondracki.

2) **Map of ecosystem types** at the scale 1 : 2 500 000 showing spatial differentiation of ecosystem types in Poland. This is a visualization elaborated based on the spatial database of basic assessment units.

3) **Matrix of ecosystem services** – containing list of types of ecosystems and attributed sets of ecosystem services along with ranks (in the scale from 0 to 5) of potential of respective ecosystem types to deliver specific services.

4) **Spatial database of ecosystem service assessment** containing information on ecosystem services: their spatial distribution, potential of respective ecosystems to their delivery, as well as selected assessment indicators, related to basic assessment units (BAU's) and to communes: basic units of the country's administrative division.

5) **Maps of ecosystem service assessment** at the scale 1 : 2 500 000 presenting spatial differentiation of potential to deliver ecosystem services (according to the matrix of ecosystem services) as well as an assessment of these services carried out by calculating values of selected indicators divided into indicators of potential to deliver a given service, and indicators of production and delivery of goods and services.

6) **The final expert report** (including this Synthesis) in printed and digital versions.

Results

1. Types of ecosystems occurring in Poland

Ecosystem typology adopted for the purpose of this assignment is based on EUNIS typology. It was adapted to the Polish conditions a.o. by taking into account data on land cover (land cover classes according to CLC level 3).

The following table demonstrates typology of ecosystems in Poland based on EUNIS, with additional differentiation resulting from taking into account land cover (CLC level 3). This differentiation is the basis for determination of the basic assessment unit (BAU).

No.	BAU CODE	Ecosystem type in Poland CODE (based on EUNIS lev. 2)	Ecosystem type in Poland NAME	EUNIS level 2 CODE	EUNIS level 2 NAME	EUNIS level 3 CODE	EUNIS level 3 NAME	CLC-3 CODE	CLC-3 NAME
1	B1.331	B1	Coastal dunes and sandy shores	B1	Coastal dunes and sandy shores			331	Beaches, dunes, and sand plains
2	C1.512	C1	Surface standing waters	C1	Surface standing waters			512	Water bodies
3	C2.511	C2	Surface running waters	C2	Surface running waters			511	Water courses
4	C3.331	C3	Littoral zone of inland surface waterbodies	C3	Littoral zone of inland surface waterbodies	C3.5	Littoral zone of inland surface running waters	331	Beaches, dunes, and sand plains
5	D1.411	D1	Raised and blanket bogs	D1	Raised and blanket bogs			411	Inland marshes
6	D1.412							412	Peatbogs
7	D2.411	D2	Valley mires, poor fens and transition mires	D2	Valley mires, poor fens and transition mires			411	Inland marshes
8	D2.412							412	Peatbogs
9	D4.411	D4	Base-rich fens and calcareous spring mires	D4	Base-rich fens and calcareous spring mires			411	Inland marshes
10	D4.412							412	Peatbogs
11	D5.411	D5	Sedge and reedbeds, normally without free-standing water	D5	Sedge and reedbeds, normally without free-standing water			411	Inland marshes
12	D5.412							412	Peatbogs

13	D6.231	D6	Inland saline and brackish marshes and reedbeds	D6	Inland saline and brackish marshes and reedbeds	D6.1	Inland saltmarshes	231	Pastures
14	D6.411					D6.2	Inland saline and brackish reedbeds	411	Inland marshes
15	E1.321	E1	Dry grasslands	E1	Dry grasslands			321	Natural grassland
16	E1.333							333	Sparsely vegetated areas
17	E2.231	E2	Mesic grasslands	E2	Mesic grasslands			231	Pastures
18	E3.231	E3	Seasonally wet and wet grasslands	E3	Seasonally wet and wet grasslands			231	Pastures
19	E4.321	E4	Alpine and subalpine grasslands	E4	Alpine and subalpine grasslands			321	Natural grassland
20	E4.333							333	Sparsely vegetated areas
21	F2.322	F2	Arctic, alpine and subalpine scrub	F2	Arctic, alpine and subalpine scrub			322	Moors and heathland
22	F4.322	F4	Temperate shrub heathland	F4	Temperate shrub heathland			322	Moors and heathland
23	G1.222	G1.D	Fruit and nut tree orchards	G1	Broadleaved deciduous woodland	G1.D	Fruit and nut tree orchards	222	Fruit trees and berry plantations
24	G1.311	G1	Broadleaved deciduous woodland					311	Broad-leaved forest
25	G1.311.SW	G1.SW	Mesic broadleaved deciduous woodland					311	Broad-leaved forest
26	G1.311.W	G1.W	Wet broadleaved deciduous woodland					311	Broad-leaved forest
27	G1.311.B	G1.B	Swamp broadleaved deciduous woodland					311	Broad-leaved forest

28	G3.312	G3	Coniferous woodland	G3	Coniferous woodland			312	Coniferous forest
29	G3.312.S	G3.S	Dry coniferous woodland					312	Coniferous forest
30	G3.312.SW	G3.SW	Mesic coniferous woodland					312	Coniferous forest
31	G3.312.W	G3.W	Wet coniferous woodland					312	Coniferous forest
32	G3.312.B	G3.B	Swamp coniferous woodland					312	Coniferous forest
33	G4.313	G4	Mixed deciduous and coniferous woodland	G4	Mixed deciduous and coniferous woodland			313	Mixed forest
34	G4.313.S	G4.S	Dry mixed deciduous and coniferous woodland					313	Mixed forest
35	G4.313.SW	G4.SW	Mesic mixed deciduous and coniferous woodland					313	Mixed forest
36	G4.313.W	G4.W	Wet mixed deciduous and coniferous woodland					313	Mixed forest
37	G4.313.B	G4.B	Swamp mixed deciduous and coniferous woodland					313	Mixed forest
38	G5.324	G5	Lines of trees, small anthropogenic woodlands, recently felled woodland, early-stage woodland and coppice	G5	Lines of trees, small anthropogenic woodlands, recently felled woodland, early-stage woodland and coppice			324	Transitional woodland shrub
39	H2.332	H2	Screes	H2	Screes			332	Bare rock
40	H5.331	H5	Miscellaneous inland habitats with very sparse or no vegetation	H5	Miscellaneous inland habitats with very sparse or no vegetation			331	Beaches, dunes, and sand plains
41	H5.333							333	Sparsely vegetated areas
42	I1.211	I1.AW	Large surface arable land	I1	Arable land and market gardens			211	Non-irrigated arable land
43	I1.243	I1.AM	Mosaic arable land					243	Land principally occupied by agriculture, with significant areas of natural vegetation

44	J1.111	J1	Buildings of cities, towns and villages (high density)	J1	Buildings of cities, towns and villages (high density)	J1.1	Residential buildings of city and town centres	111	Continuous urban fabric
45	J1.112					J1.2	Residential buildings of villages and urban peripheries	112	Discontinuous urban fabric
46	J1.121					J1.4	Urban and suburban industrial and commercial sites still in active use	121	Industrial or commercial units
47	J2.112	J2	Low density buildings (in cities, towns, villages)	J2	Low density buildings (in cities, towns, villages)	J2.1	Scattered residential buildings	112	Discontinuous urban fabric
48	J2.121					J2.3	Rural industrial and commercial sites still in active use	121	Industrial or commercial units
49	J2.133					J2.7	Construction and demolition sites	133	Construction sites
50	J2.242					J2.4	Agricultural constructions	242	Complex cultivation patterns
51	J3.131.G	J3.G	Extractive industrial sites – large strip (open-pit) mines (brown coal)	J3	Extractive industrial sites			131	Mineral extraction sites
52	J3.131.P	J3.P	Extractive industrial sites - remaining					131	Mineral extraction sites

53	J4.122	J4	Transport networks and other constructed hard-surfaced areas	J4	Transport networks and other constructed hard-surfaced areas	J4.2	Road networks	122	Road and rail networks and associated land
54	J4.123					J4.5	Hard-surfaced areas of ports	123	Port areas
55	J4.124					J4.4	Airport runways and aprons	124	Airports
56	J5.511.C	J5.C	Artificial running waters (canals)	J5	Highly artificial man-made waters and associated structures	J5.4	Highly artificial non-saline running waters	511	Water courses
57	J5.512.S	J5.S	Artificial standing waters – aquaculture ponds			J5.3	Highly artificial non-saline standing waters	512	Water bodies
58	J5.512.ZZ	J5.ZZ	Artificial standing waters – dammed reservoirs			512		Water bodies	
59	J5.512.ZP	J5.ZP	Remaining artificial standing waters (mainly industrial ponds)			512		Water bodies	
60	J6.132	J6	Waste deposits	J6	Waste deposits			132	Dump sites
61	X03.521	X03	Brackish coastal lagoons	X03	Brackish coastal lagoons			521	Coastal lagoons
62	X11.141	X11	Large parks	X11	Large parks			141	Green urban areas
63	X24.142	X24	Domestic gardens of city and town centres	X24	Domestic gardens of city and town centres			142	Sport and leisure facilities

2. Delimitation of basic assessment units

Basic assessment unit (BAU) is the basic typological unit being a combination of: (a) ecosystem type defined according to EUNIS classification, and (b) land cover class (according to CLC level 3). The BAU delimitation also took into account additional detailed thematic data characterizing habitat parameters (or allowing for indirect inference about them).

Technical background of BAU delimitation:

- scale 1:100 000
- minimal mapping unit:
 - natural and semi-natural non-forested areas (meadows, pastures, wetlands, dunes and sands, sparsely vegetated areas) – **10 ha**
 - remaining areas (e.g. high density buildings, industrial areas and transport networks, arable lands, forests) – **25 ha**
 - minimum width of the spatial unit – approx. 100 m (ok. 1 mm at the map scale).

The map included in this work presents ecosystem types in Poland in the scale 1 : 2 500 000.

3. Classification of ecosystem services

The following table presents classification of ecosystem services adopted in this work, elaborated based on CICES v. 4.3 and adapted to the Polish conditions. Each service has been attributed with a unique code.

ES Type	ES Code	Name of ES	ES description	CICES v.4.3
Provisioning	Z.1	Nutrition - cultivated crops	Plant outputs s for nutrition	<i>Nutrition-Biomass-Cultivated crops</i>
	Z.2	Nutrition - reared animals	Animal outputs for nutrition	<i>Nutrition-Biomass-Reared animals and their outputs</i>
	Z.3	Nutrition - wild plants and mushrooms	Natural plant outputs for nutrition - berries, mushrooms, edible plants	<i>Nutrition-Biomass-Wild plants, algae and their outputs</i>
	Z.4	Nutrition - wild animals	Natural animal outputs for nutrition: game hunting (venison), fishing (wild fish), wild bees (honey from wild beehives)	<i>Nutrition-Biomass-Wild animals and their outputs</i>
	Z.5	Nutrition - fish from aquaculture	Natural animal outputs for nutrition: fish from aquaculture	<i>Nutrition-Biomass-Animals from in-situ aquaculture</i>
	Z.6	Biomass- based energy resources (biofuels - excluding fuel timber)	Plant-based energy resources - energy plants, straw, plant byproducts and plant waste (excluding fuel timber and peat)	<i>Energy-Biomass-based energy sources- Plant-based resources</i>
	Z.7	Biomass-based energy resources. Production of fuel timber	Timber for generating energy (incl. heat)	<i>Energy-Biomass-based energy sources- Plant-based resources</i>
	Z.8	Organic resources (materials) - production of fodder	Fodder for reared animals	<i>Materials – Biomass-Materials from plants, algae and animals for agricultural use</i>
	Z.9	Organic resources (materials) - outputs from reared animals	Non-nutrition animal outputs: wool, hides, bones, etc.	<i>Materials – Biomass-Fibres and other materials from plants, algae and animals for direct use or processing</i>
	Z.10	Organic resources (materials) - production of timber for commercial uses (other than fuel)	Timber for commercial uses other than fuel	<i>Materials – Biomass-Plant-based resources</i>
	Z.11	Organic resources (materials) - plant and animal outputs for medicinal and cosmetic use, etc.	Products from plants and animals (both grown/reared and wild) as sources of biochemical substances, particularly medicinal and cosmetic	<i>Materials – Biomass-Fibres and other materials from plants, algae and animals for direct use or processing</i>
	Z.12	Water for drinking and non-drinking purposes	Water for drinking and production needs in agriculture and industry	<i>Nutrition – Water-Surface water/Ground water for drinking</i>
	Z.13	Natural resources not acquired through mining	Resources of commercial use occurring near the Earth surface (gravel, sand, peat, amber etc.)	-

	Z.14	Abiotic energy sources	Abiotic energy sources suitable for conversion (wind, water, solar, geothermal energy)	-
Regulating and maintenance	R.1	Influence on global climate	Permanent sequestration of GHG's by ecosystems	<i>Maintenance of physical, chemical, biological conditions- Atmospheric composition and climate regulation- Global climate regulation by reduction of greenhouse gas concentrations</i>
	R.2	Shaping local climate and bioclimate	Influence on weather and climate elements (wind, precipitation, temperature, humidity, radiation) by ecosystem components, as well as influence on elements of bioclimate by components of ecosystems, particularly land cover	<i>Maintenance of physical, chemical, biological conditions- Atmospheric composition and climate regulation- Micro and regional climate regulation</i>
	R.3	Improving quality of the atmosphere	Capture and filtering of dust as well as chemical and gaseous pollutants	<i>Mediation by ecosystems- Filtration/sequestration/storage /accumulation by ecosystems</i>
	R.4	Regulation of hydrological cycle	Influence on components of the water circulation cycle (e.g. retention and outflow regulation, natural drainage, stabilization of water levels and drought prevention)	<i>Mediation of flows- Liquid flows- Hydrological cycle and water flow maintenance</i>
	R.5	Improving water quality	Influence of ecosystems on water quality, e.g. through reduction of pollutants and pathogens (from sediments, pollution, biogens, pesticides, harmful microorganisms)	<i>Mediation by ecosystems- Filtration/sequestration/storage /accumulation by ecosystems Maintenance of physical, chemical, biological conditions- Water conditions- Chemical condition of freshwaters</i>
	R.6	Regulation of cycles of chemical elements	Capacity of ecosystems to recycle elements e.g. N, P, K	<i>Maintenance of physical, chemical, biological conditions- Soil formation and composition- Weathering processes</i>
	R.7	Prevention of water and wind erosion	Ability to prevent soil erosion and landslides	<i>Mediation of flow- Mass flow- Mass stabilization and control of erosion rates/ Buffering and attenuation of mass flows</i>
	R.8	Preventing natural disasters	Prevention and mediation of results of floods and other extreme events	<i>Mediation of flow- Mass flow- Buffering and attenuation of mass flows Mediation of flow- Liquid flows- Flood protection</i>
	R.9	Pollination	Pollen transport by insects	<i>Maintenance of physical, chemical, biological conditions- Lifecycle maintenance, habitat and gene pool protection- Pollination and seed dispersal</i>

	R.10	Prevention of mass occurrences of pests and diseases	Ability of ecosystems to combat pests by organisms being their natural enemies	<i>Maintenance of physical, chemical, biological conditions- Pest and disease control- Pest control/ Disease control</i>
	R.11	Sequestration and decomposition of pollutants in the soil	Ability of the ecosystem to filter and decompose substances in the soil	<i>Maintenance of physical, chemical, biological conditions- Soil formation and composition- Decomposition and fixing processes</i>
	R.12	Regulation of soil fertility	Ability of an ecosystem to accumulate and stabilize nutrients and maintain natural physical characteristics of the soil	<i>Maintenance of physical, chemical, biological conditions- Soil formation and composition- Weathering processes</i>
	R.13	Protection and shaping of species diversity	Variation in number of species, including occurrence of protected and threatened species	-
	R.14	Protection and shaping of ecosystem diversity	Diversity of ecosystems and level of their natural state	<i>Maintenance of physical, chemical, biological conditions- Lifecycle maintenance, habitat and gene pool protection- Maintaining nursery populations and habitats</i>
	R.15	Protection and shaping of ecosystem connectivity	Conditions for mobility and dispersion of species	-
Cultural	K.1	Cognitive and physical use of nature for recreation and tourist purposes	Recreation and tourist activity whose main goal is deliberate exploration of natural areas, regeneration of physical and mental condition (various forms of sport, recreation, leisure and qualified tourism)	<i>Physical and intellectual interactions with biota, ecosystems, and land-/seascapes [environmental settings- Physical and experiential interactions- Experiential use of plants, animals and land-/seascapes in different environmental settings</i>
	K.2	Preservation of aesthetic values of landscape and its inspirational functions	Quality of the view and its aesthetic features influencing emotions, shaping feelings and creative needs, creating a sense of satisfaction	<i>Physical and intellectual interactions with biota, ecosystems, and land-/seascapes [environmental settings- Physical and experiential interactions- Physical use of land-/seascapes in different environmental settings</i>
	K.3	Education and scientific research	Education and scientific research stemming from uniqueness and diversity of ecosystems and landscapes characteristic of these ecosystems, their species diversity, and occurrence of individual natural objects	<i>Physical and intellectual interactions with biota, ecosystems, and land-/seascapes [environmental settings- Physical and experiential interactions- Experiential use of plants, animals and land-/seascapes in different environmental settings</i>
	K.4	Cultural heritage	Historic heritage - natural space shaped by man	<i>Spiritual, symbolic and other interactions with biota, ecosystems, and land-/seascapes [environmental settings]- Other</i>

			<i>cultural output- Existence/Bequest</i>
K.5	Natural heritage	Natural heritage - natural space shaped by natural processes	<i>Spiritual, symbolic and other interactions with biota, ecosystems, and land-/seascapes [environmental settings]- Other cultural output- Existence/Bequest</i>

4. Matrix of ecosystem services

The matrix of ecosystem services attached below presents the results of assessment of potential of respective types of ecosystems in Poland (more precisely: BAU typological units) to deliver ecosystem services (provisioning, regulating and maintenance, cultural). The potential was determined by using ranks arranged in the following order:

- 1 – very low potential
- 2 – low potential
- 3 – moderate/average potential
- 4 – high potential
- 5 – very high potential

Also, rank 0 has been defined to mark these types of ecosystems (BAU's) whose potential is insignificant from the point of view of ecosystem service studied – i.e. these that in practical terms do not deliver a given service.

This work also involved elaboration of:

- 1) two supplementary matrices of potential to deliver ecosystem services, in which BAU's were **aggregated** to respective:
 - (a) types of ecosystems occurring in Poland;
 - (b) land cover classes – CLC level 3.
- 2) statistical analysis of summed-up and averaged ranks, with expert commentary;
- 3) mapping (cartographic visualizations) of potential of ecosystems to deliver a given service, thereby showing spatial differentiation of this potential (according to the matrix of ecosystem services). Examples of such cartographic visualizations (maps of ecosystem service assessment)

The above-mentioned results are included in the main (full version) report.

KOD USŁUGI / KOD BAU	Z.1	Z.2	Z.3	Z.4	Z.5	Z.6	Z.7	Z.8	Z.9	Z.10	Z.11	Z.12	Z.13	Z.14	R.1	R.2	R.3	R.4	R.5	R.6	R.7	R.8	R.9	R.10	R.11	R.12	R.13	R.14	R.15	K.1	K.2	K.3	K.4	K.5
B1.331	0	0	0	0	0	0	0	0	0	0	0	0	3	5	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	4	1	3	0	5
C1.512	0	3	0	5	5	2	0	1	1	0	1	5	0	0	1	3	0	5	1	3	0	3	0	0	nd	4	5	5	3	5	4	3	0	4
C2.511	0	2	0	3	0	1	0	1	1	0	1	5	5	0	0	3	0	5	3	2	0	2	0	0	nd	3	5	5	4	4	4	3	0	4
C3.331	0	0	0	1	0	1	0	0	0	0	0	0	3	5	0	0	0	0	0	0	0	0	0	0	0	2	1	0	1	4	4	3	0	4
D1.411	0	0	0	2	0	0	0	1	0	0	4	0	2	0	1	0	3	5	1	1	2	3	1	0	2	5	5	5	4	4	4	4	0	5
D1.412	0	0	1	2	0	0	0	1	0	0	4	0	3	0	1	0	3	5	1	1	2	3	1	0	2	5	5	5	4	4	4	4	0	5
D2.411	0	1	0	2	0	1	0	2	0	0	5	0	3	0	2	0	3	5	1	2	5	5	2	0	3	5	5	5	4	4	3	3	0	5
D2.412	0	0	0	2	0	1	0	2	0	0	5	0	5	0	2	0	3	5	1	2	5	5	2	0	3	5	5	5	4	4	3	3	0	5
D4.411	0	1	0	2	0	1	0	2	0	0	5	0	3	0	2	0	3	5	1	2	5	5	2	0	4	5	5	5	4	4	3	3	0	5
D4.412	0	0	0	2	0	1	0	2	0	0	5	0	5	0	2	0	3	5	1	2	5	5	2	0	4	5	5	5	4	4	3	3	0	5
D5.411	0	0	0	2	0	0	0	2	0	0	2	0	1	0	1	0	3	5	2	2	5	4	1	0	2	5	5	5	3	4	4	4	0	5
D5.412	0	0	0	2	0	1	0	2	0	0	2	0	5	0	1	0	3	5	2	2	5	4	1	0	4	5	5	5	3	4	4	4	0	5
D6.231	0	0	0	1	0	0	0	1	0	0	1	0	0	0	1	0	1	2	0	0	2	1	3	0	1	1	1	2	4	3	2	2	0	4
D6.411	0	0	0	1	0	0	0	0	0	0	1	0	1	0	1	0	2	3	2	1	5	3	1	0	1	5	5	5	3	5	2	2	0	5
E1.321	0	1	1	2	0	0	0	3	0	0	1	0	3	4	0	0	1	1	2	2	1	3	4	1	1	3	5	1	2	4	4	4	0	4
E1.333	0	0	0	1	0	0	0	0	0	0	1	0	3	4	0	0	1	1	2	1	0	1	1	0	2	1	0	0	1	1	1	1	0	0
E2.231	0	5	1	3	0	1	0	5	5	0	2	0	0	0	3	1	2	3	1	3	3	1	4	2	3	2	1	3	5	1	4	3	1	0
E3.231	0	3	1	3	0	1	0	3	3	0	3	0	0	0	3	0	2	3	1	2	4	5	5	2	3	3	2	4	4	3	3	3	3	3
E4.321	0	2	1	1	0	0	0	4	4	0	2	0	0	0	1	0	1	1	0	1	1	3	3	2	1	2	5	1	2	3	3	4	0	5
E4.333	0	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	1	0	1	1	0	1	1	5	0	1	1	2	3	0	4
F2.322	0	0	0	1	0	0	0	0	0	0	2	0	0	0	1	0	1	1	2	1	2	2	3	3	2	1	3	1	2	3	3	3	0	5
F4.322	0	0	0	2	0	1	0	0	0	0	3	0	0	3	2	1	2	2	2	2	3	4	4	3	3	2	3	2	3	2	4	3	0	5
G1.222	4	1	1	2	0	2	0	2	2	1	1	0	0	0	2	1	1	2	0	1	2	0	4	0	0	0	0	2	2	1	2	2	3	0
G1.311.SW	0	1	5	5	0	1	5	0	0	5	5	0	0	0	5	5	5	4	5	4	5	3	5	5	2	5	5	5	5	5	5	5	0	5
G1.311.W	0	1	5	5	0	1	5	0	0	5	5	0	0	0	5	5	5	4	5	5	5	5	5	4	5	5	5	5	5	5	5	5	0	5
G1.311.B	0	0	2	2	0	1	3	0	0	3	5	0	0	0	5	3	5	5	3	3	5	4	4	4	5	5	5	5	5	5	5	5	0	5
G3.312.S	0	0	3	3	0	1	4	0	0	4	5	0	0	0	4	5	5	3	5	3	4	3	3	2	2	5	3	4	5	5	5	5	0	5
G3.312.SW	0	1	5	4	0	1	5	0	0	5	5	0	0	0	4	5	5	4	5	3	4	3	4	3	2	5	3	5	5	5	5	5	0	5

G3.312.W	0	1	4	4	0	1	5	0	0	5	5	0	0	0	5	5	5	4	5	5	5	5	4	3	2	5	3	5	5	5	5	5	5	0	5	
G3.312.B	0	0	2	3	0	1	3	0	0	3	3	0	0	0	5	5	5	5	3	3	5	4	4	2	5	5	4	5	5	5	5	5	5	0	5	
G4.313.S	0	1	3	4	0	1	4	0	0	5	5	0	0	0	5	5	5	3	5	3	5	3	5	4	3	5	3	5	5	5	5	5	5	0	5	
G4.313.SW	0	1	5	5	0	1	5	0	0	5	5	0	0	0	5	5	5	4	5	4	5	3	5	4	3	5	3	5	5	5	5	5	5	0	5	
G4.313.W	0	1	5	5	0	1	5	0	0	5	5	0	0	0	5	5	5	5	5	5	5	5	5	5	4	4	5	4	5	5	5	5	5	5	0	5
G4.313.B	0	0	3	4	0	1	3	0	0	4	5	0	0	0	5	3	5	5	3	3	5	4	5	3	4	5	5	5	5	5	5	5	5	5	0	5
G5.324	0	0	4	3	0	2	1	1	1	2	3	0	0	0	3	3	3	3	3	3	3	3	2	3	2	2	3	2	2	3	1	3	2	0	0	
H2.332	0	0	0	0	0	0	0	0	0	0	0	0	5	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	4	4	3	0	5	
H5.331	0	0	0	0	0	0	0	0	0	0	0	0	4	4	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	4	1	1	0	3		
H5.333	0	0	1	1	0	0	0	0	0	0	0	0	3	4	0	0	1	1	1	1	1	0	1	0	1	0	0	0	2	0	1	1	0	0		
I1.211	5	0	0	2	0	5	0	5	4	0	4	0	0	5	1	0	1	1	0	2	0	0	2	0	1	0	2	4	1	1	1	2	0	0		
I1.243	3	3	0	3	0	4	1	3	4	0	3	0	0	3	2	3	2	3	0	3	3	0	4	1	2	3	2	4	3	2	4	4	3	0		
J1.111	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
J1.112	1	0	0	0	0	1	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0		
J1.121	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
J2.112	1	0	0	0	0	1	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0		
J2.121	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
J2.133	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
J2.242	2	3	4	3	0	2	0	1	1	0	0	0	0	2	1	1	2	1	0	2	2	0	3	1	2	1	1	3	2	1	3	3	3	0		
J3.131	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
J4.122	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
J4.123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
J4.124	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
J5.511	0	2	0	3	0	1	0	1	1	0	1	5	3	0	0	3	0	5	3	2	0	3	0	0	nd	2	2	4	2	4	2	2	5	0		
J5.512	0	3	0	5	5	1	0	1	1	0	1	5	0	0	1	3	0	5	2	3	0	5	0	0	nd	2	2	3	3	5	3	3	3	0		
J6.132	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	
X03.521	0	0	0	4	4	1	0	1	1	0	1	0	3	5	0	1	0	5	0	2	0	3	0	1	nd	3	3	4	3	4	4	4	0	4		
X11.141	0	1	0	0	0	2	0	1	0	0	0	0	0	0	2	2	3	2	2	3	4	3	4	1	3	1	2	3	2	3	4	2	4	2		
X24.142	0	0	0	0	0	1	0	1	0	0	0	0	0	0	2	1	2	2	2	2	3	3	1	1	1	0	1	2	1	1	2	0	2	0		

5. Detailed analyses

Detailed analyses related to both characteristics of the very ecosystems (state, functions, potential to deliver ecosystem services) and characteristics of ecosystem services delivered by these ecosystems (supply/production) were possible thanks to application of a wide spectrum of **thematic data** – spatial and statistical. They enabled conducting expert analyses, as well as qualitative and quantitative assessments. The analyses were conducted in relation to basic assessment units (BAU's) and to communes: basic units of the country's administrative division.

Detailed analyses involved calculating – using the above-mentioned thematic data – values of **indicators** adopted for the purpose of this work. They were divided into indicators of potential (of an ecosystem to deliver a service) and indicators of production/supply of this service by a given ecosystem. The tables shown below present sets of selected indicators for respective categories of ecosystem services.

Results of the above-mentioned calculations are included in the above-mentioned **Spatial database of ecosystem service assessment**, which allows for cartographic visualizations of the conducted analyses. Examples of such cartographic visualizations (maps of ecosystem service assessment) are included in the main (full version) report.

A. Indicators – provisioning services

ES Code	Name of ES	Description of ES	Indicators of potential to deliver service (avg. values according to multi-annual data) (physical and/or conversion units)	Indicators of production and supply of goods and services in a given year or period (physical and/or conversion units)
Z.1	Nutrition - cultivated crops	Plant outputs for nutrition	Surface and structure of arable lands (ha, %), area and structure of crops (ha, %), multi-annual average yield and harvest (kg and t/ha). Qualitative parameters: soil bonitation, soil-agri complexes, valorisation of agricultural production space.	Primary production - yield (t/ha), crops (t). Global indicators recalculated to an area unit: physical (ha) or conversion (conversion ha).
Z.2	Nutrition - reared animals	Animal outputs for nutrition	Head count and density in physical and conversion units (n/ha, SD/ha)	Production of meat, milk, eggs, production "en course" - growth of herd. Purchase and commercial slaughter, self-supply, captured fish (t, thous. l, kg/ha/year). Global indicators recalculated to an area unit: physical or conversion.
Z.3	Nutrition - wild plants and mushrooms	Natural plant outputs for nutrition - berries, mushrooms, edible plants	Available amount of forest undergrowth - the so-called non-timber forest outputs (kg/ha, thous. PLN)	Collected and/or purchased forest undergrowth products (kg/ha/year, t/ha/year, thous. PLN)
Z.4	Nutrition - wild animals	Natural animal outputs for nutrition: game hunting	Area of water (habitat), fish stock (t, thous., ha, km ² , n/ha, kg/ha, thous. PLN)	Caught fish, venison, honey harvest (kg/ha/year, t/ha/year, thous. PLN)

		(venison), fishing (wild fish), wild bees (honey from wild beehives)		
Z.5	Nutrition - fish from aquaculture	Natural animal outputs for nutrition: fish from aquaculture	Area of water, fish stock (ha, km ² , n/ha, kg/ha)	Caught fish (kg/ha/year, t/year, thous. PLN)
Z.6	Biomass- based energy resources (biofuels - excluding fuel timber)	Plant-based energy resources - energy plants, straw, plant byproducts and plant waste (excluding fuel timber and peat)	Primary production - basic and by-production, and part of primary production being waste (t, t/ha)	Harvesting of biomass, biomass of waste from timber processing and agricultural crops and byproducts (t, m ³ , t/ha/year)
Z.7	Biomass- based energy resources. Production of fuel timber	Timber for generating energy (incl. heat)	State and growth of biomass (m ³), forest stock (m ³ /ha), species structure, age structure of forests in relation to fuel timber (branches etc.).	Harvested fuel timber (m ³ , m ³ /year, m ³ /ha)
Z.8	Organic resources (materials) - production of fodder	Fodder for reared animals	Area (ha) and structure (%) of arable lands, area (ha) and structure (%) of crops, yield (kg and t/ha) and harvest (t)	Primary production - basic and by-production, harvest (t, t/ha/year)
Z.9	Organic resources (materials) - outputs from reared animals	Non-nutrition animal outputs: wool, hides, bones, etc.	Head count and density in physical and conversion units (thous. n, n/ha, SD/ha)	Specified animal products - globally and per reference unit, e.g. area (t/ha/year).
Z.10	Organic resources (materials) - production of timber for commercial uses (other than fuel)	Timber for commercial uses other than fuel	State and growth of biomass (m ³), forest stock (m ³ /ha), species structure, age structure of forests in relation to sawmill timber, forest area (CLC, statistics)	Harvested and accumulated sawmill and fuel timber (m ³ , m ³ /year, m ³ /ha)
Z.11	Organic resources (materials) - plant and animal outputs for medicinal and cosmetic use, etc.	Products from plants and animals (both grown/reared and wild) as sources of biochemical substances, particularly medicinal and cosmetic.	Primary production, harvest (t, kg, m ³), stock (kg/ha, t/ha, m ³ /ha)	Harvesting of concrete products or groups of products (t, kg, m ³ , kg/ha, t/ha, m ³ /ha)
Z.12	Water for drinking and non-drinking purposes	Water for drinking and production needs in agriculture and industry	Water resources at disposal and water collection (m ³ , m ³ /ha). Groundwater supply (m ³ /ha). Outflow indicator (l/s/km ²)	Water collection (m ³ /region/year, m ³ /km ² /year, mm/km ² /year)
Z.13	Natural resources not acquired through mining	Resources of commercial use occurring near the Earth surface (gravel, sand, peat, amber etc.)	Exploitation resources (t, m ³)	Extraction (m ³ , t)

Z.14	Abiotic energy sources	Abiotic energy sources suitable for conversion (wind, water, solar, geothermal energy)	Areas potentially suitable for energy production (ha, km, km ² , other); hydrometeorological data (wind potential, river flow, sun exposure, geothermal water stock)	Generated thermal and/or electric (kWh/ha/year, kWh/year)
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B. Indicators – regulating and maintenance services

ES Code	Name of ES	Description of ES	Indicators of potential to deliver service (avg. values according to multi-annual data) (physical and/or conversion units)	Indicators of production and supply of goods and services in a given year or period (physical and/or conversion units)
R.1	Influence on global climate	Permanent sequestration of GHG's by ecosystems	Amount of methane, CO ₂ , water vapour captured by vegetation, soil, waters (tC/ha/year, t/ha/year), growth of biomass / primary natural production - PNP (m ³ /ha/year, t/ha/year)	Amount of methane, CO ₂ , water vapour sequestered by vegetation, soil, waters (tC/ha/year, t/ha/year)
R.2	Shaping local climate and bioclimate	Influence on weather and climate elements (wind, precipitation, temperature, humidity, radiation) by ecosystem components, as well as influence on elements of bioclimate by components of ecosystems, particularly land cover	Temperature (°C), albedo (%), precipitation (mm), wind (m/s, % tranquil.), evapotranspiration (mm); humidity (%), water vapour pressure (hPa), shading (ha, %), sun exposure (W/m ²)	Temperature amplitude (K): change of values of parameters in relation to the surroundings (%)
R.3	Improving quality of the atmosphere	Capture and filtering of dust as well as chemical and gaseous pollutants	LAI (m ² /m ²), level of reduction of concentration of pollutants by subsidence (kg/ha)	Captured aerosols and pollutants (kg/ha/year). Standards of air quality (mg/m ³ , ppm, kg/ha), subsidence index (kg/ha/year)
R.4	Regulation of hydrological cycle	Influence on components of the water circulation cycle (e.g. retention and outflow regulation, natural drainage, stabilization of water levels and drought prevention)	Water capacity of soils (m ³ /ha, pF, mm); effective infiltration (mm/ha/year, m ³ /ha/year). Dynamic resources, water bodies, unified parts of waters, unit outflow (l/s/km ²), retention (m ³)	Water excluded from hydrological cycle (e.g. water captured by plants and used by animals, soil processes - m ³ /ha/year); water capacity (v%), unit outflow (m ³ /km/year)
R.5	Improving water quality	Influence of ecosystems on water quality, e.g. through reduction of pollutants and	Water quality indicators: water burden (mg/l); dissolved substance (mg/l), ecological state of river catchment	Components removed from water (kg/m ³ /year); range of amplitude of water quality indicators (ppb, mg/l), purity classes

		pathogens (from sediments, pollution, biogens, pesticides, harmful microorganisms)		
R.6	Regulation of cycles of chemical elements	Capacity of ecosystems to recycle elements e.g. N, P, K	Indicators of balance and exchange, e.g. N, P and water quality indicators, e.g. N (mg/l), P (mg/l); conductivity ($\mu\text{S}/\text{cm}$); dissolved substance (mg/l); soil fertility (granulometric composition, TOC)	Nutrients available to plants, particularly N, P and K (kg/ha/year); CEC; SOC; percolation and outflow of nutrients (kg/ha/year); level of adsorption (kg/ha/year).
R.7	Prevention of water and wind erosion	Ability to prevent soil erosion and landslides	Type and % of land covered by vegetation (%); inclines; granulometric composition of soil (%), density of clefts (km/km^2)	Soil flushing and deflation (kg/ha/year)
R.8	Preventing natural disasters	Prevention and mediation of results of floods and other extreme events	Retention potential (m^3/ha); buffer zones (wetlands, meadow areas, forests - %, m^2/ha , ha); terrain inclines (%), granulometric composition of soil (%)	Number of minimized threats (n/a); scale of prevention of potential casualties, damages to property and infrastructure (n/year, PLN/period); active landslide zones; areas threatened with landslides; threat and risk of floods (ha/km^2 , km^2/km^2), flash flooding zones (ha/km^2 , km^2/km^2)
R.9	Pollination	Pollen transport by insects	Number of species and population size of pollinators (n/ha); habitats for pollinators (ha/ha, %, n/ha)	Numbers of pollinated plants (n/ha/year, %/year, kg/ha/year); crops and their value (t/ha, thous. PLN/ha, thous. PLN)
R.10	Prevention of mass occurrences of pests and diseases	Ability of ecosystems to combat pests by organisms being their natural enemies	Population of pests and their reducents (n/ha); ecosystems with regulatory potential w/respect to number of pests (ha/ha, %, n/ha), level of homeostasis of ecosystems (level of natural type of land cover)	Number of incidents of pest occurrence or parasite activity (n/ha/year, %/period); area of damage (ha/ha, %)
R.11	Sequestration and decomposition of pollutants in the soil	Ability of the ecosystem to filter and decompose substances in the soil	Humus content (%), granulometric composition (%)	Indicators of decomposition (kg/ha/year); pollution neutralized or immobilized (kg/ha/year); concentration in the soil (ppm, mg/kg)
R.12	Regulation of soil fertility	Ability of an ecosystem to accumulate and stabilize nutrients and maintain natural physical characteristics of the soil	Humus contents / TOC (t/ha, %), granulometric composition (%), water-air conditions - water retention (mm, m^3/m^3), heat and air capacity/conductivity (%)	Primary production, biomass growth, TOC/soil humus
R.13	Protection and shaping of species diversity	Variation in number of species, including occurrence of	Number of protected species, number of sites, number and/or area of	Number of protected species, number of sites, number and/or area of natural / rare ecosystems (n, n/ha, %)

		protected and threatened species	natural / rare ecosystems (n, n/ha, %)	
R.14	Protection and shaping of ecosystem diversity	Diversity of ecosystems and level of their natural state	Level of natural state, rarity (%/ha), level of diversity	Number and area of ecosystems in high natural state, diversity index (n/ha, %/period).
R.15	Protection and shaping of ecosystem connectivity	Conditions for mobility and dispersion of species	Diversity of ecosystems, mosaic structure of landscape, area and continuity of ecosystems (ha/km ² , %, -)	Diversity of ecosystems, area and connectivity of ecosystems, fragmentation (various indicators)

C. Indicators – cultural services

ES Code	Name of ES	Description of ES	Indicators of potential to deliver service (avg. values according to multi-annual data) (physical and/or conversion units)	Indicators of production and supply of goods and services in a given year or period (physical and/or conversion units)
K.1	Cognitive and physical use of nature for recreation and tourist purposes	Recreation and tourist activity whose main goal is deliberate exploration of natural areas, regeneration of physical and mental condition (various forms of sport, recreation, leisure and qualified tourism)	Type, number, area and state of landscapes, ecosystems, nature objects and nature sites (unique landscapes and ecosystems, natural wonders, documentation sites, habitats of rare species, nature monuments, etc. - km ² /km ² , n/km ² , n), number and quality of panoramic vistas (n/km ²)	Number of objects, accommodation points, agri-tourism facilities, B&B's, gastronomy sites/objects, other infrastructure (n/km ² , n); number of visitors (n/year); level of income (PLN/year), arranged campsites and rest sites (n, n/km ²), number of arranged vista points (n/km ²), municipal green areas (parks, gardens, etc. - n, km ² /km ²), protected areas and objects (n, km ² /km ²); travel time and area accessibility (hour), ecosystem visitor capacity (person/ha/day); road density (km/km ²); tourist trails (km/km ²)
K.2	Preservation of aesthetic values of landscape and its inspirational functions	Quality of the view and its aesthetic features influencing emotions, shaping feelings and creative needs, creating a sense of satisfaction	Number and area of individual landscapes (n, km ² /km ²)	Number of participants of outdoor events (n/year); number of outdoor events (n/year, participants/year). Number of works of art, value of sold works of art and objects "iconic" for a given region, movies filmed in a given area and tourist documentaries, budget of artistic events, diversity of types of ecosystems (n/type of landscape-ecosystem), eagerness to bear costs of ecosystem preservation (PLN/year)
K.3	Education and scientific research	Education and scientific research stemming from uniqueness and diversity of ecosystems and landscapes, species diversity, and occurrence of individual natural objects	Number of objects used for environmental education (n/km ²); type and diversity of natural objects, processes and phenomena (n, n/km ²); number of scientific studies (n/ha, n/year)	Number of environmental education events and classes, number of participants, number and/or value of research studies, number of publications (n).

K.4	Cultural heritage	Historic heritage - natural space shaped by man	Number of cultural objects using ecosystem assets or traditional forms of land use (n/ha); emblematic and symbolic species of plants and animals, habitats introduced by humans (n/ha, n, % of area)	Number of people visiting sites and objects (n/object/year), income (souvenirs and products of traditional craft) (PLN/year)
K.5	Natural heritage	Natural heritage - natural space shaped by natural processes	Natural state of ecosystems (km ² /km ²), natural objects (n/km ²), nature monuments (n/km ²), protected areas (km ² /km ²), rare and protected species (n/km ² , n)	Natural state of ecosystems (km ² /km ²), natural objects (n/km ²), nature monuments (n/km ²), protected areas (km ² /km ²), rare and protected species (n/km ² , n)

6. Analyses of ecosystem state and connectivity

In this work, exemplary analyses related to ecosystem state and connectivity were performed.

The analysis related to ecosystem **state** were performed for selected areas and based on available data concerning:

- a) (tree) defoliation level (for forest ecosystems);
- b) state of preservation of Natura 2000 habitats;
- c) state of surface waters;
- d) agri-environmental subsidies.

These data were used to assess the possibility of conducting an assessment of ecosystem state in analyzed areas.

The analysis related to ecosystem **connectivity** involved an assessment – in selected areas – of correlation between spatial distribution of potential of respective ecosystems to deliver the ecosystem service R.15 (Protection and shaping of ecosystem connectivity) with localization of main ecological corridors defined on the country's territory. The analysis of these correlations may prove useful in actions undertaken towards improving or restoring ecological connectivity (e.g. through green infrastructure development).

A detailed description of conducted analyses and their results in the form of cartographic visualizations are included in the main (full version) report.

7. Conclusion, final remarks

Within the frames of this work, remarks, conclusions and recommendations concerning matters of key importance for proper assessment (in the context of later valuation) of ecosystem services as well as using ecosystem services in decision-making, were formulated. Among these matters, primary seems the issue of – unfortunately, currently insufficient – availability of data resources necessary to perform the assessment and valuation of ecosystem services (applying / calculating values of recommended indicators). In this context, as highly important appear the roles played by respective institutions in charge of these data resources, as well as a need to urgently undertake actions such as implementation of effective procedures (administrative, legal, technical) of exchange and sharing of such data for the benefit of a wide range of recipients and users, etc. Without such actions, it would be very difficult for Poland to fully achieve Goal 2 of the EU Biodiversity Strategy.

Detailed information on the origin (sources) of data resources used in this work, as well as institutions making these resources available for the purpose of this assignment are included in the main report (full version: chapter 3 and sub-chapters 4.4.3 and 7.4).