MAPPING AND ASSESSMENT OF ECOSYSTEMS AND THEIR SERVICES IN CROATIA

CROATIAN ENVIRONMENT AGENCY

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CONCEPT OF ECOSYSTEM SERVICES

In recent years, the topic of ecosystem services has become more widespread in conservation and environmental protection at the global and European levels. In particular, this concept gained significance following adoption of the Strategic Plan for Biodiversity for the period 2010–2020 (CDB, 2010), and later became one of the key themes of the EU Biodiversity Strategy to 2020 (EC, 2011). In recognising the importance of the concept of ecosystem services, the Croatian Environment Agency has launched the project "Drafting a baseline study of established ecosystem values in the Republic of Croatia, with an assessment of costs due to losses, with a guide for practical ecosystem accounting", which resulted in this publication.

Without lessening the fact that **nature has immeasurable intrinsic value** (in and of itself) and it is necessary to conserve nature through the preservation of overall biodiversity, it was concluded that special attention should be focused on ecosystem services that are the precondition for the survival of humans on Earth. Ecosystem services imply all direct and indirect contributions of the ecosystem to the benefit of humans. Food sources, construction materials, energy sources, mediation of storms and other disasters, maintaining the conditions for life, enabling spiritual and intellectual interaction with nature, and other ecosystem services are of critical importance for humankind. Therefore, it is of the

utmost importance to view, assess and preserve ecosystems in a manner that will support the fullest possible provision of their services. The fact that species and habitats in a favourable conservation status lay the foundation for high quality ecosystem services becomes the common denominator for issues of biodiversity conservation and ecosystem services. This allows for an aligned approach to planning and implementing conservation activities.

In addition to preserving ecosystem services, it is also important to express **their value in the context of socioeconomic relations** and to include them in the appropriate environmental and economic accounting systems. International initiatives dealing with ecosystem economics, such as The Economics of Ecosystems and Biodiversity (TEEB), have led to surprising findings on the immense value of their services. Analyses have shown that **the value of ecosystem services is in the trillions of euro**. For example, the plant pollination by insects has been estimated at a value of EUR 15 billion in the EU alone. The Natura 2000 Ecological Network produces a variety of benefits worth EUR 200–300 billion annually, and the value of recreational visits to these areas is valued at

EUR 5–9 billion per year. The economic value of seagrass communities has been estimated at EUR 12–16 thousand per hectare. Unfortunately, according to the data of the FAO organisation of the UN, **up to 60% of the world's ecosystems are degraded or are used in an unsustainable manner**; 75% of the total fish stocks have been overfished or significantly depleted; since 1990, 75% of the genetic diversity of agricultural crops has been lost; and some 13 million hectares of tropical forests are cleared each year. The damaging and destruction of biodiversity results in a weakening of the ecosystems, and their quality and the scope of their surfaces for humankind is diminished.

Based on sound knowledge of the condition and services of ecosystems, it is possible to forecast how processes will unfold within the framework of various human development scenarios. Such analyses can contribute to the development of strategies and programmes for future activities and their prioritisation, for the purpose of protecting and improving ecosystem status as a joint foundation for nature conservation and for economic development. The first steps in this complex process are the **mapping and assessment of ecosystems and their services (MAES)** and the establishment of a **national framework for the restoration of degraded ecosystems**.

Box 1. **Definition of fundamental concepts**

Biodiversity is the diversity of living organisms from all sources, including terrestrial, marine and other aquatic ecosystems and ecological complexes of which they are an integral part; this includes diversity within taxa, between taxa, and ecosystem diversity (Convention on Biological Diversity, 1992; Article 2). In the procedure of ecosystem assessment, biodiversity refers to the living components of the ecosystem (biota) and is expressed in species richness.

Ecosystem is a dynamic complex of plants, animals and microorganisms and their non-living (abiotic) environment that act as a functional unit (Millennium Ecosystem Assessment, 2005). For the purposes of ecosystem assessment, it is important to determine their spatial dimension and to map them.

Ecosystem services imply the benefits that humans derive from ecosystems (Millennium Ecosystem Assessment, 2005), including all direct and indirect contributions of ecosystems to human benefit.

ECOSYSTEM SERVICES IN THE EU BIODIVERSITY STRATEGY TO 2020

The EU Biodiversity Strategy to 2020 contains six targets with 20 corresponding actions for their achievement. While Target 1 deals with achieving a favourable conservation status for threatened species and habitat types, **Target 2 is directed at ecosystem services**, stating "By 2020, ecosystems and their services are maintained and enhanced by establishing green infrastructure and restoring at least 15% of degraded ecosystems". Action 5 for the implementation of this target requires Member States to map and evaluate ecosystems and their services on their territory by 2014, with the assistance of the European Commission, and to assess the economic value of those ecosystem services and to integrate their value into the economic accounting system by 2020.

As part of the Joint Framework for the implementation of the Strategy, the **Working Group for Mapping and Assessment of Ecosystems and their Services** (MAES) was established and entrusted with developing a methodological framework and instructions for Member States for national activities. As part of the process of mapping and assessing ecosystems and their services (MAES), Member States are required to take the following steps:

Member State activity (deadline)	European Commission assistance
Ecosystem mapping (2014)	Agreement of ecosystem typology; creation of the European Ecosystem Map, with developed mapping methodology (ETC/SIA, 2013; Maes et al., 2013)
Ecosystem services mapping (2014)	No instructions passed, working on this issue
Assessment of ecosystems and their services (2014)	Proposed indicators (Maes et al., 2014)
Establishment of the national framework for the restoration of degraded ecosystems (2014)	Proposed methodology (Lammerant et al., 2013)
Assessment of economic value of ecosystems and establishing ecosystem accounting (2020)	No instructions passed, possible approaches analysed (Gocheva & Petersen, 2014)

Based on the EC guidelines passed thus far, and as part of a CEA project, **activities have commenced to map and assess ecosystems and their services in Croatia**. The Croatian Ecosystem Map has been created, the general state of ecosystems has been assessed on the basis of available data and the corresponding national indicators, ecosystem services in Croatia have been determined according to the internationally accepted classification, indicators for their reporting and monitoring proposed, and a proposal made to establish a national framework for the restoration of degraded ecosystems. This publication outlines the results of that project.

CROATIAN ECOSYSTEM MAP

The Croatian Ecosystem Map is based on the Corine Land Cover map for 2012 (CLC 2012) that will be considered current until the next mapping cycle in 2018. By using the CLC 2012 as the basis for mapping and through reinterpretation of the CLC classes in the EUNIS habitat classification, which has been set as the ecosystem typology system at the European level, compatibility has been achieved with the European mapping methodology.

In the process of drafting the Ecosystem Map, the 39 CLC classes represented in Croatia were reinterpreted into 71 ecosystem types according to EUNIS. Of those, 12 are at the second EUNIS level, while the remainder are at the third or lower levels. Those ecosystems present in areas much smaller than the minimum CLC mapping unit of 25 ha were not mapped. Pursuant to the Croatian Habitat Map, marine ecosystems were additionally mapped within one CLC polygon representing the entire territorial sea of the Republic of Croatia.

The detail of the map is limited to the given polygons of the mapped land cover units, while the accuracy was increased through the procedure of expert interpretation using additional bases and data on the distribution of habitat types. The assumption is that the detail of the map is satisfactory for the purposes of analysing and assessing ecosystems and their services.

Figure 1. Map of main ecosystem types in Croatia (EUNIS level 1)

Source: CEA/EEA

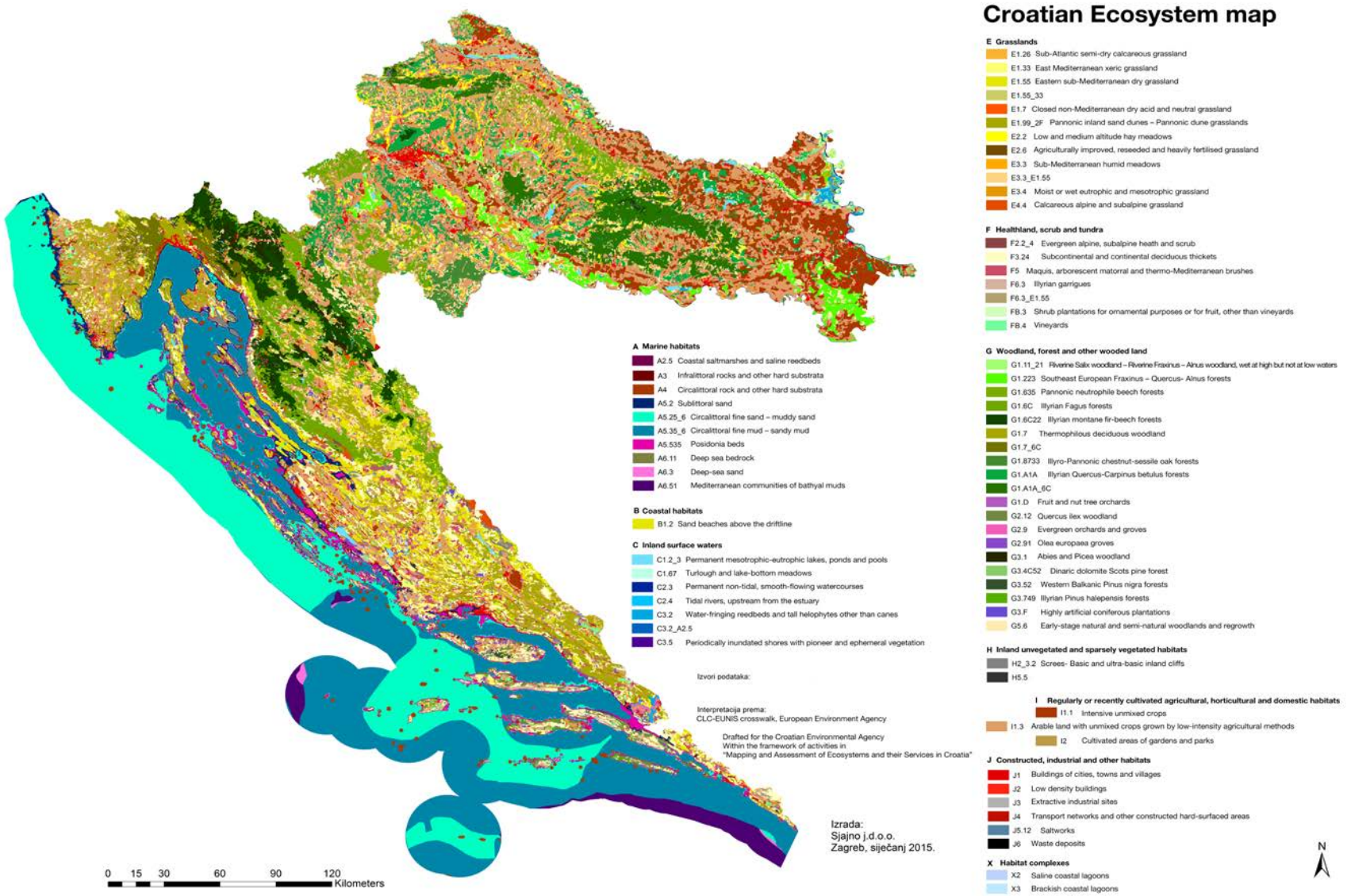
Table 1. Area of main mapped ecosystem types at EUNIS level 1[1]

EUNIS level 1		Mapped area (ha)	% terrestrial area
A	Marine habitats[2]	615.55	0,011
B	Coastal habitats	50.98	0,001
C	Inland surface waters	74,148.38	1,310
D	Mires, bogs and fens		
E	Grasslands and lands dominated by forbs, mosses or lichens	545,771.26	9,645
F	Heathland, scrub and tundra	437,463.41	7,731
G	Woodland, forest and other wooded land	2,411,297.74	42,615
H	Inland unvegetated or sparsely vegetated habitats	57,813.77	1,022
I	Regularly cultivated agricultural habitats	1,945,866.24	34,389
J	Constructed, industrial or other artificial habitats	185,069.06	3,271
X	Habitat complexes	221.54	0,004
TOTAL		**5,658,317.92**	**100,00**

Source: CEA/EEA

1 Definition of individual EUNIS classes are not fully comparable with the corresponding CLC classes
2 In the Croatian Ecosystem Map, EUNIS A2.5 Coastal saltmarshes and saline reedbeds is included in terrestrial ecosystems

Figure 2. Croatian Ecosystem Map (lower levels)



Data source: CLC 2012, Croatian Environment Agency | Marine habitats – Croatian Habitat Map, Oikon Ltd for Ministry of Culture, 2004
Interpretation according to: CLC-EUNIS crosswalk, European Environment Agency | Drafted for the Croatian Environmental Agency
Within the framework of activities in "Mapping and Assessment of Ecosystems and their Services in Croatia"

Table 2. Area of mapped Croatian terrestrial ecosystems[3]

EUNIS name		Mapped area (ha)	% terrestrial area	% total CLC
A2.5	Coastal saltmarshes and saline reedbeds	615.55	0.011	0.007
B1.2	Sand beaches above the driftline	50.98	0.001	0.001
C1.2_3	Permanent mesotrophic-eutrophic lakes, ponds and pools	29,513.54	0.522	0.335
C1.67	Turlough and lake-bottom meadows	473.40	0.008	0.005
C2.3	Permanent non-tidal, smooth-flowing watercourses	23,862.48	0.422	0.271
C2.4	Tidal rivers, upstream from the estuary	677.50	0.012	0.008
C3.2	Water-fringing reedbeds and tall helophytes other than canes	19,433.61	0.343	0.221
C3.2_A2.5	Water-fringing reedbeds and tall helophytes other than canes - Coastal saltmarshes and saline reedbeds	29.69	0.001	0.000
C3.5	Periodically inundated shores with pioneer and ephemeral vegetation	158.15	0.003	0.002
E1.26	Sub-Atlantic semi-dry calcareous grassland	26,317.91	0.465	0.299
E1.33	East Mediterranean xeric grassland	29,360.48	0.519	0.333
E1.55	Eastern sub-Mediterranean dry grassland	297,891.76	5.265	3.380
E1.55_33	Eastern sub-Mediterranean dry grassland - East Mediterranean xeric grassland	1,767.42	0.031	0.020
E1.7	Closed non-Mediterranean dry acid and neutral grassland	2,327.13	0.041	0.026
E1.99_2F	Pannonic inland sand dunes – Pannonic dune grasslands	32.75	0.001	0.000
E2.2	Low and medium altitude hay meadows	117,439.28	2.076	1.333
E2.6	Agriculturally improved, reseeded and heavily fertilised grassland	7,301.39	0.129	0.083
E3.3	Sub-Mediterranean humid meadows	1,726.78	0.031	0.020
E3.3_E1.55	Sub-Mediterranean humid meadows - Eastern sub-Mediterranean dry grassland	10,193.12	0.180	0.116
E3.4	Moist or wet eutrophic and mesotrophic grassland	38,420.10	0.679	0.436
E4.4	Calcareous alpine and subalpine grassland	12,993.13	0.230	0.147
F2.2_4	Evergreen alpine, subalpine heath and scrub	2,572.62	0.045	0.029
F3.24	Subcontinental and continental deciduous thickets	297,571.42	5.259	3.377
F5	Maquis, arborescent matorral and thermo-Mediterranean brushes	64,381.39	1.138	0.731
F6.3	Illyrian garrigues	28,636.64	0.506	0.325
F6.3_E1.55	Illyrian garrigues - Eastern sub-Mediterranean dry grassland	14,051.39	0.248	0.159
FB.3	Shrub plantations for ornamental purposes or for fruit, other than vineyards	2,316.14	0.041	0.026
FB.4	Vineyards	27,933.82	0.494	0.317
G1.11_21	Riverine Salix woodland – Riverine Fraxinus – Alnus woodland, wet at high but not at low waters	30,434.61	0.538	0.345
G1.223	Southeast European Fraxinus – Quercus- Alnus forests	140,360.03	2.481	1.593
G1.635	Pannonic neutrophile beech forests	44,309.99	0.783	0.503
G1.6C	Illyrian Fagus forests	381,970.25	6.751	4.334
G1.6C22	Illyrian montane fir-beech forests	197,658.96	3.493	2.243
G1.7	Thermophilous deciduous woodland	384,128.84	6.789	4.359
G1.7_6C	Thermophilous deciduous woodland - Illyrian Fagus forests	67,979.94	1.201	0.771
G1.8733	Illyro-Pannonic chestnut-sessile oak forests	46,330.79	0.819	0.526
G1.A1A	Illyrian Quercus-Carpinus betulus forests	311,925.19	5.513	3.540
G1.A1A_6C	Illyrian Quercus-Carpinus betulus forests - Illyrian Fagus forests	289,396.39	5.115	3.284
G1.D	Fruit and nut tree orchards	1,902.83	0.034	0.022
G2.12	Quercus ilex woodland	36,853.55	0.651	0.418
G2.9	Evergreen orchards and groves	3,459.48	0.061	0.039

3 Definition of individual EUNIS classes is not fully comparable with the corresponding CLC classes
4 Area of total CLC (including sea) is 8,812,671 ha.

G2.91	Olea europaea groves	22,135.25	0.391	0.251
G3.1	Abies and Picea woodland	46,872.82	0.828	0.532
G3.4C52	Dinaric dolomite Scots pine forest	1,945.60	0.034	0.022
G3.52	Western Balkanic Pinus nigra forests	5,313.95	0.094	0.060
G3.749	Illyrian Pinus halepensis forests	18,633.95	0.329	0.211
G3.F	Highly artificial coniferous plantations	25,378.52	0.449	0.288
G5.6	Early-stage natural and semi-natural woodlands and regrowth	354,306.80	6.262	4.020
H2_3.2	Screes- Basic and ultra-basic inland cliffs	55,287.08	0.977	0.627
H5.5	Burnt areas with very sparse or no vegetation	2,526.69	0.045	0.029
I1.1	Intensive unmixed crops	395,574.23	6.991	4.489
I1.3	Arable land with unmixed crops grown by low-intensity agricultural methods	1,548,501.87	27.367	17.571
I2	Cultivated areas of gardens and parks	1,790.14	0.032	0.020
J1	Buildings of cities, towns and villages	150,452.13	2.659	1.707
J2	Low density buildings	15,223.74	0.269	0.173
J3	Extractive industrial sites	4,614.52	0.082	0.052
J4	Transport networks and other constructed hard-surfaced areas	13,785.62	0.244	0.156
J5.12	Saltworks	567.81	0.010	0.006
J6	Waste deposits	425.23	0.008	0.005
X2	Saline coastal lagoons	177.03	0.003	0.002
X3	Brackish coastal lagoons	44.51	0.001	0.001
	TOTAL	**5,658,317.92**	**100**	**64.207**

Source: CEA/EEA

Table 3. Area of mapped Croatian marine ecosystems

EUNIS name		Mapped area (ha)	% sea	% total CLC
A3	Infralittoral rocks and other hard substrata	19,127.66	0.606	
A4	Circalittoral rock and other hard substrata	43,868.39	1.391	
A5.2	Sublittoral sand	95,672.21	3.033	
A5.25_6	Circalittoral fine sand – muddy sand	1,264,153.16	40.076	
A5.35_6	Circalittoral fine mud – sandy mud	1,467,121.31	46.511	
A5.535	Posidonia beds	143,614.51	4.553	
A6.11	Deep sea bedrock	51.86	0.002	
A6.3	Deep-sea sand	6,304.76	0.200	
A6.51	Mediterranean communities of bathyal muds	114,439.07	3.628	
	TOTAL	**3,154,352.92**	**100**	**35.793**

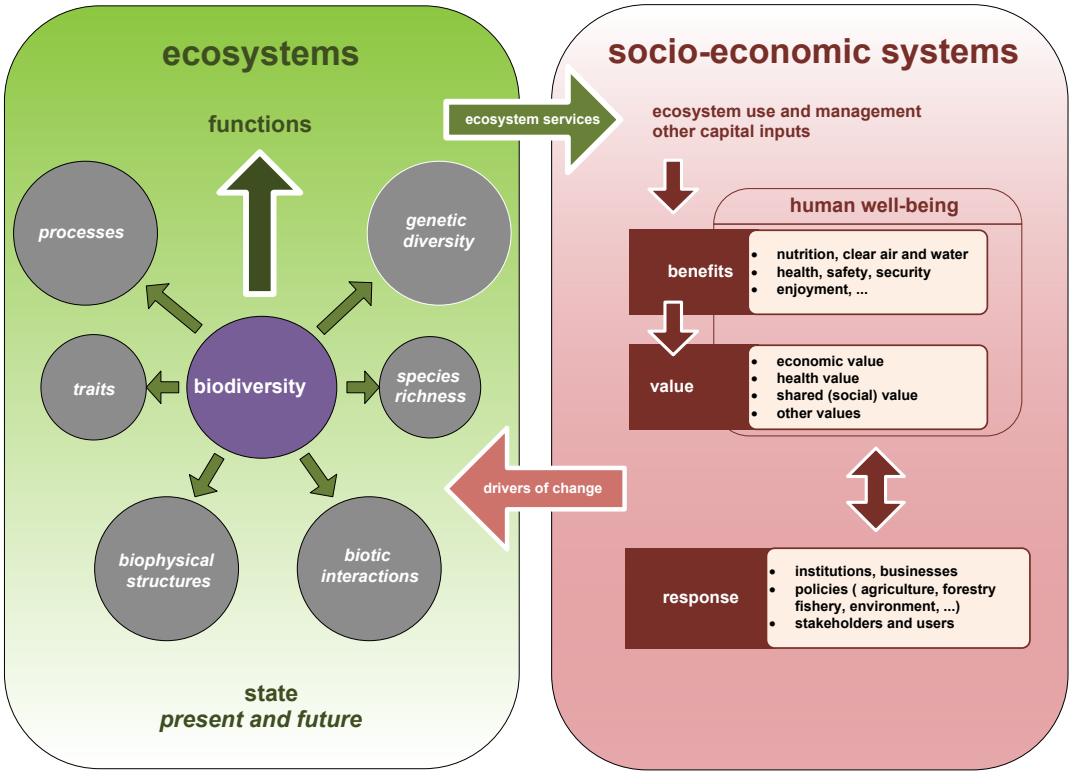
Source: CEA/EEA

ASSESSMENT OF ECOSYSTEMS AND THEIR SERVICES

The EU Biodiversity Strategy to 2020 requires the assessment of the status of ecosystems and their associated biodiversity in order to establish and monitor their potential for service provision, to direct activities towards their conservation and restoration, and to create a reliable and expert basis that can influence the making of important decisions. It has been scientifically established that only **healthy ecosystems (in good condition) have the full potential to support various ecosystem functions**, i.e. to provide their services.

In assessing ecosystems, it is necessary to view their overall condition, including drivers of change and pressures. **Biodiversity** is assessed separately, as the living component of ecosystems that is crucial for retaining the fundamental processes and for supporting ecosystem function. These processes and functions represent the ecosystem potential for the provision of various services, including material resources. Ecosystem services are **benefits** for human society and create various values that can often be expressed in monetary terms, though they may be difficult to measure, such as their importance to health, social values or importance for conservation. Human society is a beneficiary of the benefits and values ensuing from ecosystem services, but society also acts on these values via direct and indirect **drivers of change** (e.g. exploitation of natural resources, construction of buildings and infrastructure, pollution) and generating various types of **pressures**. On the other hand, society ensures **social responses** to these pressures that involve all stakeholders (institutions, business community, private sector) (Figure 3).

Figure 3: Relationship of ecosystems and socio-economic systems



Source: EEA

INDICATORS OF ECOSYSTEM CONDITION AND THEIR SERVICES

In the assessment of ecosystem condition and their services, it is necessary to define the indicators that can be used to determine status. The European guidelines recommend that **data from reports EU Member States are required to submit pursuant to various directives** should be used to develop indicators at the national level. This primarily implies reports on the conservation status of species and habitats (Habitats Directive, Birds Directive), on the ecological status of water bodies (Water Framework Directive; WFD) and on the environmental state of marine waters (Marine Strategy Framework Directive; MSFD). For forests, it has been proposed that the data of the national forest inventory that countries are required reported to the FAO for a five-year period be used. For agricultural ecosystems, certain **agri-environmental indicators (AEI)** and the Common Context Indicators (CCI) for agricultural policy should be used, which Member States include in the compulsory national monitoring plan and evaluation of the Rural Development Programme. Indicators are least available for wetlands, which are not directly the

subject of reporting according to EU Directives. The most important European biodiversity indicators include the **SEBI** (Streamlining European Biodiversity Indicators) and **CSI** (Core Set of Indicators) kept by the European Environmental Agency (EEA), and the corresponding indicators are also contained within the **National Set of Indicators** (NSI) kept by the Croatian Environment

Agency. A significant amount of data for calculating ecosystem service indicators can be derived from the **statistical data** of the Central Statistics Bureau that have been processed at the county and national levels. Within the frame of this project, indicators of ecosystem condition and services proposed by the European guidelines (Maes et al., 2014), have been considered and compared with the existing national indicators, and a proposal has been made for Croatia based on the analysis of available data. Though data are not yet collected for some of the proposed indicators or are only partially available, they form an integral part of the national framework for MAES.

Table 4. Proposal of indicators for assessment of ecosystems in Croatia (green – active indicators; yellow – data partially available; red – data currently unavailable)

Ecosystem type	Overall ecosystem condition		Diversity
	Drivers and pressures	Condition	Condition
Forests	●13. Burnt forest areas	●1. Conservation status of species of European interest ●2. Conservation status of habitats of European interest ●12. Damage to forest ecosystems ●8. Fragmentation of natural and semi-natural areas ●11. Forest and forest land area	●4. Species richness (forest ecosystems) ●5. Abundance and distribution of selected species (forest species) ●7. Status and Red List Index of wild taxa ●10. Deadwood
Cropland and grasslands	●14. Intensification and extensification ●15. Gross nutrients balance	●1. Conservation status of species of European interest ●2. Conservation status of habitats of European interest	●9. Preservation of genetic resources in agriculture ●6. Population trends of farmland birds ●5. Abundance and distribution of selected species (grassland butterflies) ●4. Species richness of agricultural ecosystems ●7. Status and Red List Index of wild taxa
Rivers and lakes		●16. Ecological status of rivers (WFD) ●17. Ecological status of lakes (WFD)	●18. Specific indicators to assess ecological status (phytoplankton, macrophytes, phytobenthos, zoobenthos, fish fauna) ●7. Status and Red List Index of wild taxa
Wetlands	●3. Changes in ecosystem representation		
Transitional waters and marine coasts		●19. Ecological status (WFD)	
Coastal and open waters		●20. Environmental status (MSFD)	●21. MSFD descriptors 1, 2, 3, 4, and 6 ●7. Status and index of threats to wild taxa

Source: CEA

Table 5. Relationships between proposed indicators for assessing ecosystems in Croatia (NSI) with the existing national and European indicators (EEA) and availability of data

Indicator	NSI	EEA	Data available
1. Conservation status of species of European interest	BR 1	SEBI 003, CSI 007	No
2. Conservation status of habitats of European interest	BR 5	SEBI 005	No
3. Representation of individual ecosystem types	BR 3, P1	SEBI 004	Yes
4. Species richness	-----	-----	Partial
5. Abundance and distribution of selected species	BR 7	SEBI 001, CSI 009	No
6. Population trends of farmland birds	BR 8	SEBI 001 AEI 25 CSI 035	No
7. Status and Red List Index of wild taxa	BR 6	SEBI 002	Partial
8. Fragmentation of natural and semi-natural areas	BR 15	SEBI 13	Yes
9. Preservation of genetic resources in agriculture	BR 10	SEBI 006, AEI 22	Yes
10. Deadwood	BR 14	SEBI 18	No
11. Forest and forest land areas	Š1		Yes
12. Damaged forest ecosystems	Š 4		Yes
13. Burnt forest areas	Š 3		Yes
14. Intensification and extensification	PO 14	AEI 015	Partial
15. Gross nutrients balance	PO 12	SEBI 19, CSI 025	Partial
16. Ecological status of rivers	KAV 1		Partial
17. Ecological status of lakes	KAV 2		Partial
18. Specific indicators for the assessment of the ecological state (phytoplankton, macrophytes and phytobenthos, zoobenthos fauna, fish fauna)	KAV 1, KAV 2		Partial
19. Biological quality of transitional and coastal waters, and biological properties of the marine environment/ Hydromorphological elements of the quality of transitional and coastal waters and the hydrographic traits of marine waters	ME 8 ME 9		Partial
20. Environmental status of coastal and open marine waters	ME 8 ME 9		Partial
21. MSFD descriptors 1, 2, 3, 4, and 6	ME 8, ME 9		Partial

FRAMEWORK FOR ESTABLISHING PRIORITIES FOR THE RESTORATION OF DEGRADED ECOSYSTEMS

After discussions held at the European level, it was concluded that the **target of 15% restored degraded ecosystems to 2020** set by the EU Strategy refers to the national level, and applies equally to the terrestrial and marine areas (Lammerant et al., 2013). Each Member State is required to adopt a national framework for establishing its priorities for ecosystem restoration. The 15% target implies improving the condition of ecosystems both in terms of their quantity (increasing area) and quality (improving biotic and abiotic conditions, reducing pollution, etc.). **The restoration of degraded ecosystems may be "active" or "passive"**. Therefore, this process can include complex undertakings aimed at artificially creating favourable conditions, or can mean allowing natural regeneration to unfold by allowing an area to recover on its own through natural processes with the limitation of human activity, which is often the most cost-effective and productive means of restoring degraded ecosystems.

The results are measured **in relation to the initial state determined for 2010**, considering that this was the baseline year for measuring progress from the EU Strategy. If there are no data on the condition for that year, it is necessary to use the most recent available data and to measure progress in relation to those in order to achieve the target of 15%. When establishing the national framework, it is necessary to determine the descriptors for each ecosystem, indicators, limit values and necessary actions, and it is particularly important to have a plan to secure the necessary financial resources.

Though it requires the investment of financial resources, the restoration of degraded ecosystems alone is not a guarantee that they will remain conserved in the future. The issue of **how to slow degradation** remains, as a result of the implementation of certain sectoral policies. This is not a financial decision, but a political one. An important argument is the concept of ecosystem services, which decision-makers can use to facilitate making political decisions and securing the necessary resources for restoration.

ECOSYSTEM CONDITION IN CROATIA AND POSSIBILITIES FOR RESTORING DEGRADED ECOSYSTEMS

Currently in Croatia, there is insufficient data in order to conduct a comprehensive assessment of ecosystem condition. As a new EU Member State, Croatia was not yet obliged to report pursuant to the Habitats Directive and Birds Directive. The different types of monitoring that are compulsory under these directives are still in the process of establishment. This section provides a summarised overview of the condition of ecosystems, based on the available data, which are largely available in the documents: Analysis of the State of Nature in the Republic of Croatia for 2008–2012 (SINP, 2014); Management Plan for Aquatic Areas (Croatian Waters, 2013); Proposal of the Monitoring System for the Ongoing Assessment of the State of the Adriatic Sea (IOR, 2014) and the National Forests Report submitted to the FAO (FRA, 2010). Within the framework of assessing condition, information is also provided on the possibility of restoring degraded ecosystems in Croatia for the main ecosystem categories based on the EUNIS classification.

A. Marine habitats

The ecological condition of transitional and coastal waters in the majority of the Adriatic Sea within the Croatian territory has been assessed with the highest degree, i.e. very good, with the exception of the area of the Port of Šibenik, the eastern part of the Bay of Kaštela and Bakar Inlet, which have been assessed to have a status one level lower (good).

A good state of the environment (according to the MSFD) has been achieved for the majority of the given descriptors (IOR, 2014). The seabed is in good condition with regard to its integrity; the pelagic food webs (primarily producers, heterotrophic microorganisms, mesozooplantkon; small pelagic fish and top predators) are in good condition; diversity is also generally in good condition (dolphins, marine birds, photophilous algae, Posidonia beds, coraligenous and planktonic pelagic communities) with the exception of red

coral. It was not possible to determine the state of marine turtles and fish communities. Red coral and commercial stocks of species (demersal, pelagic and coastal fish and stocks of shellfish) **are not in good condition**.

Individual marine habitat areas are locally threatened, such as the Posidonia beds that are threatened locally by intensive anchoring (nautical tourism), mariculture or fishing. The situation is similar with reef and other habitats. Restoration of such degraded locations can be achieved by **limiting the threatening activity and allow the ecosystem to naturally regenerate over time.** In general, it is not necessary to plan artificial restoration (or only exceptionally), e.g. projects to repopulate Posidonia beds by transplanting adult plants or through seeds, as is conducted in certain countries.

B. Coastal habitats

The total length of the Croatian coastal region, including the island coastline, is 6,248 km, while the length of coastline in which spatial plans allow for construction is 1,477 km. Built-up space, including areas for further development of settlements, covered 979 km of coastline in 2010. Of this, 498 km has been allocated for commercial activities, with 400 km allocated for tourism and hospitality activity. According to the Croatian Ecosystem Map, coastal habitats cover 50.98 ha, or 0.011% of the terrestrial area of Croatia. Coastal habitats are among the most threatened in Croatia, primarily due to the urbanising of the coast, and **their restoration should be placed among the priorities**. These are most often small localities that are degraded due to excessive exposure to anthropogenic influences such as construction, concretisation of the coastline, tourism activities, and more. Most of these habitats fall within the protected habitat types pursuant to the Habitats Directive. The **sand and gravel beaches, sandflats and mudflats, and salt marshes** are particularly threatened. For these degraded habitats, restoration is possible, in some places through protection and permitted natural processes to unfold, while in others, it would be appropriate to perform artificial restoration.

C. Inland surface waters

The inland surface waters (lakes, rivers, transitional waters), including their coastal areas that are more or less vegetated, the accompanying wetlands, river spits, tufa building communities and tufa barriers of the karst watercourses and others, in principle, are **threatened ecosystems** in Croatia. The construction of dams and

management/exploitation of water has been emphasised as the most pronounced threat to biodiversity in Croatia, considering that these activities impact the largest number of threatened species (SINP, 2014). Assessment of the general state of rivers and lakes (Croatian Waters, 2013) showed that **about 50% of the total of 1234 river bodies and 33 lake bodies do not have a good status** with regard to nutrient balance and hydromorphological burden. This is particularly pronounced in the smaller, continental rivers. Projects to restore degraded watercourses, particularly concerning their hydromorphology and the accompanying wetland habitats, **should be among the priorities** in the national restoration framework. This ecosystem category also includes the semi-natural habitats with developed aquatic and wetland vegetation, such as the active carp fishponds or abandoned gravel pits. Restoration projects for such areas (e.g. abandoned carp fishponds) could be very important for conserving the biodiversity of an area.

D. Mires, bogs and fen

There are very few such ecosystems in Croatia and they are highly threatened, most often due to a disturbed water regime. These are small sites that are subjected to overgrowth. **For most, restoration is possible**. Though the bogs in Croatia are particularly acidophilic, here they lie at the edge of their natural distribution range and their importance from the perspective of ecosystem services is not high. However, their conservation is important, as these ecosystems are rare at the national level, they represent the habitats of threatened and rare species, and they have value as scientific and education areas that are also interesting to visitors.

E. Grasslands

Grasslands are **among the top priority ecosystems for restoration in Croatia**. Croatia has exceptionally high diversity of grassland habitats – dry, wet and mesophilic – which according to the Croatian Ecosystem Map cover a total area of 545,771 ha, or 9.6% of the terrestrial area of Croatia. Many are threatened due to succession caused by the abandonment of traditional activities, such as grazing and mowing. Some of these ecosystems lie at the edge of their natural distribution range, e.g. the Pannonian and

Sub-Pannonian steppe grasslands, which are found at only a few sites. The grasslands support a large number of important species, and some types of grasslands are crucial for the survival of threatened taxa, such as the lowland hay meadows with great burnet that the large blue butterflies are dependent on. Restoration of the grasslands requires active methods, most often clearing away overgrowth. In planning restoration, it is necessary to keep in mind that most types of grasslands require **permanent management activities with the appropriate methods of mowing and/or grazing.**

F. Heathland and scrub

Most of the ecosystem types from this category that are found in Croatia are **not threatened**. In some places, their area is declining due to construction or the spread of agriculture. According to the Croatian Ecosystem Map, they cover an area of 437,463 ha (7.7% of the terrestrial territory of Croatia). These ecosystems often spread at the expense of other threatened ecosystems, usually grasslands. Therefore, in management, it is important to determine the desired ratio of scrub to grasslands in a certain area, and to plan activities accordingly.

G. Woodland, forests and other wooded land

In principle, the status of forests in Croatia is good, and 95% of forests have a natural composition. However, an increasing trend in crown damage has been observed, due primarily to pollution of the air, soil and water, and due to changes of the water regime in lowland forests. Due to extreme drought and reduced precipitation, in combination with pests (i.e. bark beetle, winter moth, gypsy moth), the share of dry trees in stands has increased,

particularly in Mediterranean areas (pine woods). A similar trend has been reported in other countries in southern Europe. In fir forests, recovery has been recorded, and this was the most affected species in previous reports. In 2012, increased defoliation was recorded due to complex forest drying (the highest extent in the past decade), with 456,673 m3 of the wood mass of conifers and deciduous trees affected. According to the data of the Ministry of Agriculture, the total burnt area in 2012 was 23,497 ha, and the share of karst in burnt areas was 83%. Fragmentation due to the construction of traffic infrastructure and other construction is also a significant threat, though not as pronounced as in many European countries. With regard to fragmentation, restoration activities are possible to enable connections between habitats for some species, i.e. construction of animal overpasses for large carnivores using vast habitat areas that are often fragmented by roads. Considering that the analysis of the change in land cover indicated a reduced share of deciduous forests (stands taller than 5 m), at the expense of surfaces covered by young forests following regeneration (SINP, 2014), it is necessary to direct activities towards achieving a more uniform share of all age categories in even aged stands. This is particularly important to **ensure sufficient areas of old stands** that are most important for biodiversity. Possible activities to restore forest ecosystems can pertain to **the local improvement of their structure and function for the purpose of preserving biodiversity**, particularly for those species tied to old forests and deadwood, as these are among the most threatened taxa.

H. Inland unvegetated or sparsely vegetated habitats

This includes the **subterranean habitats** that are particularly sensitive and subject to local degradation. At certain sites, **regeneration is possible** so as to restore their importance for biodiversity, including bat fauna and the population of rare and endemic taxa. The **rock and scree habitats are generally not threatened in Croatia**. These categories include the burnt areas that are, in some cases, suitable for restoration.

I. Regularly cultivated agricultural habitats

Cultivated agricultural habitats encompass 34% of the terrestrial area of Croatia (1,945,866 ha). In the area of these ecosystems, it is important to achieve the highest biodiversity possible through the **establishment of microhabitats and landscape elements** that also serve as habitats and as corridors for connecting the populations of numerous species of agricultural habitats. The activity of establishing new or restoring abandoned habitats of hedgerows, dry stone walls, floral rows, tree rows and glades significantly contribute to improving the functioning and services of agricultural ecosystems.

J. Constructed, industrial or other artificial habitats

These habitats are distributed over 3.27% of the territorial surface of Croatia (185,069 ha mapped). This category includes the artificial habitats that are not highly significant for biodiversity (with the exception of a small number of taxa adapted for such habitats). However, it is possible for these to take on value through the establishment of a dense network of smaller "green" habitats. The establishment of such "**green infrastructure**" also mitigates the effects of fragmentation and isolation of natural habitats, and establishes connections for many species (ecological corridors).

CLASSIFICATION OF ECOSYSTEM SERVICES

The EC Guidelines (Maes et al., 2013) propose that Member States use the classification of ecosystem services entitled the **Common International Classification of Ecosystem Services (CICES)** developed by the EEA[5] as part of efforts to develop ecosystem accounting. CICES describes the various **ecosystem products** that contribute to the benefit of humankind, which are directly dependent on the life processes and their clear association with the functions, processes and structure of ecosystems. The concept of the "final product" of ecosystems encompasses the products created based on the input resources that are considered ecosystem services. The final products are no longer functionally associated with the original ecosystems, and cannot be considered ecosystem services pursuant to CICES.

According to CICES, there are three types of ecosystem services that are divided into sectors, groups and classes.

5 http://cices.eu/

Provisioning of an ecosystem includes human benefit pertaining to nutrition, materials and energy. CICES differentiates the services provided by biological materials (biomass) from those based on water. The classification of water is a complex issue, as water is an abiotic component

of nature that, in principle, is not included in CICES.

Regulation and maintenance relate to the mitigation of harmful effects of waste, toxics and nuisances that unfolds through life processes, such as the decomposition of waste generated by living creatures. This category also includes the mediation of mass flows, liquid flows and gas/air flows (such as storms), and the maintenance of physical, chemical and biological conditions, such as insect pollination of plants.

Cultural services are the various intangible and non-consumable types of benefits, such as physical and intellectual interactions, spiritual, emblematic and other relations with nature that are tied to living beings or processes (including individual species, habitats or entire ecosystems). The services that are primarily a physical relationship of man with nature (e.g. hiking, sports fishing, etc.) are differentiated from those based on an intellectual or spiritual relationship with nature.

Though CICES does not include the **abiotic components of nature**, they are noted within the system as a part of the overall natural capital that will likely be fully processed in the nature accounting systems that the Member States are required to establish to 2020, pursuant to the EU Strategy.

Table 6. CICES classification of ecosystem services

Type of service	Sector	Group
Provisional services	Nutrition	Biomass
		Water
	Materials	Biomass, fibre
		Water
	Energy	Biomass-based energy sources
		Mechanical energy
Regulation and maintenance services	Mediation of waste, toxic and other nuisances	Mitigation by biota
		Mitigation by ecosystems
	Mediation of flows	Mass flows
		Liquid flows
		Gaseous/air flows
	Maintenance of physical, chemical and biological conditions	Lifecycle maintenance, habitats and gene pool protection
		Pest and disease control
		Soil formation and composition
		Water conditions
		Atmospheric composition and climate regulation
Cultural services	Physical and intellectual interactions with biota, ecosystems and land-/seascapes (environmental settings)	Physical and experiential interactions
		Intellectual and representational interactions
	Spiritual, symbolic and other interactions with biota, ecosystems and land-/seascapes (environmental settings)	Spiritual and/or emblematic
		Other cultural outputs

Source: EEA

EXAMPLE 1. BEES AS A DRIVER OF ECOSYSTEM SERVICES

Bee products fall among the **provisioning services** (honey, royal jelly, pollen, propolis, wax). These services are usually expressed through the indicator "honey production" and this can be relatively simply expressed in monetary terms (kilograms of produced honey per year x average market price of honey). Meanwhile, bees play an exceptionally important **regulation** role through the pollination of plants. Though this service cannot realistically be assessed in economic terms, it is important to set up an expression method that can be uniformly applied at all levels. For example, it is assessed that the value of insect pollination services in the EU is about EUR 15 billion per year. The European guidelines propose two indicators for the expression and monitoring of these services. One is the "number of hives", which directly indicates the pollination capacity of bees in a certain area. The second indicator is the "pollination capacity", which is expressed using maps based on modelling, and taking the distribution of pollinating species and other input data into account.

Table 7. Overview of the indicator "honey production" in the area of the Town of Slunj

Type of service: Provisioning	**Sector:** Nutrition	**Group:** Biomass
Class: Wild plants, algae and their outputs		
Indicator: Honey production		
Description of indicator Indicator expresses the annual production of honey in the area of the Town of Slunj **Source of data:** Town of Slunj, Economy Office		
Indicator calculation: - In the territory of the Town of Slunj, there are 20 registered beekeepers with a total of 1801 hives (2014) - Average honey production is 15 kg per hive (up to 20 kg in better years) It is assessed that total honey production is about **30 tonnes per year** The price per kilogram of honey (producer): HRK 15 to 36, average price of HRK 24 per kilogram Source: Agroklub/Beekeepers: Bee production on family farms. http://www.agroklub.com/pcelarstvo/pcelarska-proizvodnja-na-obiteljskom-gospodarstvu/3107/ **Monetary value:** 30 t honey/god x HRK 24/kg = **HRK 720,000/year.**		

EXAMPLE 2. FOREST ECOSYSTEM SERVICES

Forest ecosystems provide a large number of services of all types and sectors according to the CICES. The Forests Act lists such services as the generally beneficial forest functions.

The main **provisioning** services pertain to the supply of materials, primarily through wood biomass, and the supply of surface and ground waters, both for and not for drinking water. In Croatia, the supply of energy services based on biomass is increasing. Other provisioning services include game animals, non-timber forest products (wild berries, mushrooms, plants for consumption, medicinal plants, aromatic, herb and other plants, humus, resin, other forest products) and honey from forest species. The breeding of the indigenous Turopolje pig (Turopolje forest) and the Black Slavonian pig (Spačva basin) are of local importance. Though the presence of these animals is undesirable for forestry, they represent an important component of the Croatian biodiversity.

Forests in Croatia provide very important **regulation and maintenance** services, particularly in protecting against erosion, supporting the water regime and hydrological cycle, flood protection, global climate regulation and reducing the effect of greenhouse gases through the carbon sequestration and microclimatic regulation. These services are generally difficult to express and quantify, and few indicators are available. Indicators with readily available data are the carbon reserves in forests and carbon sequestration, which is calculated on the basis of timber reserve data. Erosion production, reserves and consumption of water, and pollination potential can be obtained through GIS analysis and modelling the available data.

Cultural services include intangible forest ecosystem products that can be viewed through the physical properties, location or situations that create general benefits for the physical, intellectual or spiritual condition of people. Some indicators of these services may be expressed by mapping, such as various forest categories under protection (forests in protected areas, forests in Natura 2000 network) and other forest areas intended for visitation, or the distribution of particularly significant forest species. Individual services can be quantified, such as the number of visitors, sold entrance tickets or fees for guided tours.

Table 8. Provisioning services provided by forest ecosystems, with proposed indicators for Croatia

Sector	Group	Class	Indicators
Nutrition	Biomass	Reared animals and their outputs	Number of head of Turopolje pig Number of head of Black Slavonian pig
		Wild plants, algae and their outputs	Distribution of nectar producing plants Distribution of the most significant species in the category of non-timber forest products (wild berries, mushrooms, food plants, medicinal, aromatic, herb and other plants) Honey production Quantity of species in category of non-timber forest products
		Wild animals and their outputs	Value of game Hunting records (game caught per species)
	Water	Potable ground water	Total water reserves per forest area (derived by modelling)
Materials	Biomass	Fibres and other materials from plants, algae and animals for direct use or processing	Timber reserves (total and by tree species) Annual yield Annual timber allocation for cut Production of forestry products (by product: total cut timber; heating timber; industrial timber – roughly processed timber); logs; cellulose wood; other industrial wood Wood consumption (logs, fuel, wood chips for energy production)
		Genetic material from all biota	Distribution of plant species with biochemical or pharmaceutical use
	Water	Surface water for non-drinking purposes	Total water resources per forest area (modelling)
		Ground water for non-drinking purposes	
Energy	Biomass-based energy sources	Plant-based resources	Reserves of heating wood (part of total timber reserves) Production of heating wood (part of annual yield) Consumption of heating wood

Table 9. Regulation and maintenance services supported by forest ecosystems, with proposed indicators for Croatia

Sector	Group	Class	Indicators
Mediation of waste, toxics and other nuisances	Mediation by ecosystems	Filtration /sequestration/ storage/ accumulation by ecosystems	
Mediation of flows	Mass flows	Mass stabilisation and control of erosion rates	Erosion protection (modelling) Forests intended for erosion control (protective forests)
		Buffering and attenuation of mass flows	
	Liquid flows	Hydrological cycle and water flow maintenance	Water balance
		Flood protection	Areas intended for flood control based on catchment management plan
	Gaseous/air flows	Storm protection	
		Ventilation and transpiration	
Maintenance of physical, chemical and biological conditions	Lifecycle maintenance, habitat and gene pool protection	Pollination and seed dispersal	Pollination potential (modelling) Honey production
		Maintaining nursery populations and habitats	Forests in protected areas in the Natura 2000 ecological network
	Pest and disease control	Pest control	
		Disease control	
	Soil formation and composition	Weathering processes	Chemical properties of forest soil
		Decomposition and fixing processes	Organic matter in soil
	Water conditions	Chemical condition of freshwaters	
	Atmospheric composition and climate regulation	Global climate regulation by reduction of greenhouse gas concentrations	Carbon storage in forests Carbon sequestration
		Micro and regional climate regulation	Forest area

Table 10. Cultural services provided by forest ecosystems with proposed indicators for Croatia

Sector	Group	Class	Indicators
Physical and intellectual interactions with biota, ecosystems and land-/seascapes (environmental settings)	Physical and experiential interactions	Experiential in the use of plants, animals and land-/seascapes in different environmental settings	Distribution of forest species with symbolic significance Forest areas open to recreation Number of visitors Number of hunters Hunting ground area
		Physical use of land- / seascapes in different environmental settings	
	Intellectual and representational interactions	Scientific	
		Educational	
		Heritage, cultural	
		Entertainment	
		Aesthetic	
Spiritual, symbolic and other interactions with biota, ecosystems and land-/seascapes (environmental settings)	Spiritual and/or emblematic	Symbolic	
		Sacred and/or religious	
	Other cultural outputs	Existence	
		Bequest	Distribution of forests important for the conservation of biodiversity Distribution of areas with forests having cultural value Number of visitors

Table 11. Overview of the indicator "carbon storage in forests" in the area of the Town of Slunj

Type of service: Regulation and maintenance service	**Sector:** Maintenance of physical, chemical and biological conditions	**Group:** Atmospheric composition and climate regulation
Class: Global climate regulation by reduction of greenhouse gas concentrations		
Indicator: Carbon storage in forests		
Description of indicator: Shows the total carbon reserves stored in the timber stocks in forests, for three management units, which approximately covers the territory of the Town of Slunj **Source of data**: Public data on forests. An overview. www.javni-podaci.hrsume.hr		
Calculation of indicator: **Timber stocks are multiplied by a factor of 0.47 (IPCC carbon fraction (CF)0.47** and are expressed in millions of metric tonnes Koranska Dubrava district – timber stocks: 226,070 m3 x 0.47 = 106,252.9 million metric tonnes Kremenita Glavica district – timber stocks: 77,940 m3 x 0.47 = 36,631.8 million metric tonnes Crno Osovje – Veliki Lisac district – timber stocks: 235,212 m3 x 0.47 = 110,549.6 million metric tonnes TOTAL: **253,434.3 million metric tonnes**		

ECOSYSTEM ACCOUNTING

In drafting the conceptual framework for assessing the value of ecosystem services and for the ecosystem accounting system, there are a variety of methods, approaches and classifications. In anticipation of concrete instructions to be drafted by the EC as part of meeting Target 2 of the EU Biodiversity Strategy, it is possible to begin national activities by consulting the available documents addressing these issues at the level of selecting an approach for establishing national accounting.

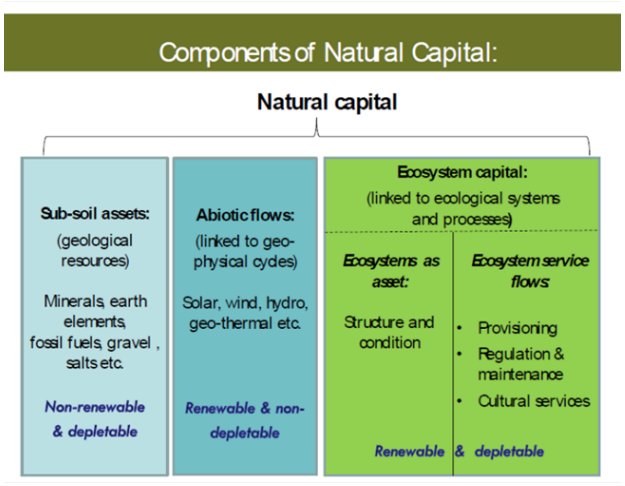
The first step is to decide on whether to establish **Nature Capital Accounting** (i.e. including services from the abiotic geophysical components of nature) or whether to concentrate only on ecosystem accounting (based on the biotic components of nature). Activities to date at the global and European levels have concentrated on ecosystem services, though the recommendations are that future efforts should aim for a comprehensive overview of natural resources and services, including the abiotic components of nature. This includes the geophysical resources, i.e. mineral resources, wind and geothermal sources, which are already included in the economic accounts as a part of production. For some components, it is impossible to create a complete calculation, such as for a stable climate. One argument for including the services of abiotic nature is the fact that they are often very difficult to separate from ecosystem services. For example, water is both an abiotic resources and a fundamental component of numerous ecosystem processes.

Quantifying the natural capital, including the abiotic components of nature (Figure 4), in the sense of assessing stocks and quantities of natural resources used for various human activities, are a part of the statistics of various sectors (energy, mining, water sector, etc.). Data on the quantity and exploitation and use of natural resources are represented in various measurement units and can be compared with regard to their mass, volume or energy value. Data on abiotic natural resources offer insight into the exploitation

of existing resources, and represents a foundation for assessing the possible risk and vulnerability of ecosystems during exploitation. These data form the basis for developing indicators that can contribute to assessing environmental impacts and in projecting socioeconomic trends, the consequences of use and, ultimately, the exhaustion of resources.

An example of an indicator of abiotic nature is the exploitation of mineral resources (indicator included in the National Set of Indicators[6]) that is drafted for the needs of the Report on the State of the Environment in Croatia.[7] The indicators show data on the balance and quantities of exploited mineral resources and a spatial overview of exploitation fields and exploration areas within the context of environmental protection. The indicators also provide information on concessions, fees and royalties for the exploration and exploitation of mineral resources.

Figure 4. Components of natural capital



Source: EEA

The assessment of natural capital includes physical and monetary data. The methodology for monetary assessments has not been aligned, globally or in the EU, though intensive work has been ongoing on this issue in recent years. To date, environmental accounting has been developed, and its framework is the System of Environmental Accounting[8]. This system was conceived such that the national accounting systems kept by individual states are compatible. Through this system, data on the use of natural resources and the quantity of waste generated are already being collected. Ecosystem accounting will supplement such assessments that are based on the abiotic natural resources.

In the establishment of national frameworks, it is key to:

- **select services that will be included in the national accounting**
- **set the principles for assessing value**
- **select the appropriate methods for assessing value**

Namely, ecosystem services can be analysed and expressed in various ways, not necessarily using the same sets of data. It is necessary to decide how to assess the ultimate value of certain services if there are partial assessments of individual segments. The **availability of the necessary data** will significantly affect the approach taken. A good quality calculation is only possible if it is based on clearly defined,

well structured and comprehensive sets of data that can be references in space and can be compared in time and space.

It is of crucial importance to **define how to include the intrinsic value of nature in the calculation**, bearing in mind that this, though difficult to express in monetary terms, should be an integral part of every assessment, through the use of additional indicators or through an approximation of increases in the calculated services.

6 http://www.azo.hr/NacionalnaListaPokazateljaNLP
7 http://www.sabor.hr/izvjesce-o-stanju-okolisa-u-republici-hrvatskoj-20
8 http://unstats.un.org/unsd/envaccounting/seea.asp

PROPOSAL OF FURTHER MAES ACTIVITIES IN CROATIA

- Include the Croatian Ecosystem Map into overviews and calculations of the appropriate indicators from the National Set of Indicators, and other proposed indicators of the condition of ecosystems and their services
- Establish the collection of additional data for indicators for which there are currently only partial sets of data, particularly those necessary for Croatia's reporting based on the EU Directives (Habitats Directive, Birds Directive, Water Framework Directive, Marine Strategy Framework Directive)
- Quantify and, where appropriate, map individual ecosystem services at the national level, taking into account that the EC is preparing instructions for alignment of the mapping of ecosystem services in Member States
- Test the methodology for mapping individual ecosystem services at lower levels (e.g. administrative units, protected areas, Natura 2000 areas, level of specific projects)
- Conduct comprehensive assessment of the condition of ecosystems in Croatia and adopt the Framework for the restoration of degraded ecosystems with priorities, pursuant to the EU Biodiversity Strategy to 2020
- Conduct an analysis of services of abiotic components of nature for inclusion into the future Nature Capital Accounting system
- Define the methodology for Ecosystems/Nature Capital Accounting in cooperation with the economic sector, and conduct the necessary calculations
- Ensure that Ecosystems/Nature Capital Accounting is included in national accounting (obligation under the EU Biodiversity Strategy to 2020)
- Systematically implement activities on reporting, education and public participation in the MAES process

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ABBREVIATIONS

AEI - Agri-environmental indicators

CEA- Croatian Environment Agency

CLC - Corine Land Cover

CBD - Convention on Biological Diversity

CICES - Common International Classification of Ecosystem Services

CSI - Core Set of Indicators

EC – European Commission

EEA – European Environment Agency

EU – European Union

EUNIS – European Nature Information System

FAO - Food and Agriculture Organisation of United Nations

FRA - Forest Resources Assessment

MAES – Mapping and assessment of ecosystems and their services

MSFD – Marine Strategy Framework Directive

NSI – National Set of Indicators

SEBI - Streamlining European Biodiversity Indicators

SINP – State Institute for Nature Protection

TEEB - The Economics of Ecosystems and Biodiversity

WFD – Water Framework Directive

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