

Table 1. Ecosystem conditions and their attributes

| | Label | ES name | Definition | CICES 5.1 classes | Suggested indicators | | | Data sources [actual use] | Data sources [capacity] | Potential ES bundles |
|-----------|----------------------|------------------------------|---|-------------------|--|---|---|--|--|----------------------|
| Condition | Management intensity | Intensity of land management | The intensity of land management is a relevant characteristic of forests, grasslands, agricultural and water-based ecosystems (w.g. fishponds), and it is a factor in the supply of several ecosystem services. To cover this aspect we have to define and create comparable categories of management intensity (based on e.g. livestock density on grasslands) | – | management intensity index | | | expert knowledge, ecosystem type, forest management data, agricultural statistical data (fertilizer use, grazing intensity, etc.), remote sensing data | | |
| | Soil quality | Overall soil quality | Soil quality is an integrative ecosystem characteristics determining the (potential) growth vigour of major agricultural crops, forests, and biomass in general. This semi-persistent ecosystem characteristics is typically influenced by the fertility, thickness, and structure of the soils. | – | soil quality index | | | | expert knowledge, ecosystem type, soil maps, DTM (digital terrain model), forestry databases | |
| | Biodiversity | Presence of biodiversity | The composition/diversity of the biotic components of an ecosystem is one of its most relevant characteristics determining capacities for a number of services. | – | <i>a)</i> presence/abundance of a (few) selected key species (groups) (remarkable biodiversity); | <i>b)</i> a naturalness index giving an aggregate evaluation of the “capacity” of the sites to maintain high levels of remarkable or general biodiversity | <i>c)</i> presence/abundance for a few particularly problematic invasive species. | primary species records (e.g. distribution maps), biodiversity proxies, species distribution model outputs, ecosystem type, expert knowledge | | |

Table 2. Provisioning Ecosystem Services and their attributes

| | Label | ES name | Definition | CICES 5.1 classes | Suggested indicators | | | Data sources [actual use] | Data sources [capacity] | Potential ES bundles |
|--------------|---------------------------|--|--|-------------------|--|---|---|--|---|--|
| Provisioning | Wild animals | Wild animals and their outputs for nutrition or materials | Sustainable longterm potential of the ecosystem to supply wild fish or game and so contribute nutrition or materials to humans. | 1161, 1162 | a) wild fish or game output [kg/ha/y] (It can be an aggregated indicator for all relevant species, or species specific indicators for a few pre-selected key species) | b) an index of sustainable and long term output levels (only for capacity) | | local statistical data, e.g. angler permits, hunters associations | expert knowledge, ecosystem type, digital terrain model (DTM), biodiversity, management intensity | Fishing and hunting is partly bundled to active recreation 3111. |
| | Reared animals | Reared animals and their outputs for nutrition or materials | Sustainable longterm potential of the ecosystem to supply nectar and pollen for honeybees and so contribute to honey production, to supply forage through mowing or grazing to domestic animals, or to enable fish cultivation by providing nutrients and appropriate habitat in in-situ aquaculture. Intensive production principally relying on imported feed should not be considered here. | 1131, 1132, 1141 | a) domestic animal products, like honey, milk, meat, fish, wool, etc. in their natural quantities [e.g. kg/ha/y] (specific to species/product) | b) sustainable fodder, e.g. hay, provisioning capacities of the sites in natural units [e.g. t/ha/y]; | c) an index of sustainable and long term output levels (only for capacity) | local statistical data (registered beekeepers and colonies, registered number of livestock and fish) | expert knowledge, literature, ecosystem type, digital terrain model DTM, biodiversity (naturalness: for honey), management intensity, except grazing intensity for grazing animals, soil fertility, hydrography | Bee pastures/honey production is inherently bundled with 2221 pollination. |
| | Agricultural crops | Cultivated terrestrial plants grown for nutritional purposes | Sustainable longterm potential of of the ecosystem to the growth of cultivated, land-based crops and fruits grown by humans for food or harvested and used as raw material for the production of food. | 1111 | a) harvested crop yields in their natural quantities [e.g. kg/ha/y] (specific to species/product) | b) an index of sustainable and long term output levels (only for capacity) | | local statistical data of agricultural crop area and harvest yield | expert knowledge, literature, ecosystem type, digital terrain model DTM, soil fertility, hydrography | Cultivated plants are often bundled, through agricultural systems, with 1131 reared animals. |
| | Wild plants for nutrition | Wild plants (berries, mushrooms, herbs) used for nutrition | Sustainable longterm potential of the ecosystem to supply mushrooms, fruits, berries and medicinal herbs provided spontaneously by the ecosystem. Cultivated plants and mushrooms are not included. | 1151 | a) an index characterising sustainable and long term output levels – either for specific key species, or species group(s), or an overall aggregated index (just for capacity) | b) sustainable annual outputs of (specific) wild fruits, or berries or mushrooms, or medicinal herbs [kg/ha/y] | both a) and b) can be an aggregated indicator for all relevant species, or specific to a (few) pre-selected key species (groups) | local statistical data (collection permits issued) | expert knowledge, literature, ecosystem type, biodiversity (naturalness), soil type, management intensity | Mushroom/berry collecting activities are partly bundled to active recreation 3111. |
| | Timber and firewood | Wild plants used for materials and energy | Sustainable longterm potential of the ecosystem to provide timber (material) and firewood (energy) to humans. | 1152, 1153 | a) timber/firewood/wood output [m ³ /ha/y] – the average annual output throughout an entire management cycle typical for the forest type (for capacity, this indicator does not depend on forest age) | b) timber/firewood/wood output [m ³ /ha/y] – the actually harvested (or to be harvested) quantities in the study period (for actual use) | Both a) and b) can be aggregated for all relevant species, or they can be species specific indicator(s), focusing on just a (few) pre-selected key species. | statistical data of actual harvest yields | expert knowledge, literature, ecosystem type, digital terrain data (DTM), forest inventory data, e.g. share of main tree species, forest growth models | This service is partly bundled to 2261 global climate regulation through carbon sequestration. |

Table 3. Cultural Ecosystem Services and their attributes

| | Label | ES name | Definition | CICES 5.1 classes | Suggested indicators | | Data sources [actual use] | Data sources [capacity] | Potential ES bundles |
|----------|------------------------------------|--|--|------------------------|--|--|---|---|--|
| Cultural | Touristic attractiveness of nature | Physical and experiential interactions with nature | Contribution of ecosystems through their attractiveness to tourism, recreation, outdoor sports, observation and enjoyment of aesthetic beauty of the landscape. Attractiveness and use of abiotic features – like caves, rocks, and other karst geomorphological features – also belongs here. | 3111, 3112, 3124, 6111 | a) actual tourism activity | b) index for touristic attractiveness (capacity) | visitor numbers, social media (e.g. Instagram photos), questionnaire surveys (speleological associations), local statistical data | expert knowledge, ecosystem type, digital terrain model (DTM), geomorphological/cave map, tourism infrastructure map, relief, management intensity, biodiversity, hydrography, remote sensing data, accessibility | This service can be partly bundled with some provisioning services, e.g. wild animals (1161, 1162) and wild plants (1151) as they are harvested through popular recreational activities, like angling, hunting, gathering. |
| | Education and training | Nature-based education and training | Capacity/use of ecosystems (including abiotic features) as subject matter for in-situ teaching or skill development. | 3122, 6121 | an index for education and training capacities | | educational trails, forest schools (and their visitor statistics), scientific activities | expert knowledge, literature, ecosystem type, biodiversity, geomorphological/cave map, hydrography, accessibility | Can be partly bundled to normal recreational activities: 3111, 3112, 6111. |

Table 4. Regulating Ecosystem Services and their attributes

| | Label | ES name | Definition | CICES 5.1 classes | Suggested indicators | Data sources [capacity] | Potential ES bundles |
|------------|--|---|---|-------------------|---------------------------------------|--|---|
| Regulating | Climate regulation | Regulation of atmospheric composition by carbon sequestration and storage | Global climate regulation by reduction of greenhouse gas concentrations through carbon sequestration and storage by the biomass and soil. Actual use is always equal to capacities in the case of this service. | 2261 | amount of carbon sequestered [t/ha/y] | expert knowledge, literature (IPCC methodology), ecosystem type, digital terrain model (DTM), forest inventory data, national greenhouse gas inventory | This service is partly bundled to timber and firewood provisioning capacities: 1152, 1153. |
| | Erosion prevention | Control of erosion rates | Prevention risk of soil loss by stabilisation and control of mass flow due to the presence of natural soil cover. | 2211 | erosion prevention capacity index | expert knowledge, ecosystem type, digital terrain model (DTM), management intensity, pollution sources, soil quality (thickness) | This ES often comes tightly bundled with 2213 water flow regulation and water quality regulation/pollutant removal 2251, 2111, 2112. |
| | Water quality regulation and pollutant removal | Regulation and maintenance of chemical condition of water | Regulation and maintenance of good chemical condition of freshwaters by living processes, as well as transformation, fixing and storage of organic or inorganic pollutants, that enable human consumption and use of water. | 2251, 2111, 2112 | index for water quality protection | expert knowledge, ecosystem type, digital terrain model (DTM), management intensity, pollution sources, soil quality (thickness) | This ES often comes tightly bundled with 2213 water flow regulation and 2211 erosion prevention. |
| | Water flow regulation | Hydrological cycle and water flow regulation | Contribution of ecosystems through their land cover to slowing down the passage of surface water into the karst system, and thus to the balanced water yield of karst wells and springs, as well as the mitigation of torrential surface runoff (flash floods). | 2213 | water retention capacity index | expert knowledge, ecosystem type, digital terrain model (DTM), management intensity, pollution sources, soil quality (thickness) | This ES often comes tightly bundled with other regulating ES, e.g. 2211 erosion prevention, or water quality regulation/pollutant removal 2251, 2111, 2112. |

Table 5. Prioritization sheet of the adjusted ES against selection criteria

Please fill in each cells of the below table by adding 1 if the particular criteria is relevant for the service and 0 if it is not. Please collect all your questions and comments arising during the exercise.

| Ecosystem service | | Selection criteria | | | | | | | | | | Sum of scores |
|-------------------|---|--|--|---|---|---|--|---|-------------------------------------|---|---|---------------|
| | | 1. ecosystem types concerned | | | 2. benefits for local people | | | 3. local relevance | | 4. relation to other ES | | |
| | | 1.1 | 1.2 | 1.3 | 2.1 | 2.2 | 2.3 | 3.1 | 3.2 | 4.1 | 4.2 | |
| | | can be linked to specific karst ecosystems | can be linked to an ecosystem type of large land surface | can be linked to an ecosystem type of high conservation value | provides economic benefit for the local economy | provides non-marketed livelihood for local people | has a high capacity for benefit which is still underutilized | important in the perception of local people | is part of an important local issue | is inherently bundled with one or more other ES | is in trade-off with one or more other ES | |
| Provisioning | timber and firewood | | | | | | | | | | | |
| | hay, fodder/output of grazed livestock (subcategory of the ES, reared animals') | | | | | | | | | | | |
| | cultivated fish (subcategory of the ES, reared animals') | | | | | | | | | | | |
| | honey (subcategory of the ES, reared animals') | | | | | | | | | | | |
| | wild game (subcategory of the ES, wild animals') | | | | | | | | | | | |
| | wild fish (subcategory of the ES, wild animals') | | | | | | | | | | | |
| | medicinal herbs (subcategory of the ES, wild plants for nutrition') | | | | | | | | | | | |
| | mushrooms (subcategory of the ES, wild plants for nutrition') | | | | | | | | | | | |
| | wild fruits or berries (subcategory of the ES, wild plants for nutrition') | | | | | | | | | | | |
| Cultural | agricultural crop | | | | | | | | | | | |
| | touristic attractiveness of nature education and training | | | | | | | | | | | |
| Regulating | water quality regulation and pollutant removal | | | | | | | | | | | |
| | water flow regulation and erosion prevention climate regulation | | | | | | | | | | | |

Table 6. Participants of the stakeholder workshops for identification and validation of ESs and PBBs, distributed into stakeholder groups by PAs

| | Notranjska Regional Park | Žumberak-Samoborsko gorje Nature Park | Kalkalpen National Park | Bükk National Park | Apuseni Nature Park | Bijambare Protected Landscape | Tara National Park | Totals |
|---|--------------------------|---------------------------------------|-------------------------|--------------------|---------------------|-------------------------------|--------------------|--------|
| NGOs | 2 | 6 | 2 | 1 | 4 | 9 | 3 | 27 |
| PA management | 5 | 9 | 6 | 15 | – | 10 | 14 | 61 |
| Stakeholders/ interest groups/ businesses | 13 | 16 | 19 | 26 | 26 | 16 | 17 | 107 |
| Municipalities | 1 | 2 | 4 | – | 5 | 5 | 2 | 18 |
| Ministries | 1 | 6 | – | – | 1 | 2 | – | 10 |
| Forestry | 5 | 3 | – | 2 | 2 | 2 | 1 | 18 |
| Public institutions | 6 | 4 | – | 4 | 3 | 10 | 4 | 31 |
| Media | 2 | | | | | 2 | 1 | 5 |