Ecosystem Service	**Recreation through observation of nature**
CICES class name	Characteristics of living systems that enable activities promoting health, recuperation or enjoyment through passive or observational interactions
CICES Section	Cultural (Biotic)
CICES Class code	3.1.1.2

Brief Description

- Watching plants and animals where they live; using nature to destress
- The biophysical characteristics or qualities of ecosystems or species that are viewed/observed by people or enjoyed in other passive ways by virtue of sounds and smells, etc.

Sample Indicators

Indicator values from			
Experiment or direct measurement	🔬	Survey	📋
Expert assessment	🖳	Statistical- or census data	📊
Model or GIS	🖥	Literature values	📖
Stakeholder participation	🖥	Not provided	🚫

Table 1: Field Scale

Indicator	Unit	Indicator values from
[17] Capacity for nature-based recreation indicator. The indicator is based on the vicinity of water, land relief, accessibility from urban areas, presence of HNV farmland and variation in land cover.	[-]	🖥
[3] Hedges between agriculture and other use	Not provided	🚫
[3] Number of elements and land cover types in a viewshed	#	🚫
[3] Diversity of land cover/ land use types (calculated by adapting Shannon Index 'H', Gini index, or Simpson's Diversity Index' D')	[-]	🚫
[28] Abundance of large butterflies (species with median wingspan>5.4 cm)	Not provided	🔬

[28] Abundance of birds that are either: colourful species, species that people attract to their homes with feeders or species with hunting value	Not provided	
[28] Ant species richness as a predictor of the abundance of birds, including those described above	Not provided	

Table 2: Farm Scale

Indicator	Unit	Indicator values from
[3] Hedges between agriculture and other use	Not provided	
[3] Number of elements and land cover types in the viewshed	#	
[3] Diversity of land cover/ land use types (calculated by adapting Shannon Index 'H', Gini index, or Simpson's Diversity Index' D')	-	
[23] Four-level index based on the provision of walking trails/ecotourism/environmental education	poor-fair-good-excellent	
[33] Recreation opportunities: Indicator calculated by a formula derived from survey and expert assessment. Up to five attributes were considered: singular natural resources, scenic beauty, accessibility, tourism attraction capacity, and tourism use aptitude. Results were corrected by carrying capacity of land use types, considering factors such as flora and fauna factor, perimeter area ratio and slope factor.	persons * ha^{-1}	

Table 3: Regional Scale

Indicator	Unit	Indicator values from
[7] Tourism: Ratio of tourism income to GDP	%	
[18] Average travel cost of tourists	$ * yr^{-1}	
[11] Potential number of visitors calculated from population statistics and assuming travel distance of 80 km for daily trips and 8 km for short trips	#	
[11] Actual number of visits from surveys or statistics	#	
[29] Density of rural tourism establishments. Values were normalized [0-1] using benchmark values where available and observed values otherwise.	# * km^{-2}	

[30] Number of visitors	# * yr⁻¹	
[32] Forest recreation: share of land that is forested	%	
[9] Area of natural or semi-natural habitats not affected by roadside noise louder than 55dB(A)	m²	
[9] Area of natural or semi-natural habitats not affected by roadside noise louder than 55dB(A) and accessible from the nearest city within a given time constraint	m²	
[19] (Designated) recreational trails	km	
[30] Area covered by recreational landscape	ha	
[10] Total number of recreational areas	#	
[4] Number of areas used for social amenity (e.g., picnic areas) in the area	#	
[13] Recreation & ecotourism potential, calculated based on: *Distance to singular natural resources (e.g., diverse forests, presence of water bodies) [0 -100] *Scenic beauty (viewsheds) [0-100] *Accessibility (gaussian distance to roads) [km] *Tourism attraction capacity (distance to natural attractions concentration [1-100], variety of natural attractions [1-100], distance to tourism services [km]) *Tourism use aptitude [1-100] (based on land cover) Selection and weighing of factors based on expert assessment	Index 0 - 100	
[13] Recreation & ecotourism opportunities, calculated as: (Recreation & ecotourism potential /100) * ((physical carrying capacity of an area) * (erodibility of the area) * (correction factor for account for fauna) * (perimeter/area ratio))	persons * ha⁻¹	
[1] Recreational potential calculated by a composite model that considers the degree of naturalness, nature protection, and presence of water. Dimensionless index	Index 0-1	
[12] Recreation potential: continuous index, based on presence of certain ecosystems (i.e., forest, coastline), certain ecosystem characteristics (i.e., naturalness) and their accessibility	-	
[16] Recreational potential, calculated as the sum of scores for density of public rights of way (footpaths, bridleways), the cultural heritage value of land use and proximity of similar alternative sites, each (1-5), multiplied by the score for the population living within 3 km travel distance of any part of the site (1-5)	-	
[21] Recreation & aesthetic values: values are assigned to different land cover classes. The matrix by Burkhard et al., 2012 (DOI: 10.1016/j.ecolind.2011.06.019) was adapted the and used in this study.	Index 0-5	

[20] Recreational surface per capita, calculated as recreational areas (forests, abandoned land, water courses and grassland areas) within a distance of 5 km to settlements divided by the number of residents	ha * capita[-1]	🖥
[24] Recreational potential: the following indicators were normalized, and the average was calculated: - Degree of naturalness: hemeroby index based on the land cover type [1 (natural/ without actual human impact) - 7 (artificial)] - Protected areas: occurrence of protected areas [not provided] - Attractiveness of water bodies: Distance to the nearest stagnant surface water body or water courses of the first or second order	Not provided	🖥
[27] Recreation potential: (1- (modelled utility value of recreational nature areas (considering both qualities of the area and distance to a person) divided by population density))	0-1	🖥 , 🖥
[31] Recreation: expert-based index for ES provision by land cover class [1-5] multiplied by the area of land cover class [km^2]	Index 1-5 * km^{-2}	🖳 , 📖 , 🖥
[31] Recreation value: expert-based index for ecosystem service supply by land cover class [1-5] multiplied by the area of the land cover class [km^2] and a literature-based monetary value of the ecosystem service	$ * ha^{-1} * yr^{-1}	🖳 , 📖 , 🖥
[15] Spatial mapping by stakeholders: stakeholders could place green stickers on a map to mark the supply hotspots of this ecosystem service. Red stickers were used to mark locations where the supply of this service is declining. Two different sizes of stickers were used to represent a radius of 0.75 km or 1 km, respectively.	Index 0-5	🖥👥
[35] Index based on naturalness (based on Corine Landcover Class), level of conservation (based on presence of protected areas) and accessibility to the human population (based on distance from areas with high population density)	-	🖥 , 📈
[22] Roadside variation: number of "land use patches" intersected by or adjacent to all roads and paths, except motorways and railways, divided by total road length. Values were scaled [0-1]	km^{-1}	🖥
[22] Accessibility: Share of the land surface within 100 meters from the road. Values were scaled [0-1]	%	🖥
[34] (Water activities): Numer of river watching sites	#	🚫
[34] (Water activities): Number of visitors or facilities (e.g. hotels or restaurants	#	🚫
[34] (Water activities): Length of walkway or cycleway	km	🚫
[34] (Water activities): Turnover from tourism	$ * ha^{-1}	🚫

Indicator	Unit	Indicator values from
[8] Open landscapes: Share of land under agricultural cultivation (keeping landscapes open through agriculture is seen as increasing aesthetic value)	%	🖥️
[3] Hedges between agriculture and other use	Not provided	🚫
[3] Diversity of land cover/ land use types (calculated by adapting Shannon Index 'H', Gini index, or Simpson's Diversity Index' D')	[-]	🚫
[8] Diversity of landscapes: Shannon index of land use	[-]	🖥️
[3] Number of elements and land cover types in a viewshed	#	🚫
[34] Proximity to urban areas of scenic rivers or lakes	km	🚫
[18] WTP - willingness to pay for landscape preservation considering likely landscape changes	$	📋
[37] Number of visitors arrivals	#	📊
[37] Number of domestic visitors arrivals	#	📊
[37] Number of foreign visitors arrivals	#	📊
[37] Number of active enterprises in the area	#	📊
[37] Number of active enterprises in agriculture (crop production, support activities to agriculture)	#	📊
[37] Number of active enterprises in accommodation and food services activities	#	📊
[37] Number of farms with other gainful activities (agritourism, recreational and social activities)	#	📊
[37] Number accommodation establishments	#	📊
[37] Number of hotels and similar establishments	#	📊
[37] Number of holiday- and other short-stay accommodations, camping grounds, recreational vehicle parks and trailer parks	#	📊
[38] For services that can be monetized: value of cultural services	USD / km^2 * year)	🚫
[38] For services that can not be monetized: qualitative value assessment using Likert-scales	-	🚫

Table 4: National Scale

Indicator	Unit	Indicator values from
[2] Number of visits per year	# * area^{-1} * yr^{-1}	🖥️

[2] Valuation: Number of visits per year multiplied by value indicator. The value indicator depends on the habitat mix for that location	$ * area^{-1} * yr^{-1}	
[6] Number of "day leisure visits" (any round trip of less than one day in duration made from home or a holiday destination for leisure purposes)	# * grid cell^{-1}	
[11] Potential number of visitors calculated from population statistics and assuming travel distance of 80 km for daily trips and 8 km for short trips	#	, ,
[11] Actual number of visits from surveys or statistics	#	, ,
[14] Number of visitors per year	#	
[26] Number of visitors in agricultural areas	Not specified	
[26] Number of rural enterprises offering tourism-related services	Not specified	
[26] Number of birdwatchers	Not specified	
[26] Farm tourism	Not specified	
[25] Modelled probability of visitation by recreationists/tourists, based on land cover class, mean elevation, distance from a nearest major road, path density, county and population.	0-1	,
[26] Walking and biking trails	Not specified	
[3] Number of elements and land cover types in a viewshed	#	
[3] Hedges between agriculture and other use	Not provided	
[3] Diversity of land cover/ land use types (calculated by adapting Shannon Index 'H', Gini index, or Simpson's Diversity Index' D')	-	
[36] Opportunities for experiential uses of landscapes number of habitats protected in Annex 1 of the EC Habitats Directive (Council Directive 92/43/EEC). Point values are interpolated using inverse distance weighting.	-	
[36] Frequency data of preferences: respondents of a questionnaire are asked to identify 3 places and landscapes that they have visited and are of high aesthetic value, the predominant land use/cover of each site, and the recreational activities they normally carry out at these locations. Frequency data from this preference assessment is then mapped for the identified sites.	n/a	
[36] Frequency of responses associating land use/cover with aesthetic values are asked to identify 3 places and landscapes that they have visited and are of high aesthetic value, the predominant land use/cover of each site, and the recreational activities they normally carry out at these locations. Frequency data from this preference assessment was then mapped for the identified sites.	n/a	

Table 5: Multinational Scale

Indicator	Unit	Indicator values from
[3] Hedges between agriculture and other use	Not provided	⃠
[3] Number of elements and land cover types in a viewshed	#	⃠
[3] Diversity of land cover/ land use types (calculated by adapting Shannon Index 'H', Gini index, or Simpson's Diversity Index' D')	-	⃠
[12] Recreation potential: continuous index, based on presence of certain ecosystems (i.e., forest, coastline), certain ecosystem characteristics (i.e., naturalness) and their accessibility	-	🖥

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