Ecosystem Service	**Aesthetics from interactions with nature**
CICES class name	Characteristics of living systems that enable aesthetic experiences
CICES Section	Cultural (Biotic)
CICES Class code	3.1.2.4

Brief Description

- The beauty of nature
- The biophysical characteristics or qualities of species or ecosystems that are appreciated for their inherent beauty

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**
[2] Presence of water bodies	Not provided	
[2] Presence of sublime features, e.g., mountains	Not provided	
[3] Functional diversity: Colour richness of flowers	# of colour groups visible to humans: white, yellow, purple, violet	
[3] Functional intensity: Average size of flowers or discernible sub-sets of inflorescences (of colour groups visible to humans)	cm	
[3] Functional stability: Average species richness of flowers within groups visible to humans during the flowering season	# of species	

[3] Overall species richness of flowers in colour groups visible to humans	# of species	
[3] Overall species richness of flowers	# of species	
[4] Abundance of large butterflies (species with median wingspan >5.4 cm)	Not provided	
[4] Abundance of birds that are either: colourful species or species that people attract to their homes with feeders	Not provided	
[4] Ant species richness as predictor of the abundance of birds, including those described above.	Not provided	
[26] Rating score [1 - 10]: Panoramic photographs are created on site that show the 'best representation' of the landscape. In a questionnaire, respondents are asked to rate them based purely on aesthetic criteria. The median score across all questionnaires is used.	n/a	,

Table 2: Farm Scale

Indicator	Unit	Indicator values from
[2] Presence of water bodies	Not provided	
[2] Presence of sublime features, e.g., mountains	Not provided	
[5] Aesthetic landscape enhancement by a specific feature	poor-fair-good-excellent	
[6] 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	km^{-1}	,
[6] Landscape variation: length of land cover "edges" per hectare land surface	km * ha^{-1}	,
[6] Share of farmers surveyed that state that their farm should look well-tended	%	,
[6] Share of farmers surveyed that consider open landscapes valuable landscape elements	%	,

Table 3: Regional Scale

Indicator	Unit	Indicator values from

[1] Complexity: -Number of independently perceived visual elements in the scene -Visual richness, the degree of scene intricateness and "how much is going on." -The amount of information or the number of elements in the immediate environment -The promise of more information if one has more time to observe from the specific point -The degree of simplicity versus complexity in the spatial structure -Presence of multiple elements with diverse forms elements at a given resolution -Diversity, richness and interspersion of landscape -The amount of diversity or variety in a scene, the engaging amount of information -The perceived degree of landscape variety (from not varied to varied) -Composition, distribution, organization and variation of landscape elements contributing to visual richness and diversity	not provided	⃠
[1] Diversity: -The degree of perceived visual variation among landscape elements -Visual diversity; the number and degree of image elements or different features -The diversity of landscape components "as the expression of vertical relationships between land use and abiotic features." -"Simply describes differences in nature, quality or aspect", also "the nature and relative size of the fields within the farm." -Composition, diversity, and relative abundance (evenness) of landscape cover types and land uses	not provided	⃠
[1] Heterogeneity: grain size, visual compartmentalization and versatility within the landscape	not provided	⃠
[1] Biodiversity: diversity of plants, insects or specific ecological groups relevant to scenic properties	not provided	⃠
[1] Texture: The attribute of visual quality evaluated as smooth, medium or rough, or proportion of the landscape area covered by it	not provided	⃠
[1] Pattern: presence of regularly repeated elements or clear patterns	not provided	⃠
[1] Variety:	not provided	⃠

-Scene as being varied or diverse in overall content; "diversity of colors, textures, shapes and masses, forms and spaces or other visible attributes that add a diversity or mixture of visual experiences."		
[1] Color diversity and contrast: -Variety of colors, chromatic diversity, visual contrast among available colors	not provided	⃠
[1] 3D complexity: -Heterogeneity in tree height and vertical vegetation layers -Visual grouping, density and structuring of vegetation, thinning intensity (managed ecosystems) -Presence of specific structural vegetation forms such as a tree, bush -Presence/absence & diversity of man-made elements, either overall or as a modification to the landscape, sometimes as an undesirable factor	not provided	⃠
[1] Edge: -Presence, amount or density of distinct borders between areas -Presence of linear edge features such as hedgerows, walls, tree lines; visual properties of field margins -Edge condition	not provided	⃠
[1] Relief: -Topographic heterogeneity, variability in relief, non-uniform geomorphology, the contrast between flat and sloping	not provided	⃠
[1] Ephemera and seasonality: -Presence of elements and types of land use that change with seasons or overtime -Perception of seasonal change	not provided	⃠
[1] Time depth: -Visual evidence of historical continuity and diversity, sometimes as architectural variety and presence of landmarks -Level of succession (in woodlands)	not provided	⃠
[2] Presence of water bodies	Not provided	⃠
[2] Presence of sublime features, e.g., mountains	Not provided	⃠
[6] 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	km^{-1}	,

[6] Landscape variation: length of land cover "edges" per hectare land surface	km * ha^{-1}	
[6] Share of farmers surveyed that state that their farm should look well-tended	%	
[6] Share of farmers surveyed that consider open landscapes valuable landscape elements	%	
[7] Natural-aesthetical value: expert opinion/regional preferences	Not provided	
[7] Recreation potential: number of visitors	#	
[18] Average travel cost of tourists	€ * yr^{-1}	
[8] Visibility of particularly beautiful spots (e.g., mountains, open water, forests, heterogeneous landscapes)	Index 0 - 100	
[14] Occurrence of protected areas, large forests, water bodies	Not provided	
[9] Open landscapes: Share of land under agricultural cultivation (keeping landscapes open through agriculture is seen as increasing aesthetic value)	%	
[9] Diversity of landscapes: Shannon index of land use	-	
[10] Number of residential properties in the direct vicinity of major rivers (number of properties is seen here as an indicator for aesthetic appreciation and inspiration)	#	
[11] 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	
[12] Modelled landscape aesthetic value for a viewpoint: 360° panoramic photos of representative landscapes are created and assigned aesthetic scores [1-10] by stakeholders. The response is used to calibrate a regression model that relates landscape elements within the photos with the assigned aesthetic score. The following features are considered in the model: - Landscape metrics (area-weighted mean patch area distribution [m^2]	-	

- median radius of gyration distribution [m^2] -modified Simpson's evenness index [-] - number of patches [#] - patch richness [-] - range perimeter–area ratio distribution [-] - coefficient of variation of shape index distribution [-] - median of shape index distribution [-]). - Land use classes (Settlement [0/1], Road [0/1], Forest [0/1], Water [0/1]) - Viewshed in three distance zones (near zone 0–1.5 km, middle zone 1.5–10 km, far zone 10–50 km) [m^2]		
[13] Recreation & aesthetic values: values for land cover classes. The matrix by Burkhard et al., 2012 (DOI: 10.1016/j.ecolind.2011.06.019) was adapted and used in this study.	Index 0-5	
[15] Flower diversity: Plants Simpson's biodiversity index	Not specified	
[16] Visual quality index (VQI), based on 19 parameters (terrain ruggedness, presence of: waterfalls, wells and springs, area of standing water, length of flowing water, presence of the coast, habitat richness, area of woodland, presence of single large trees, number of plant species, hedgerow length, number of vegetation colours, area of human-influenced land, number of spot utilities/quarries, building area, road length, dry-stone walls length, presence of scheduled ancient monuments, presence of designated historic parks or gardens, presence of listed buildings)	Index 0 - 1	
[17] Utility sum based on the following indicators: -Level of the presence of linear landscape elements within a grid cell [1 - 3]: hedgerows, tree rows, tree alleys and windbreaks -Level of the presence of point landscape elements within a grid cell [1 - 3]: hedgerows, tree rows, tree alleys and windbreaks -Level of presence of livestock within a grid cell [0 - 1]: occurrence of grasslands used as a proxy -Level of the diversity of crop production within a grid cell [1 - 3]: average plot size within field blocks used as a proxy	-	
[19] Landscape beauty index; Values per land use class based on: - a questionnaire-based photo survey on alpine landscapes - topographical visibility analysis (from DEM) - Shannon index of landscape diversity (Shannon index)	Not provided	

Each of the three components was weighted equally.		
[20] Area providing an aesthetic and inspiring environment	ha	
[21] Aesthetic value of landscapes: values from landscape preference studies	Not provided	
[22] Cumulative viewshed: visibility of green areas (such as farmland and forest) from residential land (using the visibility function in ArcGIS's Spatial Analyst)	#	
[23] Landscape aesthetics and landmark: Participatory mapping. Respondents in an online survey mark on map areas in their region where different cultural ecosystem services are supplied. Then, the proportion of markings in each of the investigated land cover classes is calculated. After that, values are calculated for subregions. The proportions are multiplied with the area extent of the respective land cover classes in the sub-region, and result for all land cover classes are summed up.	ha	
[18] Willingness to pay (WTP) for landscape preservation considering likely landscape changes	€	

Table 4: National Scale

Indicator	Unit	Indicator values from
[2] Presence of water bodies	Not provided	
[2] Presence of sublime features, e.g., mountains	Not provided	
[24] Shannon Diversity Index of landscapes	-	
[25] Number of visitors in agricultural areas	#	
[27] 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 and the predominant land use/cover of each site. Frequency data from this preference assessment was then mapped for the identified sites.	Not provided	

Table 5: Multinational Scale

Indicator	Unit	Indicator values from

[2] Presence of water bodies	Not provided	⊘
[2] Presence of sublime features, e.g., mountains	Not provided	⊘

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