

Ecosystem Service	Biotic remediation of waste
CICES class name	Bio-remediation by micro-organisms, algae, plants, and animals
<b>CICES Section</b>	Regulation & Maintenance (Biotic)
CICES Class code	2.1.1.1

# **Brief Description:**

Transformation of organic and inorganic materials, including fertilizers and pesticides, by plants, animals, bacteria, fungi or algae. Biotic remediation of wastes mitigates their harmful effects and reduces the costs of disposal by other means.

# **Sample Indicators**

Indicator values from			
Experiment or direct measurement	ß	Survey	و) ) ۱۱۱۱
Expert assessment	•	Statistical- or census data	áÓ
Model or GIS	<b>ا</b> ر	Literature values	
Stakeholder participation	); ; ; ;	Not provided	$\otimes$

### Table 1: Field Scale

Indicator	Unit	Indicator values from
<sup>[2]</sup> Organic waste used	kg * m <sup>-2</sup> * yr <sup>-1</sup>	
<sup>[1]</sup> Natural attenuation/ clean groundwater: Indicator value calculated as:		
$I = \frac{\sum  \log\left(\frac{i}{i_{max}}\right) }{n}$		
With: I – Indicator value, i – variable i measured, i <sub>max</sub> – maximum ecologic potential of variable i in benchmark reference, n – number of variables.	-	<u>\$</u> ,
Where performance is considered better than in the benchmark and deviation, therefore, has a positive effect,		
$ log(\frac{\cdot}{i_{max}}) $ is subtracted from the sum instead of added. For this ES, variables were: -Soil organic matter [% dw]		



-Bacterial biomass [mg C *(g dw) <sup>-1</sup> ] -pH in KCl -Physiological diversity bacteria [bBiolog. CLPP: Hill's slope] -Water suluble P (Pw) [mg * I <sup>-1</sup> ] and extractable P (PAL) [mg * kg <sup>-1</sup> ]	

#### Table 2: Farm Scale

Indicator	Unit	Indicator values from
<sup>[3]</sup> Share of nitrogen retained during water passage between agricultural sub-catchment and sea. Values were scaled [0-1]	%	Ţ
<sup>[3]</sup> Share of farmers that express clearly a value and care for the health of the land. Values were scaled [0-1]	%	<b>≖</b>

## Table 3: Regional Scale

Indicator	Unit	Indicator values from
<sup>[6]</sup> Nitrate leaching	kg * ha <sup>-1</sup> * yr <sup>-1</sup>	<b>-</b>
<sup>[5]</sup> Risk of nitrate leaching: exchange frequency of the soil water in the root layer. Infiltration rate divided by field capacity	%	<u>بر</u>
<sup>[3]</sup> Share of nitrogen retained during water passage between agricultural sub-catchment and sea. Values were scaled [0-1]	%	<u>حگی</u>
<sup>[3]</sup> Share of farmers that express clearly a value and care for the health of the land. Values were scaled to [0-1]	%	<u>*</u>
<sup>[4]</sup> Nutrient regulation: assigned values depend on the land cover class. The matrix defined by Burkhard et al., 2012 (DOI:10.1016/j.ecolind.2011.06.019) was adapted and used in this study.	Index 0 - 5	Ţ
<sup>[7]</sup> Share of riparian forest cover in 25 m buffer along rivers. Values were normalized [0-1] using benchmark values where available and observed values otherwise.	%	$\otimes$
<sup>[7]</sup> Share of natural forest cover in municipality's surface. Values were normalized [0-1] using benchmark values where available and observed values otherwise.	%	$\otimes$



<sup>[8]</sup> Water purification and provision, calculated as: $W = NPP * (1 - VCNPP) * IC_s * S_{cf}$ With: W – water purification and provision, NPP – Net Primary Production calculated from NDVI-values and expressed on a relative scale set to [0 – 1000], VCNPP – coefficient of variation of NPP [0 – 1], IC <sub>s</sub> – soil infiltration capacity [0 – 1], S <sub>cf</sub> – slope average correction factor of the study area [0 – 1]	n/a	<u></u>
<sup>[8]</sup> Waste purification, calculated as: $W = NPP * (1 - VCNPP) * I_w * O_w * 1.75$ With: NPP – Net Primary Production calculated from NDVI- values and expressed on a relative scale set to [0 – 1000], VCNPP – coefficient of variation of NPP [0 – 1], I <sub>w</sub> – water input to the system (calculated as rainfall * (1-runoff coefficient) and scaled to a range of [0 – 1]), O <sub>w</sub> – water bodies occupancy percentage and flat floodplain area [0 – 1]	n/a	₽.J
<sup>[11]</sup> Volume of purified water	m <sup>3</sup> /(km <sup>2</sup> * year)	$\otimes$
<sup>[11]</sup> Mass of a specific nutrient retained	ton/ (km <sup>2</sup> * year)	$\otimes$
<sup>[12]</sup> Area of undisturbed creek banks that serve as buffers to pesticide and fertilizer runoff	n/a	0

#### Table 4: National Scale

Indicator	Unit	Indicator values from
<sup>[9]</sup> "Recycling capacity" of external nutrients: Amount of phosphorus in pig manure that can be spread on tillage soils and P deficient grassland soils.	t P * yr <sup>-1</sup>	- -

#### Table 5: Multinational Scale

Indicator	Unit	Indicator values from
<sup>[10]</sup> Nutrient regulation: Values were assigned to Corine land cover classes, based on values published by Burkhard et al. (2009; DOI: 10.3097/LO.200915) and modified for the context of riparian zones.	Index 0 - 1	



# **References**

No.	Citation
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 $<sup>^{\</sup>rm 6*}$  The impact area discussed on this factsheet is not a focus of the cited paper



Impact Area & Indicator Factsheet: Ecosystem Services

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