Ecosystem Service	**Cultivated terrestrial plants for materials**
CICES class name	Fibres and other materials from cultivated plants, fungi, algae and bacteria for direct use or processing (excluding genetic materials)
CICES Section	Provisioning (Biotic)
CICES Class code	1.1.1.2

Brief Description

- Material from plants, fungi, algae or bacterial that can be used by humans, including use as animal feed
- The ecological contribution to the production of plants, fungi, algae or bacteria that can be harvested and used as animal feed or raw material for non-nutritional purposes

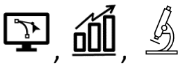
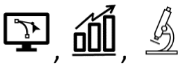
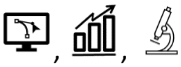
Sample Indicators

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**
[14] Yield	Not provided	
[19] Biotic production	kg * m^{-2} * yr^{-1}	
[19] Net primary production (NPP)	kg dm * m^{-2} * yr^{-1}	
[20] Net primary productivity (NPP): average of total above and below ground dry mass at harvest over a 30-years simulation period	Mg / (hectare * year)	

Table 2: Regional Scale

Indicator	Unit	Indicator values from
[6] Yield	kg * ha^{-1} * yr^{-1}	
[17] Annual biomass yield	t dm * ha^{-1} * yr^{-1}	
[3] Biomass for industrial use/processing	t * ha^{-1} * yr^{-1}	
[12] Provisioning of material: Modelled biomass yield	t dm * ha^{-1} * yr^{-1} t dm * ha^{-1}	
[16] Timber production in the region	m^3	
[8] Crop production: assigned value depends 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	
[8] Production of biochemicals and medicine: assigned value depends 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	
[15] Cultivated medicinal plants: expert-based index for ES provision by land cover class [1-5] multiplied by area of land cover class [km2]	Index 1-5 * km^{-2}	
[15] Cultivated medicinal plants' value: expert-based index for ES provision by land cover class [1-5] multiplied by area of land cover class [km2] and literature-based monetary value of ES	$ * ha^{-1} * yr^{-1}	
[17] Biomass stock in the landscape (crops and trees) at any one time	t dm * ha^{-1}	
[2] Annual growth rates of woody species representative for the land use type	t db * ha^{-1}	
[9] Yield potential	very low 1 to very high 5	
[7] Share of arable land use within each NUTS2 region	%	
[18] Percentage of the products of a land use class that is used for construction purposes (e.g., roofs, pillars)	%	

[1] Area of agricultural ecosystems under sustainable management	Not provided	
[1] Organic farming	Not provided	
[15] Agricultural inputs (e.g. materials, compost): expert based index for ES provision by land cover class [1-5] multiplied by area of land cover class [km2]	Index 1-5 * km^{-2}	
[15] Agricultural inputs' (Support for local production base e.g. materials for floating agricultural bed, compost and irrigation) value: expert based index for ES provision by land cover class [1-5] multiplied by area of land cover class [km^2] and literature-based monetary value of ES	$ * ha^{-1} * yr^{-1}	
[18] Rating of current service provision per land use class by expert-stakeholders	0-10	
[18] Rating of increases/decreases of service provision in scenarios, relative to the status quo	%	

Table 3: National Scale

Indicator	**Unit**	**Indicator values from**
[5] Total biomass production on agricultural land	t dm	
[13] Yields of fibre crops	t * ha^{-1} t dm * ha^{-1} MJ * ha^{-1}	
[13] Yields of crops used for medicinal and cosmetic purposes	t * ha^{-1} t dm * ha^{-1} MJ * ha^{-1}	
[13] Fibre crop area	ha	
[13] Area of crops used for medicinal and cosmetic purposes	ha	
[1] Area of agricultural ecosystems under sustainable management	Not provided	
[1] Organic farming	Not provided	
[4] Summed gross margin of production (area of crop multiplied by the gross margin per unit area)	$	

[11] Historical analysis: materials used in (farmhouse) buildings in a region: carrier material (e.g., straw, bendable wood), insulation (e.g., e.g., moss), stable wood, timber, weatherproof wood, weather protection roofing (e.g., straw, reed), flowers, ropes (e.g., hemp), special wood used for handcrafts/ornamentation	Not provided	
[11] Historical analysis: materials used for agricultural purposes in a region: mulching, peat, plaggen, river sediments, hedges	Not provided	

Table 4: Multinational Scale

Indicator	Unit	Indicator values from
[1] Area of agricultural ecosystems under sustainable management	Not provided	⊘
[1] Organic farming	Not provided	⊘
[7] Biomass: Energy output from agricultural biomass	MJ * ha^{-1}	
[10] Crops: values for 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 0-5	
[10] Biochemicals & medicines: values for 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 0-5	

Table 5: Global Scale

Indicator	Unit	Indicator values from
[1] Area of agricultural ecosystems under sustainable management	Not provided	⊘
[1] Organic farming	Not provided	⊘

References

No.	Citation
1[3*]	Feld CK, Sousa JP, da Silva PM, Dawson TP (2010) Indicators for biodiversity and ecosystem services: towards an improved framework for ecosystems assessment. Biodiversity and Conservation 19(10): 2895-2919. DOI: 10.1007/s10531-010-9875-0
2	Felipe-Lucia MR, Comin FA (2015) Ecosystem services-biodiversity relationships depend on land use type in floodplain agroecosystems. Land Use Policy 46: 201-210. DOI: 10.1016/j.landusepol.2015.02.003
3*	Fürst C, Frank S, Witt A, Koschke L, Makeschin F (2013) Assessment of the effects of forest land use strategies on the provision of ecosystem services at regional scale. Journal of Environmental Management 127: S96-S116. DOI: 10.1016/j.jenvman.2012.09.020
4	Holland RA, Eigenbrod F, Armsworth PR, Anderson BJ, Thomas CD, Heinemeyer A, Gillings S, Roy DB, Gaston KJ (2011) Spatial covariation between freshwater and terrestrial ecosystem services. Ecological Applications 21(6): 2034-2048. DOI: 10.1890/09-2195.1
5	Kirchner M, Schmidt J, Kindermann G, Kulmer V, Mitter H, Prettenthaler F, Rudisser J, Schauppenlehner T, Schonhart M, Strauss F, Tappeiner U, Tasser E, Schmid E (2015) Ecosystem services and economic development in Austrian agricultural landscapes - The impact of policy and climate change scenarios on trade-offs and synergies. Ecological Economics 109: 161-174. DOI: 10.1016/j.ecolecon.2014.11.005
6	Koschke L, Furst C, Lorenz M, Witt A, Frank S, Makeschin F (2013) The integration of crop rotation and tillage practices in the assessment of ecosystem services provision at the regional scale. Ecological Indicators 32: 157-171. DOI: 10.1016/j.ecolind.2013.03.008
7	Schulp CJE, Van Teeffelen AJA, Tucker G, Verburg PH (2016) A quantitative assessment of policy options for no net loss of biodiversity and ecosystem services in the European Union. Land Use Policy 57: 151-163. DOI: 10.1016/j.landusepol.2016.05.018
8*	Zhang ZM, Gao JF, Fan XY, Lan Y, Zhao MS (2017) Response of ecosystem services to socioeconomic development in the Yangtze River Basin, China. Ecological Indicators 72: 481-493. DOI: 10.1016/j.ecolind.2016.08.035
9	Bastian O, Lupp G, Syrbe RU, Steinháußer R (2013) Ecosystem services and energy crops - Spatial differentiation of risks. Ekologia Bratislava 32(1): 13-29. DOI: 10.2478/eko-2013-0002
10	Clerici N, Paracchini ML, Maes J (2014) Land-cover change dynamics and insights into ecosystem services in European stream riparian zones. Ecohydrology and Hydrobiology 14(2): 107-120. DOI: 10.1016/j.ecohyd.2014.01.002
11	Dittrich A, von Wehrden H, Abson DJ, Bartkowski B, Cord AF, Fust P, Hoyer C, Kambach S, Meyer MA, Radzevičiūtė R, Nieto-Romero M, Seppelt R, Beckmann M (2017) Mapping and analysing historical indicators of ecosystem services in Germany. Ecological Indicators 75: 101-110. DOI: 10.1016/j.ecolind.2016.12.010
12	Kay S, Crous-Duran J, Ferreiro-Domínguez N, García de Jalón S, Graves A, Moreno G, Mosquera-Losada MR, Palma JHN, Roces-Díaz JV, Santiago-Freijanes JJ, Szerencsits E, Weibel R, Herzog F (2018) Spatial similarities between European agroforestry systems and ecosystem services at the landscape scale. Agroforestry Systems 92(4): 1075-1089. DOI: 10.1007/s10457-017-0132-3
13	Maes J, Liquete C, Teller A, Erhard M, Paracchini ML, Barredo JI, Grizzetti B, Cardoso A, Somma F, Petersen JE, Meiner A, Gelabert ER, Zal N, Kristensen P, Bastrup-Birk A, Biala K, Piroddi C, Egoh B, Degeorges P, Fiorina C, Santos-Martín F, Naruševičius V, Verboven J, Pereira HM, Bengtsson J, Gocheva K, Marta-Pedroso C, Snäll T, Estreguil C, San-Miguel-Ayanz J, Pérez-Soba M, Grêt-Regamey A, Lillebø AI, Malak DA, Condé S, Moen J, Czúcz B, Drakou

[3*] The impact area discussed on this factsheet is not a focus of the cited paper

No.	Citation
	EG, Zulian G, Lavalle C (2016) An indicator framework for assessing ecosystem services in support of the EU Biodiversity Strategy to 2020. Ecosystem Services 17: 14-23. DOI: 10.1016/j.ecoser.2015.10.023
14	Daryanto S, Fu BJ, Wang LX, Jacinthe PA, Zhao WW (2018) Quantitative synthesis on the ecosystem services of cover crops. Earth-Science Reviews 185: 357-373. DOI: 10.1016/j.earscirev.2018.06.013
15	Huq N, Bruns A, Ribbe L (2019) Interactions between freshwater ecosystem services and land cover changes in southern Bangladesh: A perspective from short-term (seasonal) and long-term (1973-2014) scale. Science of the Total Environment 650: 132-143. DOI: 10.1016/j.scitotenv.2018.08.430
16	Jaligot R, Chenal J, Bosch M, Hasler S (2019) Historical dynamics of ecosystem services and land management policies in Switzerland. Ecological Indicators 101: 81-90. DOI: 10.1016/j.ecolind.2019.01.007
17	Kay S, Crous-Duran J, García de Jalón S, Graves A, Palma JHN, Roces-Díaz JV, Szerencsits E, Weibel R, Herzog F (2018) Landscape-scale modelling of agroforestry ecosystems services in Swiss orchards: a methodological approach. Landscape Ecology 33(9): 1633-1644. DOI: 10.1007/s10980-018-0691-3
18	Koo H, Kleemann J, Fürst C (2018) Land use scenario modeling based on local knowledge for the provision of ecosystem services in northern Ghana. Land 7(2): 59. DOI: 10.3390/land7020059
19*	Tang LL, Hayashi K, Kohyama K, Leon A (2018) Reconciling Life Cycle Environmental Impacts with Ecosystem Services: A Management Perspective on Agricultural Land Use. Sustainability 10(3): 630. DOI: 10.3390/su10030630
20	Nguyen TH, Cook M, Field JL, Khuc QV, Paustian K (2018) High-resolution trade-off analysis and optimization of ecosystem services and disservices in agricultural landscapes. Environmental Modelling & Software 107: 105-118. DOI: 10.1016/j.envsoft.2018.06.006