Key ecosystem services to measure and value

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Which ecosystem services?

- How to chose which services should be quantified and valued for SEEA-EEA?
- Most popular/important to a community? – which communities?
- Most knowledge and understanding of underlying biophysical processes – reflected in number times quantified/mapped?
- Strongest evidence of contribution to well-being and importance to people – reflected in # of valuations?
- Base on data availability?
- Or some combination of the above?

- Frequency in the literature and frequency of times service mapped/ valued reflects aspects of all of above?

Literature reviews on ecosystem services

- There are many – e.g.

- Crossman, N. D., B. Burkhard, S. Nedkov, L. Willemen, K. Petz, I. Palomo, E. G. Drakou, B. Martin-Lopez, T. McPhearson, K. Boyanova, R. Alkemade, B. Egoh, M. B. Dunbar, and J. Maes. 2013. A blueprint for mapping and modelling ecosystem services. Ecosystem Services **4**:4-14.
- Bagstad, K. J., D. J. Semmens, S. Waage, and R. Winthrop. 2013. A comparative assessment of decision-support tools for ecosystem services quantification and valuation. Ecosystem Services **5**:27-39.
- Martínez-Harms, M. J., and P. Balvanera. 2012. Methods for mapping ecosystem service supply: a review. International Journal of Biodiversity Science, Ecosystem Services & Management **8**:17-25.
- Milcu, A. I., J. Hanspach, D. Abson, and J. Fischer. 2013. Cultural Ecosystem Services: A Literature Review and Prospects for Future Research. Ecology and Society **18**.
- Egoh, B., E. G. Drakou, M. B. Dunbar, J. Maes, and L. Willemen. 2012. Indicators for mapping ecosystem services: a review. Report EUR 25456 EN. Publications Office of the European Union, Luxembourg.
- Harrison, P. A., P. M. Berry, G. Simpson, J. R. Haslett, M. Blicharska, M. Bucur, R. Dunford, B. Egoh, M. Garcia-Llorente, N. Geamănă, W. Geertsema, E. Lommelen, L. Meiresonne, and F. Turkelboom. 2014. Linkages between biodiversity attributes and ecosystem services: A systematic review. Ecosystem Services **9**:191-203.
- Schägner, J. P., L. Brander, J. Maes, and V. Hartje. 2013. Mapping ecosystem services' values: Current practice and future prospects. Ecosystem Services **4**:33-46.
- Luederitz, C., E. Brink, F. Gralla, V. Hermelingmeier, M. Meyer, L. Niven, L. Panzer, S. Partelow, A.-L. Rau, R. Sasaki, D. J. Abson, D. J. Lang, C. Wamsler, and H. von Wehrden. 2015. A review of urban ecosystem services: six key challenges for future research. Ecosystem Services **14**:98-112.
- Laurans, Y., A. Rankovic, R. Billé, R. Pirard, and L. Mermet. 2013. Use of ecosystem services economic valuation for decision making: Questioning a literature blindspot. Journal of Environmental Management **119**:208-219.

Choose ecosystem services on level of importance?

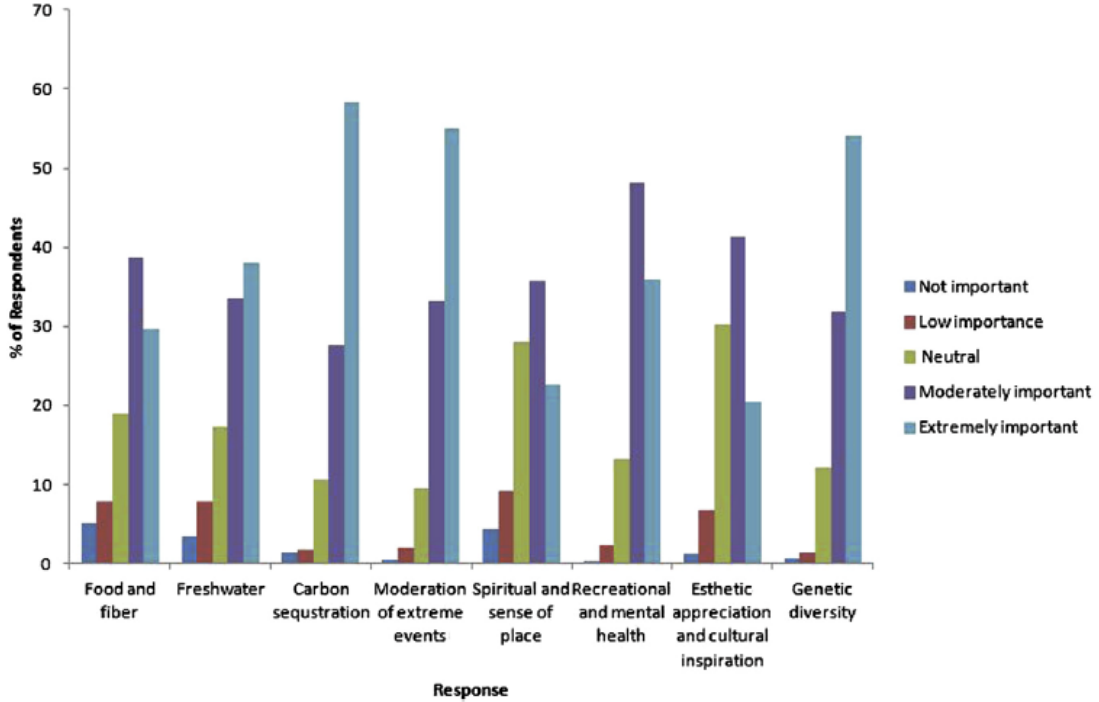


Fig. 4. Survey results for the question: "please list the relative importance of each ecosystem services from extremely important to not important".

Source: Liu, S., N. D. Crossman, M. Nolan, and H. Ghirmay. 2013. Bringing ecosystem services into integrated water resources management. Journal of Environmental Management **129**:92-102.

Choose ecosystem services on frequency mapped?

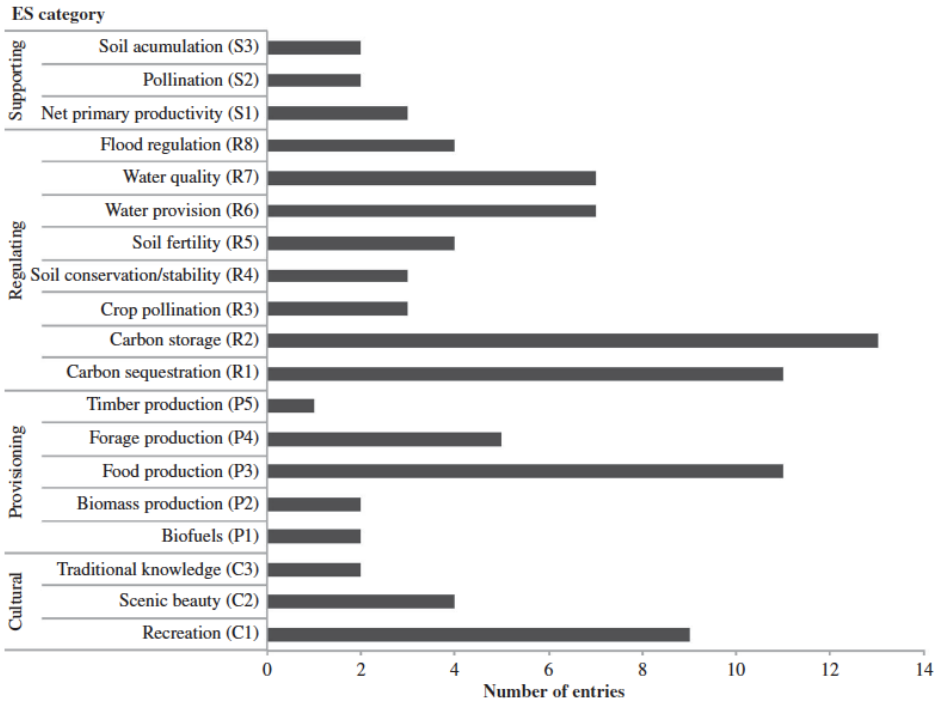


Figure 2. Frequency distribution of studies mapping ESs (entries correspond to each service within each reference).

Source: Martínez-Harms, M. J., and P. Balvanera. 2012. Methods for mapping ecosystem service supply: a review. International Journal of Biodiversity Science, Ecosystem Services & Management **8**:17-25.

Choose ecosystem services on frequency valued?

Table 1
The number of value estimates per valuation method and ecosystem service.
Source: compiled based on data presented in Appendix 1.

Ecosystem service	No. of esti-mates	'Market' values						Revealed preference		Stated preference		Other
		Direct market value			Cost based methods							
		DMP	PES[a]	FI/PF	AC	MC/RC	RC	HP	TC	CV	GV	
Total	**665**	**297**	**4**	**51**	**60**	**13**	**56**	**3**	**24**	**93**	**13**	**51**
Provisioning services	**287**	**219**	**0**	**23**	**8**	**2**	**14**	**0**	**0**	**1**	**8**	**12**
1 Food	133	118		8		1					3	3
2 Water	38	5		10	7	1	9				3	3
3 Raw materials	100	83		5	1		5				2	4
4 Genetic resources	3	2		8							3	1
5 Medicinal resources	6	4									1	1
6 Ornamental resources	7	7										
Regulating services	**152**	**20**	**0**	**7**	**51**	**9**	**40**	**0**	**0**	**7**	**0**	**18**
7 Air quality regulation	1											1
8 Climate regulation	36	12			9	5	6				1	3
9 Moderation of disturbance	48	2		2	26	1	10				4	3
10 Water flow regulation	5			2	1		1					1
11 Waste treatment	31	1		1	5	2	19				1	2
12 Erosion prevention	17	4			7	1	1				1	3
13 Soil fertility mainten.	7	1			2		2					2
14 Pollination	3			2								1
15Biological control	4				1		1					2
Habitat services	**81**	**10**	**3**	**13**	**1**	**2**	**2**	**0**	**0**	**34**	**4**	**12**
16 Nursery service	28	9		12	1		2			1		3
17 Genepool Protection	53	1	3	1		2				33	4	9
Cultural services	**145**	**48**	**1**	**8**	**0**	**0**	**0**	**3**	**24**	**51**	**1**	**9**
18 aesthetics information	12	2						3		6		1
19 Recreation	122	40		8					23	43	1	7
20 Inspiration for culture and art	2	1								1		
21 Spiritual experience	1									1		
22 Cognitive development	8	5							1			1

Source: de Groot, R., L. Brander, S. van der Ploeg, R. Costanza, F. Bernard, L. Braat, M. Christie, N. Crossman, A. Ghermandi,L. Hein, S. Hussain, P. Kumar, A. McVittie, R. Portela, L. C. Rodriguez, P. ten Brink, and P. van Beukeringh. 2012. Global estimates of the value of ecosystems and their services in monetary units. Ecosystem Services **1**:50-61.

New models/data or exisitng data and models?

The Ecosystem Services Partnership Visualisation Tool & database

Fig. 3. Web interface of the ma
(a) Upload ES maps and metadat

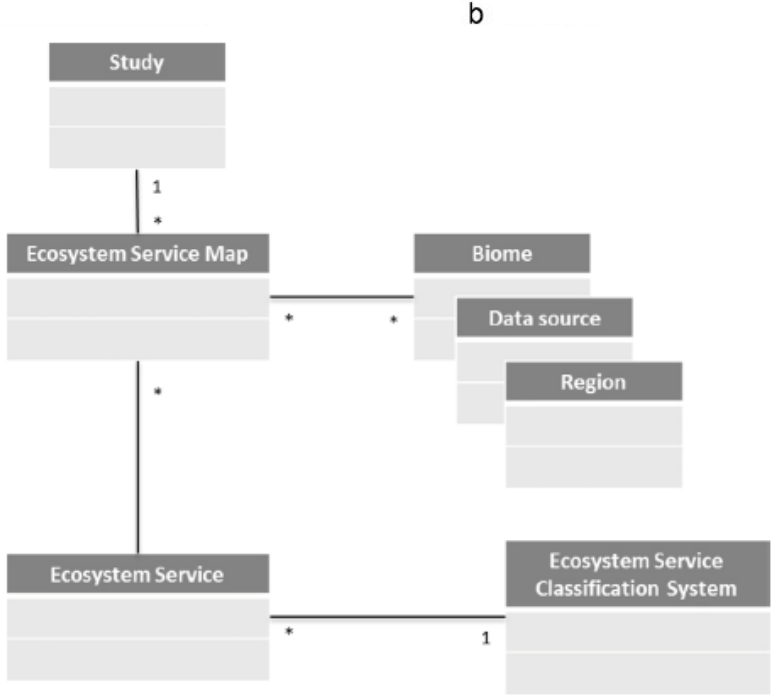
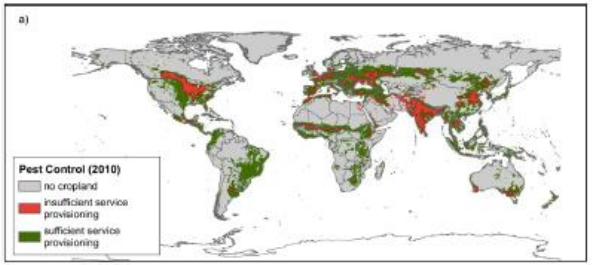


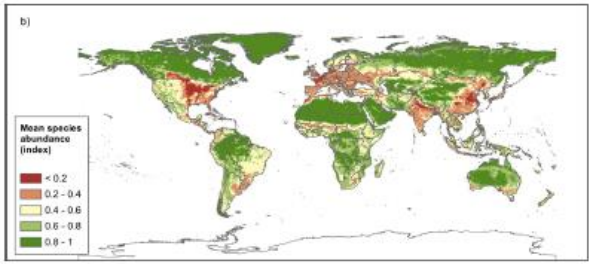
Fig. 2. Graphic representation of the database structure. Asterisk (*) represents multiplicity. Two asterisks in a line represent a "many-to-many" relationships, while an asterisk and a 1, represent a "one-to-many" relationship. Each box is an abstract representation of a database table with all fields removed for brevity.

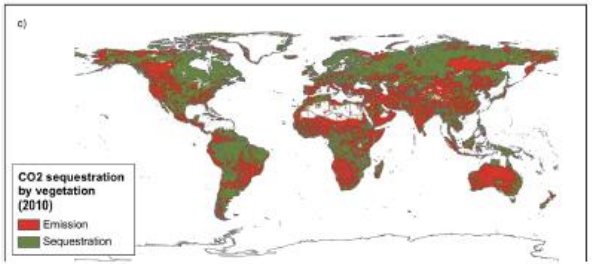
interfaces appear:

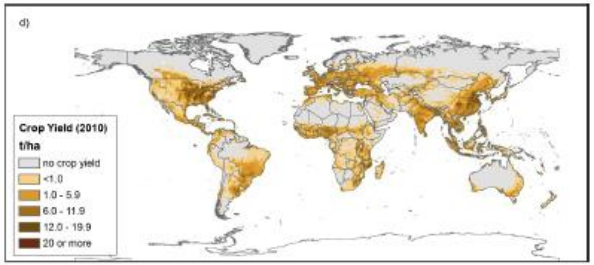
Source: Drakou, E. G., N. D. Crossman, L. Willemen, B. Burkhard, I. Palomo, J. Maes, and S. Peedell. 2015. A visualization and data-sharing tool for ecosystem service maps: Lessons learnt, challenges and the way forward. Ecosystem Services **13**:134-140.

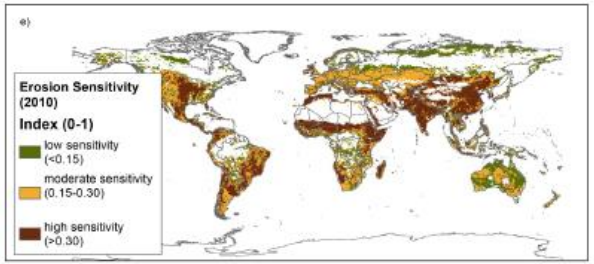
Available data – e.g. IPBES (PBL global ES modelling)

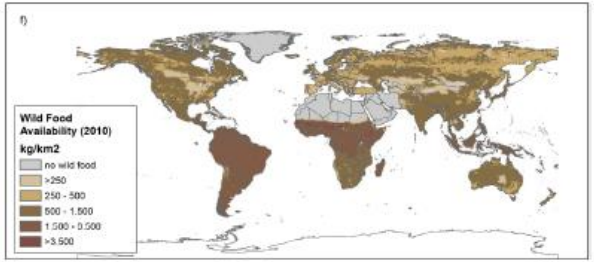




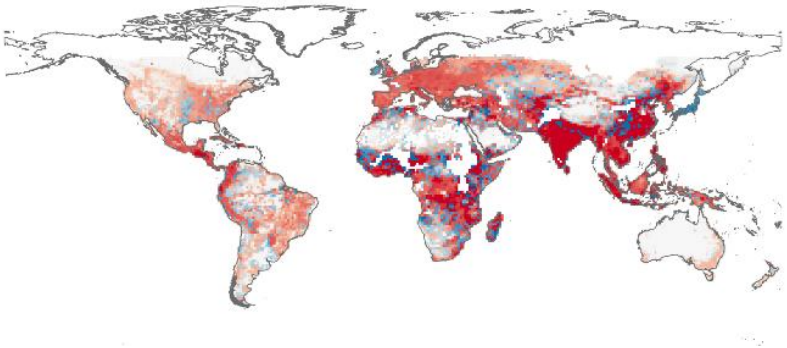


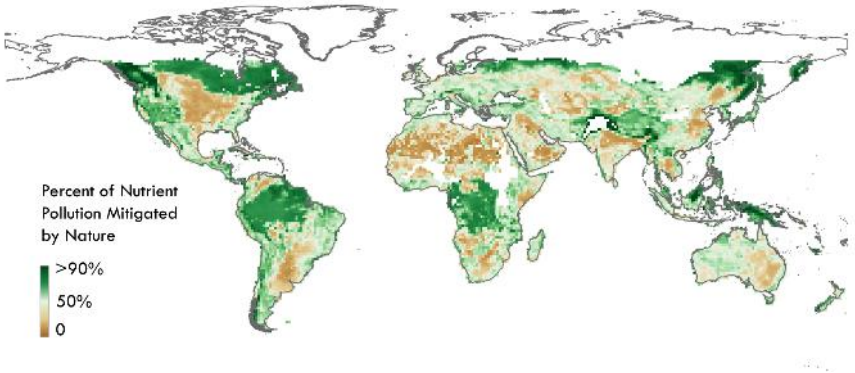






Available data – e.g. IPBES (NatCap global models)





If new data needed - which data/models/tools?

Table 1
Examples of ecosystem service related tools.

Tool name	Tool type	Link	Access	Spatial scale
Digital Observatory for Protected Areas (DOPA)	Toolkit	dopa.jrc.ec.europa.eu/explorer	Open	Global
Ecosystem Service Valuation Toolkit	Toolkit	http://esvaluation.org/	Demo available	Global
InVEST (Integrated Valuation of Environmental Services and Tradeoffs)	Toolkit	http://www.naturalcapitalproject.org/InVEST.html	Open	Global
ARIES (Artificial Intelligence for Ecosystem Services)	Toolkit	http://ariesonline.org/	Open	Global
MIMES (Multi-scale Integrated Models of Ecosystem Services)	Toolkit	http://www.afordablefutures.com/services/mimes	Not available yet	Global
Catalogue of Assessments on Biodiversity and Ecosystem Services	Data catalogue	http://ipbes.unepwcmc-004.vm.brightbox.net/	Open	Global
Marine Ecosystem Service partnership database (MESP)	Data catalogue	http://www.marineecosystemservices.org/explore	Open	Global
BioCarbon Tracker	Combined	http://tracker.biocarbontracker.com/login/?next=/interface/	Open	Global
Capturing Coral Reef Ecosystem Services (CCRES)	Combined	http://www.worldbank.org/projects/P123933/capturing-coral-reef-ecosystem-services-ccres?lang=en	Open	Global
Ecosystem Services mapping gateway	Combined	http://www.nerc-bess.net/ne-ess/	Open	UK

Source: Drakou, E. G., N. D. Crossman, L. Willemen, B. Burkhard, I. Palomo, J. Maes, and S. Peedell. 2015. A visualization and data-sharing tool for ecosystem service maps: Lessons learnt, challenges and the way forward. Ecosystem Services **13**:134-140.

If new data needed - which data/models/tools?

TABLE **5.4**

Summary of major ecosystem services model tools. Dynamic models are in orange, while snapshot models are in blue.

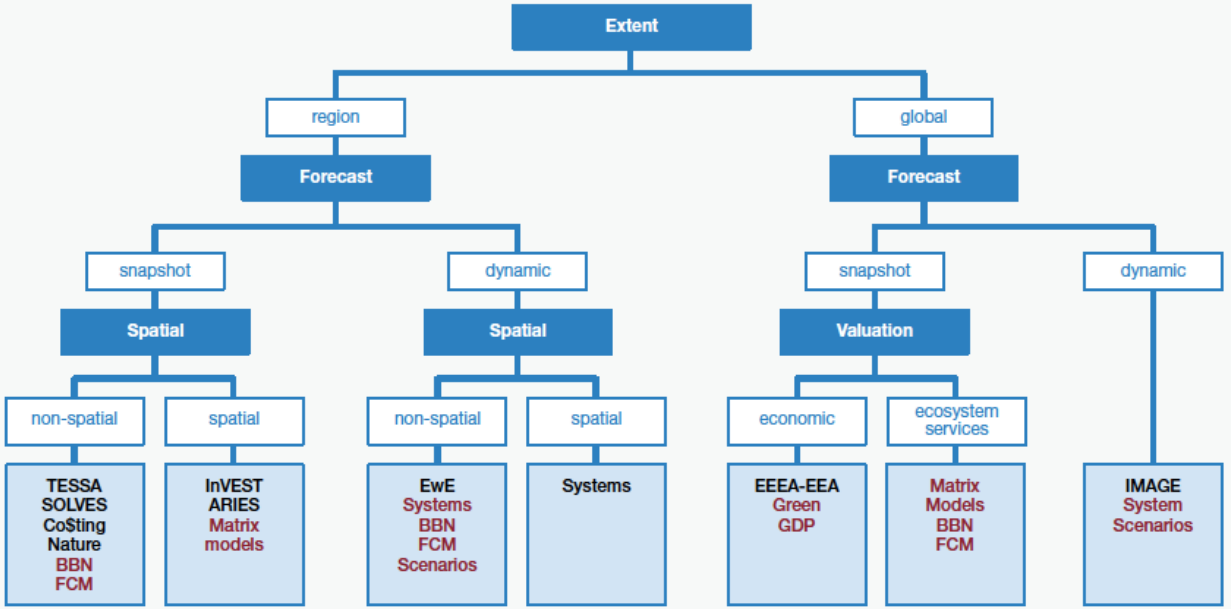
Tool	Model type	Scale in space, time	Ease of use	Community of practice	Flexibility	Reference
IMAGE	Process	Global, dynamic	Difficult	Small	Low	Stehfest *et al.*, 2014
EcoPath with EcoSim	Process	Region, dynamic	Medium	Large	High	Christensen et al., 2005
ARIES	Expert	Region, dynamic	Difficult	Small	High	Villa *et al.*, 2014
InVEST	Process and correlative	Region, static	Medium	Large	Medium	Sharp *et al.*, 2014
Co$ting nature	Correlative	Region, static	Easy-medium	Small	Medium	www.policysupport.org/costingnature
TESSA	Expert	Region, static	Easy	Small	Low	Peh *et al.*, 2014
Corporate ecosystem services review	Expert	Region, static	Easy	Small	Low	Hanson *et al.*, 2012
LUCI	Correlative	Region, static	Easy	Small	Medium	www.lucitools.org

Source G. Peterson, J. Kabubo-Mariara, N. Crossman, B. Rashleigh, P. Munoz, J. Anticamara, M. V. Mdemu and A. Aunins, 2016: Modelling consequences of change in biodiversity and ecosystems for nature's benefits to people. In : IPBES (2016): The methodological assessment report on scenarios and models of biodiversity and ecosystem services.

If new data needed - which data/models/tools?

FIGURE **5.6**

The decision tree outlines the sets of ecosystem service models that are currently available. The tree is defined by the extent of the model, type of forecast desired (snapshot or dynamic interaction among variables), and whether spatial or non-spatial analysis is conducted. The boundaries between different modelling approaches are less sharp than shown in this tree, because with some effort space or time can be incorporated in snapshot or non-spatial models. Modelling approaches are shown in black, and modelling tools are shown in red.



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Key attributes when modelling and mapping

Mapped ecosystem service		Accounting definitions		ES Indicator	Quantification unit			Input data source	Quantification method	Spatial details			Mapped year or period	Study objective met	Comments
		Type (e.g. stock, flow, process, function)	**Beneficiary** (e.g. supply, demand, benefiting/ providing area)		**Quantity** (e.g. kg)	**Area** (e.g. ha or watershed)	**Time** (e.g. year)	(model output, measured/primary, aggregated statistics)	(process, empirical, participatory + name of model)	**Scale** (global, national, regional, local)	**Extent** (size)	**Resolution** (pixel size, minimal mapping unit)	(e.g. 2000 or 1990 - 2050)	(1 = yes; to 5= no)	(e.g limitations, key assumptions)
Provisioning	Food														
	Water														
	–														
	Other														
Regulating	Air quality														
	Climate														
	–														
	Other														
Other															

Source: Crossman, N. D., B. Burkhard, S. Nedkov, L. Willemen, K. Petz, I. Palomo, E. G. Drakou, B. Martin-Lopez, T. McPhearson, K. Boyanova, R. Alkemade, B. Egoh, M. B. Dunbar, and J. Maes. 2013. A blueprint for mapping and modelling ecosystem services. Ecosystem Services **4**:4-14.

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