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Note on definitions related to ecosystem conditions and their services based on different glossaries

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Contents

1	Introduction.....	4
2	Description of the three glossaries.....	4
3	Concepts related to ecosystem condition.....	5
4	Creating an experimental ‘operative MAES glossary’.....	6
	References.....	8
	Annex 1.....	9

1 Introduction

Assessments of ecosystems and their services (ES) are a relatively new and intensively expanding field connecting policy and science. There are several glossaries of definitions for ES related terms out in the literature, which mostly consist of compilations of the relevant definitions from various scientific disciplines. However, ES studies are currently moving from a science-dominated exploratory phase into a more policy-oriented and practical operationalization phase. This change is initiated and governed by the integration of ES assessments into major international policy targets, including the EU Biodiversity (Strategy Target 2, Action 5). This change of the context, however, also means new expectations towards glossaries (sets of definitions), which should be:

- harmonized – no contradictions among terms, explore disciplinary divergences underlying certain terms (e.g. quantitative means diff things in social vs natural sciences), and base the definitions on a shared language;
- comprehensive -- encompassing all major elements of the MAES conceptual framework as well as their delimitations (borderline cases, exceptions) and relationships; and
- operative – effectively assisting the implementations of the MAES assessments.

In the followings three major ES glossaries, which were already conceived in this practical, policy oriented context: MAES, SEEA-EEA, and OpenNESS glossaries are reviewed. Next a few particularly critical issues are illustrated with the help of examples. Finally, a proposal for a consistent set of working definitions is given for the EU MAES assessment (an ‘operative MAES glossary’). Furthermore, according to the current stage of the EU MAES process a particular emphasis is put on the interpretation of ecosystem condition and the closely related concepts throughout the process. The resulting set of definitions can be relevant for many operative assessment and accounting applications, including national MAES processes and KIP-INCA.

2 Description of the three glossaries

The EU MAES (Mapping and Assessment of Ecosystems and their Services) initiative aims at implementing the mapping and assessment of the ecosystems and their services at EU level, as well as supporting the member states with guidance to achieve action 5 of the Biodiversity Strategy by mapping and assessing the state of ecosystems and their services.

Each MAES report published its own glossary. This study relies on a joint glossary combined from the first three MAES reports (Maes et al. 2013, 2014, Erhard et al. 2016), which are referred to as MAES1, MAES2, and MAES3 below. This combined MAES glossary was then extended by two further major glossaries in the field of ecosystem assessment.

The Experimental Ecosystem Accounting program of the System of Environmental-Economic Accounting (SEEA-EEA) aims at integrating ecosystems, their extent, condition and services into standard measures of economic activity. The SEEA-EEA 2012 ‘white cover’ publication (European Commission et al., 2013) contains a comprehensive glossary of terms related to the SEEA-EEA goals. The definitions are generally very long and detailed, explaining uncertainties, boundary cases and relationships to other terms in detail.

The most comprehensive set of ES-related definitions to date is probably the glossary compiled by the EU FP7 project OpenNESS (Potschin et al. 2014). This glossary embraces the knowledge and perspective of most scientific disciplines involved in ES assessment, and the number of definitions is much larger. The glossary was compiled through an iterative consultation process, and is mainly based on MA, TEEB, and UK NEA glossaries, but includes also definitions from 55 further sources (mainly scientific papers), as well as a number of new definitions. The consultative process lead to

considerable harmonization, but the resulting set of definitions is still quite heterogeneous, with many conceptual overlaps and partial contradictions. Nevertheless, given the diversity of definition sources and the broad interdisciplinary coverage, this glossary is a very valuable resource for MAES.

The three glossaries contain altogether definitions for 243 terms. However there are overlaps: in some cases the different glossaries contain different (i.e. incompatible) definitions for the same term, whereas there are also some cases where essentially the same definition is included under different terms in the different glossaries (synonyms). The number of terms and the overlaps between the three glossaries are illustrated in fig. 1.

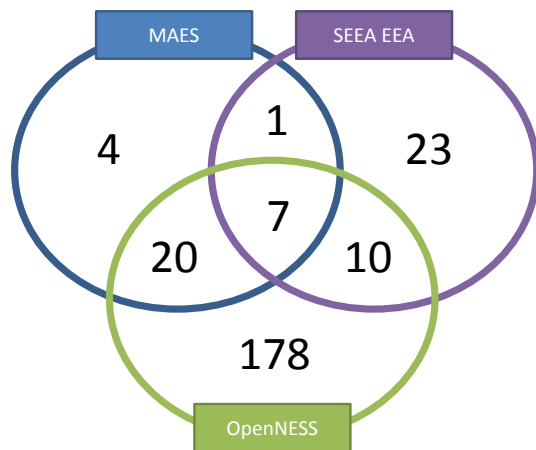


Figure 1: The number of definitions in the studied glossaries, and the overlaps between them.

3 Concepts related to ecosystem condition

According to the SEEA-EEA definition, **ecosystem condition** is ‘the overall quality of an ecosystem asset, in terms of its characteristics (...which) also underpins the capacity of an ecosystem asset to generate ecosystem services’, whereas **ecosystem capacity** ‘refers to the ability of a given ecosystem asset to generate a set of ecosystem services in a sustainable way into the future’. These definitions essentially match the corresponding definitions in OpenNESS. So accordingly SEEA-EEA and OpenNESS condition influences capacity -- but they are not the same.

The different MAES reports contain slightly different definitions for **ecosystem condition**. Whereas the concept is missing from MAES1, MAES2 relies on a definition from MA: ‘The capacity of an ecosystem to yield services, relative to its potential capacity (MA, 2005). For the purpose of MAES, ecosystem condition is, however, usually used as a synonym for ‘ecosystem state’.’ Thus the first sentence equates condition to capacity, while the second sentence seems to partially contradict, as **ecosystem state** is defined as ‘the physical, chemical and biological condition of an ecosystem at a particular point in time which can also be referred to as its quality’, which is much more in line with the SEEA-EEA / OpenNESS definitions as the first sentence. This concept became integrated into the MAES3 definition of **ecosystem condition**: ‘The physical, chemical and biological condition of an ecosystem at a particular point in time. The capacity of an ecosystem to yield services, relative to its potential capacity (MA, 2005). For the purpose of MAES, ecosystem condition is, however, usually used as a synonym for ‘ecosystem state’.’ Accordingly, there is a clear tendency that the MAES interpretation for ecosystem condition converges towards the SEEA-EEA / OpenNESS definitions. However, the MAES3 definition still contains the MA definition, which seems to be poorly adapted to the operative context, and thus can become the source of confusions.

A further layer of complexity in the current MAES definitions relates to two very similar terms, ecological state and status, which gained different meanings through their key positions in disciplinary jargons. According to MAES1 definitions, **ecosystem state** is essentially a synonym

ecosystem condition (*‘the physical, chemical and biological condition of an ecosystem’*), whereas **ecosystem status** is essentially state measured in a specific way defined by EU legislation (*‘ecosystem state (...) measured against time and compared to an agreed target in EU environmental directives’*). However, both the terms and the underlying definitions have evolved significantly in the following MAES reports to reduce the risks for potential misunderstanding. Accordingly, ecosystem state was merged into ecosystem condition in MAES3, and ecosystem status was replaced by conservation status, with two definitions explicitly borrowed from the related legislation (Habitats Directive).

The operative way forward is to make a clear distinction between the ES-specific concept of ‘capacity’ (i.e. *of an ecosystem to yield a specific service*), and the more general concept of ‘condition’ (i.e. *the overall quality of an ecosystem which influences its capacity for various ES*). Thus an operative definition for **ecosystem condition** could be: *‘the overall quality of an ecosystem unit, in terms of its main characteristics underpinning its capacity to generate ecosystem services’* (combined from SEEA-EEA & OpenNESS definitions, simplified – see also the principles discussed in the next chapter). Similarly, the SEEA-EEA definition for (**ecosystem**) **capacity** (*‘the ability of a given ecosystem unit to generate a specific ecosystem service in a sustainable way’*) should be transferred to the MAES glossary. Thus, in an operative sense, the main distinction between condition and capacity is that condition is always general, whereas capacity is always service-specific. The adaptation of a third, closely related term, **ecosystem characteristic**, seems to be also beneficial. In SEEA-EEA **ecosystem characteristic**, defined in the following way: *‘Key attributes of an ecosystem unit describing its components, structure, processes, and functionality, frequently closely related to biodiversity. The term characteristics is intended to be able to encompass all of the various perspectives taken to describe an ecosystem.’* In the case of state and status the trajectory drawn by the three MAES reports should be followed, thus considering ecosystem state a synonym for ecosystem condition, and **‘status’** should be simply interpreted as *‘A specific aspect of ecosystem condition classified following criteria defined in the environmental protection objectives in EU legislation’*.

4 Creating an experimental ‘operative MAES glossary’

To support the MAES process an experimental ‘operative MAES glossary’ was created. The starting point was the MAES & SEEA-EEA sets of definitions, which were extended with the corresponding OpenNESS definitions for the same terms into a common database. Next the individual definitions were reviewed for conflicts and contradictions, and new terms were added for gap-filling. The most important principles were:

- **conventions:** stick to (at least one of) the original definitions (word use, order of clauses, etc.) as much as possible;
- **clarity:** overly complex definitions were simplified, clauses repeating parts of other definitions were dropped (this also increased coherence (see below) at the price of less self-contained definitions);
- **consistency:** internal contradictions and conceptual overlaps (hidden synonyms), circularities, and (reliance on) undefined terms with vague meaning were corrected; and new terms were added for the gaps identified;
- **coherence:** each definition was adjusted to make reference to and thus to clarify its relationships to other related terms in the glossary, so that the whole glossary would become more meaningful and operative (‘cross-references’ between the concepts);
- **symmetry** in the internal structure / logic of the network of interrelated concepts was also sought and ensured;

- **parsimony**: limit the glossary to as few terms as possible, focusing at key terms that are (1) most central to create a shared understanding, and (2) most problematic (prone to misunderstandings) during the practical implementation.

In addition to the conceptual principles mentioned above, the definitions were also harmonized in terms of style wherever this made sense:

- terms were changed into singular (e.g. ‘ecosystem service’ instead of ‘ecosystem services’);
- wording was adjusted to reflect conceptual similarities (e.g. a term ‘ecosystem capacity’ would suggest a universal capacity, whereas ‘capacity (for an ES)’ makes it more intuitive that a single ecosystem (unit) can have multiple capacities); and
- the self-introductory parts were dropped from the definitions (e.g. ‘Ecosystem capacity refers to...’, ‘A conceptual framework (or conceptual model) is...’).

To create a common uniform ‘style’ SEEA-EEA definitions were generally needed to be made more concise, and in some cases even to be cut into several standalone terms. In general, there were principally three major reasons for extending the initial set of MAES and SEEA-EEA concepts with ‘new’ ones:

- to establish the ‘language’: i.e. to include all terms that are necessary for efficient discussions on MAES related topics (e.g. conceptual framework, valuation, method, model, indicator);
- to support the ‘operationalization’ of the different steps of the practical implementation of a mapping and assessment process (e.g. ecosystem unit, ecosystem type, basic spatial unit, spatial resolution, mapping); and
- to avoid potential interpretation ambiguities or pitfalls as much as possible (e.g. ecosystem typology vs. ecosystem type; or ecosystem service vs. ES classification vs. ES type);

The gaps identified in the merged pool of MAES and SEEA-EEA definitions were primarily filled from the OpenNESS glossary wherever possible. However, in a few cases other sources had to be sought (Haines-Young & Potschin, 2013; OECD, 2016; UNSD 2008; and Hinkel, 2008), and new definitions were also created in a few (6) cases. The resulting new experimental ‘operative MAES glossary’ (see Annex 1) consists of 60 definitions altogether. The key sources for the terms in this harmonized glossary are summarized in fig. 2.

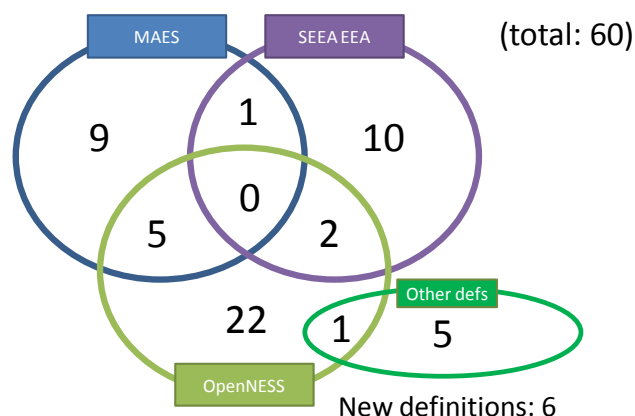


Figure 2: The definitions of the new experimental ‘operative MAES glossary’ (see Annex 1) summarized according to the key sources for each term

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Annex 1

Definitions suggested for the revised MAES Glossary

REL	Suggested term	Suggested meaning	Source	Synonyms	Comments
xx	abiotic	Referring to the physical and chemical (non-living) environment, for example, temperature, moisture, light, nutrient, or natural mineral substances	OpenNESS [Lincoln et al. 1998]		
x	analytical framework	An analytical framework consists of a conceptual framework complemented with the main definitions and classifications needed for its operational use.	based on OECD Glossary Statistical Terms, modified [UNSD SNA]		<i>Made reference to 'conceptual framework' and classifications. (In MAES assessments the most important 'classifications' are the ecosystem typology, and the ES classification)</i>
xxx	assessment	The analysis and review of information derived from research for the purpose of helping someone in a position of responsibility to evaluate potential actions or think about a problem. Assessment means assembling, summarising, organising, interpreting and possibly reconciling pieces of existing knowledge and communicating them so that they are relevant and helpful to an intelligent but inexperienced decision-maker. Assessments are inherently transdisciplinary processes where scientists and stakeholders work together to match data to the elements of a shared conceptual framework.	based on MAES, significantly extended [Parson 1995]		<i>Significantly extended based on transdisciplinarity literature and made more consistent with that term. There is a much shorter def that I like: 'assessment' means 'Transdisciplinary problem solving' (Hinkel 2008 p6) (as opposed to 'research', which generally monodisciplinary and seeks answer to totally different questions)</i>
xxx	basic spatial unit [BSU]	The smallest spatial unit of a mapping project for which the elements of its conceptual framework are estimated. The typical size of BSUs is called spatial resolution.	based on SEEA-EEA, modified	spatial resolution, minimum mapping unit (MMU)	<i>Simplified, made more general and more connected to other definitions</i>
xx	beneficiary	Individuals and economic units (e.g. enterprises, households, governments) who receive the benefits to which ecosystem services contribute	SEEA-EEA		

REL	Suggested term	Suggested meaning	Source	Synonyms	Comments
xxx	benefit	Positive change in wellbeing from the fulfilment of individual or societal needs and wants. Benefits generated by ecosystem services are no longer inherently connected to the source ecosystems.	combined from MAES [TEEB 2010] & OpenNESS		<i>Combined and simplified from two defs.</i>
x	biodiversity	The variability among living organisms from all sources, including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems	MAES [CBD 1992]	biological diversity	
x	biophysical valuation	The process whereby the importance of an element of the MAES framework is estimated with indicators in biological, chemical or physical units using appropriate data and models	based on MAES and OpenNESS, significantly simplified [TEEB]	quantification, evaluation	<i>Simplified, generalized, and made more similar to related definitions (symmetry)</i>
x	biotic	Living or recently living, used here to refer to the biological components of ecosystems, that is, plants, animals, soil microorganisms, leaf litter and dead wood.	MAES		
x	boundary concepts	Terms, such as 'ecosystem services' that help to structure and ease exchange across policy fields, political-administrative levels, and stakeholder groups by providing the basis for a shared understanding	based on OpenNESS, simplified [Mollinga 2010]		<i>Simplified to the first half</i>
xxx	capacity (for an ES)	The ability of a given ecosystem unit to generate a specific ecosystem service in a sustainable way.	based on SEEA-EEA, modified	potential (for an ES), potential supply (of an ES), expected ecosystem service flow	<i>Replaced 'asset' with 'unit' and adjusted to an 'each ES can have its own capacity' perspective</i>

REL	Suggested term	Suggested meaning	Source	Synonyms	Comments
xxx	conceptual framework [CF]	A model describing the relevant elements of a physical or social system and the main connections between them for the purposes of understanding and communication	based on OpenNESS, modified [Myopoulos (1992), Kung et al., (1986) and Wikipedia]	conceptual model	<i>Simplified and made more coherent w other defs</i>
xx	cultural (ecosystem) service	All the non-material, and normally non-consumptive, outputs of ecosystems that affect physical and mental states of people. CES are primarily regarded as the physical settings, locations or situations that give rise to changes in the physical or mental states of people, and whose character are fundamentally dependent on living processes; they can involve individual species, habitats and whole ecosystems.	OpenNESS [CICES4.3]		
x	degradation	A persistent decline in the condition of an ecosystem unit	based on SEEA-EEA, simplified		<i>Simplified the version in S. This is now much more consistent than M123, which links degradation directly to services, and thus cause potential ambiguities where e.g. crop production is reduced due to restoration. Linking degradation to condition also links it to ES -- but indirectly, and not to a specific ES, but to an unspecified 'majority' of ES.</i>
xx	demand (for an ES)	The amount of an ecosystem service required or desired by society. Demand for relevant ES types can be mapped and assessed in an ecosystem assessment as an additional conceptual framework element.	based on OpenNESS, extended [Villamagna et al. 2013]		<i>Extended with MAES relevant parts to increase coherence, and position this concept in an assessment context. Mapping demand however potentially requires a different set of BSUs linked to beneficiaries instead of ecosystems.</i>
xx	disservice	Negative contributions of ecosystems to human well-being; undesired negative effects resulting from the generation of ecosystem services.	OpenNESS		<i>Negative ecosystem outputs, which can be perceived/discussed as 'disservice' (like pests, allergic pollen, or other environmental nuisances) can generally be described in terms of a positive ecosystem functioning (a regulating ES): the capacity/role of the given ecosystem in avoiding the harmful outputs.</i>

REL	Suggested term	Suggested meaning	Source	Synonyms	Comments
x	economic valuation	The process whereby the perceived importance or preference people have for a specific element of the MAES framework is estimated in monetary terms	based on MAES and OpenNESS, simplified	monetary valuation	<i>Simplified, generalized, and tried to avoid the term value (consistence/circularity)</i>
xxx	ecosystem	1 (in a general context): Dynamic complex of plant, animal, and microorganisms communities and their non-living environment interacting as a functional unit. Humans may be an integral part of an ecosystem, although 'socio-ecological system' is sometimes used to denote situations in which people play a significant role, or where the character of the ecosystem is heavily influenced by human action. 2 (in a practical MAES context): --> see 'ecosystem unit'	based on OpenNESS, containing elements of MAES [MA 2005 = CBD 2003 (= UN 1992?)]		<i>Added a clear distinction between ecosystem (general term) and ecosystem unit (assessment unit). This reflects actual use practice of this term. In a MAES context 'ecosystem' is a synonym for 'habitat' (as defined by EUNIS and spatialised with CLC).</i>
xx	ecosystem accounting	Ecosystem accounting is a coherent and integrated approach to the measurement of ecosystem assets and the flows of services from them into economic and other human activity.	SEEA-EEA		
xxx	ecosystem assessment	Assessment of the causes of ecosystem change, their consequences for nature and human well-being, and management and policy options.	based on MAES, modified [UK NEA 2011]		<i>Simplified to make use of the definition for 'assessment'</i>
xx	ecosystem asset	Any set of ecosystem units in their respective conditions. Ecosystem asset represent stocks in an accounting context.	based on SEEA-EEA, modified		<i>Linked to 'ecosystem unit' for parsimony & coherence. In a practical assessment ecosystem assets are defined thematically and/or geographically (e.g. all forests of a specific catchment).</i>
xxx	ecosystem characteristic	Key attributes of an ecosystem unit describing its components, structure, processes, and functionality, frequently closely related to biodiversity. The term characteristics is intended to be able to encompass all of the various perspectives taken to describe an ecosystem.	based on SEEA-EEA, simplified		<i>Simplified focussing at the most relevant elements of the def</i>

REL	Suggested term	Suggested meaning	Source	Synonyms	Comments
xxx	ecosystem condition [EcC]	The overall quality of an ecosystem unit, in terms of its main characteristics underpinning its capacity to generate ecosystem services.	combined from SEEA-EEA & OpenNESS, simplified	ecosystem state, ecosystem health, ecosystem integrity, naturalness, (hemeroby)	<i>Simplified version of S amalgamated with the def from O with the 'measurement' part dropped (for coherence w the definitions of the other MAES framework elements & valuation/indicators). The M2-M3 defs were highly incoherent, partly overlapping w related concepts of 'ecosystem capacity'. Ecosystem condition closely corresponds to "state" in the DPSIR framework.</i>
xxx	ecosystem extent [EcE]	The size of an ecosystem unit, commonly in terms of spatial area	based on SEEA-EEA, simplified		<i>Simplified and added reference to 'ecosystem unit'</i>
xx	ecosystem map	A map of ecosystem units classified into ecosystem types	new term		<i>Created as the meaning of this word combination is nontrivial: 'the 'ecosystem type' membership of BSUs/EcUs on a map'. Other MAES-related maps (of ecosystem condition/service/...) are more straightforward (and thus need no explanation)</i>
xx	ecosystem process	Any physical, chemical or biological change or reaction which occurs within or among ecosystems. Ecosystem processes include production, decomposition, and fluxes of nutrients and energy.	based on MAES, slightly adjusted [MA 2005]		<i>Added 'or among' for making the concept more appropriate for explaining intermediate ecosystem services (consistency)</i>
xxx	ecosystem service [ES]	The contributions of ecosystems to benefits obtained in economic, social, cultural and other human activity	based on MAES and SEEA-EEA, significantly simplified	ecosystem goods and services, final ecosystem service, nature's contributions to people	<i>Simplified M def in the following way: first part --> adjusted according to SEEA-EEA (and most modern definitions that distinguish ES from benefits) in order to improve internal coherence (ES contribute to benefits which contribute to HWB), even though this distinction might not be really operational in some cases; second part --> dropped & moved to a standalone term (flow of ES) in order to improve glossary coherence and symmetry</i>
x	ecosystem service bundle	A set of associated ecosystem services that are linked to a given ecosystem and that usually appear together repeatedly in time and/or space.	OpenNESS		

REL	Suggested term	Suggested meaning	Source	Synonyms	Comments
xxx	ecosystem service classification	A classification of ecosystem services according to the ecological processes they rely on, and the benefits they contribute to	based on OpenNESS, significantly modified		<i>Merged from O: 'classification system [for ES]' and O: 'ecosystem service typology', +tried to make it more meaningful, and improve coherence (links to ecosystem, benefits), and symmetry (similarity of definition structure to 'ecosystem typology'), +applied a structure that reflects the principles of ISIC which classifies 'economic activities' through their main 'resources' and 'outputs' (UNSD SNA)</i>
xxx	ecosystem service type [EST]	A specific category defined by an 'ecosystem service classification'	new term		<i>Added for completeness (gap filling), following the structure/logic of 'ecosystem type' (symmetry). CICES classes (or groups, divisions, etc.), or IPBES NCP types are examples for ecosystem service types.</i>
xxx	ecosystem type [EcT]	A specific category defined by an 'ecosystem typology'	new term	habitat type, land cover type, 'land cover ecosystem unit (LCUE) type'	<i>Simplified from SEEA-EEA 'land cover / ecosystem functional unit (LCEU)', taking the parts defining a specific type</i>
xxx	ecosystem typology	A classification of ecosystem units according to their relevant ecosystem characteristics, usually linked to specific objectives and spatial scales	new term		<i>Simplified from SEEA-EEA 'land cover / ecosystem functional unit (LCEU)', taking the parts defining the entire classification system. Habitat classifications and land use / land cover classifications can be seen as specific cases for ecosystem typologies.</i>
xxx	ecosystem unit [EcU]	An instance of an ecosystem type within a basic spatial unit. In cases when the spatial resolution is relatively fine, it is a meaningful simplification to assume that each basic spatial unit is occupied by just a single ecosystem unit, in which case these two concepts (BSU, EcU) will coincide.	new term	ecosystem accounting unit, (frequently referred to simply as) ecosystem	<i>Created for clarity, to disentangle some confusion in the meaning of S: 'basic spatial unit' & S: 'land cover ecosystem unit'. In cases when the spatial resolution is relatively fine, it is a meaningful simplification to assume that each basic spatial unit is occupied by just a single ecosystem unit, in which case these two concepts (BSU, EcU) will coincide.</i>

REL	Suggested term	Suggested meaning	Source	Synonyms	Comments
xx	environmental service	an extension of the term 'ecosystem service' to include also the contributions of abiotic natural resources to benefits	based on SEEA-EEA (2012, see 'ecosystem service') & Haines-Young & Potschin 2010		<i>Separated from the definition of ES in SEEA-EEA, added as a gap-filling for symmetry reasons</i>
x	final ecosystem service	--> see 'ecosystem service'			<i>Replaced by a 'hard link' to the proposed synonym</i>
xxx	flow (of an ES)	The amount of an ES that is actually mobilized in a specific area and time	based on OpenNESS, simplified	actual use (of an ES)	<i>Adjusted for consistency, also contains elements from M: 'ecosystem service'</i>
x	green infrastructure	A strategically planned network of natural and semi-natural areas with environmental features designed and managed to deliver a wide range of ecosystem services	MAES [EC 2013a]		
x	habitat	1. The sum of the abiotic and biotic factors of the environment, whether natural or modified, which are essential to the life and reproduction of the species 2. A further specification of 'ecosystem type' in terms of environmental condition and biodiversity.	OpenNESS (Council of Europe)	ecosystem type (see definition 2)	<i>Shortened, and added a second (more MAES-oriented) meaning</i>
xx	human inputs (to ES)	Anthropogenic contributions added to ecosystems such as fertilizers or energy (including labour) that are invested to turn ecosystem functions into ecosystem services and benefits	based on MAES and OpenNESS, modified	energy inputs	<i>Dropped the second meaning of O: 'human inputs' as it would overlap with the concept of 'pressures', and harmonized the rest of the 2 defs (consistency)</i>
xxx	human well-being	A state that is 'intrinsically and not just instrumentally valuable' (or good) for a person or a societal group (e.g. basic materials for a good life, health, good physical and mental state, good social relations, security)	based on OpenNESS, simplified, contains elements of MAES [Alexandrova 2012, MAESA 2005]		<i>Slightly simplified</i>

REL	Suggested term	Suggested meaning	Source	Synonyms	Comments
xx	indicator	An indicator is a number or qualitative descriptor generated with a well-defined method which reflects a phenomenon of interest (the indicandum) and its change over time. Indicators are frequently used by policy-makers to set environmental goals and evaluate their fulfilment.	based on OpenNESS, modified [Heink & Kowarik (2010)]		<i>Simplified and added a reference to 'method' (coherence, consistency, parsimony)</i>
xx	intermediate (ecosystem) service	An ecosystem process not used directly by a beneficiary, but which underpins (final) ecosystem services (ecosystem outputs that are directly used by people). 'Intermediate ES' should not be considered a subtype of 'ecosystem services': in fact these are mutually exclusive categories, and this distinction is sometimes emphasized by using the term 'final ES' as a synonym of ES. Nevertheless, the 'boundary' between intermediate and final ecosystem services (sometimes called 'production boundary') is context dependent, and should be set clearly and consistently for any ecosystem assessment work. This means that there can be contexts in which an 'intermediate ES' would actually be a (final) service through a direct use by a certain beneficiary or through the avoidance of societal costs if the service is degraded.	based on OpenNESS, significantly extended	supporting services	<i>Changed 'ecological function or process' to 'ecosystem process' +added explanations on the confusing relationship to 'ES' and 'production boundary' (consistency, coherence)</i>
xxx	MAES framework	The conceptual framework for the EU Mapping and Assessment of Ecosystems and their Services (MAES) programme (Target 2 Action 5 of the EU Biodiversity Strategy to 2020). The main elements of the MAES framework are the extent and condition of ecosystem types, and the capacities and flows of ecosystem service types, which need to be valuated with appropriate methods.	new term		<i>New key term, intended to be a gap-filling referring to many defs, and referred to by many other definitions</i>
xxx	mapping	The process of creating a cartographic representation (map) of objects in geographic space. In the MAES context mapping means a spatially detailed assessment of the elements of the MAES framework, which aims inter alia at creating cartographic representations of the studied elements.	based on OpenNESS, extended		<i>Simplified slightly, and added new MAES specific parts</i>
xx	method	A reproducible process relying on specific types of inputs for achieving a specific goal	based on Hinkel 2008		<i>Added as a gap-filling for coherence</i>
xx	methodology	The particular chain of methods, data and other relevant resources (e.g. stakeholders) that are involved in solving a specific problem	based on Hinkel 2008		<i>Added as a gap-filling for coherence</i>

REL	Suggested term	Suggested meaning	Source	Synonyms	Comments
xx	model	A simplified representation of a complex system or process including elements that are considered to be essential parts of what is represented. Models aim to make it easier to understand and/or quantify by referencing to existing and usually commonly accepted knowledge. Models for ecosystem services (or condition) are formalised relationships between ecosystem characteristics which can be used as methods to estimate unknown characteristics based on already known ones.	based on OpenNESS, significantly extended		<i>Significantly extended the definition for clarity ('ES models') and coherence (references to 'methods' and 'characteristics')</i>
x	policy maker	A person with the authority to influence or determine policies and practices at an international, national, regional or local level.	OpenNESS [UK NEA 2011]		
x	pressure	Human induced processes that alter the condition of ecosystems	based on MAES, simplified		<i>Simplified (to make more coherent & less redundant) + added 'human induced'</i>
x	production boundary	The imaginary 'boundary' between ecological and social system which should be specified in an ecosystem accounting context. Ecosystem processes that cross this boundary and contribute to social benefits should be considered as (final) ecosystem services, whereas processes, that do not cross this boundary are to be considered internal processes of ecosystems (intermediate ES).	based on OECD Glossary Statistical Terms, modified [UNSD SNA]		<i>Added for completeness, this term can usefully serve understanding in discussions about intermediate/final ES in my opinion</i>
xx	provisioning (ecosystem) service	Those material and energetic outputs from ecosystems that contribute to human well-being	OpenNESS [CICES4.3]		
xx	regulating (ecosystem) service	All the ways in which ecosystems and living organisms can mediate or moderate the ambient environment so that human well-being is maintained. This includes the degradation of wastes and toxic substances by exploiting living processes (bioremediation).	OpenNESS [CICES4.3]		
x	restoration	The process of actively managing an ecosystem unit in order to improve ecosystem condition	based on MAES, modified [CBD, 2012]		<i>Modified to be consistent and symmetric w degradation (+coherence)</i>
x	sociocultural valuation	The process whereby the perceived importance or preference people have for a specific element of the MAES framework is estimated in terms other than money	based on OpenNESS, simplified	non-monetary valuation	<i>Slightly simplified and changed the term from 'nonmonetary' to 'sociocultural' to be more symmetric in term use</i>

REL	Suggested term	Suggested meaning	Source	Synonyms	Comments
xx	stakeholder	Any group, organisation or individual who can affect or is affected by the problem addressed in a study / assessment.	based on OpenNESS, slightly adjusted		<i>Made a bit more general ('an ES' --> 'the focus of the study')</i>
x	status (conservation / ecological / environmental status)	A specific aspect of ecosystem condition classified following criteria defined in the environmental protection objectives in EU legislation	based on MAES, significantly simplified [EEC 1992]	ecosystem status	<i>A simplification of the two related MAES definitions. Status for different ecosystem types is defined in the Habitats Directive (as 'conservation status'), the Water Framework Directive (as 'ecological status'), and the Marine Strategy Framework Directive (as 'environmental status').</i>
xx	tiered approach	A classification of methods available in an assessment context according to level of detail and complexity with the aim to provide advice on method choice. The provision and integration of different tiers enables ES assessments to use methods consistent with their needs and resources.	based on OpenNESS, slightly adjusted		<i>Added a reference to 'assessment' context</i>
x	trade-off (in ES)	Situation in which one service increases and another one decreases. This may be due to simultaneous opposite response to the same pressure or due to true interactions among services.	OpenNESS		
xx	transdisciplinarity	A reflexive, integrative, and problem-oriented scientific principle aiming at the solution of complex and pressing real-life problems by joint efforts of various scientific and non-scientific bodies (stakeholders) making use of various knowledge forms (including scientific, local, place-based, and practitioners' knowledge).	based on OpenNESS, significantly simplified [Lang et al. 2012, Turnhout et al. 2012]	postnormal science	<i>Considerably simplified</i>
xx	valuation	The process whereby the importance of something (e.g. an element of the MAES framework) is estimated in monetary (economic valuation) or non-monetary (bio-physical valuation, socio-cultural valuation) terms	based on OpenNESS, significantly simplified [IPBES 2016]		<i>Simplified and generalized from O: 'ES valuation', and made more coherent with other definitions (biophysical/economic/sociocultural valuation, MAES framework --> symmetry)</i>

Recommendations of terms to be dropped from the previous MAES Glossaries (reports 1-3)

biophysical structure*	<i>This term should be left open and rely on the common meanings of the words (this term is not so central for MAES)</i>
drivers of change*	<i>This term is not central to the MAES framework (it is central to another one, DPSIR). Furthermore, in the MAES context this term overlaps with 'pressures'</i>
ecological value*	<i>Openness recommends not to use this term due to inherent ambiguities.</i>
ecosystem function*	<i>Function has a dual meaning: functioning (operation) vs functional (usefulness). The former MAES definition combines these two meanings, but it is still relatively redundant with 'ecosystem condition' and 'capacity' which are much clearer concepts.</i>
ecosystem state*	<i>Ambiguous term. For administrative/legal use MAES should recommend 'ecological/conservation status', whereas for assessment purposes 'ecosystem condition' should be preferred. The merit of this term, however, is that it establishes a link to the DPSIR framework, so "ecosystem state" is still mentioned as an acceptable/useful synonym of "ecosystem condition".</i>
ecosystem status*	<i>See above. Ecological/conservation status should be used instead (as in the 3rd MAES study)</i>
eea-39*	<i>This term is not central to the MAES framework</i>
functional traits*	<i>This term is not central to the MAES framework</i>
socio-economic system*	<i>This term should be left open and rely on the common meanings of the words (this is also not so central for MAES)</i>
value*	<i>This term should be left open as a word with a widely understood common meaning</i>