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Land cover mapping, land cover classification and accounting unitsPreliminary Draft

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Draft for Outcome paper on

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1 Terminology

We suggest renaming the issue: ***Land cover mapping, ecosystem classification and statistical units***. Although ecosystems are yet vaguely defined in SEEA Vol. 2, classifying them should likely be within the domain of this topic.

It is preferred to use the term *statistical unit* to refer to the units for which statistics are compiled in an ecosystem account. This can define a hierarchy with specific properties at various levels of aggregation, and can be likened to the business statistical unit hierarchy of establishment, company and enterprise. Criteria exist for the delineation of each level and its aggregation to the next.

Related terms such as *analytical unit*, *observation unit* and *reporting unit* have their own uses in statistical terminology and should be avoided to minimize confusion.

2 Concepts

2.1 Perspective

The SEEA Experimental Ecosystem Accounts has a focus on accounting for the environment from the perspective of ecosystems. In economic statistics, the statistical unit is an establishment, which is delineated consisting of similar economic activity in one local area. In ecosystem accounts, the statistical unit is delineated as an area with similar land dominant cover type and other biophysical characteristics. The Ecosystem accounts is intended to describe the measurement of the flow of benefits to humanity provided by ecosystems, and measurement of conditions in terms of the capacity of ecosystems to provide benefits.

2.2 Need for simplification, flexibility and accuracy

An account is, by necessity, a simplification of reality. It is the core information that remains reasonably consistent between applications and over time. Accounts apply classifications standards and methods that may be revised but the principles and general structure must remain comparable.

Information available will vary by jurisdiction. Any guidelines on ecosystem accounting should be sufficiently flexible for any jurisdiction, local, sub-national or supra-national, to adhere to the principles using sub-nationally or locally-available data.

As well, ecosystem accounts will be applied at varying spatial scales. Information available for one location may not be available for another. Furthermore, the need for national aggregates will require estimates and assumptions that will increase the uncertainty for these aggregates. The nature of the decisions being made with these estimates should take into account this reliability. Some applications, such as communication, awareness-raising, education and priority-setting do

not need highly accurate data. Others, such as determining restoration costs or optimizing local payments for services will require more accurate estimates[1].

2.3 Accounting versus analysis, application and scientific knowledge

Our knowledge of ecosystem function is already vast and it is growing exponentially. Given that account contains only core information, it cannot be expected to represent the full and dynamic state of scientific knowledge. Again, this implies the need for simplification and flexibility by embedding the main accounting principles and remaining open to new knowledge. Some new knowledge could be incorporated through changes in the classifications and methods. Ultimately, changes in the principles and structure may be required to take into account major advances in understanding.

An ecosystem account should be seen as a platform technology[2] that supports many types of applications and analysis. That is not to say that all of the information required to support those applications or to conduct those analyses can or should be included within a core account. It is more productive to consider the role that a core ecosystem account can play as a source of coherent, consistent information augmented by specific information required for a specific analytical requirement. For example, an ecosystem account may make use of biodiversity or net carbon balance measures as indicators of the condition or quality of the ecosystems represented. However, not all of the information required to compile these indicators need be included in the core account.

2.4 Delineation versus attribution

It is essential to distinguish the information required to *delineate* a statistical unit from the information one would wish to *attribute* to it. Samples for business surveys for example, are drawn from a business register that contains basic information about every business in the country. For a business register to be comprehensive, it needs to limit its content to basic information such as location, industry classification, revenues and employment range. The surveys themselves then gather the detailed information that is analysed. Similarly, in ecosystem accounting statistical units that are required to cover the surface area of a country are more easily delineated with simple, readily-available information.

3 Definitions

3.1 Statistical units

S***tatistical units*** are the contiguous land, freshwater and marine surface areas to which information is attributed and which provides the basis to aggregate this information to regional, national and global levels. It is recognized that individual ecosystem services may need to be attributed to levels in the hierarchy that are appropriate to the scale of that service. For example, a managed forest provides, among others, timber as a local provisioning service. A wetland, on the other hand, is a part of a complex hydrological network that controls floods and water supply over a large area.

The smallest statistical unit is based on observable core biophysical characteristics such as land cover, elevation (or depth in the case of water) and climate. This information should be available for the entire country and available consistently for multiple time-periods at a resolution

[1] This is discussed in more detail in the Outcome paper on Policy Applications (Wang, Uhde, Bordt, 2012).

[2] Other examples are information and communications technologies, fuel cells, and nanotechnology. These are multi-valent technologies that serve the basis of new applications.

appropriate for the expected level of aggregation. For terrestrial eco-units, this is normally derived from satellite land cover data. Cells with similar characteristics are treated as a single polygon.

An area of homogenous biophysical characteristics could be further subdivided to facilitate aggregation to various presentations. For example, if an area of homogenous land cover, elevation and climate crosses a river, transportation corridor, administrative boundary or watershed, it could be further sub-divided so that it does not cross these boundaries. On the other hand, in a complex landscape or when using high resolution data, it may be necessary to smooth the land cover information to avoid having a unmanageable number of units or a register of units that is changing too much over time.

Units are classified according to their core biophysical characteristics (such as needle-leaf forest, high elevation, temperate) and can be aggregated as such to provide one possible presentation aggregate. For example, to calculate the total national area of all needle-leaf forest, high elevation, temperate eco-units.

A unit may provide certain services on its own or be co-dependent with other units to provide other services.

A landscape is a contiguous set of units that is delineated based on the degree to which they are co-dependent. For example, a small lake unit surrounded by a needle-leaf forest, high elevation, temperate unit will interact mostly with that unit.[3] A forest within an urban area will interact mainly with the urban area. Other rules for delineating landscapes are discussed in the Methods section.

3.2 Accounting aggregates

The focus of national accounts is the production of goods and services for market and maintenance and accumulation of capital. The focus of ecosystem accounts is the production of ecosystem services and the accumulation of the holding of structure of material components of ecosystems (ecological health). The main classifications of national accounts are classification of sectors, kind of economic activity and central product classification. The main classifications of ecosystem accounts are classification of ecosystems types and classification of ecosystem services (CICES).

Accounting aggregates of ecosystem accounts can be build also on bases of geographical areas e.g. drainage area and administrative boundary and by landscape.

[3] This is a necessary simplification understanding that similar lakes that are sufficiently proximate will also be somewhat co-dependent because of streamflow and interactions with the same fauna.

3.3 Classification of ecosystem types

The **classification of ecosystem types** is a hierarchical set of land cover and other characteristics such as elevation and climate that are attributed to each unit. The starting point is the FAO LCCS 3.0 (Land Cover Classification Version 3.0)[4] which provides a method of developing land cover map legends that are non-ambiguous and non-overlapping. This is essential for comparison between countries since one interpretation of "forest" is rarely the same as another. The FAO software defines land cover categories in terms of % coverage and type of vegetation, as well as other properties of and characteristics of land coverAt this stage, the most appropriate high-level classification of land cover is taken from the SEEA Central Framework:

Code	Category
01	Artificial surfaces (including urban and associated areas)
02	Herbaceous crop
03	Woody crops
04	Multiple or layered crops
05	Grassland
06	Tree covered area
07	Mangroves
08	Shrub covered area
09	Shrubs and/or herbaceous vegetation, aquatic or regularly flooded
10	Sparsely natural vegetated areas
11	Terrestrial barren land
12	Permanent snow and glaciers
13	Inland water bodies
14	Coastal water bodies and inter-tidal areas
15	No dominant land cover

Maintaining this as a high-level classification will ensure compatibility of national classifications with the other accounts in the SEEA Central Framework. Sub-categories could include, for example, elevation, climate and detailed classes of vegetation types. In Canada, for example, individual wetland types may fit most appropriately in different categories.

This classification may need to be revised after more data have been compiled. Countries may desire, for example, to include areas of marine water that do not fit into the class "Coastal water bodies and inter-tidal areas".

3.4 Landscape classification

Landscapes are more complex than ecosystem types and therefore their classification is more complex. Combining adjacent units based on their co-dependence will result in amalgamations such as artificial surfaces combined with grassland. An initial classification would include at least all possible two-way combinations of the ecosystem type classification. Further experience will be required to determine which of these combinations exist and which are most common.

[4] See: http://www.glcn.org/sof_7_en.jsp.