

Experimental Ecosystem Accounting (EEA)

1st Sub-Regional Course on SEEA

23-27 Sept. 2013, Malaysia

Day 5, Lecture 1

Background on EEA

- Presents a separate approach from the SEEA Central Framework
- Complements the Central Framework by providing a different perspective on relationships between the environment (ecosystems) and society.
- Developed as part of the broader process of revising the SEEA 2003
- Integrated system of information on distinct stocks and flows
- A synthesis of current knowledge related to ecosystem services, ecosystem condition and related concepts
- Called “experimental” because while the book provides a strong basis of coherent concepts and principles, significant methodological challenges remain and further testing of concepts is needed.

Relationships to Central Framework

- Extends the range of flows (production boundary) for accounting compared to SNA and SEEA in physical and monetary terms
- Many flows from the Central Framework are also included in EEA (e.g. flows of timber), but extension of EEA is to attribute flows to spatial areas
- Some Central Framework natural input flows are excluded from EEA (e.g. Mineral and energy resources)

Role of National Statistical Offices

- Contribute expertise with compiling data from many different sources to provide a coherent and integrated picture
- Leading role with establishing and maintaining the definitions of concepts and classifications
- Include work within broader quality frameworks
- Understanding relevant measures already implicitly recorded in the national accounts
- Understanding application of spatial referencing of information

Blends underlying concepts

- Conceptual model in ecosystem accounting formed from established concepts in
 - Ecology
 - Economics
 - National accounts
 - Statistical measurement

Why ecosystem accounts?

- Information for tracking changes in ecosystems, such as degradation
- Information for linking those changes to human activities and human well-being
- Extends the scope of our information for analysis of impacts on the environment (and, thus, ultimately, on societies)
- Information on ecosystem services and the trade-offs involved

What is an ecosystem?

dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit

-UN Convention on Biological Diversity

•Note:

- definition is indeterminate of spatial scale
- Ecosystems are inevitably inter-connected or overlapping
- Thus, the scale of analysis depends on the relationships we want to study , which, for ecosystem accounting, is primarily the relationships/flows between ecosystems and societies

Ecosystem services



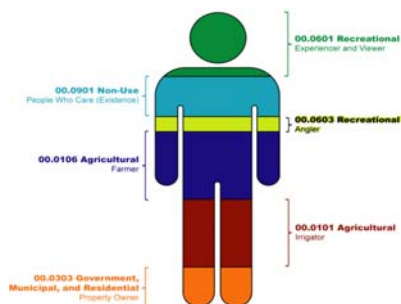
Ecosystem Services

“are the contributions of ecosystems to benefits used in economic and other human activity”

- “contributions” because ecosystem services can be combined with other inputs (e.g. infrastructure in the economy) to provide benefits
- In some cases the contributions may be equivalent to the benefit (where there are negligible other inputs)
- ecosystem services may relate to either flows of inputs from the environment to the economy (e.g. from the logging of timber resources) or flows of residuals to the environment (e.g. emissions, waste) from economic and other human activity
- Not all flows from the environment are ecosystem services
 - Excludes extracted minerals
 - Must be an identifiable benefit to human well-being
- Note: same ecosystem usually provides multiple ecosystem services of different types

Ecosystem Services

- In Japan: Satoyama and Satoumi are the concepts for mosaic ecosystem types, which provide bundles of services
- In a USEPA report, ecosystems services were mapped out according to the various “uses” of a typical beneficiary
- Note: no beneficiaries -> no ecosystem services



Source: USEPA, 2012



“Satoumi”, Source: Japan Satoyama-Satoumi Assessment 2010 (UNU)

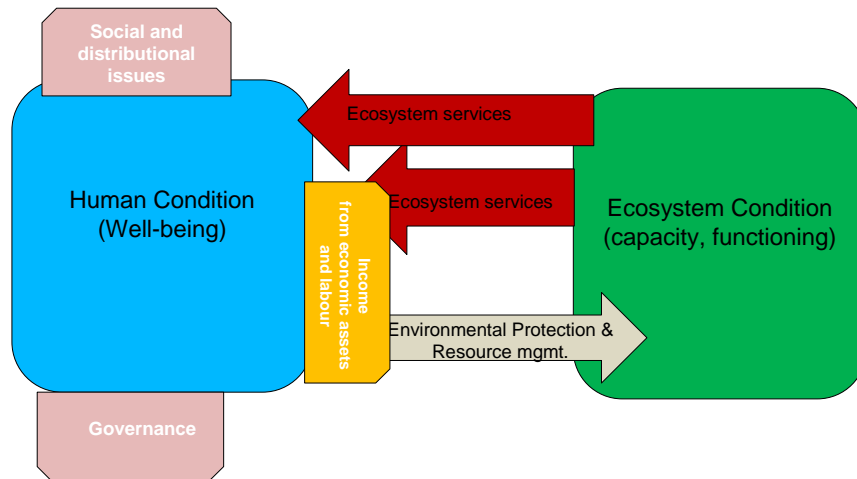
DISCUSSION QUESTION

- What are some examples of ecosystem services that would be important to measure in your country?

3 Types of Ecosystem Services

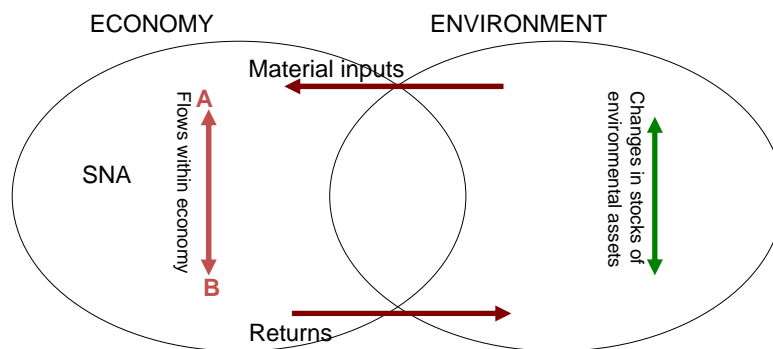
- Provisioning: material and energy contributions generated by or in an ecosystem
- Regulating: result from the capacity of ecosystems to regulate climate, hydrological and bio-chemical cycles, and other natural processes.
- Cultural services: generated from the physical settings, locations or situations which give rise to intellectual and symbolic benefits that people obtain from ecosystems through recreation, relaxation, and spiritual reflection.
 - Note: could include knowledge that an ecosystem containing important biodiversity or culturally-significant monuments will be preserved, even if not actually experienced by directly visiting the ecosystem

Ecosystems & Human Well-being



Two approaches in SEEA

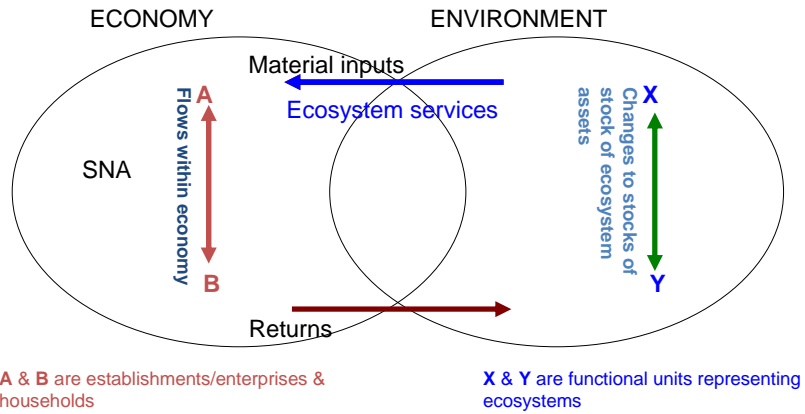
SEEA Part I:



A & B are establishments/enterprises, government & households

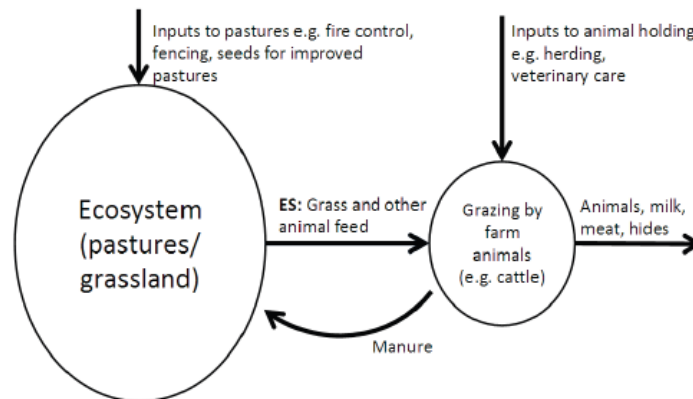
Two Approaches in SEEA

SEEA Part II – ecosystem accounts:



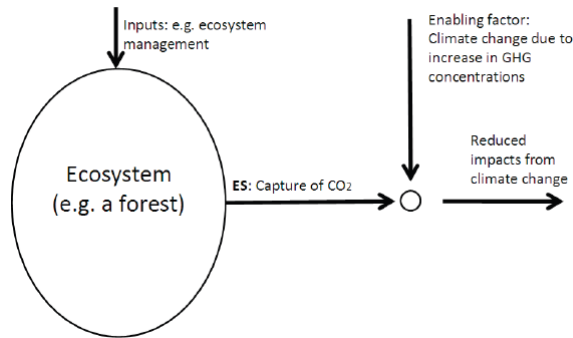
Provisioning Service Example

Figure 3.1. Provisioning of fodder for livestock



Regulating Service Example

Figure A3.4 Sequestering of carbon



Other Examples of Services and Their Benefits

Service example	Benefit example
Provisioning	
Fodder (grass, herbs, leaves, etc.)	Livestock products
Freshwater	Crops
	Drinking water
Fish	Fish
Regulating	
Carbon sequestration	Climate regulation
Air filtration by vegetation	Cleaner air
Ecosystem regulation of water and soil erosion flows (e.g. landslide protection)	Protection of lives and property
Cultural	
Ecosystems provide attractive spaces and landscape features	Recreation

Ecosystem Service (flow) Accounting

	Type of LCEU								
	Ag	Urban	Forest	Wetlands	...				
Type of ecosystem services (by CICES)									
Provisioning services									
Regulating services									
Cultural services									

Ecosystem Assets

- Spatial area comprised of characteristics that are fundamental to analysis of ecosystems, such as:
- Stocks and changes in stocks measured from 2 perspectives: ecosystem condition and ecosystem extent
- “Operational” characteristics of an ecosystem asset
 - Structure (e.g. food web)
 - Composition (biotic and abiotic components)
 - Processes (e.g. photosynthesis)
 - Functions (e.g. resilience)
- Contrast with “individual resources”

Ecosystem Condition

- *The overall quality of an ecosystem asset, in terms of its characteristics (EEA para. 2.35)*
 - Land cover
 - Biodiversity
 - Spatial extent
 - Soil type
 - Freshwater
 - Altitude and slope
 - Climate
- In principle, condition (along with ecosystem extent) reflects changes to expected future flows of ecosystem services
- Vast possibilities for suitable indicators of condition of an ecosystem asset
- Approach is to prioritize the most relevant characteristics first

Land cover account

- Equivalent to land cover account in SEEA Central Framework (Chapter 5)

Table 4.1 Physical account for land cover (hectares)³⁹

	Artificial surfaces	Cropland	Grassland	Tree covered areas	Mangroves	Shrub covered areas	Regularly flooded areas	Sparse natural vegetated areas	Terrestrial barren land	Permanent snow, glaciers and inland water bodies	Coastal water and inter-tidal areas
Opening stock of resources	12 292.5	445 431.0	106 180.5	338 514.0	214.5	66 475.5	73.5	1 966.5		12 949.5	19 351.5
Additions to stock											
Managed expansion	184.5	9 355.5									
Natural expansion			64.5								1.5
Upwards reappraisals			4.5	181.5							
Total additions to stock	184.5	9 355.5	69.0	181.5							1.5
Reductions in stock											
Managed regression			4 704.0	3 118.5	9.0	1 560.0	1.5				
Natural regression					1.5	64.5					
Downwards reappraisals						4.5					
Total reductions in stock			4 704.0	3 118.5	10.5	1 629.0	1.5				
Closing stock	12 477.0	454 786.5	101 545.5	335 577.0	204.0	64 846.5	72.0	1 966.5		12 949.5	19 353.0

Spatial unit

- The statistical units of ecosystem accounting are spatial areas
- 3 different types of units are defined:
 - Basic spatial units (BSU)
 - Land cover/ecosystem functional units (LCEU)
 - Provisional classification provided in EEA
 - Ecosystem accounting units (EAU)
 - Based on the purpose of analysis

Spatial Units

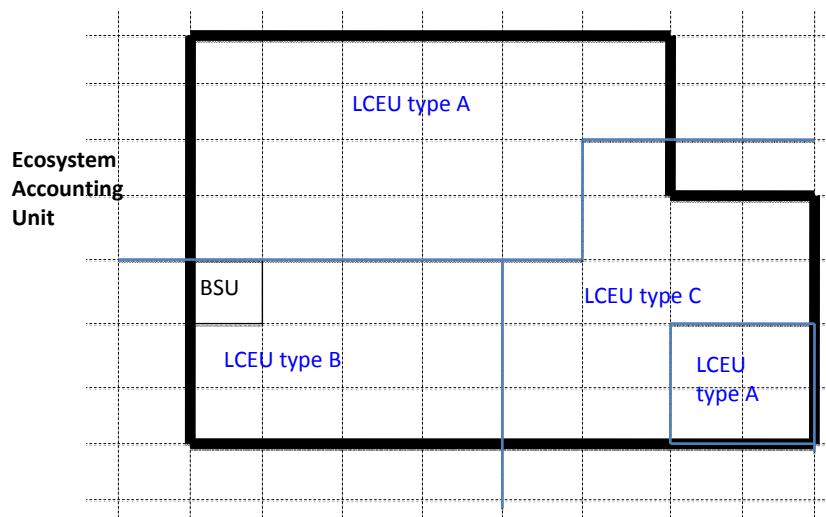


Table 2.1 Provisional Land Cover/Ecosystem Functional Unit Classes

Description of classes
Urban and associated developed areas
Medium to large fields rainfed herbaceous cropland
Medium to large fields irrigated herbaceous cropland
Permanent crops, agriculture plantations
Agriculture associations and mosaics
Pastures and natural grassland
Forest tree cover
Shrubland, bushland, heathland
Sparsely vegetated areas
Natural vegetation associations and mosaics
Barren land
Permanent snow and glaciers
Open wetlands
Inland water bodies
Coastal water bodies
Sea

EEA, Chapter 2

4 differences from EEA assets compared to SNA produced assets

1. Ecosystem assets have the potential to regenerate without human involvement. Produced assets must be created (produced) new each time. Produced assets must be created (produced) new each time.
2. A single ecosystem asset may generate varying baskets of ecosystem services over a series of accounting periods. For produced assets, even if a single produced asset may be considered to generate multiple capital services, it is assumed that it generates the same set of capital services over its life even if the user of the asset changes and the asset is used in different industries.
3. Ecosystem services from an ecosystem asset may be used by a range of different users (enterprises, households, etc). In contrast, the capital services from a produced asset are used only by the economic owner of the asset.
4. There is not a one-to-one relationship between the capacity of an ecosystem asset to generate ecosystem services and the actual use of ecosystem services in economic and other human activity. For produced assets their capacity to generate capital services is either fully used or assumed to be at a relatively stable level of use relative to capacity.

-EEA, Chapter 4

Ecosystem Degradation

- May include depletion of natural resources and also the reduction of the capacity of ecosystems to generate other ecosystem services
- Measured via changes in stock to ecosystem extent and condition
- As with depletion, only refers to declines caused by economic activities and other human influence
- Also possibility for ecosystem “enhancement”
 - From activities to restore an ecosystem

Carbon Account

- Distinction between 2 types of services: carbon storage and carbon sequestration
 - Sequestration is net accumulation for the period
- Generally, if a spatial area has a high carbon stock already, this implies a relatively low scope for carbon sequestration and a low carbon stock generally implies a high scope for sequestration
- DISCUSSION QUESTION: Why is this?

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 ecosystems

-UN Convention on Biological Diversity (CBD)

- Linked to ecosystem extent
- Linked to numbers of endemic species
- “a fundamental characteristic of ecosystems” – EEA, para. 2.11

	Ecosystem extent	Characteristics of ecosystem condition				
		Vegetation	Biodiversity	Soil	Water	Carbon
	Area (proportion of EAU)	Indicators (e.g. Leaf area index, biomass index)	Indicators (e.g. species richness, relative abundance)	Indicators (e.g. soil fertility, soil carbon, soil moisture)	Indicators (e.g. river flow, water quality, fish species)	Indicators (e.g. net carbon balance, primary productivity)
Type of LCEU						
Forests						
Agricultural land						
Urban areas						
Inland water bodies						

Note: key interest with these tables is particularly with evaluating the trends over time.

Areas for Development in EEA

- Testing of methods and options for measuring ecosystem services and ecosystem condition
- Testing of classifications and measurement boundaries within the conceptual model (especially CICES and land classifications)

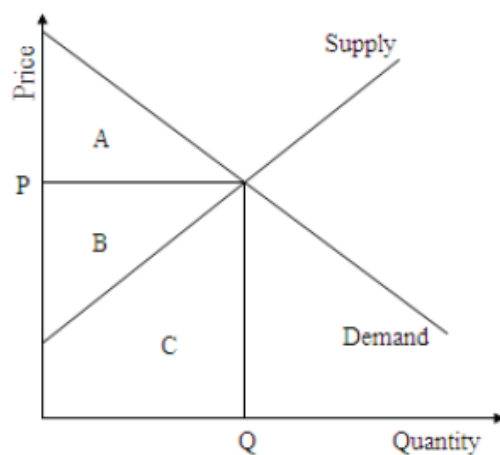
Valuation of Ecosystem Services and Ecosystem Assets

- Prices not directly observable
- Some prices and values embedded in market prices of marketed products (fish, timber, agricultural outputs) and marketed assets (land)
- Generally the prices are “missing” reflecting externalities and that many ecosystem services are public goods
- Non-market valuation techniques commonly used to place a value on the welfare impact of losing or gaining ecosystem services
- For accounting purposes want a measure of exchange value excluding consumer surplus
- Complexity of determining future supply profile – should not assume sustainable use
- Valuing degradation very challenging

3 Types of Benefits from Ecosystem Services:

1. Generated from economic assets (including land and natural resources) that are privately or publicly owned and managed, and which contribute to the production of private benefits (e.g. agricultural production).
2. Generated from economic assets that are privately owned and managed but which contribute to the production of public benefits, i.e. the benefit accrues to other economic units or society more broadly rather than exclusively to the private owner/manager of the land (e.g. absorption of carbon dioxide by a privately owned forest).
3. Generated from areas that are not privately owned or managed and contribute to the generation of public benefits (e.g. ecosystem services from public areas such as national parks and some marine areas).

Figure 5.1 Consumer and producer surplus



Thank You for your attention!

Daniel Clarke
clarke@un.org