SEEA
Experimental Ecosystem Accounting

Julian Chow
United Nations Statistics Division

SEEA Training Seminar for the ECA

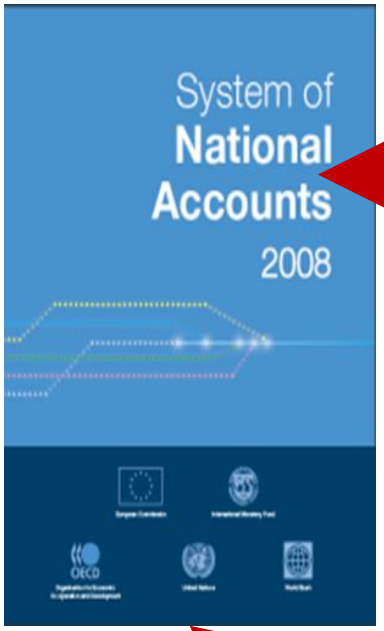
2-5 February 2015
Addis Ababa

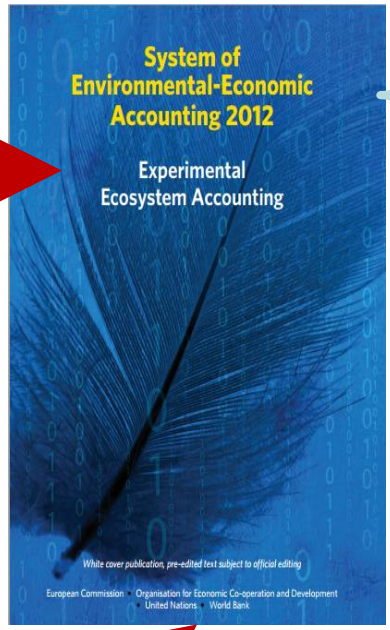
SEEA: enabler for the transformative agenda

SNA

SEEA Part 1 - Central Framework

SEEA Part 2 - Experimental Ecosystem Accounting



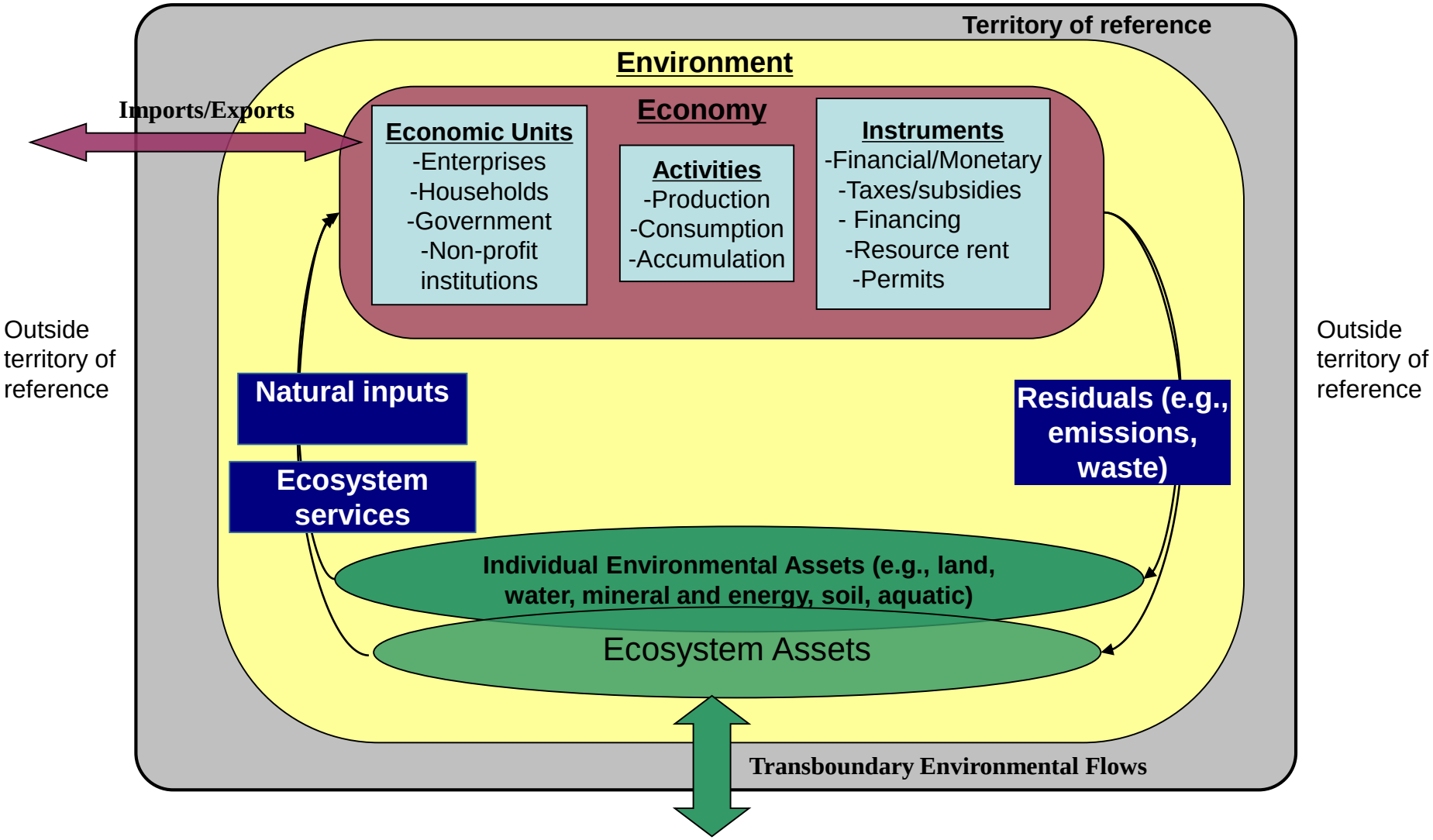


Enable integration of biophysical data, monitoring changes in ecosystem and linking those changes to economic and human activity

Inform post 2015 development agenda and SDGs

Enable partnership at international, regional, sub-regional and national level.

SEEA Conceptual Framework



SEEA Central Framework

- Internationally agreed statistical framework to measure environment and its interactions with economy
- Adopted as international statistical standard by UN Statistical Commission in 2012
- Developed through inter-governmental process
- Published by UN, EU, FAO, IMF, OECD, WB

The SEEA Central Framework Accounts

1. **Flow accounts**: supply and use tables for products, natural inputs and residuals (e.g. waste, wastewater) generated by economic activities.
   - physical (e.g. m^2 of water) and/or monetary values (e.g. permits to access water, cost of wastewater treatment, etc.)

2. **Stock accounts** for environmental assets: natural resources and land
   - physical (e.g. fish stocks and changes in stocks) and/or monetary values (e.g. value of natural capital, depletion)

3. **Activity / purpose accounts** that explicitly identify environmental transactions already existing in the SNA.
   - e.g. Environmental Protection Expenditure (EPE) accounts, environmental taxes and subsidies

4. **Combined physical and monetary accounts** that bring together physical and monetary information for derivation indicators, including depletion adjusted aggregates

SEEA Experimental Ecosystem Accounting

- Complements SEEA Central Framework
- Integrated statistical framework for accounting for ecosystem assets and associated ecosystem services
- Important first step in development of statistical framework for ecosystem accounting

SEEA-Experimental Ecosystem Accounting - Background

- Complements SEEA Central Framework with focus on ecosystems perspective
- Developed as part of broader process of revising SEEA 2003
- Integrated system of information on distinct stocks and flows
- Not a statistical standard but synthesizes current knowledge related to ecosystem services, ecosystem condition and related concepts
- "Experimental" because significant methodological challenges remain and further testing of concepts needed

Relationship to SEEA Central Framework

- Extends range of flows (production boundary) for accounting compared to SNA and SEEA in physical and monetary terms
- Many flows from Central Framework also included in Experimental Ecosystem Accounting (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 Experimental Ecosystem Accounting (e.g. mineral and energy resources)

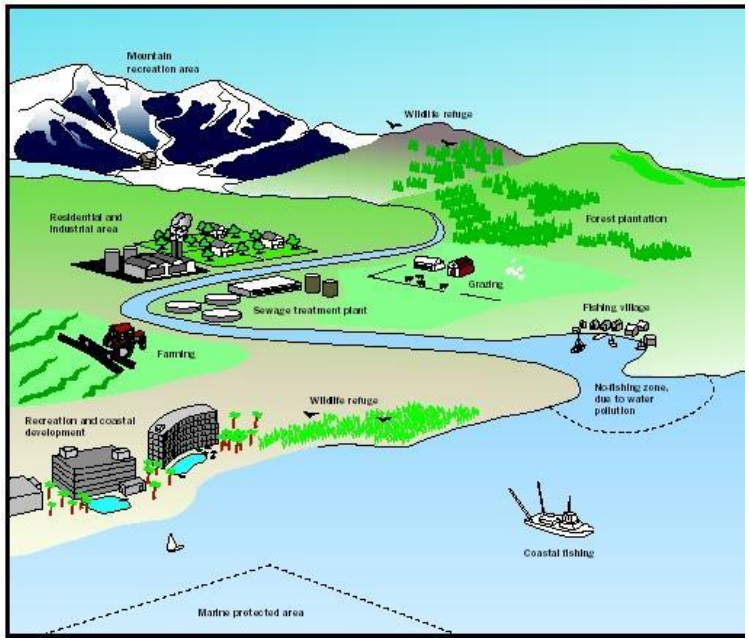
SEEA Experimental Ecosystem Accounting

- Ecosystem accounting is a tool to understand and monitor **the contributions of ecosystems to economic and human activity**
- Ecosystems include natural as well as man-dominated systems such as croplands or intensive pastures
- Requires a spatial approach (combination of maps and statistics)

The SEEA Experimental Ecosystem Accounting brings in two new dimensions:

1. Spatial characteristics expressed in spatial units
2. Integrated or holistic view of multiple characteristics for each unit

Minimum dataset scheme
Unifying themes



- Land
- Water
- Carbon
- Biodiversity
- Nutrients
- Pollution
- Human activities
- Ecosystem services

Image source: http://www.waterencyclopedia.com/La-Mi/Land-Use-Planning.html

The EEA is focused on living (renewable) natural resources

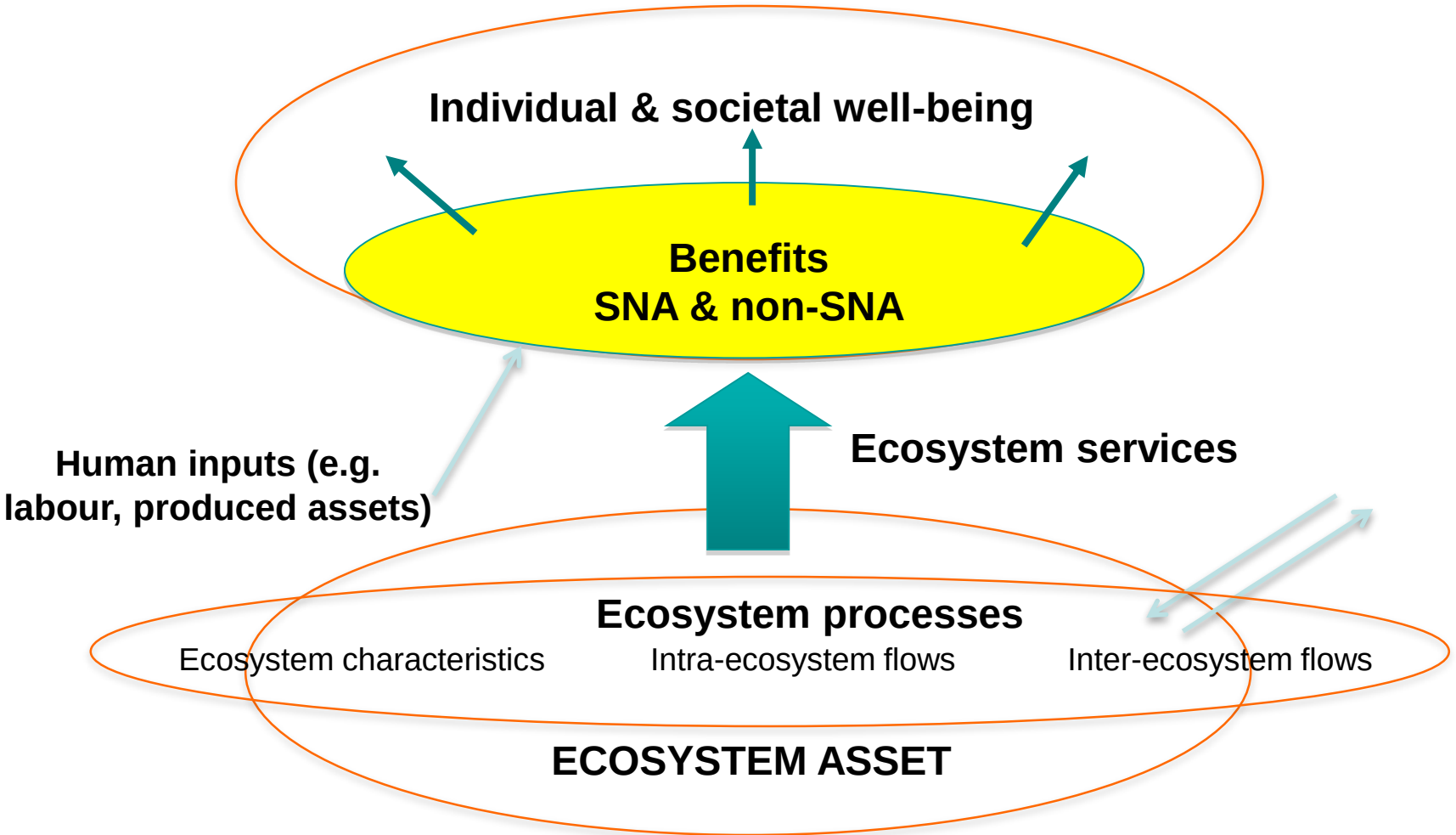
SEEA Experimental Ecosystem Accounting

Aims at measuring the contributions of ecosystems to economic activity in a national accounting framework

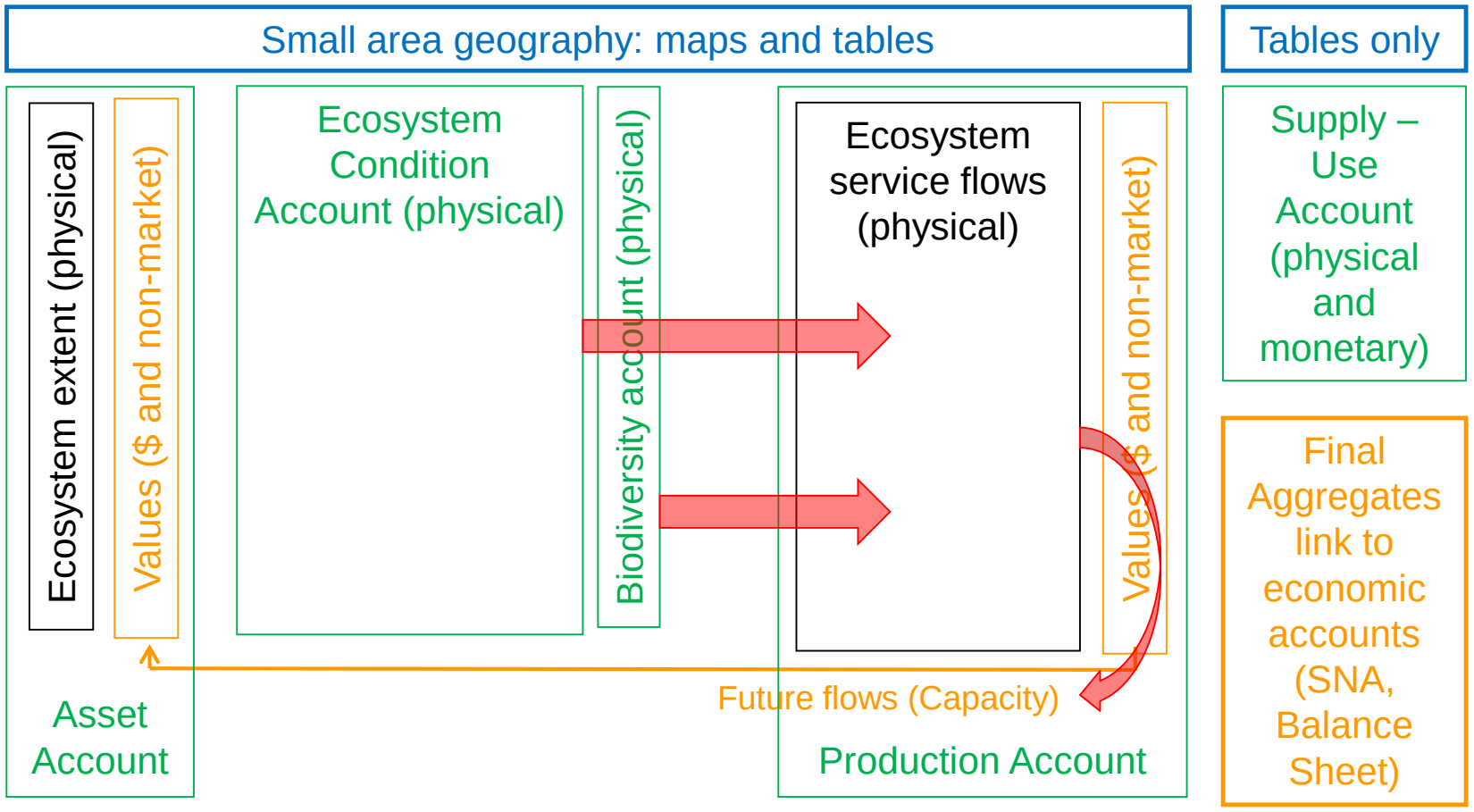
– in *physical* and *monetary* units:

- Ecosystem conditions
- Ecosystem flows
  - **Provisioning services**: the products that can be harvested or extracted from ecosystems
  - **Regulating services**: the regulation of biological, hydrological and climate processes
  - **Cultural services**: the non-material benefits of ecosystems e.g. related to tourism or cultural experiences

Linking ecosystem assets and well-being through ecosystem services



SEEA-EEA from an accounting perspective



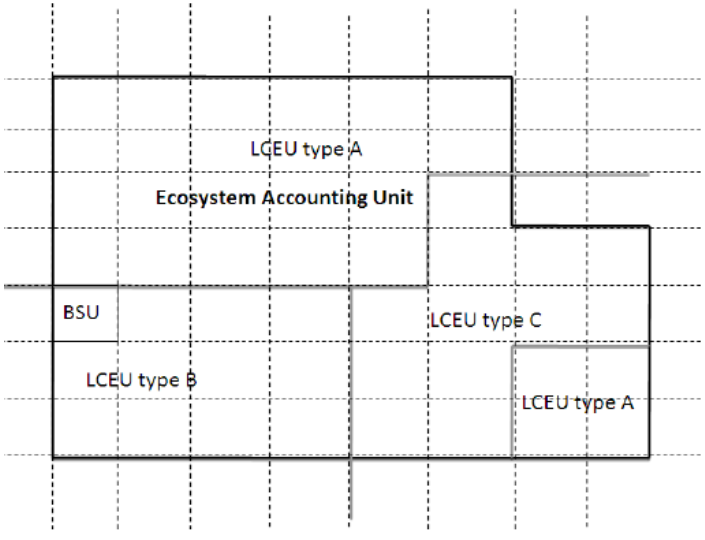
Approach for developing SEEA Experimental Ecosystem Accounting

1. Land Cover Accounting
2. Land Use Accounting
3. Framing the Measurement of Ecosystem Conditions
4. Carbon Accounting
5. Biodiversity Accounting
6. Water Accounting
7. Accounting for Ecosystem Services
8. Integrating Ecosystem Accounting with National Accounts

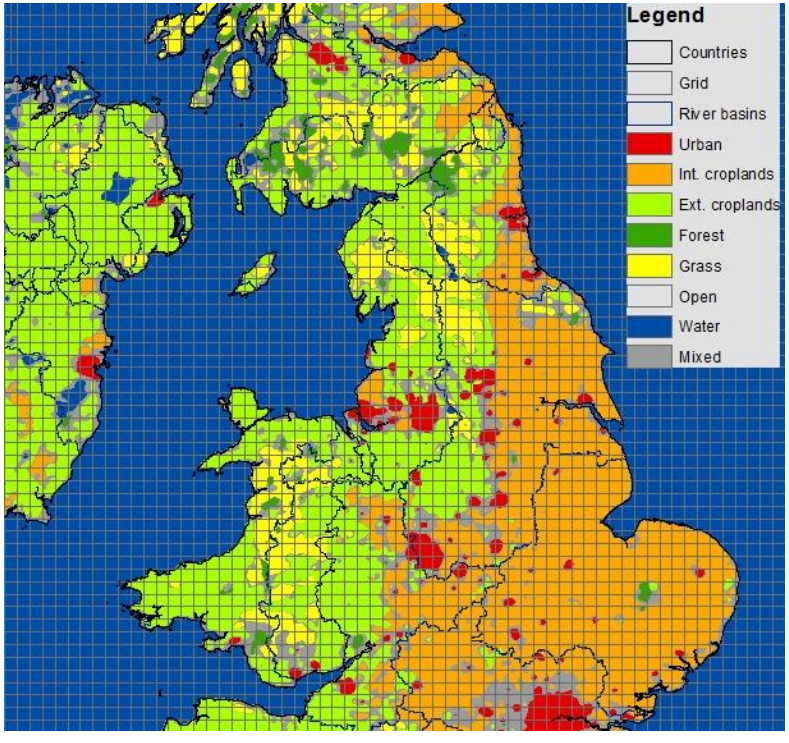
Spatial data perspective: harmonizing reporting units

- Measurement units for social, economic and environmental parameters remain untouched
- New accounting and reporting units created for ecosystem accounting purposes

Stylised depiction of relationships between BSU, LCEU and EAU



Overlay of units (UK)



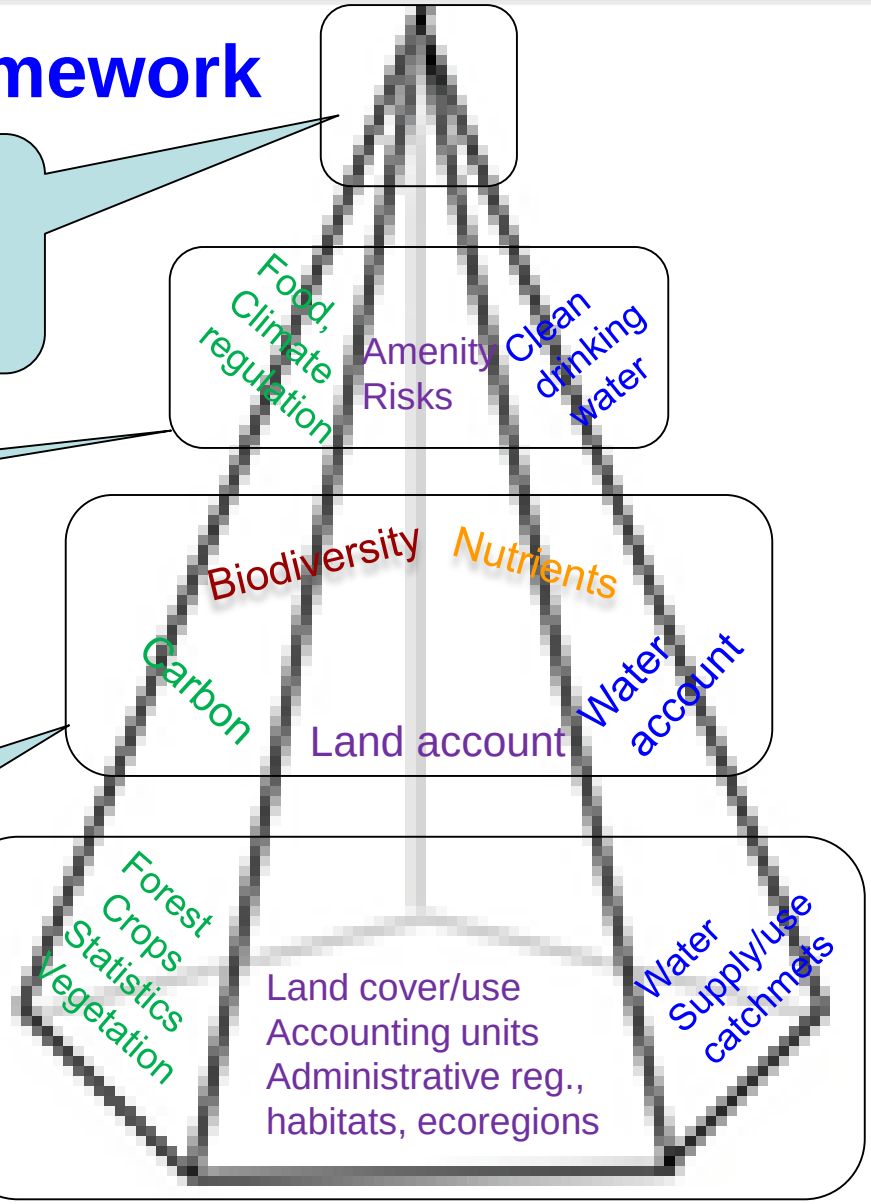
SEEA-EEA integration framework

Integration of ecosystem services in macroeconomic aggregates, like GDP and NDP

Ecosystem services in monetary and physical terms

Consistent physical and monetary asset accounts

Raw data collection, processing and harmonization

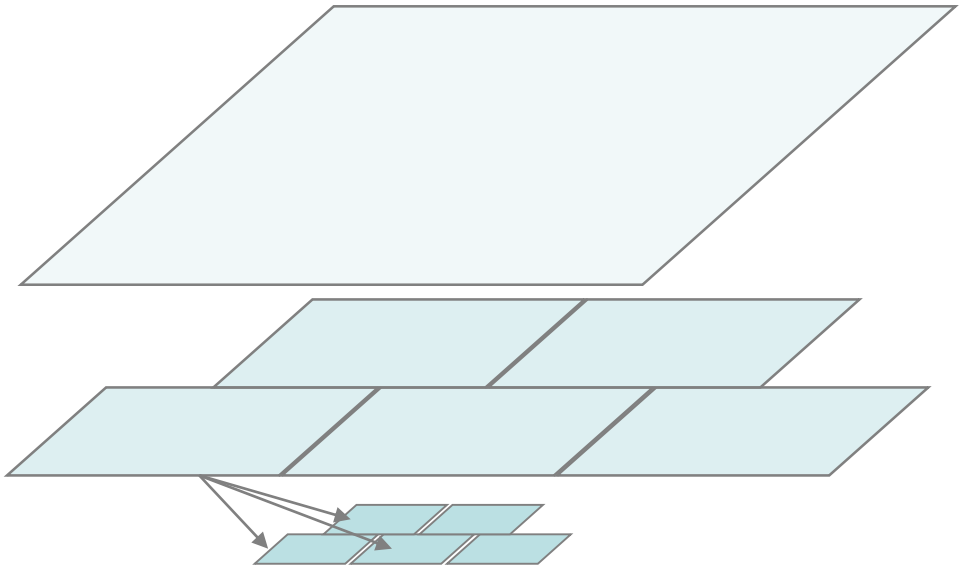


Hierarchical (nested-grid) aggregation

Ecosystem Accounting Unit (EAU)

Land Cover/Ecosystem Functional Unit (LCEU)

Basic Spatial Unit (BSU)



Country

State

Region

Statistical Areas

Parcel

Grid cell (e.g. 20m x 20m or 100m x 100m)

Exercise 1

- What are the three spatial units in Ecosystem Accounting, and what is their meaning ?

Answer 1

- **Ecosystem Accounting Unit** (EAU) = a country, province or watershed for which an account is prepared
- **Land cover/ecosystem functional unit** (LCEU) = a homogeneous land cover or ecological unit e.g. ‘pine forest’
- **Basic Spatial Unit** = a grid cell / pixel

Ecosystems conditions

- For each ecosystem “characteristic”:
  - Vegetation
  - Biodiversity (species)
  - Soil
  - Water
  - Carbon
  - Air
  - Others?

select appropriate **indicators** of quality (p. 86)

SEEA-EEA recommended approach

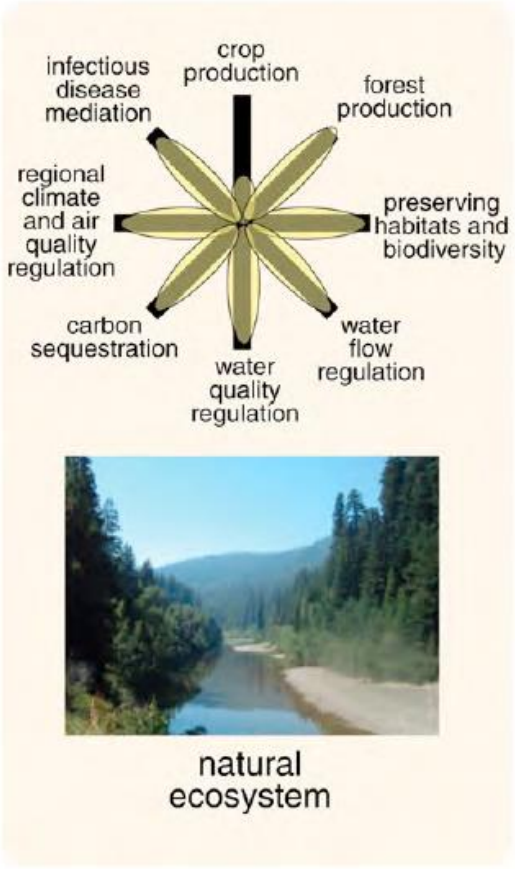
Table 4.4 Changes in ecosystem condition for an LCEU

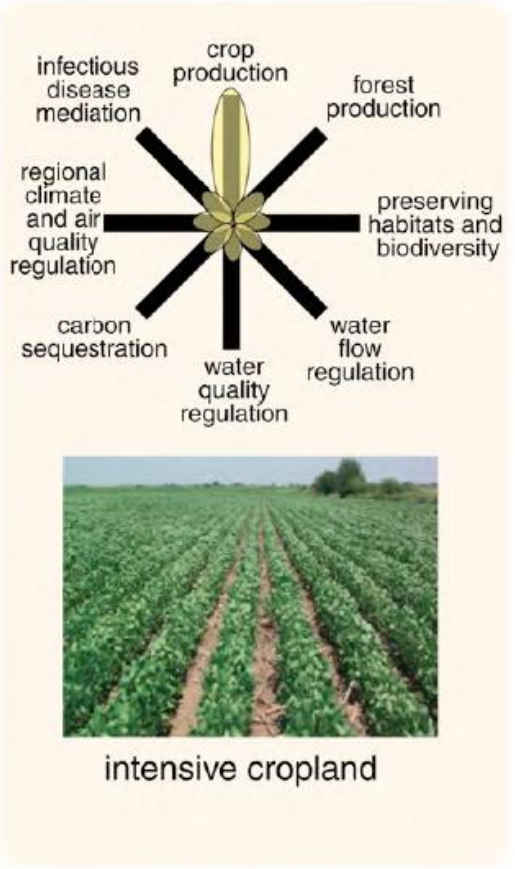
		Characteristics of ecosystem condition				
		Vegetation	Biodiversity	Soil	Water	Carbon
		Indicators (e.g. Leaf area index, biomass, mean annual increment)	Indicators (e.g. species richness, relative abundance)	Indicators (e.g. soil organic matter content, soil carbon, groundwater table)	Indicators (e.g. river flow, water quality, fish species)	Indicators (e.g. net carbon balance, primary productivity)
Opening condition						
Improvements in condition						
	Improvements due to natural regeneration (net of normal natural losses					
	Improvements due to human activity					
Reductions in condition						
	Reductions due to extraction and harvest of resources					
	Reductions due to ongoing human activity					
	Catastrophic losses due to human activity					
	Catastrophic losses due to natural events					
Closing condition						

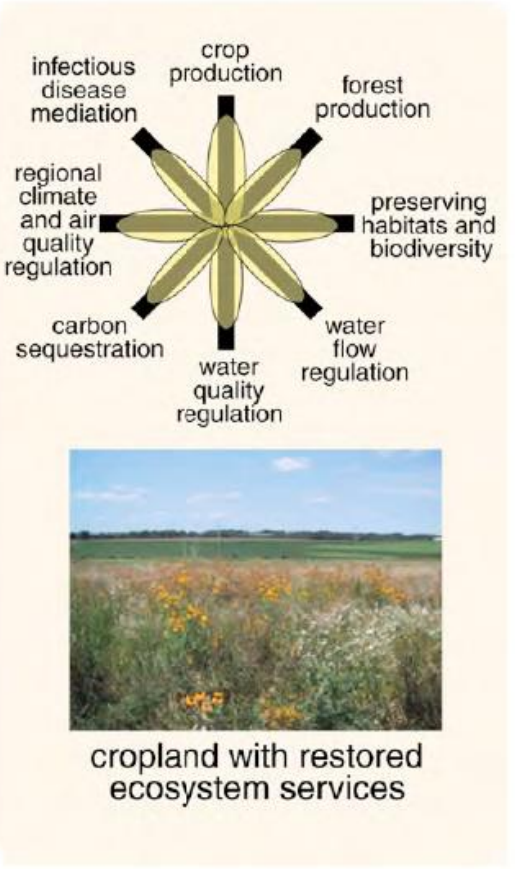
Using basic measures, can derive table of changes in condition.

Could also be done by referencing each indicator to a reference condition.

Expected “bundle of services”

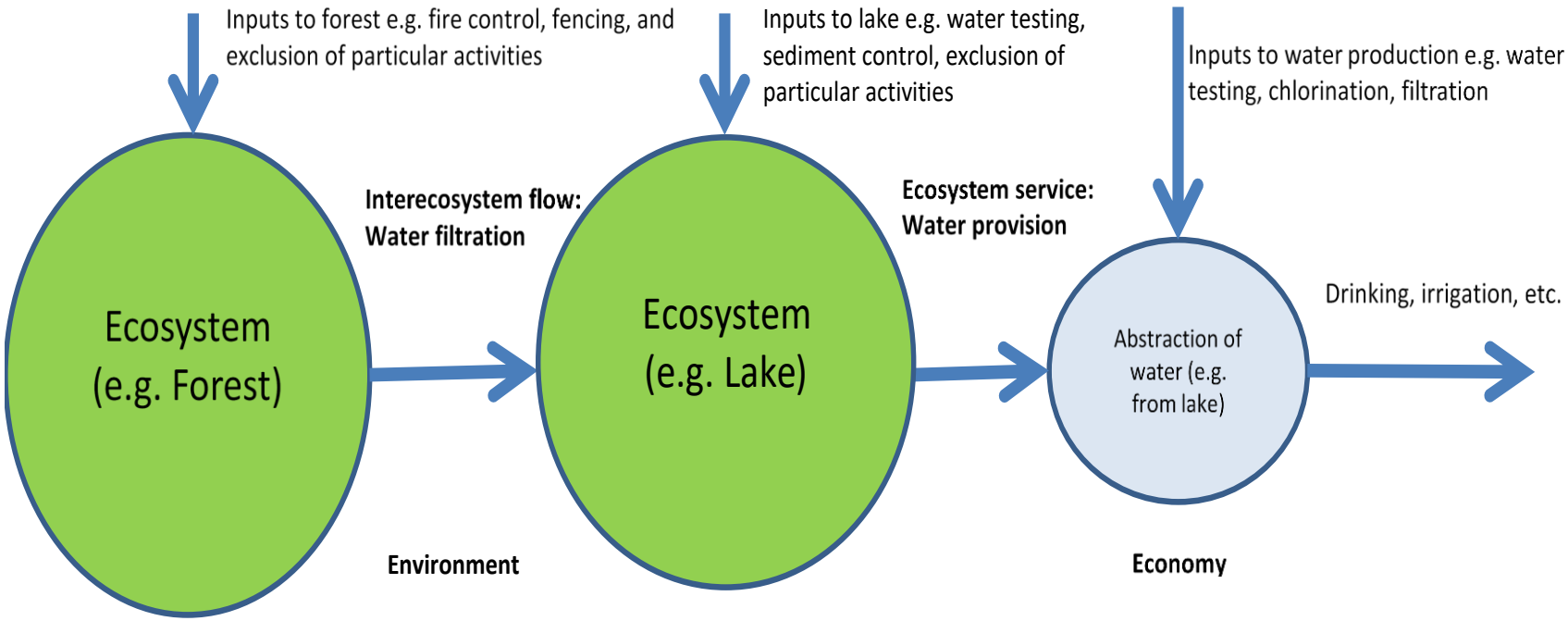






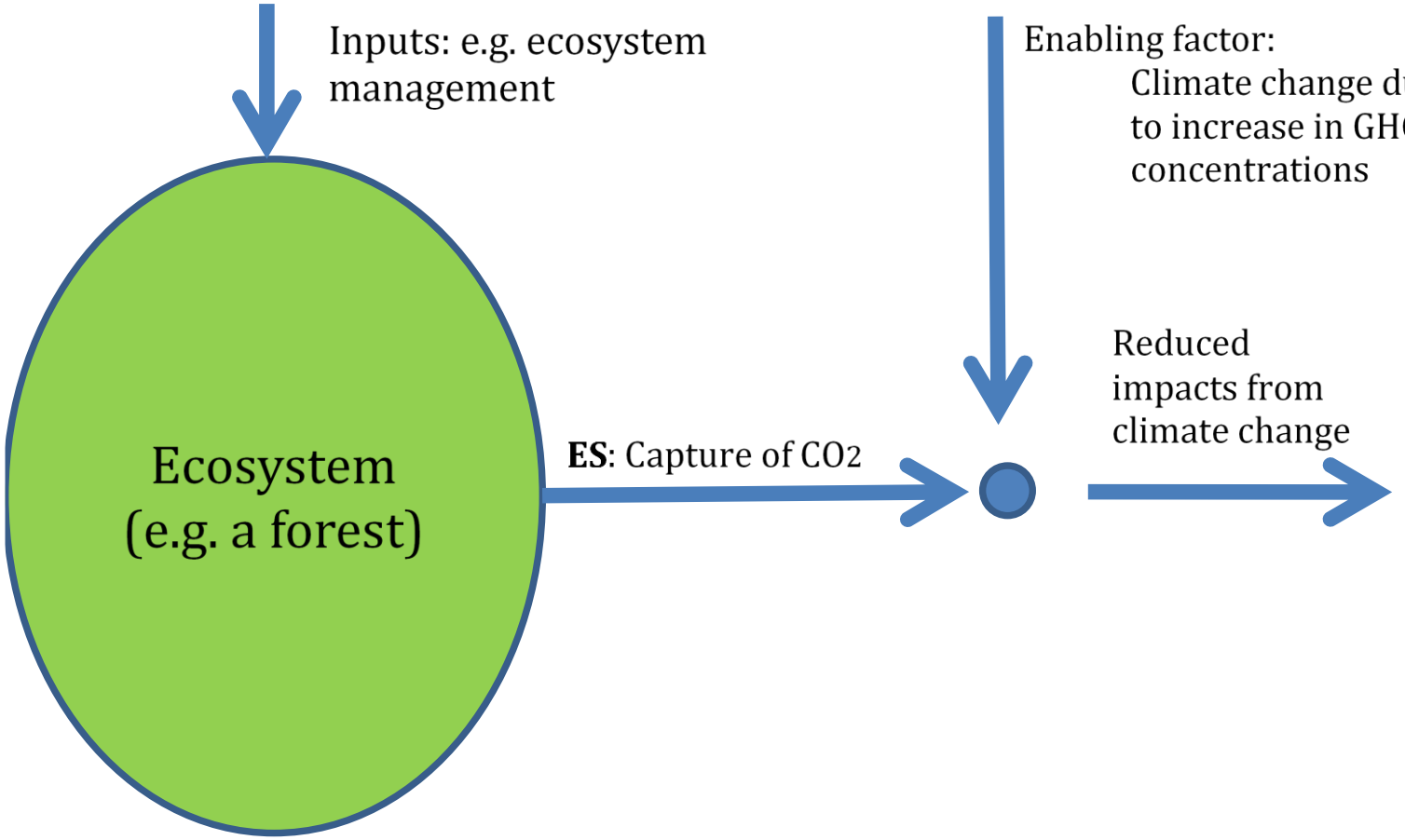
(Foley et al. 2005 Science)

Water provisioning and water filtration services



- SEEA only accounts for the final ecosystem service of water provisioning

Carbon sequestration



Source: SEEA-EEA, Fig. A3.4, p. 71

Level 1: Questions

1. What bundle of **services** could this lake be providing?
2. What indicators of **condition** would you suggest for this lake?
3. Is an **increase** in the measure good, bad or ambiguous?
4. How might a 10% **decrease** in the condition indicators (getting 10% worse) affect each of the services?

Level 1: Possible answers

1. Services: fishing, drinking water, crane habitat, carbon
2. Indicators: pH, temperature, pollutants (N, P, K, toxins), species diversity, species abundance (the fish), biomass production (algal blooms), turbidity…
3. Good/bad/ambiguous
   - Ambiguous = pH, temperature, diversity, abundance (relative to natural condition)
   - Good = diversity, abundance (to a point)
   - Bad = pollutants, turbidity (again relative to a natural condition)
4. 10% decrease in indicator
   - E.g., abundance → small impact on fishing, no impact on drinking water, small impact on crane habitat

Ecosystem accounting table

LCEU	Ecosystem service													
	Crop production		Fodder production		Drinking water extraction		Hunting		Air quality regulation		Forest carbon sequestration		Recreational cycling	
	Total	Mean (SD)	Total	Mean (SD)	Total	Mean (SD)	Total	Mean (SD)	Total	Mean (SD)	Total	Mean (SD)	Total	Mean (SD)
	Mtons MEQ	kg MEQ ha^{-1} yr^{-1}	ktons dm	kg dm ha^{-1} yr^{-1}	10^3 m^3 water	m^3 water ha^{-1} yr^{-1}	kg meat	kg meat km^{-2} yr^{-1}	tons PM_{10}	kg PM_{10} km^{-2} yr^{-1}	ktons C	kg C ha^{-1} yr^{-1}	10^3 trips	trips ha^{-1} yr^{-1}
Pasture	-	-	521	12,041 (1,573)	9,110	3,099 (2,231)	9,100	21 (17)	405	911 (532)	-	-	1,872	103 (78)
Cropland	2.46	36,314 (1,785)	-	-	14,855	3,082 (2,422)	14,732	20 (17)	715	956 (534)	-	-	2,631	99 (73)
Forest	-	-	-	-	4,577	3,214 (2,624)	8,100	24 (20)	686	2,040 (1,221)	55	1,563 (263)	1,472	126 (94)
Water	-	-	-	-	3,289	9,460 (3,698)	-	-	40	624 (569)	-	-	147	110 (92)
Urban	-	-	-	-	7,862	4,321 (3,527)	-	-	285	547 (562)	-	-	2,735	70 (57)
Heath	-	-	-	-	219	1,293 (821)	678	32 (25)	45	2,062 (1,111)	-	-	30	82 (59)
Peat	-	-	-	-	0	0 (0)	70	13 (3)	7	970 (345)	-	-	3	92 (44)
Other nature	-	-	-	-	1,187	3,093 (2,567)	1,513	25 (20)	69	1,155 (710)	-	-	226	128 (93)
Provincial total	2.46		521		41,099		34,193		2,252		55		9,116	

Matching SDGs with SEEA accounts (1)

SDGs	Targets	SEEA accounts	Indicators
15.1	by 2020 ensure conservation , restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements	**Land accounts**	Proportion of land area covered by forests, wetlands, mountains and drylands
		Ecosystem assets accounts	Degradation of designated terrestrial and inland freshwater ecosystems (Decline in the expected ecosystem service flows/conditions in designated terrestrial and inland freshwater ecosystems)
15.2	by 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests, and increase afforestation and reforestation by x% globally	**Ecosystem assets accounts**	Proportion of land area covered by forests
15.3	by 2020, combat desertification, and restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land-degradation neutral world	**Land accounts**	Land used for maintenance and restoration of environmental functions
		Ecosystem assets accounts	Degradation of designated land area (Decline in the expected ecosystem service flows/conditions in designated land area)

Matching SDGs with SEEA accounts (2)

SDGs	Targets	SEEA accounts	Indicators
15.4	by 2030 ensure the conservation of mountain ecosystems, including their biodiversity, to enhance their capacity to provide benefits which are essential for sustainable development	**Ecosystem assets accounts**	Degradation of designated mountain ecosystems (Decline in the expected ecosystem service flows/conditions in designated mountain ecosystems)
15.5	take urgent and significant action to reduce degradation of natural habitat, halt the loss of biodiversity, and by 2020 protect and prevent the extinction of threatened species	**Biodiversity accounts**	Species abundance indices disaggregated by ecosystem types
		Biodiversity accounts	Threatened species disaggregated by IUNC Red List categories
		Ecosystem assets accounts	Degradation of designated natural habitat area (Decline in the expected ecosystem service flows/conditions in designated natural habitat area)
15.6	ensure fair and equitable sharing of the benefits arising from the utilization of genetic resources, and promote appropriate access to genetic resources	**Ecosystem services accounts**	Provisioning services (genetic resources) provided by designated type of ecosystems

Matching SDGs with SEEA accounts (3)

SDGs	Targets	SEEA accounts	Indicators
15.8	by 2020 introduce measures to prevent the introduction and significantly reduce the impact of invasive alien species on land and water ecosystems, and control or eradicate the priority species	**Ecosystem services accounts**	Regulatory services (pest and disease control incluing invasive alien species) provided by designated land and water ecosystems
15.9	by 2020, integrate ecosystems and biodiversity values into national and local planning, development processes and poverty reduction strategies, and accounts	**Ecosystem accounts**	Country implements and reports on SEEA Experimental Ecosystem Accounting
15.a	mobilize and significantly increase from all sources financial resources to conserve and sustainably use biodiversity and ecosystems	**Environmental protection expenditure accounts**	Level of national expenditure on environmental protection, disaggregated by environmental activity domain (biodiversity and ecosystems) and by institutional sector
			Level of national expenditure on finance resource management and preservation, disaggregated by environmental activity domain (biodiversity and ecosystems) and by institutional sector
15.b	mobilize significantly resources from all sources and at all levels to finance sustainable forest management, and provide adequate incentives to developing countries to advance sustainable forest management, including for conservation and reforestation	**Environmental Protection expenditure accounts**	Level of national expenditure on environmental protection, disaggregated by environmental activity domain (sustainable forest management) and by institutional sector

Thank You!

seea@un.org