



Services Supply Account

(Levels 1 and 2)

Project: Advancing the SEEA
Experimental Ecosystem Accounting



United Nations



UNEP



Convention on
Biological Diversity



NORWEGIAN MINISTRY
OF FOREIGN AFFAIRS



Overview: Services Supply

1. Learning objectives
2. Review of Level 0 (5m)
3. Level 1 (Compilers)
 - Concepts (15m)
 - Group exercise & Discussion (30m)
4. Level 2 (Data providers)
 - Data options, examples & issues (15m)
 - Group exercise & Discussion (15m)
5. Closing Discussion (10m)





SEEA-EEA Training Levels 1 and 2

- **Learning objectives**

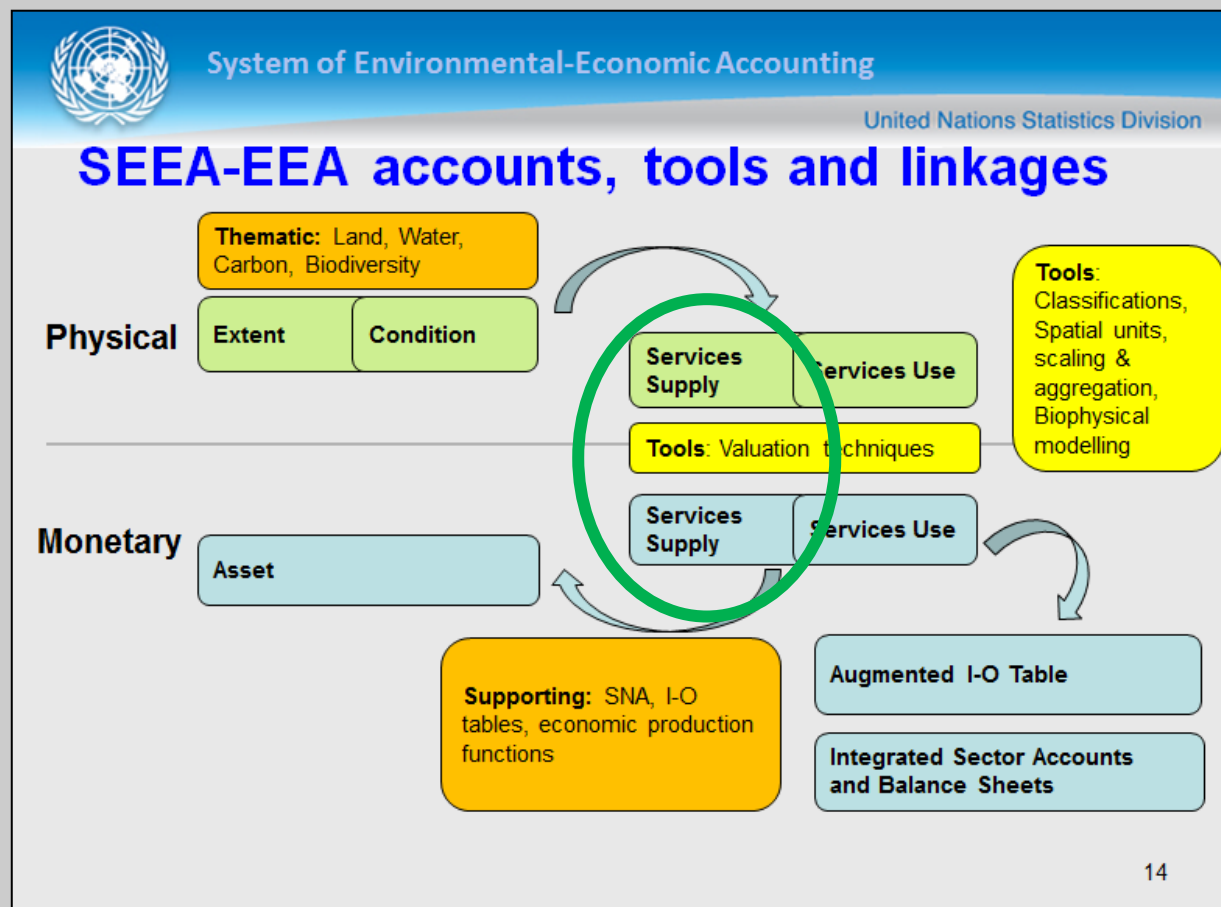
- Level 1: To understand:
 - Why accounting for Ecosystem Services is important
 - The basics of the “ecosystem services cascade” and the difference between its components
 - How Services Supply is treated in the SEEA, including basic concepts and the structure of the accounts that include services
 - How to start to compile a Services Supply account
- Level 2:
 - Understand the data options and sources
 - Be aware of how other countries have approached Ecosystem Services Supply



Review of Level 0: Services Supply Account



Account 6: Services Supply





Level 0: Account 6: Services Supply

- **What?**

- Physical and monetary flows of “final” ecosystem **services** from ecosystems to beneficiaries
- Directly used by (or affect) people

- **Why?**

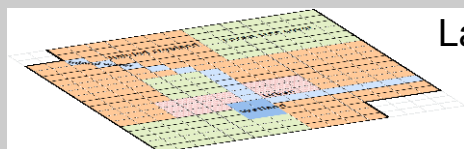
- Inform policies of contribution of ecosystems to human well-being
- Assess trade-offs between development and conservation
- Link to standard economic production measures in SNA
- Link to other SEEA-EEA accounts (**Condition, Services Use, Monetary Asset** valuation)
- Indicators:
 - Flows of individual services (physical and monetary) → change
 - Indices of aggregated services by ecosystem type → change



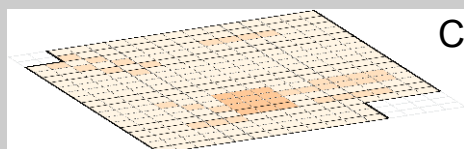
Level 0: Account 6: Services Supply

- What does a Services Supply Account look like?

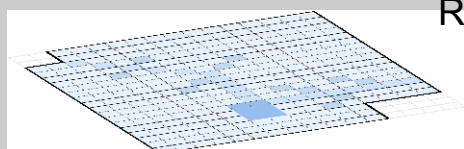
Maps



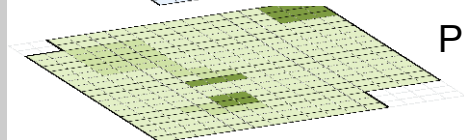
Land cover



Cultural



Regulating



Provisioning

Tables

Type of service	Ecosystem type			
	Urban and associated	Forest tree cover	Agricultural land	Open wetlands
Provisioning		e.g., tonnes of timber	e.g., tonnes of wheat	
Regulating	e.g., tonnes of CO ₂ stored / released	e.g., tonnes of CO ₂ stored / released	e.g., tonnes of CO ₂ stored / released	e.g., tonnes of P absorbed
Cultural	e.g., hectares of parkland	e.g., number of visitors / hikers		e.g., hectares of duck habitat



Lookup tables
Biophysical modelling

Valuation

Monetary Services Supply



Level 0: Account 6: Services Supply

Example (Services Supply in physical units)

Ecosystem service		Units	Land cover type								Provincial total
			Urban	Pasture	Cropland	Forest	Heath	Peat	Surface Water	Other nature	
Provisioning	Hunting	kg meat	-	9,100	14,732	8,100	678	70		1,513	34,193
	Drinking water extraction	10 ³ m ³ water	4,071	7,026	11,227	3,117	214	-	478	862	26,995
	Crop production	10 ⁶ kg produce	-	-	1,868	-	-	-	-	-	1,868
	Fodder production	10 ⁶ kg dry matter		533	251						784
Regulation	Air quality regulation	10 ³ kg PM ₁₀	272	404	717	700	45	7	40	69	2,254
	Carbon sequestration	10 ⁶ kg carbon	875	8,019	273	50,664	393	149	-	1,056	61,429
Cultural	Recreational cycling	10 ³ trips	2,690	1,863	2,611	1,565	30	3	139	220	9,121

Source: Remme et al., 2014 (Limburg, the Netherlands)



Level 0: Account 6: Services Supply

- **What does a Services Supply Account look like?**
 - Spatially-detailed physical measures of “final” services according to a common **Classification**:
 - Provisioning
 - Regulating
 - Cultural
 - Physical measures (crops, flood control, clean drinking water, carbon sequestration, recreation, ...)
 - **Valuation** where appropriate and available
 - **Monetary Services Supply**



Level 0: Account 6: Services Supply

- **What do you need to create a Services Supply Account?**
 - **Ecosystem Extent, Ecosystem Condition**
 - Common spatial infrastructure (**Spatial Units**)
 - Common **Classification** of services
 - **Data:**
 - Field studies
 - Transfer from other locations (**benefits transfer, valuation**)
 - Economic production (agriculture, forestry, fisheries, water)
 - **Biophysical modelling**
 - **Expertise:** ecologists, geographers (GIS), economists, policy analysts, statisticians



Level 1: Services Supply Account

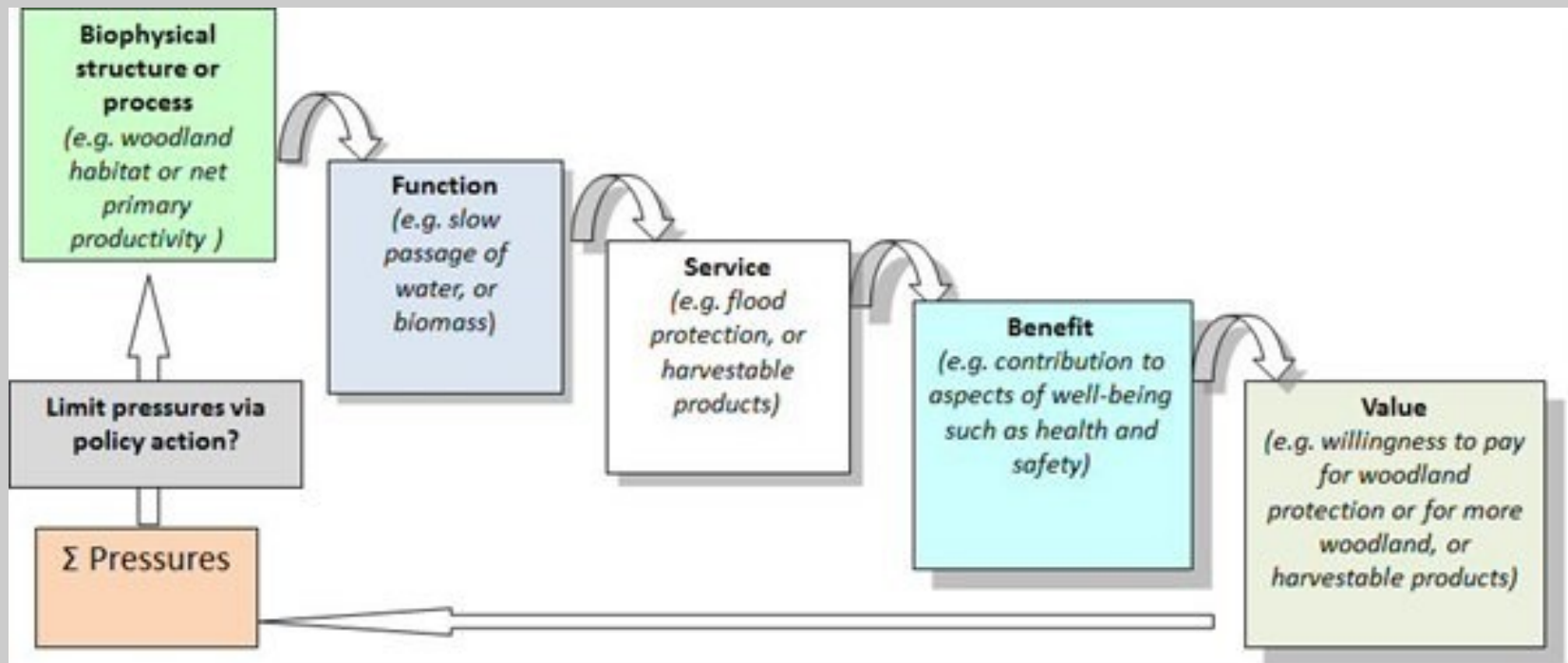


Level 1: Account 6: Services Supply

- **Why Services Supply Accounts?**
- Ecosystems provide services that are essential to the economy and human activities:
 - Food supply
 - Clean water
 - Flood protection
 - Carbon sequestration
 - Recreation, cultural and religious importance
- Ecosystems are being converted and degraded
 - Which ones are most important to conserve?
 - How can they best be managed to maintain services?
 - Link with national planning and accounting to ensure ecosystems are mainstreamed in decisions



The Ecosystem Services Cascade

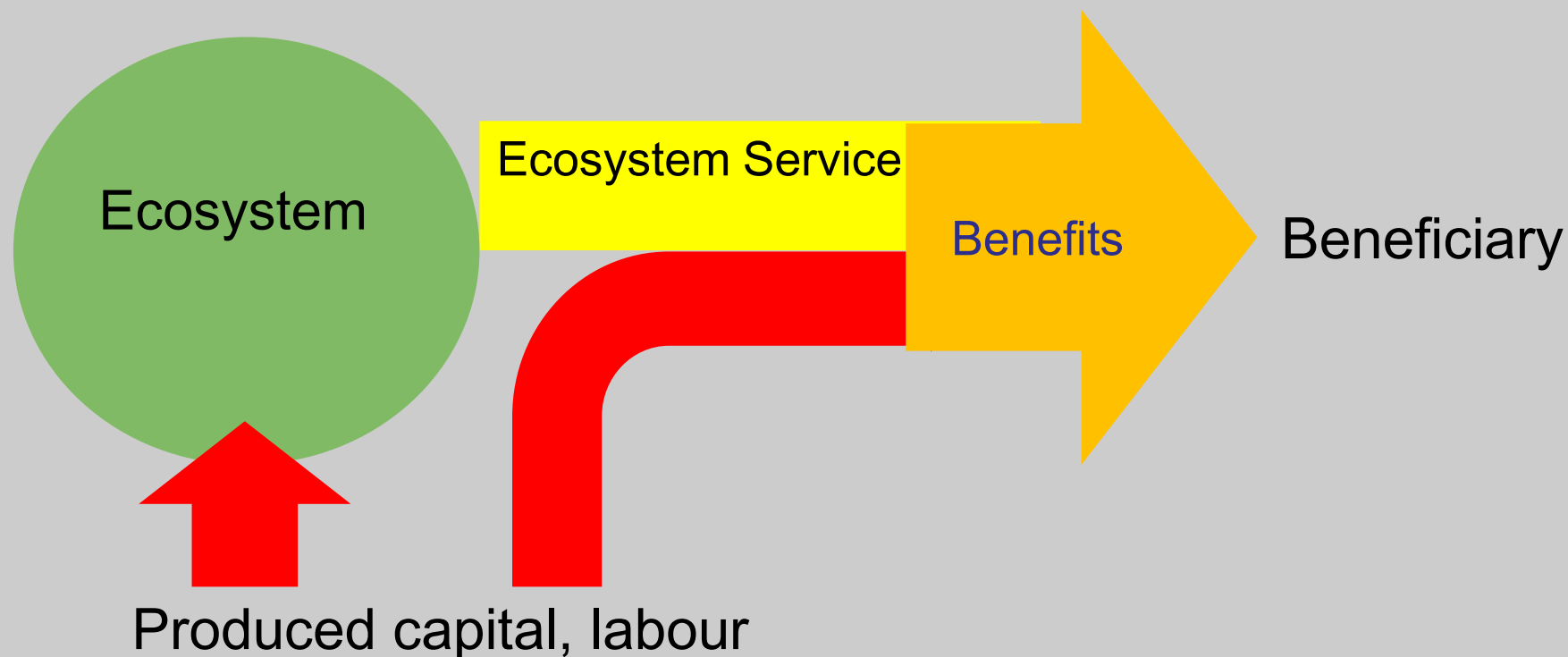


Source: Nottingham School of Geography

- **Ecosystem services** are the contribution of ecosystems to benefits for people...



Ecosystem services (are not benefits)



Ecosystem services are the contribution of ecosystems to benefits for people.



Level 1: Account 6: Services Supply

- **Ecosystem services are the contribution of ecosystem to benefits for people...**
 - They are **not** the benefits; benefits require capital and labour to use
 - We need to calculate the contribution of ecosystems, for example:

$$\text{Crops} = f(\text{nature, equipment, inputs, labour, energy...})$$
 - To grow crops, nature provides biomass growth, nutrients, water, flood control, pollination...
 - Without these, there would be no crops.
 - In the Services Supply Account, we measure the physical services (e.g., the addition to biomass of the crop).



Types of Ecosystem Services

Provisioning Services

= goods that can be harvested from, or extracted from ecosystems

Example:
providing fish for fisheries, or providing wood for timber harvest

Regulating Services

= the regulation of climate, hydrological, ecological and soil processes

Example:
pollination, carbon sequestration, flood control

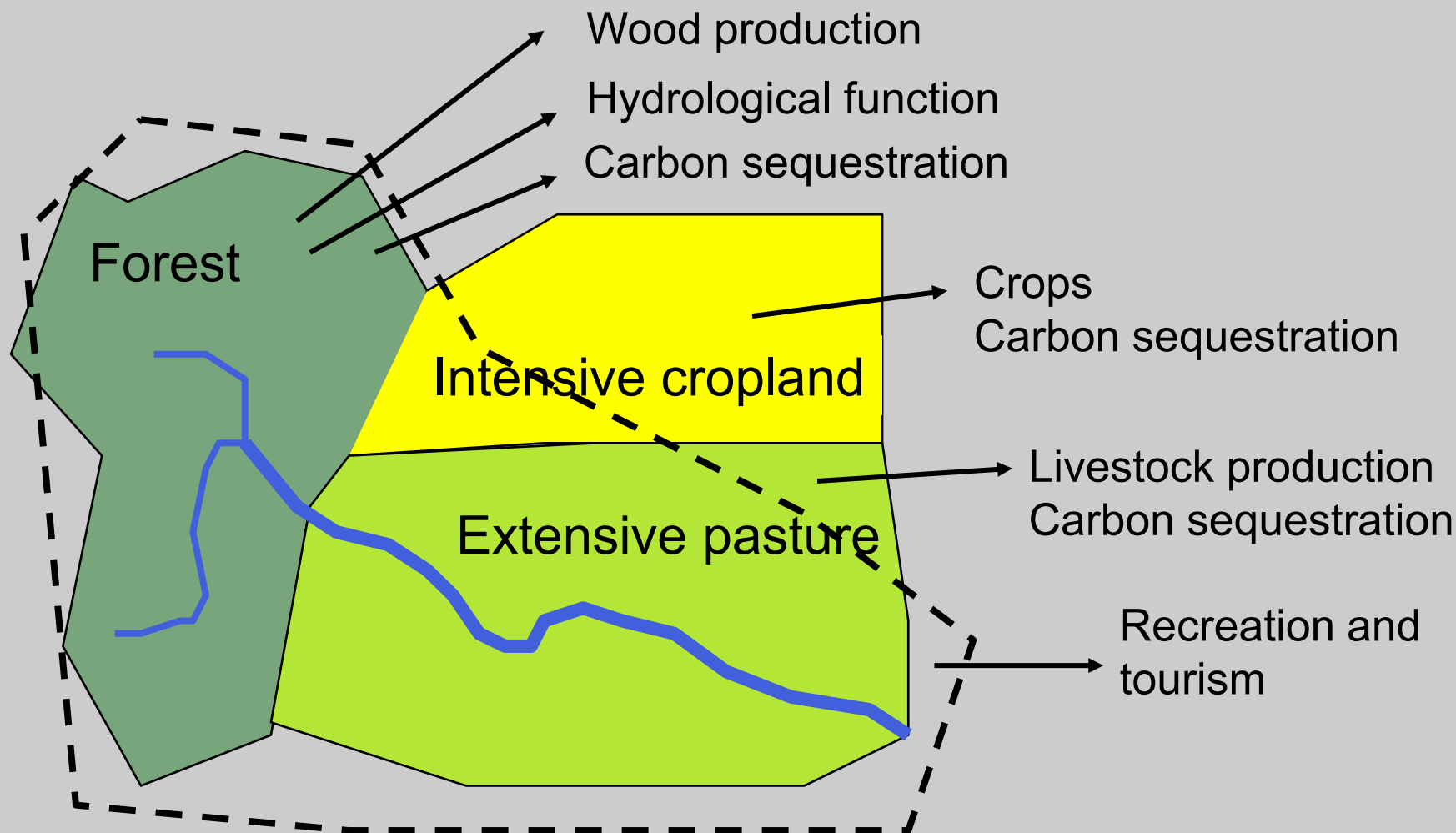
Cultural Services

= the non-material benefits provided by ecosystems

Example:
recreation, tourism, providing a setting for cultural or religious practices



Ecosystem services and maps





Level 1: Account 6: Services Supply

- **The SEEA-EEA focuses on “final” services**
 - The point **before** human involvement transforms the services to benefits
 - biomass → harvesting
 - fish → capture
 - Ecosystem processes and functions are **not** final services
 - e.g., reproduction, predation, food web, nutrient cycle...
 - **Biodiversity** itself is not a “final” service
 - It is an aspect of **Ecosystem Condition** and is recorded in the **Biodiversity Account**.



Level 1: Account 6: Services Supply

- **Services**
 - Based on **Common International Classification of Ecosystem Services (CICES)**
 - Not mutually exclusive
 - A list of “final” services
 - Detailed (4-digit)
 - Does **not** include “supporting” or “intermediate” services (= ecosystem functions)

Section	Division	Group
01. Provisioning	01.01 Nutrition	01.01.01 Biomass
		01.01.02 Water
	01.02 Materials	01.02.01 Biomass
		01.02.02 Water
	01.03 Energy	01.03.01 Biomass-based energy sources
		01.03.02 Mechanical energy
02. Regulation & Maintenance	02.01 Mediation of waste, toxics and other nuisances	02.01.01 Mediation by biota
		02.01.02 Mediation by ecosystems
	02.02 Mediation of flows	02.02.01 Mass flows
		02.02.02 Liquid flows
		02.02.03 Gaseous / air flows
	02.03 Maintenance of physical, chemical, biological conditions	02.03.01 Lifecycle maintenance, habitat and gene pool protection
		02.03.02 Pest and disease control
		02.03.03 Soil formation and composition
		02.03.04 Water conditions
		02.03.05 Atmospheric composition and climate regulation
03. Cultural	03.01 Physical and intellectual interactions with biota, ecosystems, and land-/seascapes [environmental settings]	03.01.01 Physical and experiential interactions
		03.01.02 Intellectual and representative interactions
	03.02 Spiritual, symbolic and other interactions with biota, ecosystems, and land-/seascapes [environmental settings]	03.02.01 Spiritual and/or emblematic
		03.02.02 Other cultural outputs



Level 1: Account 6: Services Supply

- How?
 - Direct measure (e.g., socio-economic survey on recreational use, field survey of available fish...)
 - **Remember Level 0 – Biophysical modelling?**
 - **Lookup tables:** Take values from another location
 - **Statistical approaches:** Estimate based on known explanatory variables
 - **Geostatistical interpolation:** Estimate from nearby known locations
 - **Process-based modelling:** Use models of processes (e.g., land cover change, demand for services...)
 - The group exercise will use only **Lookup Tables...**



Level 1: Account 6: Services Supply

- Compilation Group Exercise (30m)
 - Situation:
 - **Know** total services supply for some EUs
 - **Need to** calculate:
 - Missing services supply for missing EUs based on known data and lookup table
 - Objective (Groups of 3-5):
 1. Calculate missing services
 2. Calculate totals
 3. Report and discuss results



Level 1: Account 6: Services Supply

Group Exercise: Step 1 – Calculate unknown services

e.g., Crop for EU04 =
 $(18,700 / 500) * 281.3$

e.g., Carbon for EU04 =
 $(500 * 20)$

Services Supply Database

EU	Extent (ha)	(C) Crop	(R) Recreation	(W) Water	(S) Carbon Sequestration	tonnes /ha/year	tonnes /year
		tonnes/year	trips/year	m ³ /year	tonnes /ha/year		
EU01 = Herbaceous crops	500.0	18,700.0	500.0	600.0	20		
EU02 = Tree covered areas	262.5	0.0	1,500.0	500.0	30		
EU03 = Inland water bodies	68.8	0.0	1,600.0	15,000.0	5		
EU04 = Herbaceous crops	281.3				20		
EU05 = Tree covered areas	75.0				30		
EU06 = Artificial surfaces (urban)	56.3	0.0	500.0	500.0	0		
EU07 = Artificial surfaces (urban)	68.8	0.0	700.0	400.0	0		
EU08 = Shrubs..regularly flooded (wetland)	37.5	700.0	5,000.0	10,000.0	40		
EU09 = Inland water bodies	50.0				5		
EU10 = Tree covered areas	225.0				30		
EU11 = Herbaceous crops	175.0				20		
Total	1,800.0						



Level 1: Account 6: Services Supply

- Is everyone clear on the objectives?
- 30 minutes group work
- Please ask questions!
- Results:
 - Each group report:
 - Totals for each service
 - Which EU generates the most of each service?
 - Were there any surprises?

	Extent (ha)	(C) Crop	(R) Recreation	(W) Water	(S) Carbon Sequestration	
		tonnes/year	trips/year	m ³ /year	tonnes /ha/year	tonnes /year
EU						
EU01 = Herbaceous crops	500.0	18,700.0	500.0	600.0	20	
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Total	1,800.0					



Level 2: Services Supply Account



Level 2: Account 6: Services Supply

- Learning objectives (Level 2)
 - Understand the data options and sources
 - Be aware of how other countries have approached Services Supply Accounting



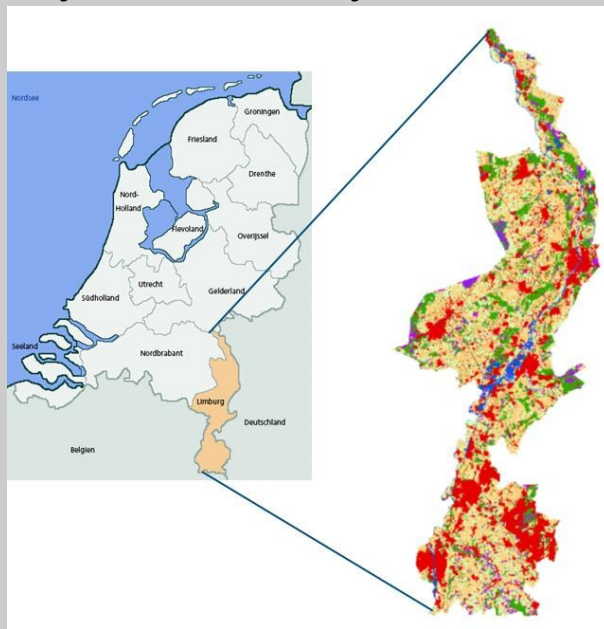
Level 2: Account 6: Services Supply

- A full Services Supply Account is more complex than the exercise:
 - More services (48 “final” services in CICES)
 - More types of data (tonnes, risks, visitors, air quality, cultural significance...)
 - Less measured data → need models to estimate
 - High variability among ecosystem types and region (e.g., salt marsh carbon = 650 to 1750 tCO₂/ha/year)
- **Do not** need to include all services:
 - High priority services → measure or estimate
 - Get started with available data



Ecosystem services in an account

- Ecosystem service account developed for Limburg Province, the Netherlands
- 2200 km², 1.1 million inhabitants
- Analysis of 7 ecosystem services



Source: Remme et al., 2014 (Limburg, the Netherlands)



Level 2: Account 6: Services Supply

Example (services in physical units)

Ecosystem service		Units	Land cover type								Provincial total
			Urban	Pasture	Cropland	Forest	Heath	Peat	Surface Water	Other nature	
Provisioning	Hunting	kg meat	-	9,100	14,732	8,100	678	70		1,513	34,193
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Cultural	Recreational cycling	10 ³ trips	2,690	1,863	2,611	1,565	30	3	139	220	9,121

Note: Units of measure are **very** different

Source: Remme et al., 2014 (Limburg, the Netherlands)



Level 2: Account 6: Services Supply

- Data options and sources
 - Field studies
 - Literature on similar sites or specific research
 - Transfer from other locations (**Benefits Transfer, Valuation**)
 - Ecosystem valuation research databases (e.g., www.evri.ca)
 - Economic production (agriculture, forestry, fisheries, water)
 - Socio-economic statistics already available with spatial detail
 - **Biophysical modelling**
 - Know conditions, can estimate some services using production functions (e.g., hydrology → flood control)



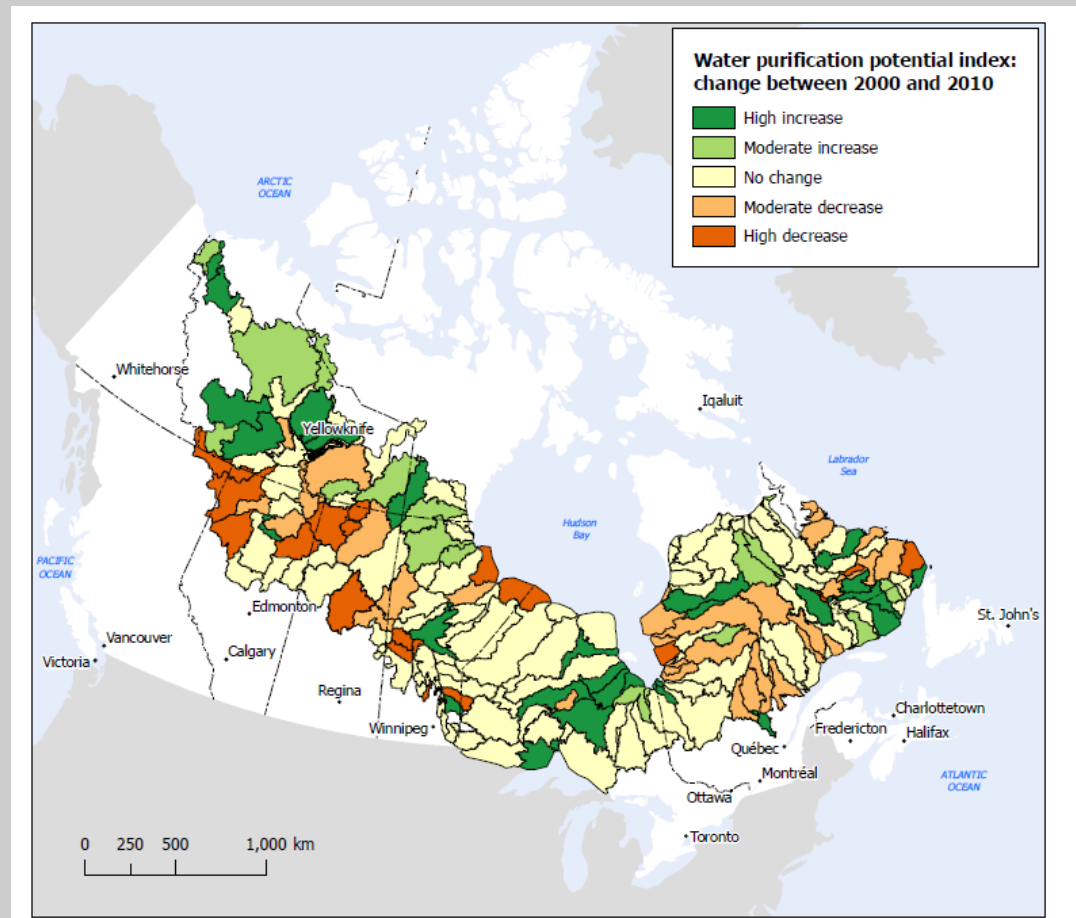
Level 2: Account 6: Services Supply

Canada Example

Water purification **potential** change by drainage area for boreal wetlands

Index based on:

- % forest cover
- % agricultural land
- % riparian forest
- % wetlands
- % anthropogenic disturbance
- % burn area
- Edge & linear density (fragmentation)
- Human footprint
- Slope
- Nitrogen & Sulphur exceedance (from atmospheric deposition)



Source: Statistics Canada, 2013



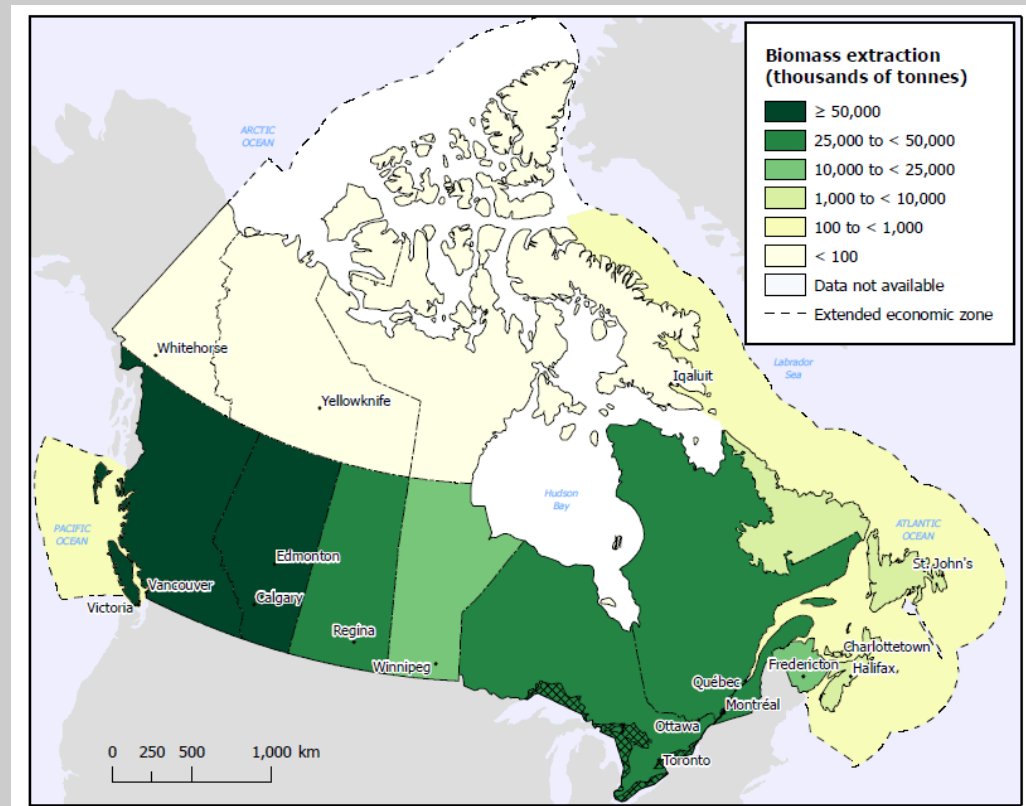
Level 2: Account 6: Services Supply

Canada example

Net biomass extraction for human use

Includes:

- Agricultural crops
- Livestock and poultry
- Milk
- Maple products and honey
- Forestry
- Fisheries (inland and marine)



Source: Statistics Canada, 2013



Level 2: Account 6: Services Supply

Canada example

Weight of commercial fish landings by marine statistical area

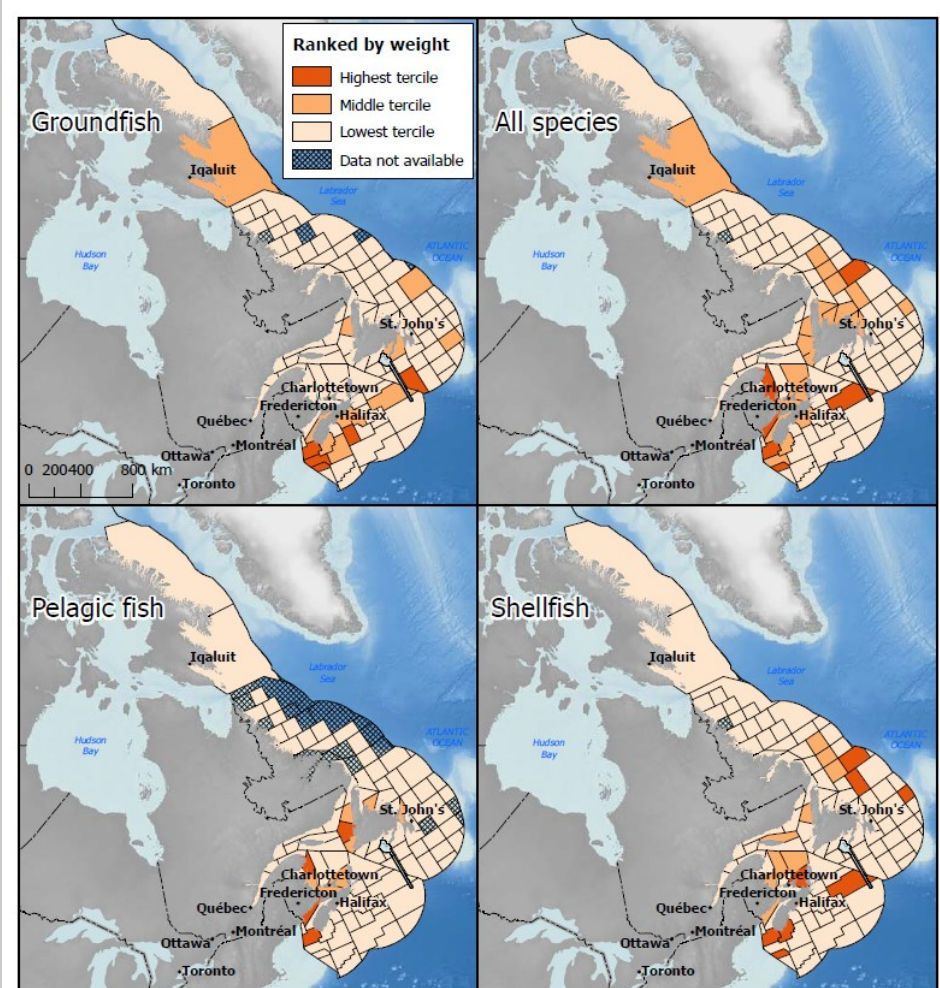
Includes:

- Groundfish
- Pelagic fish
- Shellfish

Also done for west coast

Statistical area defined by Ministry of Fisheries and Oceans

Source: Statistics Canada, 2013





Level 2: Account 6: Services Supply

- Some services flow data are available

Service	Flow measure
Provisioning services	
Timber services	timber increment
Crops	crop production
Livestock	livestock production
Water provision	annual freshwater supply
Regulating services	
Water quantity regulation	total amount of water stored
	total amounts of pollutants removed annually
Climate regulation	annual carbon fixation
Storm protection	total number of storms mitigated
Air quality regulation	total amount of pollutants removed via dry deposition on leaves
Erosion control	total amount of soil retained
Pollination	increased yield of crops due to pollination
Soil quality regulation	increased yield of crops attributable to soil quality
Cultural services	
Recreation	number of visitors

Source: (Maes, Paracchini et al. 2011)



Level 2: Account 6: Services Supply

- **Data sources:** Socio-economic statistics
 - Agricultural statistics: crop, livestock production
 - Energy statistics: biomass for fuel
 - Fisheries statistics: catch, stock
 - Forestry statistics: timber stock, harvest
 - Park surveys: visitors, use
 - Water statistics: withdrawals, consumption
 - Natural disasters: incidence of floods, erosion, storms
 - Soil inventories: erosion potential
 - Health statistics: regulation of biotic environment
- Best if they are national and good quality



Level 2: Account 6: Services Supply

- **Data sources:** Environmental statistics
 - Iconic species ranges & habitats
 - Land cover → carbon sequestration, air filtration
 - Hydrology & weather data: Flow rates, variability → flood risk
 - Topography, land cover, soil & weather data → erosion and landslide risk
 - Carbon storage and sequestration (see **Carbon Accounts**)
 - Remote sensing → primary production
- Best if they are national and good quality



Level 2: Account 6: Services Supply

- **Data sources:** Ecosystem valuation databases
 - Based on codifying scientific studies
 - Include data for many countries, ecosystem type, physical services measures
 - Environmental Valuation Reference Inventory (www.evri.ca)
 - TEEB Ecosystem Service Valuation Database ([ESVD](#))
 - Gulf of Mexico Ecosystem Services Valuation Database (www.gecoserv.org)
 - Need to understand location, definitions and methods used



Level 2: Account 6: Services Supply

- **Data sources:** Specific studies & models
 - These may not be included in valuation databases
 - Specific studies:
 - National or regional ecosystem assessments (Millennium Ecosystem Assessment, UK National Ecosystem Assessment)
 - Small-area studies (e.g., one park, one region)
 - TEEB studies and country studies (multiple ecosystems and services)
 - Decision-support models:
 - There are landscape-scale and site-scale models that can help estimate service flows (AIRES, InVEST, LUCI...)
 - See **Biophysical Modelling**



Level 2: Account 6: Services Supply

- **Data sources:** Special surveys and case studies
 - High-priority data gaps may also be addressed by collecting **new** data
 - Ecological field studies to determine “production functions”
 - Socio-economic surveys to determine use of services (e.g., water, food, recreation)
 - Case-studies for specific locations or social groups (e.g., dependence on nature of low-income residents)
 - If possible, add questions to existing surveys, for example,
 - Households use of water, source of food, incidence of hazards (flooding, erosion, drought, disease), source of biomass for fuel



Level 2: Account 6: Services Supply

- Group exercise (15m) (Groups of 3-5)
 1. In your country, what are **three** important **ecosystem services** that should be included in a Services Supply Account?
 2. Which ecosystem types supply them?
 3. What **national data** are available in your country on the supply of these services?
 4. Report your results



Level 2: Account 6: Services Supply

- Concepts Group exercise (15m)
- Group reports
 - The **ecosystem services** you selected
 - The main land cover types for each
 - Are **national data** available in your country on the supply of these services?
- Discussion
 - What other ecosystem services would be important to measure?
 - On what topic might a special survey be used to fill priority data gaps?



Level 2: Account 6: Services Supply

- Discussion and questions
- Take home points
 - Services Supply in biophysical terms is one of the **most important** aspects of ecosystem accounting
 - Data on Services Supply are available from many sources
 - There are some simple methods and models available to integrate these data and fill gaps
 - Start by focussing on available data and priority services



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Level 2: Account 6: Services Supply

■ Further Information

- [SEEA Experimental Ecosystem Accounting](#) (2012)
- SEEA-EEA [Technical Guidance](#) (forthcoming)
 - Detailed supporting documents
 - [“Linkages between ecosystem service accounts and ecosystems asset accounts”](#) and
 - [“Biophysical Modelling and Analysis of Ecosystem Services in an Ecosystem Accounting Context”](#) by Lars Hein



Evaluation of the training module

- Please complete the online evaluation form for this module: <http://www.tinyurl.com/pbopmy2>
- For this module
 - What did you learn that you could apply in your work?
 - Was the presentation clear and informative?
 - Was it too simple? Too complex?
 - Was there anything you did not understand?
 - What additions or deletions would you suggest (recognizing that the unit is intended for a general audience)?
 - Do you have any suggestions as to how the SEEA-EEA may be improved (concepts, principles) in this area?



Acknowledgements

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- Contact: seea@un.org



Convention on
Biological Diversity

