System of Environmental Economic Accounting

Ecosystem services flow accounts in the SEEA Ecosystem Accounting

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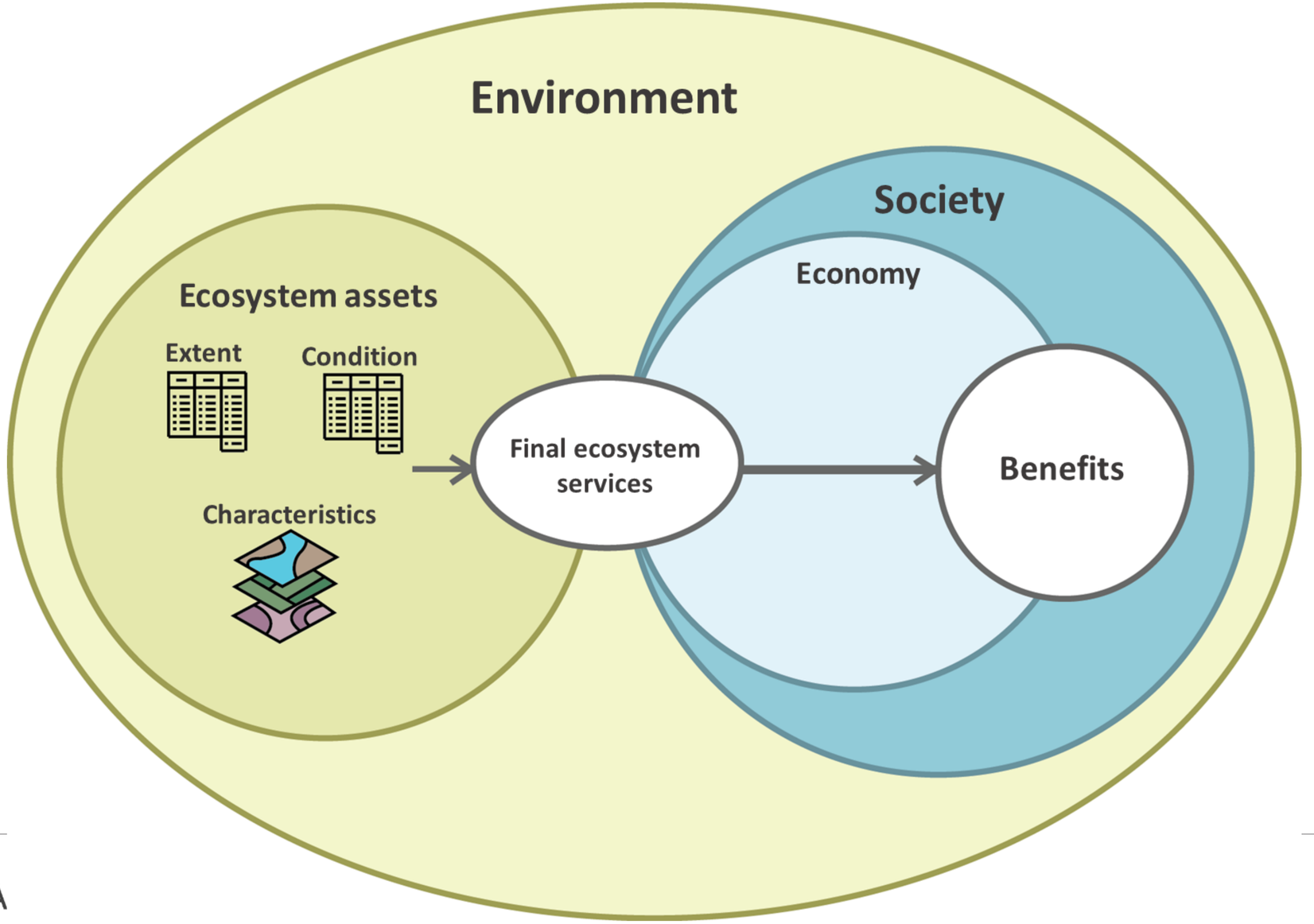
SEEA EA Framework



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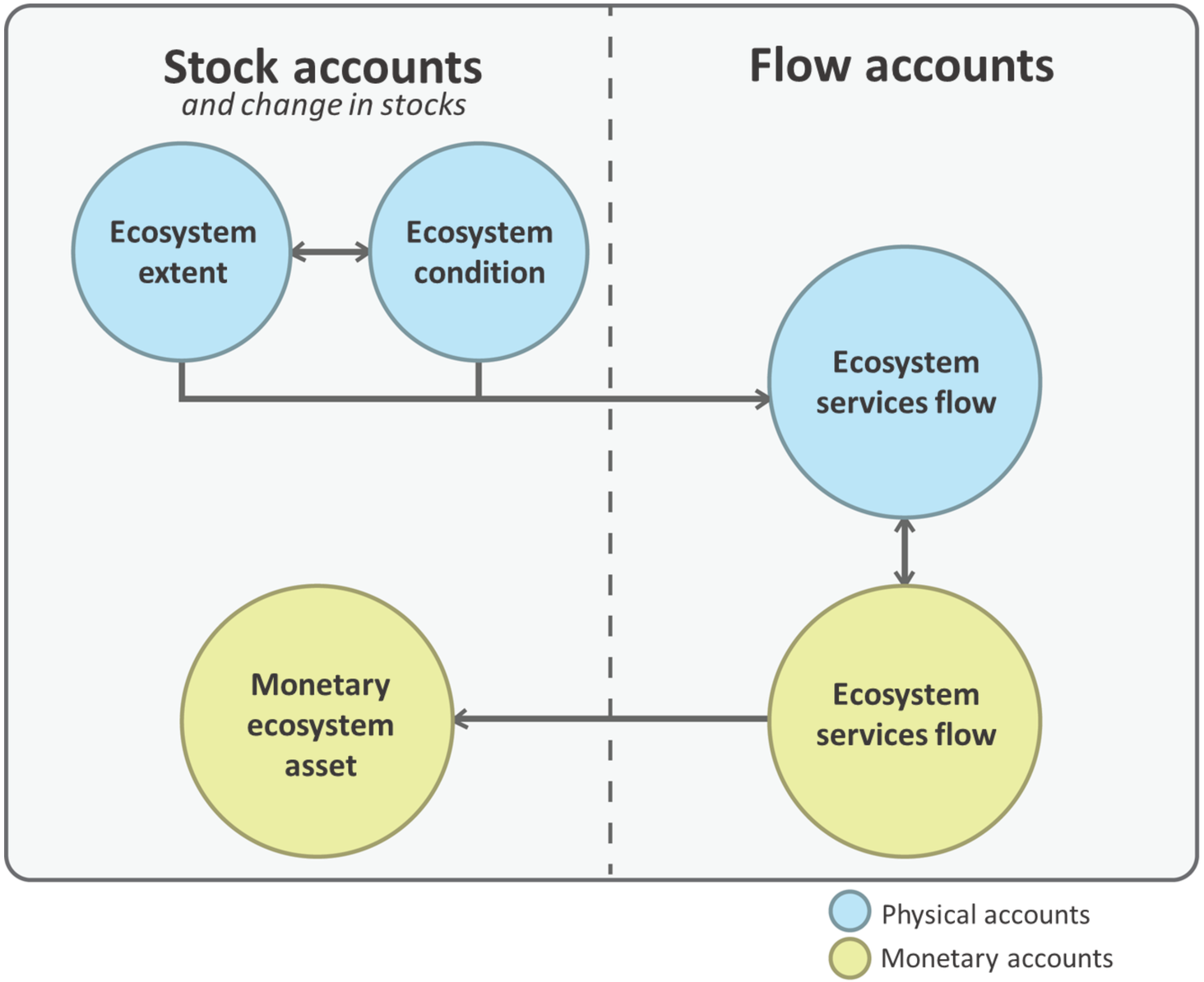
Ecosystem accounts – core accounts



Ecosystem services flow account

- Ecosystem services are not same as benefits
- Need to understand ecosystem services and their reference list
- The account records **flows of ecosystem services** supplied by ecosystem assets and used by economic units (industries, households, government) during an accounting period
  - **Alignment between supply and use** (i.e. supply needs to match use of a particular service)
- Both **physical and monetary units**

SEEA EA Framework – an illustrative example

1 Asset – **forest**

2 **Conditions**

Soil depth

3 **Services**

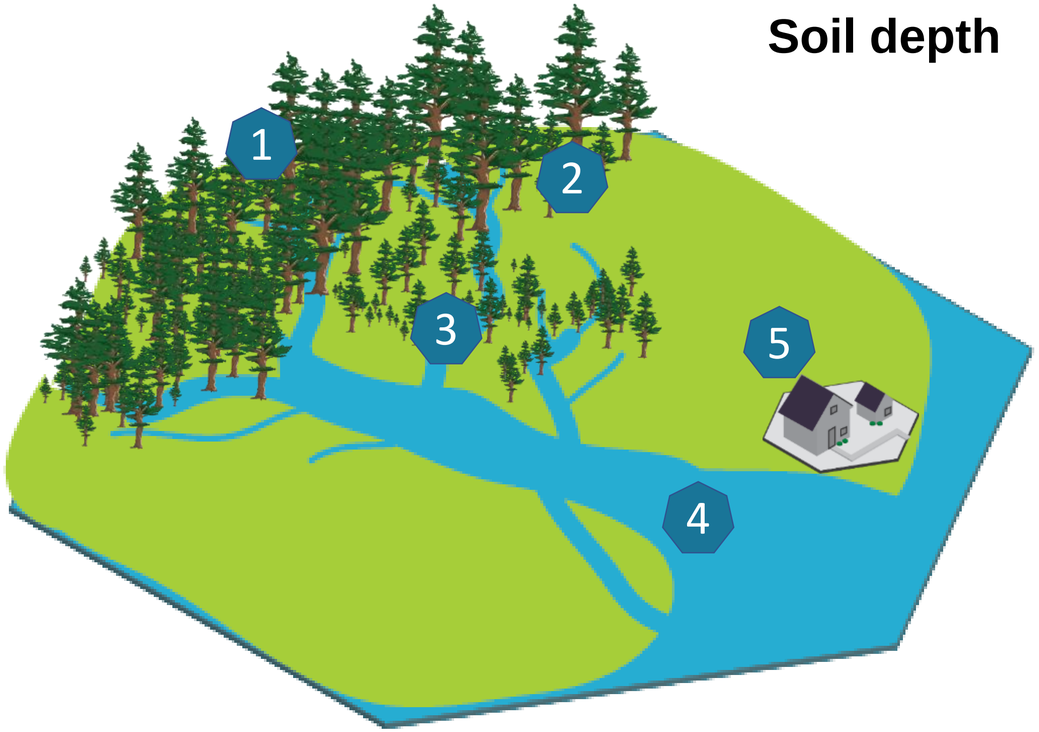
Water filtration

4 **Benefits**

Clean water

5 **Beneficiaries**

People



Ecosystem services

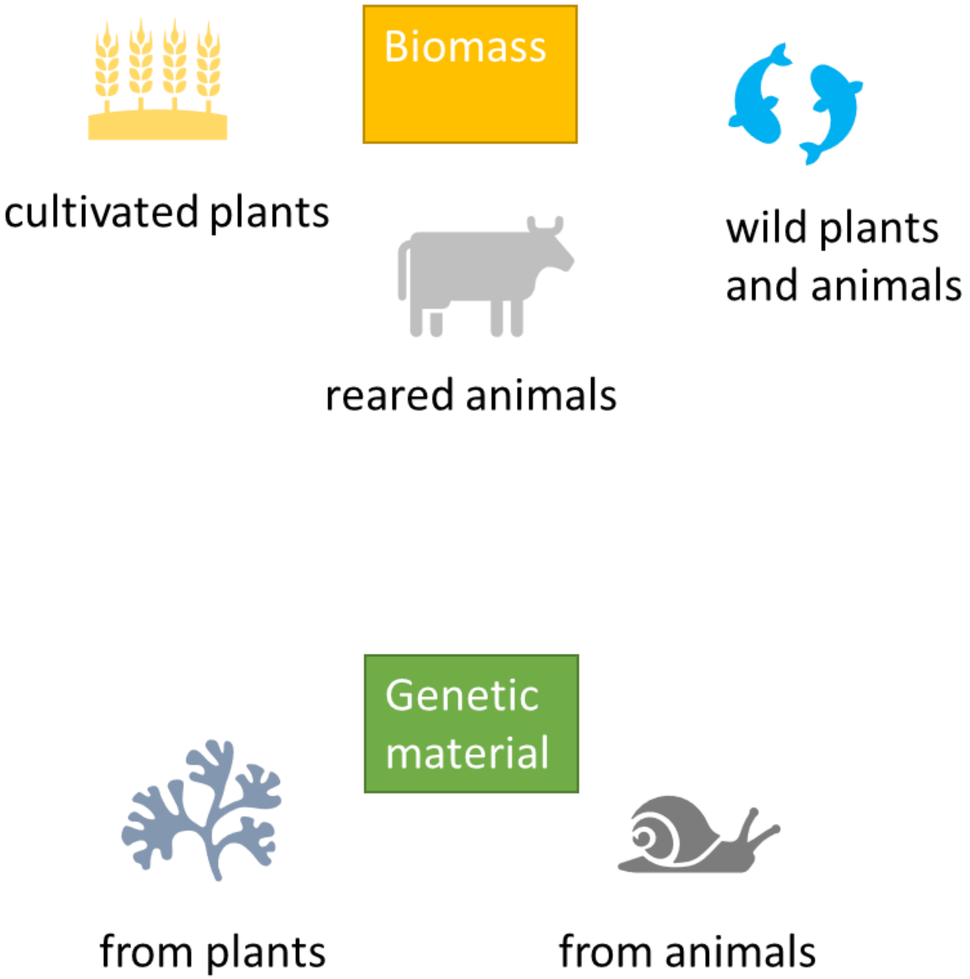
- SEEA EA includes a **reference list** of ecosystem services
- Final and intermediate ES

- Provisioning:
  - > Biomass
    - Grazed biomass
    - Livestock
    - Aquaculture
    - Wood
    - Wild fish + other
    - Wild animals, plants + other
  - > Genetic material
  - > Water supply
- Cultural:
  - > Recreation-related
  - > Visual amenity
  - > Education, scientific and research
  - > Spiritual, artistic and symbolic services
- Other ES
- Non-use

- Regulating and maintenance services
  - > Global climate regulation
  - > Rainfall pattern
  - > Local (micro and meso) climate regulation
  - > Air filtration
  - > Soil quality regulation
  - > Soil and sediment retention
  - > Solid waste remediation
  - > Water purification
  - > Water flow regulation
  - > Flood control
  - > Storm mitigation
  - > Noise attenuation
  - > Pollination
  - > Biological control
  - > Nursery population & habitat maintenance

Provisioning services

Selected ecosystem services (reference list)		
Provisioning services		
	Biomass provisioning	Crop provisioning
		Grazed biomass provisioning
		Livestock provisioning services
		Aquaculture provisioning services
		Wood provisioning services
		Wild fish and other natural aquatic biomass provisioning services
		Wild animals, plants and other biomass provisioning services
	Genetic material services	
	Water supply	
	Other provisioning services	



Regulating and maintenance services

Examples

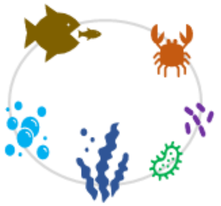
Regulating and maintenance services	
	Global climate regulation services
	Rainfall pattern regulation services
	Local (micro and meso) climate regulation services
	Air filtration services
	Soil quality regulation services
	Soil and sediment retention services
	Solid waste remediation services
	Water purification services
	Water flow regulation services
	Flood control services
	Storm mitigation services
	Noise attentuation services
	Pollination services
	Biological control services
	Nursery population & habitat maintenance services
	Other regulating and maintenance services

mediation of wastes

Transformation of biochemical (and physical) inputs to ecosystems

regulation of flows

Regulation of baseline flows and extreme events



Lifecycle maintenance, gene pool protection

Cultural services

Examples

Cultural services		
	Recreation-related services	
	Visual amenity services	
	Education, scientific and research services	
	Spiritual, artistic and symbolic services	
	Other cultural services	

Direct, in-situ interactions with living systems

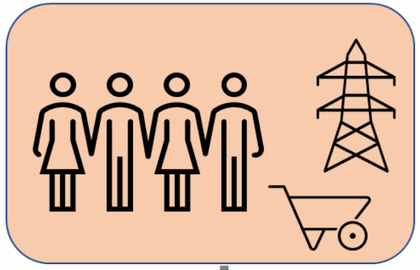
Physical and experiential interactions

Intellectual and representative interactions

Ecosystem services supply, actual flow and use

what ecosystems can provide

what humans (economy and society) need



Ecosystem Service Actual Flow

Supply table	ET 1	ET 2	…
ES 1			
ES 2			
ES …			

Use table	Industries	Households	…
ES 1			
ES 2			
ES …			

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Supply Table

SUPPLY		Economic units															Ecosystem type (based on the EFG level 3 of IUCN GET)																					
		Industries															Terrestrial												Freshwater			Marine						
																	T1 Tropical-subtropical forests				T2 Temperate-boreal forests and woodlands				...		T7		F1	...	FM1	M1	...	MFT1				
Ecosystem services (reference list)	MEASUREMENT UNIT	Agriculture	Forestry	Fisheries	Mining and quarrying	Manufacturing	Electricity, gas, steam and air-conditioning supply	Water supply; sewerage, waste management and remediation activities	Services	Other industries	Total industry	Government consumption	Household consumption	Total supply by resident economic units	Supply by non-resident economic units – Imports	Total supply by economic units	Tropical-subtropical lowland rainforests T1.1	Tropical-subtropical dry forests and scrubs T1.2	Tropical-subtropical montane rainforests T1.3	Tropical heath forests T1.4	Boreal and temperate high montane forests and woodlands T2.1	Deciduous temperate forests T2.2	...	Temperate pyric sclerophyll forests and woodlands T2.6	...	...	...	Derived semi-natural pastures and old fields T7.5	Permanent upland streams F1.1	...	Intermittently closed and open lakes and lagoon FM1.3	Seagrass meadows M1.1	...	Coastal saltmarshes and reedbeds MFT1.3	Total supply by resident ecosystem assets	Supply from non-resident ecosystem assets - Imports	Total supply by ecosystem assets	TOTAL SUPPLY
Provisioning services																																						
Biomass provisioning: Crop provisioning																																						
Grazed biomass provisioning																																						
Livestock provisioning services																																						
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Water supply																																						
Other provisioning services																																						
Regulating and maintenance services																																						
Global climate regulation services																																						
Rainfall pattern regulation services																																						

Use Table

USE			Economic units															Ecosystem type (based on the EFG level 3 of IUCN GET)																					
			Industries															Terrestrial												Freshwater			Marine						
																		T1 Tropical-subtropical forests				T2 Temperate-boreal forests and woodlands				...		T7		F1	...	FM1	M1	...	MFT1				
Ecosystem services (reference list)		MEASUREMENT UNIT	Agriculture	Forestry	Fisheries	Mining and quarrying	Manufacturing	Electricity, gas, steam and air conditioning supply	Water supply; sewerage, waste management and remediation activities	Services	Other industries	Total industry	Government consumption	Household consumption	Total use by resident economic units	Exports - final ecosystem services	Total use by economic units	T1.1 Tropical-subtropical lowland rainforests	T1.2 Tropical-subtropical dry forests and scrubs	T1.3 Tropical-subtropical montane rainforests	T1.4 Tropical heath forests	T2.1 Boreal and temperate high montane forests and woodlands	T2.2 Deciduous temperate forests	...	T2.6 Temperate pyric sclerophyll forests and woodlands	...	...	...	T7.5 Derived semi-natural pastures and old fields	F1.1 Permanent upland streams	...	FM1.3 Intermittently closed and open lakes and lagoons	M1.1 Seagrass meadows	...	MFT1.3 Coastal saltmarshes and reedbeds	Total use by resident ecosystem assets	Exports – intermediate services	Total use by ecosystem assets	TOTAL USE
Provisioning services																																							
Biomass provisioning	Crop provisioning																																						
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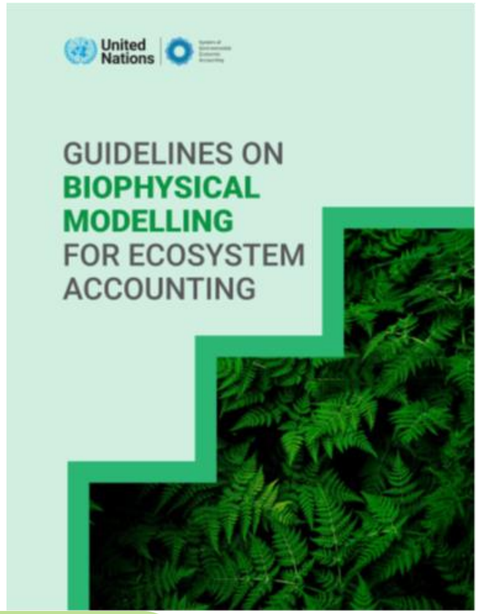
Biophysical modelling of ecosystem services

- What is biophysical modelling?
  - > Quantitative estimation of biophysical phenomena or processes that are difficult to fully observe directly
  - > Biophysical models are very useful for understanding ecosystem service supply
- Why do we need biophysical modelling?
  - > Data needed for ecosystem accounts not usually captured in regular data sources
  - > Measuring ecosystem services directly is often difficult or costly to measure in situ
  - > Data may only be available for specific locations
- Many modelling techniques are available, including look-up tables, spatial interpolation, geostatistical models, dynamic systems, etc.
- Many platforms are available for modelling ecosystem services, including AIRES, InVEST, INCA/ESTIMAP, etc.

Biophysical guidelines

- Why developed?
  - > Diverse models and tools have proliferated over the past decade and are constantly evolving.
  - > Most models not developed specifically for accounting purposes, many models produce results can be used directly in SEEA EA or produce results that can be modified for use in SEEA EA.
- Audience:
  - > Ecosystem accounts compilers + managers
  - > Assumes familiarity with SEEA Ecosystem Accounting but does not assume knowledge of biophysical modelling
- Tiered approach:
  - > Recognizes countries are in different circumstances (data availability + expertise)



TIER 1

Ecosystem services modelled from global datasets with no or little user input data

TIER 2

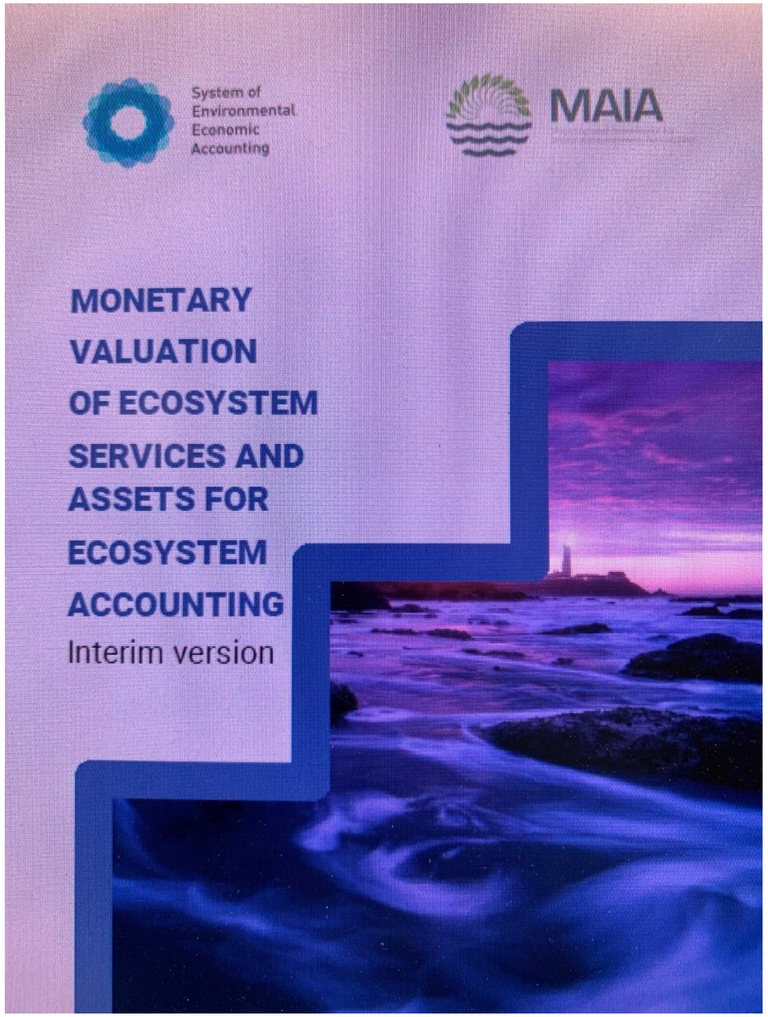
Ecosystem services modelled from national datasets customized for national contexts, some validation

TIER 3

Ecosystem services modelled with local data and direct surveys, better validation, and best available tools

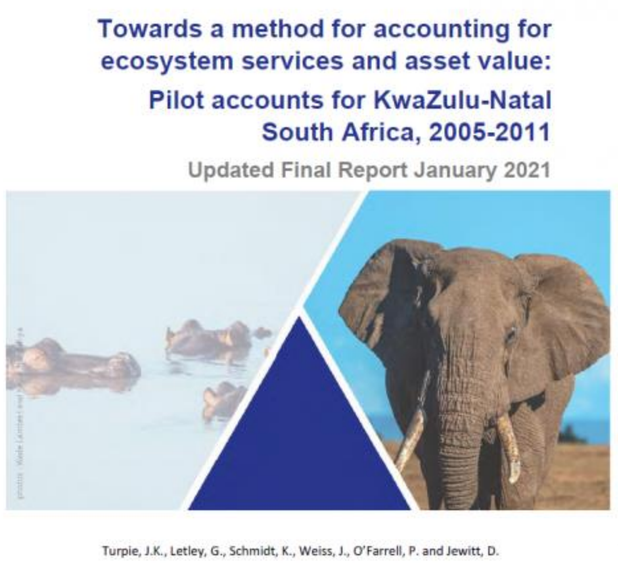
Technical report on valuation

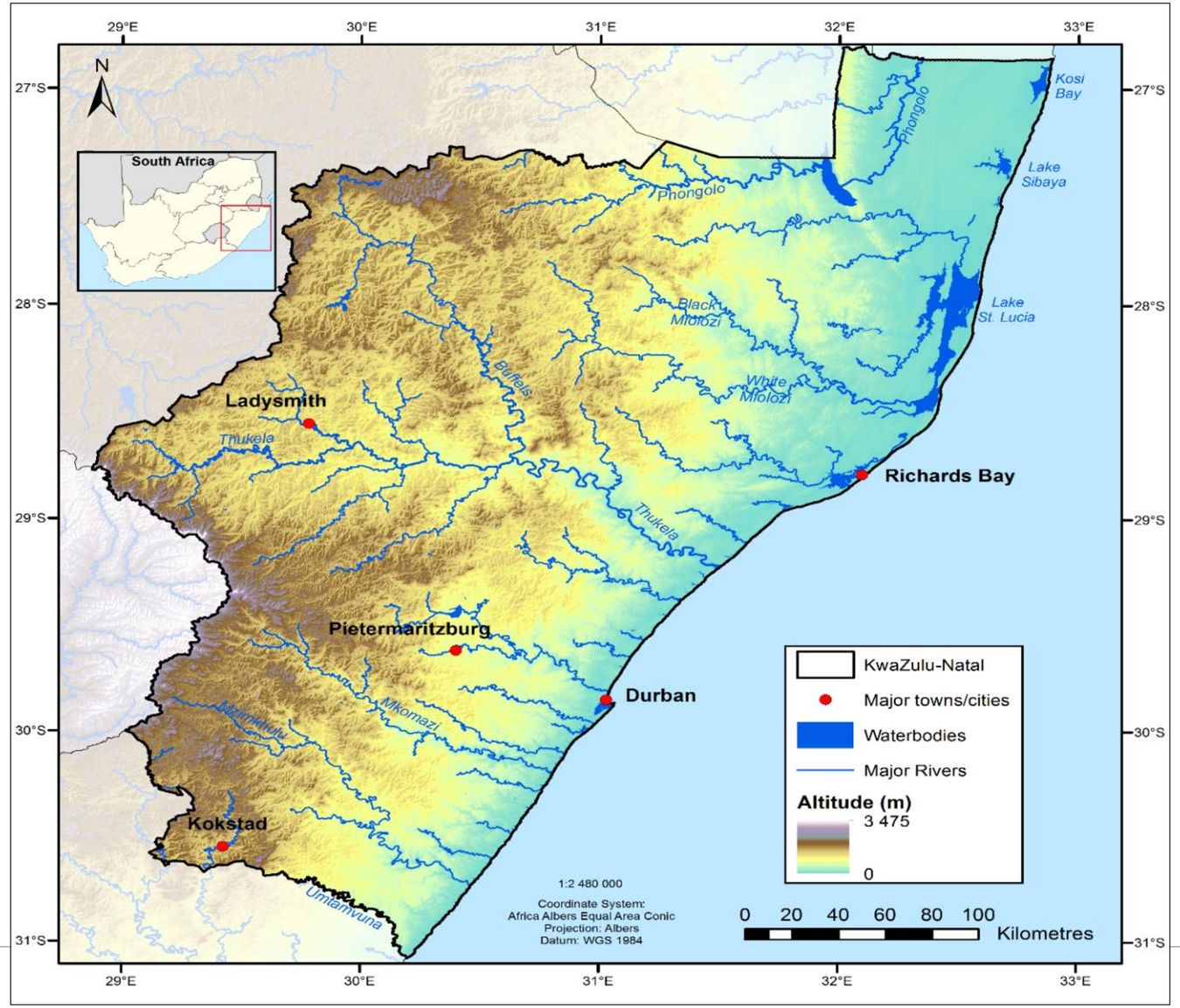
- Support SEEA EA implementation in countries
- Technical report – (not guidelines)
- Scope:
  - > Valuation methods suitable for accounting
  - > Valuation methods for each of the ecosystem services
  - > Valuing ecosystem assets
  - > Other considerations
    - Value transfer
    - Platforms and tools
    - Communicating values



Example: South Africa

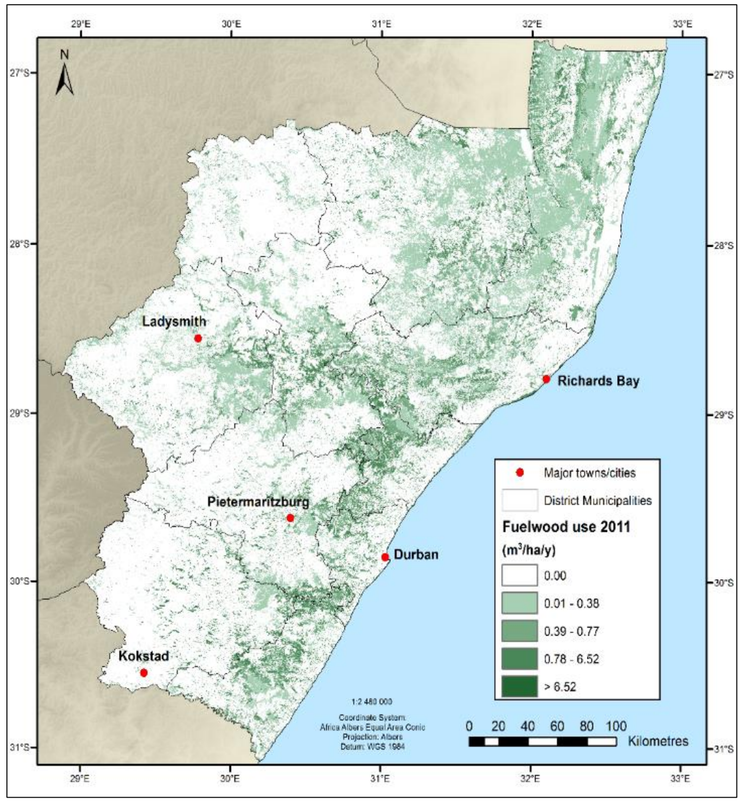
- Output of the NCAVES project
- Modelled 11 different ES for 2005 and 2011
- Kwazulu-Natal (KZN) province
- Physical + monetary

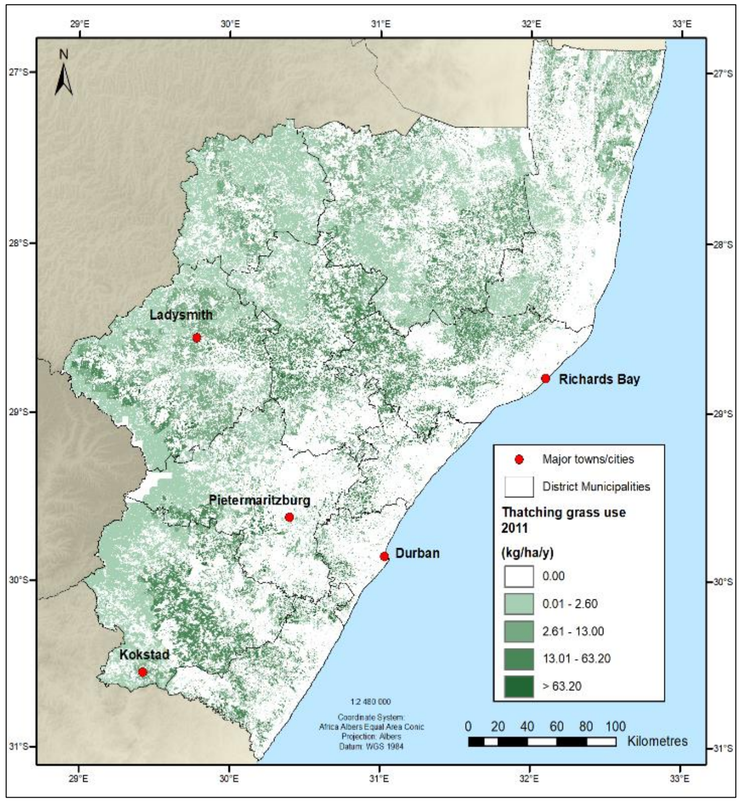


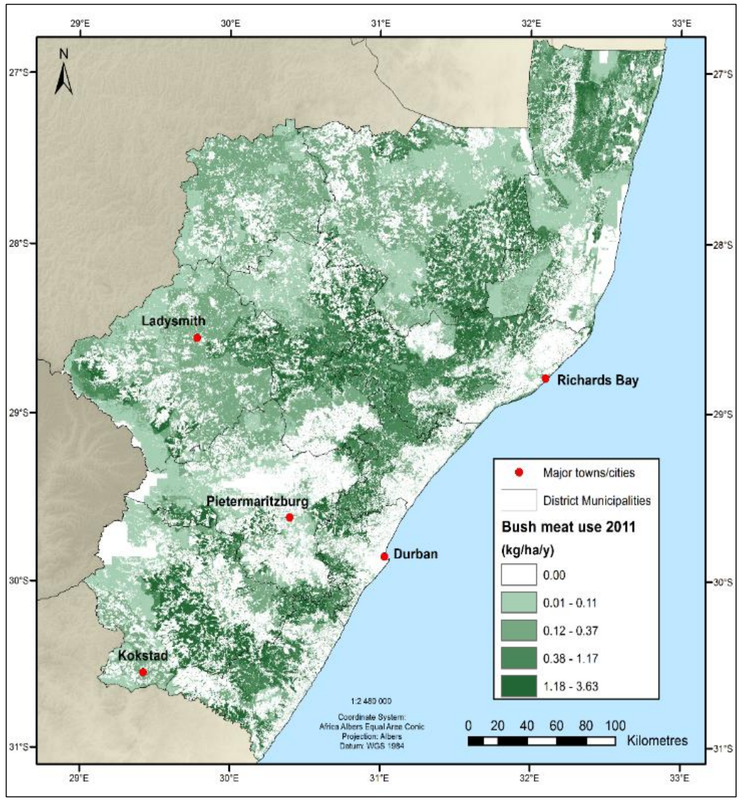


Source: Turpie et al. 2021

Example South Africa







- Results in form of maps

Source: Turpie et al. 2021

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Example: South Africa

- All 11 ES modeled spatially
- After integration, physical supply and use tables (and monetary SUTs + monetary asset account)

Table 5.1. Total biophysical supply per ecosystem type 2005

Resource \ Biome	Freshwater ecosystems	Grassland	Indian Ocean Coastal Belt	Savanna	Forests	Estuaries	Cultivated	Urban green space	Total
Wood products (m^3)	3 523	695 638	235 125	787 294	267 047	169			**1 988 796**
Non-wood products (tonnes)	834	46 494	11 489	34 952	2 911	38			**96 718**
Livestock production (LSU)	1 716	684 698	52 162	289 663	2 010	340			**1 030 589**
Crop production (tonnes)							43 305 781		**43 305 781**
Experiential value (R millions)	14	237	179	218	55	24	85	885	**1 698**
Carbon storage (Tg C)	5	512	61	348	33	0	279		**1 237**
Pollination (R millions)	0	12	6	31	2	0			**51**
Flow regulation (million m^3)	78	3 315	421	2 198	634	36			**6 682**
Flood attenuation (R millions)								31	**31**
Sediment retention (million tonnes)	2	45	6	27	18	2			**99**
Water quality amelioration (tonnes P)	-	3 829	525	5 394	97	6			**9 850**

Source: Turpie et al. 2021

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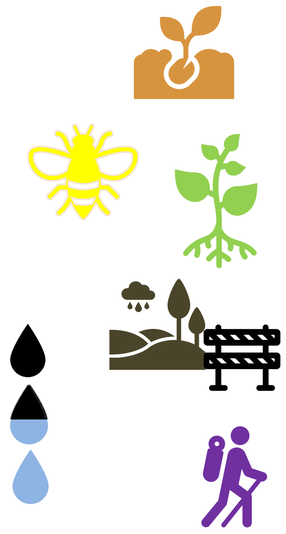
Example of Supply table for Europe



	Ecosystem types										
				Woodland & forest							
	Urban	Cropland	Grassland	Available for Wood Supply	Other	Wetland	Heathland and shrub	Sparsely vegetated land	Rivers and lakes	Coastal /intertidal area	Total
crop provision (1,000 tonne)		93,936									93,936
timber provision (1,000 m3)				885							885
crop pollination (1,000 tonne)		10,447									10,447
soil retention (mlln tonne)		1,115									1,115
carbon sequestration (mlln tonne)	-	-	-	306		-	-	-	NA	NA	306
flood control (1,000 hectare)	26	313	767	2,923		67	72	0,2	NA	NA	4,170
water purification (1,000 tonne)	510	13,882	2,314	3,032		73	154	45	216		20,166
habitat & species maintenance (mlln euro)	NA	15,731	4,473	12,448		683	1,250	385	689	NA	35,660
nature-based recreation (1,000 nbr visits)	66	3,279	6,237	24,198		1,971	2,318	1,058	778	220	40,125

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THANK YOU

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