System of Environmental Economic Accounting

Classification

(Level 1)

October 2017

United Nations

Overview: Classification

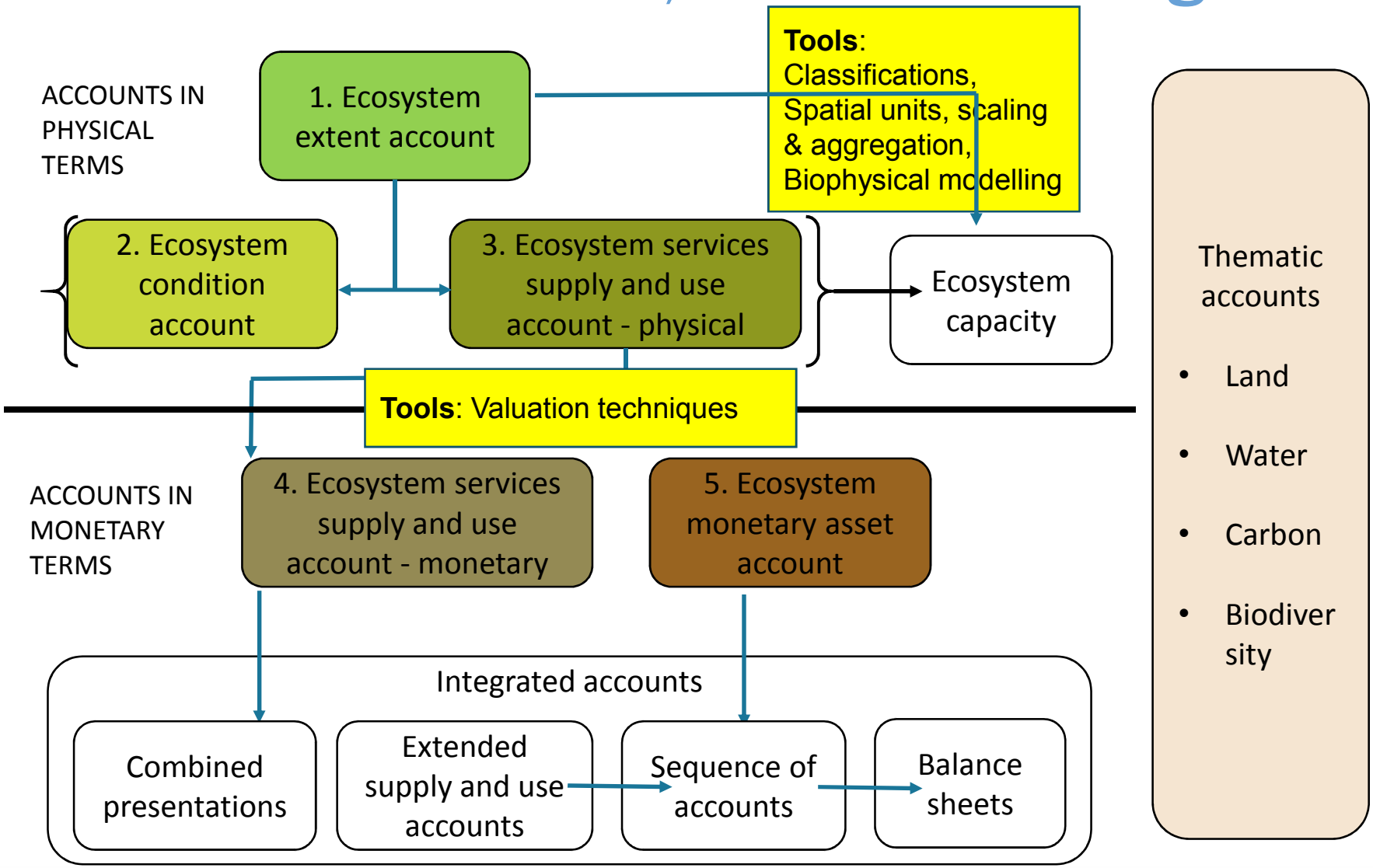
1. Learning objectives
2. Review of "Level 0" (5m)
3. Level 1 (Compilers):
   - Classification principles (15m)
   - Group exercise (15m)
4. Closing Discussion(10m)

Learning objective

- Learning objectives
  - Level 1:
    - Understand the basic concepts of SEEA-EEA classifications
    - Learn the steps of classifying national data according to SEEA-EEA classifications
  - Level 2:
    - Understand the current status of development of classification of ecosystem services

Review of Level 0: Classification

SEEA-EEA accounts, tools and linkages



Level 0: Tools 1: Classifications

- Whats?
  - From SEEA-CF:
    - Land cover, land use
    - Economic units, industry sectors
  - New:
    - Final ecosystem services
- Why:
  - Accounting needs **C**onsistent and **C**oherent and **C**omprehensive **C**lassifications
    - **C**onsistent: use same classification for same concept
    - **C**oherent: with other classification
    - **C**omprehensive: **C**lassifications **C**ertify **C**omplete **C**overage"

Level 0: Tools 1: Classifications

Land Cover

- From SEEA-CF (p.276)
- Uses FAO LCCS 3 (Food and Agriculture Organization – Land Cover Classification System v3) definitions
- High-level aggregate
- May adapt to local situations
- Used as basis for ecosystem type

01 Artificial surfaces (including urban and associated areas)
02 Herbaceous crops
03 Woody crops
04 Multiple or layered crops
05 Grassland
06 Tree covered areas
07 Mangroves
08 Shrub covered areas
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

Level 0: Tools 1: Classifications

Land Use

- From SEEA-CF (p. 266)
- Detailed (4-digit level)

1.0 Land
- 1.1 Agriculture
- 1.2 Forestry
- 1.3 Aquaculture
- 1.4 Built up and related areas
- 1.5 Maintenance and restoration of environmental functions
- 1.6 Other uses of land
- 1.7 Land not in use

2.0 Inland waters
- 2.1 Aquaculture and holding facilities
- 2.2 Maintenance and restoration of environmental functions
- 2.3 Other uses of inland waters
- 2.4 Inland waters not in use

3.0 Coastal waters
- 3.1 Aquaculture and holding facilities
- 3.2 Maintenance and restoration of environmental functions
- 3.3 Other uses of coastal waters
- 3.4 Coastal waters not in use

4.0 Exclusive Economic Zone (EEZ)
- 4.1 Aquaculture and holding facilities
- 4.2 Maintenance and restoration of environmental functions
- 4.3 Other uses of coastal waters
- 4.4 Coastal waters not in use

Level 0: Tools 1: Classifications

Services

- Based on Common International Classification of Ecosystem Services (CICES)
- Not mutually exclusive
- A list of "final" services
- More detail (4-digit)
- Does not include "supporting 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 0: Tools 1: Classifications

- From SEEA-CF: Economic Units
  - Enterprises (business ◎ industry)
  - Households (people and non-corporate business)
  - Government
  - Rest of the world

- SEEA-EEA adds a spatial dimension:
  - Local
  - Regional
  - National
  - Global

Level 1: Tools 1: Classification

Level 1: Tools 1: Classifications

Classification Principles

- Hierarchical: Aggregation and disaggregation
  - Level 1
    - Level 1.1
      - Level 1.1.1
        - Level 1.1.1.1

- More detailed levels must be possible to aggregate to higher levels
  - And the same for disaggregation

Level 1: Tools 1: Classifications

Classification Principles

- Concordance of classifications
  - > SEEA CF – Land Cover – 14 Classess
- National land cover classifications
  - > Range from few to many (10 – 100's or more)
- Link national/regional classifications via **concordance tables**

Level 1: Tools 1: Classifications

- Concordance - Example

Sum of Area (ha)	
AR_LU_BASE_SEEA_CF	Total
1 Artificial surfaces (including urban and associated areas)	14859
2 Herbaceous crops	193019
4 Multiple or layered crops	14
5 Grassland	135772
6 Tree-covered areas	16830
8 Shrub-covered areas	11
9 Shrubs and/or herbaceous vegetation, aquatic or regularly flooded	504
13 Inland water bodies	9859
Grand Total	**370868**

Level 1: Tools 1: Classifications

- **Concordance - Example**

Sum of Area (ha)	AR_LU_SEEA_CF	
AR_LU_FEU	6 Tree-covered areas	Grand Total
2.2.0 Production forestry	9328	9328
3.1.3 Other forest production	6	6
Box Ironbark Forest	2227	2227
Creekline Grassy Woodland	658	658
Drainage-line Woodland	690	690
Floodplain Riparian Woodland	853	853
Grassy Woodland/Riverine Grassy Woodland Mosaic	27	27
Heathy Dry Forest	250	250
Heathy Woodland	8	8
Hillcrest Herb-rich Woodland	731	731
Low Rises Woodland	2	2
Metamorphic Slopes Shrubby Woodland	90	90
Plains Savannah	69	69
Plains Woodland	1394	1394
Red Gum Swamp	47	47
Riverine Chenopod Woodland	321	321
Riverine Chenopod Woodland/Lignum Swamp Mosaic	121	121
Riverine Chenopod Woodland/Plains Grassland Mosaic	1	1
Semi-arid Woodland	7	7
Grand Total	**16830**	**16830**

Level 1: Tools 1: Classifications

Classification Principles

- Time stable
  - > If a classification changes then all other linked classifications need to be updated
- Time series data
  - > Relies upon being able to use data from different periods with different classifications
- Prepare ahead
  - > Coordination is very important
    - Different classifications across agencies, regions, etc.

Level 1: Tools 1: Classifications

- **Compilation Group Exercise (15m)**
  - Situation:
    - Have a land cover database according to national classification
    - Need a summary table by SEEA Land Cover Classification
  - Objective (Groups of 3-5 persons)
    - Classify each land cover type according to SEEA Land Cover Classification
    - Compile totals

Level 1: Tools 1: Classifications

- **Compilation Group Exercise: Step 1: Classify each type**

National Land Cover Database

Land Cover Database

Land Cover	Area (ha)	SEEA Land Cover Class
Urban residential	32	
Urban commercial	15	
Urban park - football fields	8	
Roads	4	
Woodland	23	
Coniferous forest	40	
Decuiduous forest	45	
Crops - wheat	30	
Crops - apples	20	
Shrubland - dry	12	
Swamp	5	
Peatland	13	
River	23	
Estuary	30	
Coral reef	20	
Crops - apples and hay	12	
Mineral excavation area	12	
Rocky shore	5	
Desert (sand)	16	
Lake	24	
Total	**389**	

SEEA Land Cover Classification

SEEA Land Cover Classification	
01 Artificial surfaces (including urban and associated areas)	The class is composed of any type of areas with a predominant artificial surface. Any urban or related feature is included in this class, for example, urban parks (parks, parkland and laws). The class also includes industrial areas, and waste dump deposit and extraction sites.
02 Herbaceous crops	The class is composed of a main layer of cultivated herbaceous plants (graminoids or forbs). It includes herbaceous crops used for hay. All the non-perennial crops that do not last for more than two growing seasons and crops like sugar cane, where the upper part of the plant is regularly harvested while the root system can remain for more than one year in the field, are included in this class.
03 Woody crops	The class is composed of a main layer of permanent crops (trees or shrub crops) and includes all types of orchards and plantations (fruit trees, coffee and tea plantation, oil palms, rubber plantation, Christmas trees, etc.).
04 Multiple or layered crops	This class combine two different land cover situations: Two layers of different crops. A common case is the presence of one layer of woody crops (trees or shrubs) and another layer of herbaceous crop, e.g., wheat fields with olive trees in the Mediterranean area and intense horticulture, or oasis or typical coastal agriculture in Africa, where herbaceous fields are covered by palm trees. Presence of one important layer of natural vegetation (mainly trees) that covers one layer of cultivated crops. Coffee plantations shadowed by natural trees in the equatorial area of Africa are a typical example.
05 Grassland	This class includes any geographical area dominated by natural herbaceous plants (grasslands, prairies, steppes and savannahs) with a cover of 10 per cent or more, irrespective of different human and/or animal activities, such as grazing or selective fire management. Woody plants (trees and/or shrubs) can be present, assuming their cover is less than 10 per cent.
06 Tree-covered areas	This class includes any geographical area dominated by natural tree plants with a cover of 10 per cent or more. Other types of plants (shrubs and/or herbs) can be present, even with a density higher than that of trees. Areas planted with trees for afforestation purposes and forest plantations are included in this class. This class includes areas seasonally or permanently flooded with freshwater. It excludes coastal mangroves (—07).
07 Mangroves	This class includes any geographical area dominated by woody vegetation (trees and/or shrubs) with a cover of 10 per cent or more that is permanently or regularly flooded by salt and/or brackish water located in the coastal areas or in the deltas of rivers.
08 Shrub-covered areas	This class includes any geographical area dominated by natural shrubs having a cover of 10 per cent or more. Trees can be present in scattered form if their cover is less than 10 per cent. Herbaceous plants can also be present at any density. The class includes shrub-covered areas permanently or regularly flooded by inland fresh water. It excludes shrubs flooded by salt or brackish water in coastal areas (—07).
09 Shrubs and/or herbaceous vegetation, aquatic or regularly flooded	This class includes any geographical area dominated by natural herbaceous vegetation (cover of 10 per cent or more) that is permanently or regularly flooded by fresh or brackish water (swamps, marsh areas, etc.). Flooding must persist for at least two months per year to be considered regular. Woody vegetation (trees and/or shrubs) can be present if their cover is less than 10 per cent.
10 Sparsely natural vegetated areas	This class includes any geographical areas were the cover of natural vegetation is between 2 per cent and 10 per cent. This includes permanently or regularly flooded
11 Terrestrial barren land	This class includes any geographical area dominated by natural abiotic surfaces (bare soil, sand, rocks, etc.) where the natural vegetation is absent or almost absent (covers less than 2 per cent). The class includes areas regularly flooded by inland water (lake shores, river banks, salt flats, etc.). It excludes coastal areas affected by the tidal
12 Permanent snow and glaciers	This class includes any geographical area covered by snow or glaciers persistently for 10 months or more.
13 Inland water bodies	This class includes any geographical area covered for most of the year by inland water bodies. In some cases, the water can be frozen for part of the year (less than 10 months). Because the geographical extent of water bodies can change, boundaries must be set consistently with those set by class 11, according to the dominant situation during the year and/or across multiple years.
14 Coastal water bodies and intertidal areas	The class is defined on the basis of geographical features of the land in relation to the sea (coastal water bodies, i.e., lagoons and estuaries) and abiotic surfaces subject to water persistence (intertidal areas, i.e., coastal flats and coral reefs).

Level 1: Tools 1: Classifications

- **Compilation Group Exercise: Step 2: Calculate totals**

National Land Cover Database

Land Cover Database

Land Cover	Area (ha)	SEEA Land Cover Class
Urban residential	32	
Urban commercial	15	
Urban park - football fields	8	
Roads	4	
Woodland	23	
Coniferous forest	40	
Decuiduous forest	45	
Crops - wheat	30	
Crops - apples	20	
Shrubland - dry	12	
Swamp	5	
Peatland	13	
River	23	
Estuary	30	
Coral reef	20	
Crops - apples and hay	12	
Mineral excavation area	12	
Rocky shore	5	
Desert (sand)	16	
Lake	24	
Total	**389**	

SEEA Land Cover Table

SEEA Land Cover Class	Area (ha)
01 Artificial surfaces (including urban and associated areas)	
02 Herbaceous crops	
03 Woody crops	
04 Multiple or layered crops	
05 Grassland	
06 Tree-covered areas	
07 Mangroves	
08 Shrub-covered areas	
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 intertidal areas	
Total	

Level 1: Tools 1: Classifications

- Is everyone clear on the objectives?
- 15 minutes group work
- Please ask questions
- Results:
  - > Report totals
  - > Do totals add to national total?

SEEA Land Cover Class	Area (ha)
01 Artificial surfaces (including urban and associated areas)	
02 Herbaceous crops	
03 Woody crops	
04 Multiple or layered crops	
05 Grassland	
06 Tree-covered areas	
07 Mangroves	
08 Shrub-covered areas	
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 intertidal areas	
Total	

Level 1: Tools 1: Classifications

- **Compilation Group Exercise: The answers**

Land Cover Database

Land Cover	Area (ha)	SEEA Land Cover Class
Urban residential	32	01
Urban commercial	15	01
Urban park - football fields	8	05
Roads	4	01
Woodland	23	06
Coniferous forest	40	06
Decuiduous forest	45	06
Crops - wheat	30	02
Crops - apples	20	03
Shrubland - dry	12	08
Swamp	5	09
Peatland	13	09
River	23	13
Estuary	30	14
Coral reef	20	14
Crops - apples and hay	12	04
Mineral excavation area	12	01
Rocky shore	5	10
Desert (sand)	16	11
Lake	24	13
Total	**389**	

SEEA Land Cover Class	Area (ha)
01 Artificial surfaces (including urban and associated areas)	63
02 Herbaceous crops	30
03 Woody crops	20
04 Multiple or layered crops	12
05 Grassland	8
06 Tree-covered areas	108
07 Mangroves	0
08 Shrub-covered areas	12
09 Shrubs and/or herbaceous vegetation, aquatic or regularly flooded	18
10 Sparsely natural vegetated areas	5
11 Terrestrial barren land	16
12 Permanent snow and glaciers	0
13 Inland water bodies	47
14 Coastal water bodies and intertidal areas	50
Total	**389**

Level 1: Tools 1: Classifications

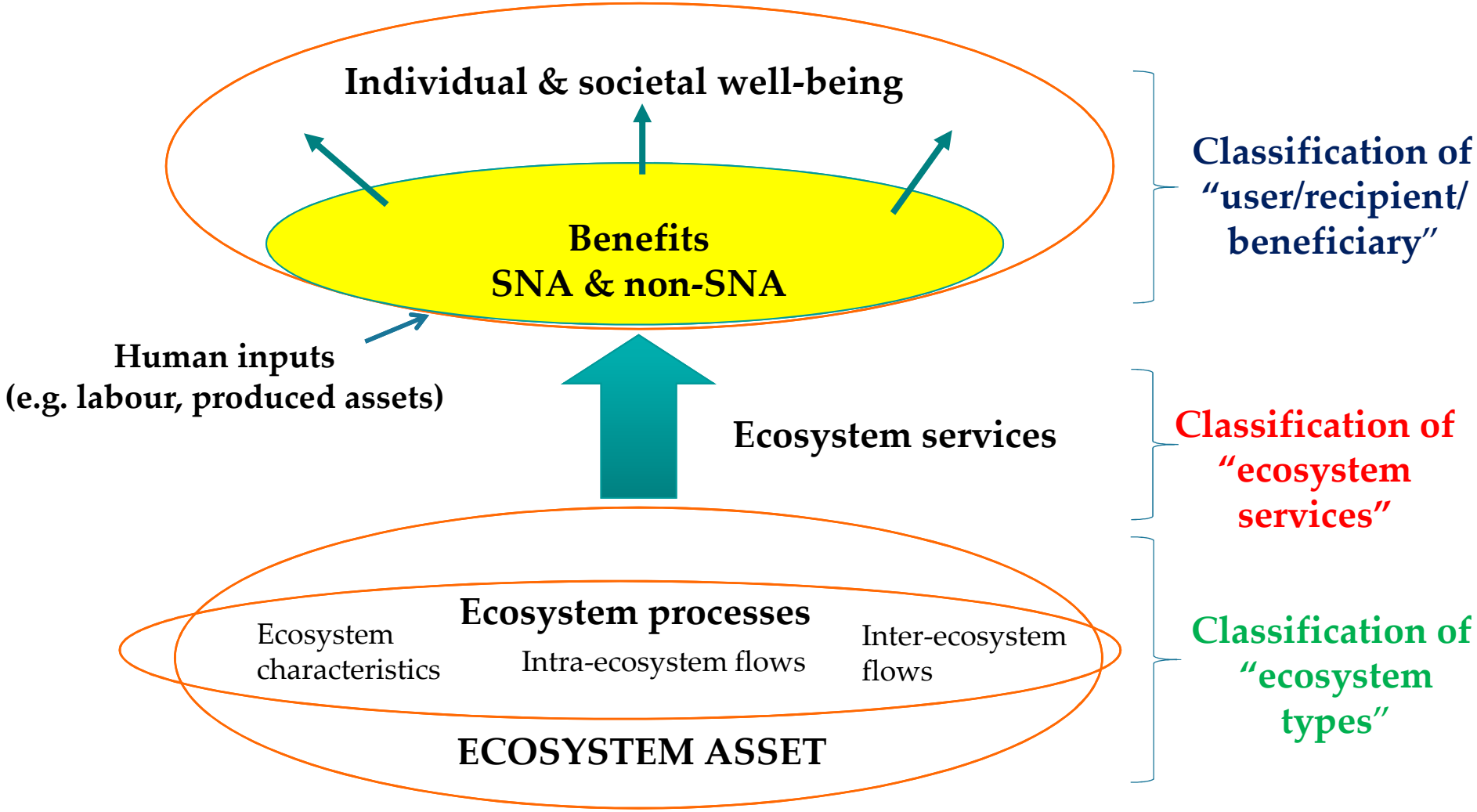
- Take home points
  - > Need common and systematic classifications
  - > SEEA provides classifications for:
    - Land Cover, Land Use, Land Ownership
    - Economic Units, Industry Sectors
  - > Classifications should be:
    - Hierarchical
    - Mutually-exclusive
    - Collectively exhaustive
  - > If two classifications of the same concept are different, you need to develop concordance tables
- Discussion and Questions

Level 1: Tools 1: Classifications

- SNA 2008
- SEEA Central Framework, SEEA-EEA, applications
- SCBD Quick Start Package (www.ecosystemaccounting.net)
- World Bank WAVES: Designing Pilots for Ecosystem Accounting
- Statistics Canada, 2013. Human Activity and the Environment: Measuring Ecosystem Goods and Services 2013. 16-201-XWE. Ottawa: Government of Canada.
- Weber, J., 2014. Ecosystem Natural Capital Accounts: A Quick Start Package. 77 (Technical Series). Montreal: Secretariat of the Convention on Biological Diversity.
- Further Information
  - > SEEA 2012 Experimental Ecosystem Accounting
  - > SEEA EEA Technical Recommendations

Level 2: Classification of ecosystem services

Three distinct classifications for ecosystem accounting



Ecosystem extent account

Classification of ecosystem types

	Type of Ecosystem Unit															
	Artificial surfaces	Herbaceous crops	Woody crops	Multiple or layered crops	Grassland	Tree-covered areas	Mangroves	Shrub-covered areas	Regularly flooded areas	Sparse natural vegetated areas	Terrestrial barren land	Permanent snow and glaciers	Inland water bodies	Coastal water and inter-tidal areas	Sea and marine areas	TOTAL
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Opening extent																
Additions to extent																
Managed expansion																
Natural expansion																
Upward reappraisals																
Reductions in extent																
Managed regression																
Natural regression																
Downward reappraisals																
Net change in extent																
Closing extent																

Ecosystem condition account

(End of accounting period)

Classification of ecosystem types

Type of Ecosystem Unit	Ecosystem characteristics						
	Vegetation	Water resources	Soil	Carbon	Biodiversity	Air	...
Artificial surfaces							
Herbaceous crops							
Woody crops							
Multiple or layered crops							
Grassland							
Tree-covered areas							
Mangroves							
Shrub-covered areas							
Regularly flooded areas							
Sparse natural vegetated areas							
Terrestrial barren land							
Permanent snow and glaciers							
Inland water bodies							
Coastal water and inter-tidal areas							
Sea and marine areas							

Ecosystem services supply table

	UNITS	Type of economic unit							Type of Ecosystem Unit														TOTAL SUPPLY
		Agriculture, forestry and fisheries	Electricity, gas supply	Water collection, treatment and supply	Other industries	Households	Accumulation	Rest of the world - Imports	Artificial surfaces	Herbaceous crops	Woody crops	Multiple or layered crops	Grassland	Tree-covered areas	Mangroves	Shrub-covered areas	Regularly flooded areas	Sparse natural vegetated areas	Terrestrial barren land	Permanent snow and glaciers	Inland water bodies	Coastal water and inter-tidal areas	Sea and marine areas	
									1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Ecosystem services Provisioning services Regulating services Cultural services		A							B														
Products		C							D														

A: No data are recorded in this quadrant as in concept economic units cannot supply ecosystem services.

B: In this quadrant the supply of ecosystem services by type of EU is recorded.

C: This quadrant is the equivalent of the standard physical supply and use table showing the supply of products by different economic units. This reflects the production of benefits to which the ecosystem services contribute. The scope of products is all goods and services produced in an economy.

D: No data are recorded here as, in concept, EUs cannot supply products.

Ecosystem services supply and use table

E: Here the use of ecosystem services by types of economic units is recorded. This includes both the use of ecosystem services as input to further production and the use of ecosystem services as final consumption.

F: At this stage, it is not anticipated that data would be recorded here as it represents the use of ecosystem services by other EUs – i.e. intermediate ecosystem services.

G: This quadrant is the equivalent of the standard physical supply and use table showing the use of products by different economic units.

H: No data are recorded here as, in concept, EUs cannot use products.

	UNITS	Type of economic unit							Type of Ecosystem Unit														TOTAL USE
		Agriculture, forestry and fisheries	Electricity, gas supply	Water collection, treatment and supply	Other industries	Households	Accumulation	Rest of the world - Exports	Artificial surfaces	Herbaceous crops	Woody crops	Multiple or layered crops	Grassland	Tree-covered areas	Mangroves	Shrub-covered areas	Regularly flooded areas	Sparse natural vegetated areas	Terrestrial barren land	Permanent snow and glaciers	Inland water bodies	Coastal water and inter-tidal areas	Sea and marine areas	
									1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Ecosystem services Provisioning services Regulating services Cultural services		E							F														
Products		G							H														

Ecosystem services supply table
(focus on quadrant B)

Classification of ecosystem types

Classification of ecosystem services

	UNITS	Type of economic unit							Type of Ecosystem Unit															TOTAL SUPPLY
		Agriculture, forestry and fisheries	Electricity, gas supply	Water collection, treatment and supply	Other industries	Households	Accumulation	Rest of the world - Imports	Artificial surfaces	Herbaceous crops	Woody crops	Multiple or layered crops	Grassland	Tree-covered areas	Mangroves	Shrub-covered areas	Regularly flooded areas	Sparse natural vegetated areas	Terrestrial barren land	Permanent snow and glaciers	Inland water bodies	Coastal water and inter-tidal areas	Sea and marine areas	
									1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Ecosystem services Provisioning services Regulating services Cultural services		A							B															
Products		C							D															

Ecosystem services use table (focus on quadrant E)

Classification of ecosystem types

Classification of "user/recipient/ beneficiary"

Classification of ecosystem services

	UNITS	Type of economic unit							Type of Ecosystem Unit														TOTAL USE
		Agriculture, forestry and fisheries	Electricity, gas supply	Water collection, treatment and supply	Other industries	Households	Accumulation	Rest of the world - Exports	Artificial surfaces	Herbaceous crops	Woody crops	Multiple or layered crops	Grassland	Tree-covered areas	Mangroves	Shrub-covered areas	Regularly flooded areas	Sparse natural vegetated areas	Terrestrial barren land	Permanent snow and glaciers	Inland water bodies	Coastal water and inter-tidal areas	Sea and marine areas	
		1	2	3	4	5	6	7	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Ecosystem services Provisioning services Regulating services Cultural services		E							F														
Products		G							H														

Classification of ecosystem services

Three commonly used classifications for ecosystem accounting

- Common International Classification of Ecosystem Services (CICES)
  - > developed by the European Environment Agency
  - > available at https://cices.eu/
- Final Ecosystem Goods and Services Classification System (FEGS-CS)
  - > Developed by the US Environmental Protection Agency
  - > Available at https://www.epa.gov/eco-research/final-ecosystem-goods-and-services-classification-system
- National Ecosystem Services Classification System (NESCS)
  - > Developed by the US Environmental Protection Agency
  - > Available at https://www.epa.gov/eco-research/national-ecosystem-services-classification-system-framework-design-and-policy

Final Ecosystem Goods and Services Classification System (FEGS-CS)

- Explicitly linked ecosystem services to an environmental type and a defined beneficiary

Source: Landers, D.H & Nahik, A.M (2013) *"A Final Ecosystem Goods and Services Classification System (FEGS-CS)"*

FEGS-CS: Environmental Classes

- Coverage is global made up of 3 Environmental Classes:
  - > Aquatic,
  - > Terrestrial
  - > Atmospheric
- 15 Environmental Sub-Classes

1. AQUATIC

11. Rivers and Streams
12. Wetlands
13. Lakes and Ponds
14. Estuaries and Near Coastal and Marine
15. Open Oceans and Seas
16. Groundwater

2. TERRESTRIAL

21. Forests
22. Agroecosystems
23. Created Greenspace
24. Grasslands
25. Scrubland / Shrubland
26. Barren / Rock and Sand
27. Tundra
28. Ice and Snow

3. ATMOSPHERIC

31. Atmosphere

Source: Landers, D.H & Nahik, A.M (2013) *"A Final Ecosystem Goods and Services Classification System (FEGS-CS)"*

FEGS-CS: Beneficiary Categories

00.01. AGRICULTURAL

00.02. COMMERCIAL / INDUSTRIAL

00.03. GOVERNMENT, MUNICIPLE, AND RESIDENTIAL

00.04. COMMERCIAL / MILITARY TRANSPORTATION

00.05. SUBSISTENCE → …including,
- 00.0501 Water Subsisters
- 00.0503 Timber, Fiber, Fur / Hide Subsisters

00.06. RECREATIONAL

00.07. INSPIRATIONAL

00.08. LEARNING

00.09. NON-USE → …including,
- 00.0901 People Who Care (Existence)
- 00.0902 People Who Care (Option / Bequest)

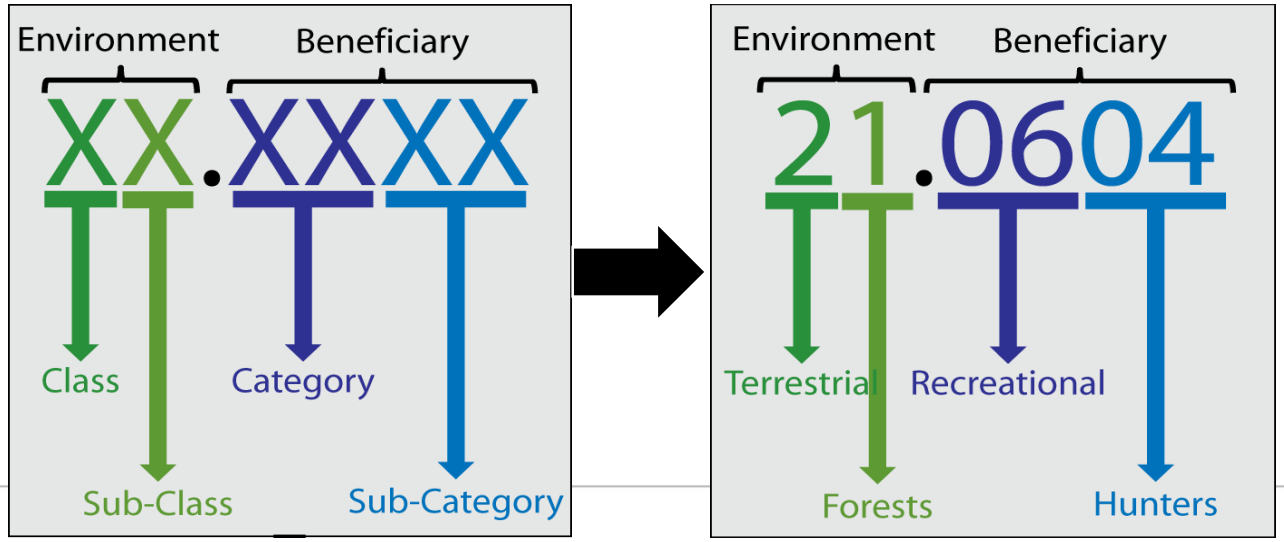
00.10. HUMANITY

Under the 10 Beneficiary Categories, there are a total of 38 Beneficiary Sub-Categories

Source: Landers, D.H & Nahik, A.M (2013) *"A Final Ecosystem Goods and Services Classification System (FEGS-CS)"*

FEGS-CS: Classification Scheme

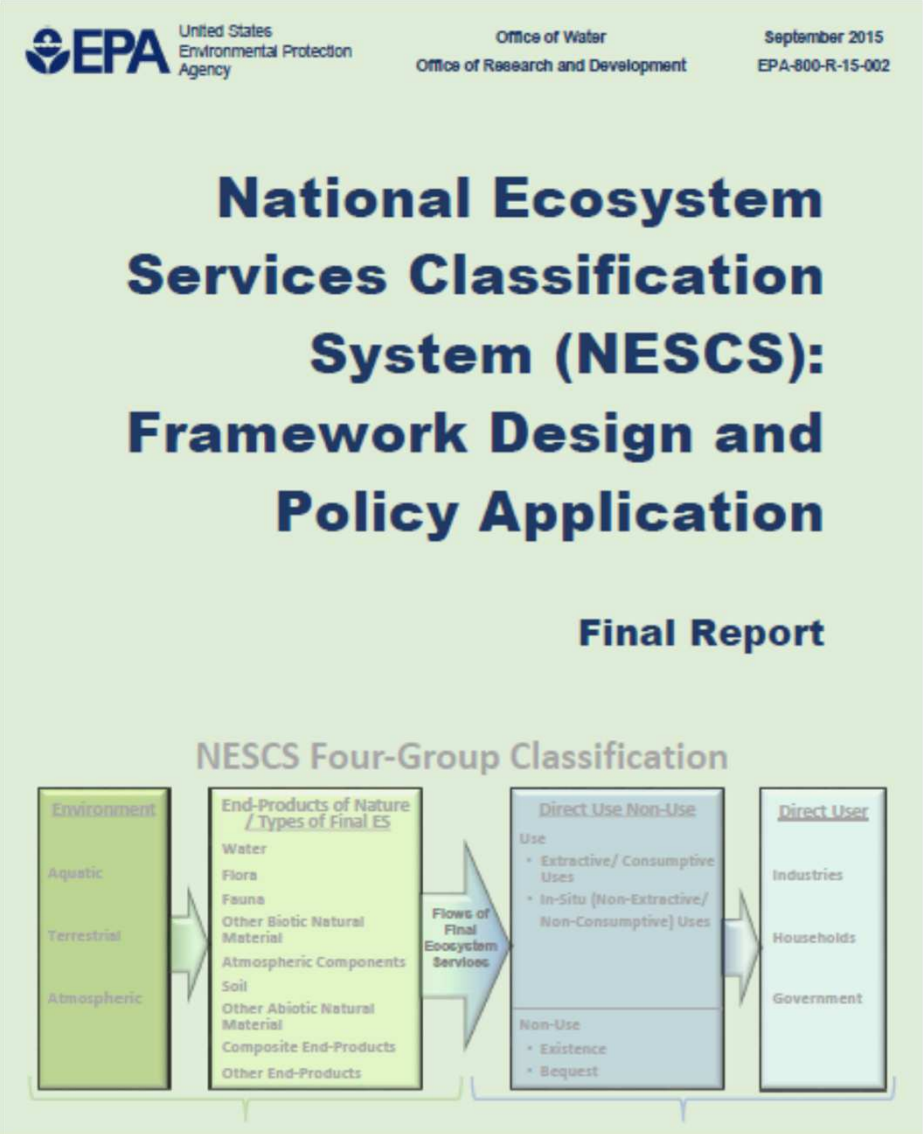
FEGS Classification Structure	
X	Environmental Class
XX.	Environmental Sub-Class
XX.XX	Beneficiary Category
XX.XXXX	Beneficiary Sub-Category



Source: Landers, D.H & Nahik, A.M (2013) *"A Final Ecosystem Goods and Services Classification System (FEGS-CS)"*

National Ecosystem Services Classification System (NESCS)

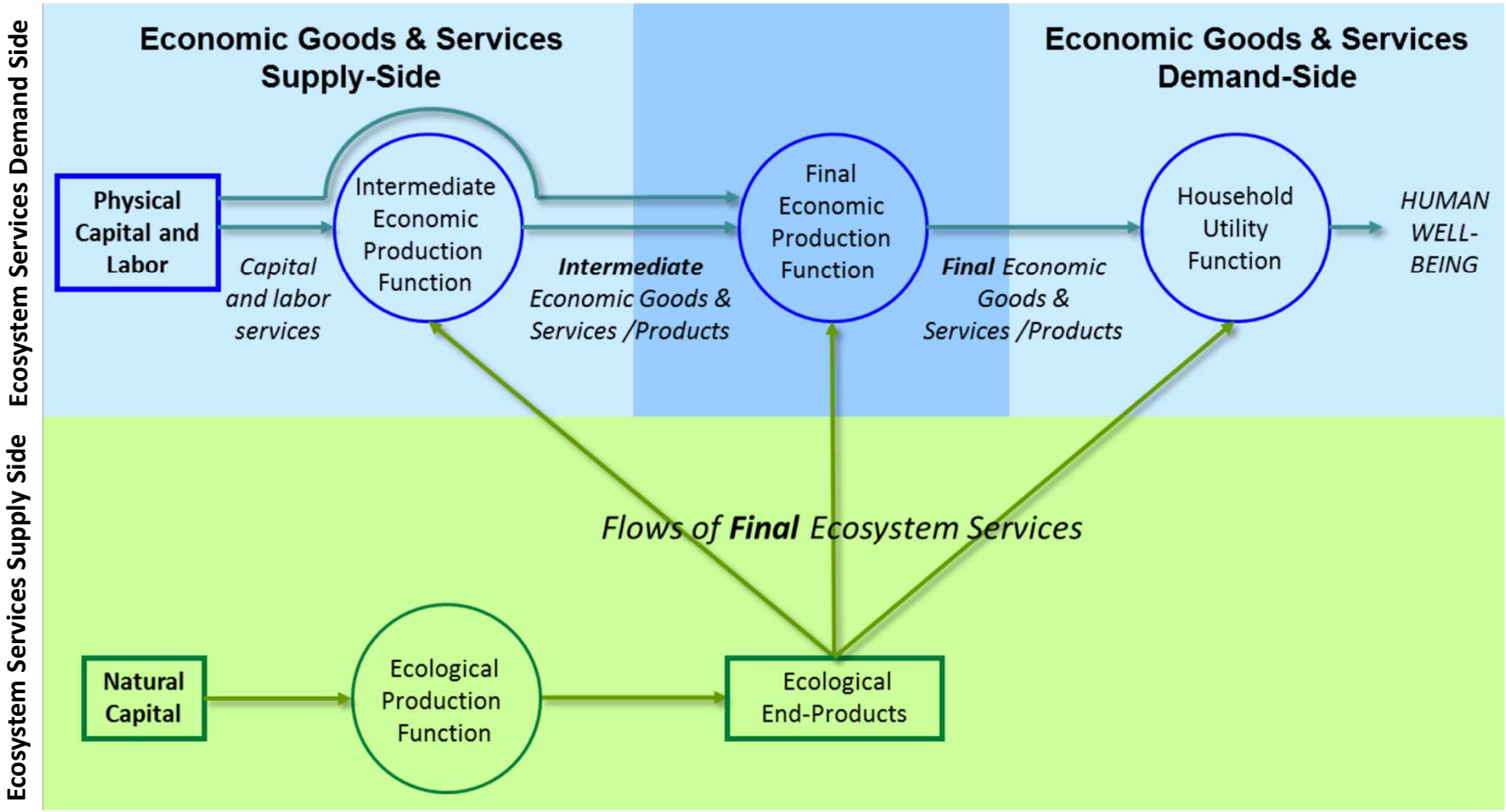
- classify the flows of final ecosystem services from environmental types as defined by the FEGS-CS to economic uses and users.



SEEA

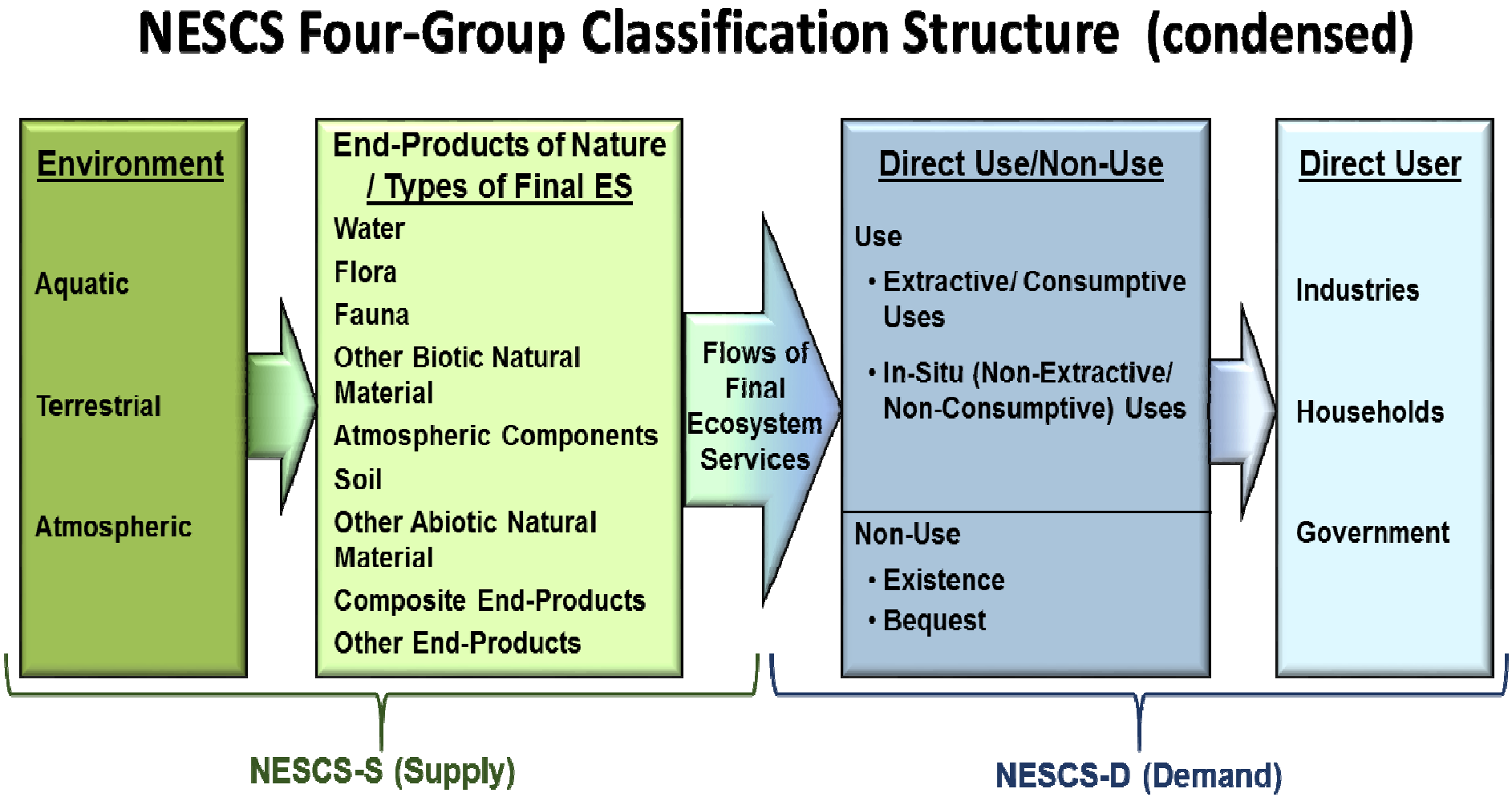
Source: United States Environmental Protection Agency (2015).“*National Ecosystem Services Classification System (NESCS): Framework Design and Policy Application* ”

NESCS: Conceptual framework



Source: United States Environmental Protection Agency (2015).*"National Ecosystem Services Classification System (NESCS): Framework Design and Policy Application "*

NESCS: Classification structure



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Source: United States Environmental Protection Agency (2015). "*National Ecosystem Services Classification System (NESCS): Framework Design and Policy Application* "

NESCS: Classification structure and Coding System

	NESCS–S		NESCS–D	
Group	**Environment**	**End-product**	**Direct Use/Non-use**	**Direct User**
Definition	Ecosystems where end-products spatially occur, or producers of "end-products"	Biophysical components of nature that are directly used or appreciated by humans	Different ways in which end-products are used or appreciated by humans	Sectors that directly use or appreciate the end-products
Hierarchy and Coding System NESCS Category Representation*: WW.XX.YYYY.ZZZZZZZ				
Class	**W**	**WW.X**	**WW.XX.Y**	**WW.XX.YYYY.Z**
Sub-Class	**WW**	**WW.XX**	**WW.XX.YY**	**WW.XX.YYYY.ZZZ**
Detail			**WW.XX.YYYY**	**WW.XX.YYYY.ZZZZZZZ**
Example 1 – ocean water used as a medium to haul freight NESCS Code = 15.12.1202.1483111				
Class	Aquatic: **1**	Water: 1	Direct Use: **1**	Industry: **1**
Sub-Class	Open Ocean and Seas: **15**	Liquid Water: **12**	In-Situ Use: **12**	Transportation and Warehousing: **148**
Detail			Transportation medium: **1202**	Deep Sea Freight Transportation: **1483111**
Example 2 – direct fresh water intake used for home gardening NESCS Code = 11.12.1105.201				
Class	Aquatic: **1**	Water: 1	Direct Use: **1**	Households: **2**
Sub-Class	Rivers and Streams: **11**	Liquid Water: **12**	Extractive Use: **11**	Households: **201**
Detail			Support of plant or animal cultivation: **1105**	

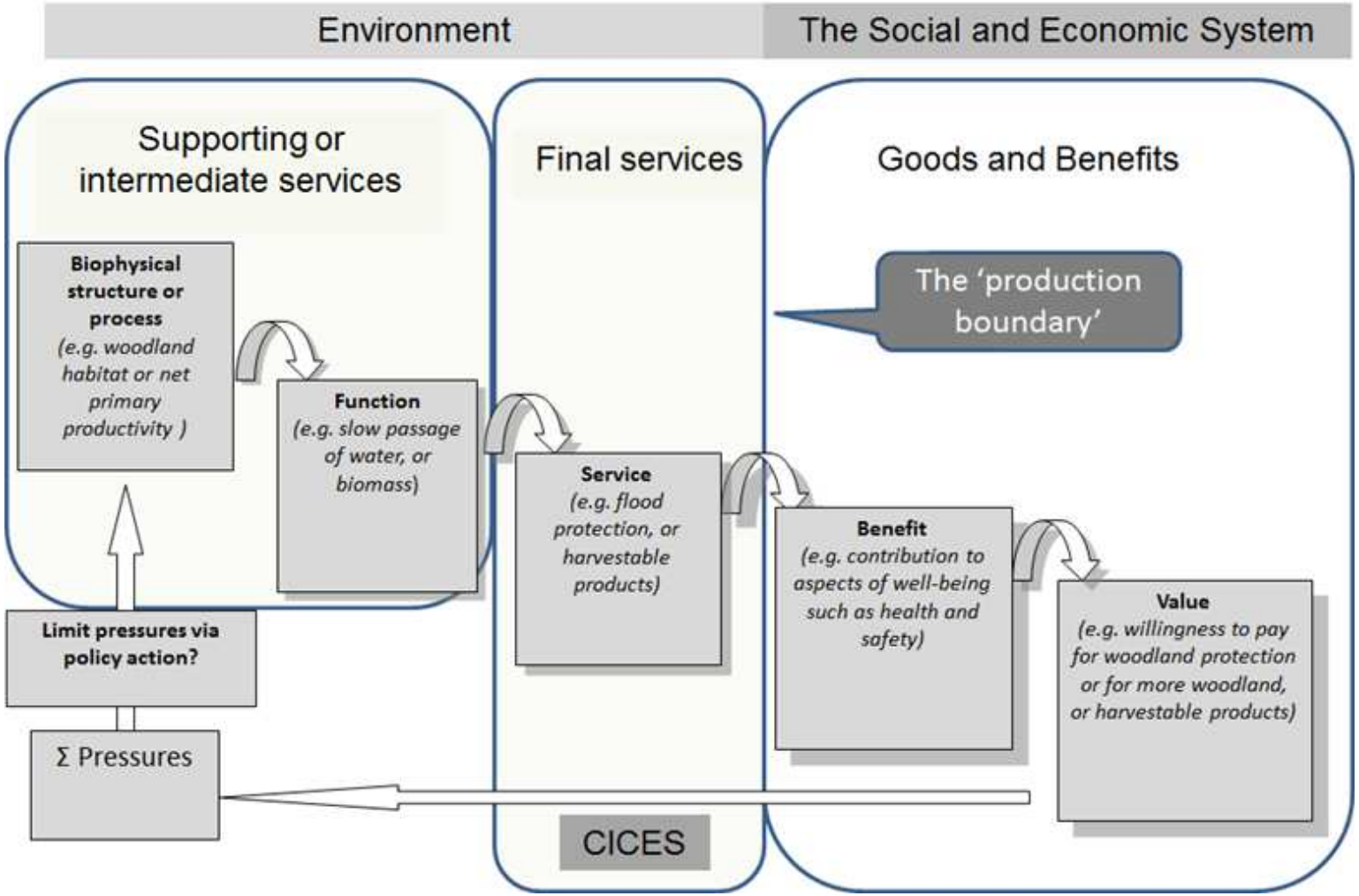
Source: United States Environmental Protection Agency (2015). *National Ecosystem Services Classification (NESCS): Framework Design and Policy Application "*

NESCS: Example – Terrestrial acidification

NESCS-S					NESCS-D					
Env. Class	Env. Sub-Class	End-product Class	End-product Sub-Class or Example	Direct Use/ Non-Use Class	Direct Use/ Non-Use Sub-Class	Direct Use/ Non-Use Detail	Examples of Direct Uses/ Non-Use	Direct User Class	Direct User Sub-Class	User Detail
2. Terrestrial	21. Forests	2. Flora	Sugar maple trees	1. Direct Use	11. Extractive Use	1101. Raw material for transformation	Input for maple syrup, furniture, construction	1. Industry	111. Agriculture, Forestry, Fishing and Hunting	1113. Forestry and Logging (e.g., **21.2.1101.1113**)
									123. Construction	123. Construction
									131–33. Manufacturing (Manufg.)	1311. Food Manufg. 1321. Wood Product Manufg. 1337. Furniture and Related Product Manufg.
					12. In-situ Use	1207. Recreation/tourism	Fall color viewing	1. Industry	148–49. Transportation and Warehousing	1487. Scenic and Sightseeing Transportation
									172. Accommodation and Food Services	1721. Accommodation 1722. Food Services and Drinking Places
								2. Households	201. Households	
						1209. Aesthetic appreciation	Scenic views for commuters	2. Households	201. Households	(e.g., **21.2.1209.201**)
				2. Non-Use	21. Existence	2101. Existence	Existence use	2. Households	201. Households	
					22. Bequest	2201. Bequest	Bequest use	2. Households	201. Households	
			Red spruce trees	1. Direct Use	11. Extractive Use	1101. Raw material for transformation	Input for musical instruments, furniture, construction	1. Industry	111. Agriculture, Forestry, Fishing and Hunting	1113. Forestry and Logging
									131–33. Manufacturing (Manufg.)	1321. Wood Product Manufg. 1337. Furniture and Related Product Manufg. 1339992. Musical Instrument Manufg.
				2. Non-Use	21. Existence	2101. Existence	Existence use	2. Households	201. Households	
					22. Bequest	2201. Bequest	Bequest use	2. Households	201. Households	(e.g., **21.2.2201.201**)

Source: United States Environmental Protection Agency (2015).*"National Ecosystem Services Classification System (NESCS): Framework Design and Policy Application "*

Common International Classification of Ecosystem Services (CICES)



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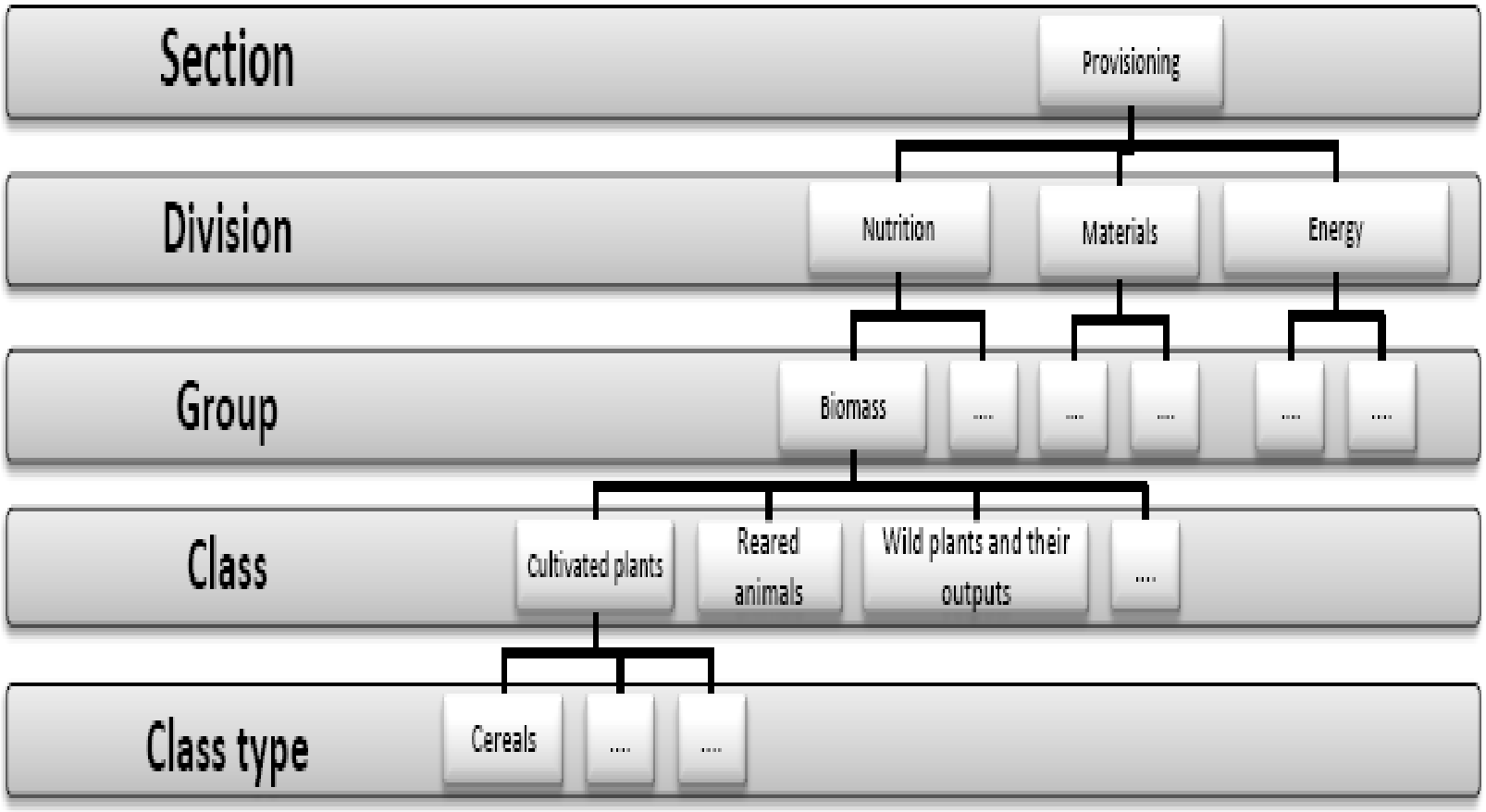
Source: Haines-Young, R. and M.B. Potschin (2017): Common International Classification of Ecosystem Services (CICES) V5.0 and Guidance on the Application of the Revised Structure.

CICES: Scope and coverage

- Provisioning:
  - the nutritional, material and energetic contributions of living systems to essential human needs & economic activity
- Regulation and maintenance:
  - the ways in which living organisms can mediate or moderate the ambient environment that affects human quality of life, safety and production systems
- Cultural:
  - the non-material, and normally non-consumptive, outputs of ecosystems that affect the physical and mental well being of people

CICES: Structure



SEEA

Source: Haines-Young, R. and M.B. Potschin (2017): Common International Classification of Ecosystem Services (CICES) V5.0 and Guidance on the Application of the Revised Structure.

Division	Group	Class	Code
Nutrition	Biomass	Cultivated plants (Terrestrial), fungi, algae and their outputs	1.1.1.1
	Biomass	Reared animals (Terrestrial) and their outputs	1.1.1.2
	Biomass	Wild plants, fungi, algae and their outputs [both terrestrial and aquatic]	1.1.1.3
	Biomass	Wild animals and their outputs [both terrestrial and aquatic]	1.1.1.4
	Biomass	Plants and algae from in-situ aquaculture	1.1.1.5
	Biomass	Animals from in-situ aquaculture	1.1.1.6
Materials	Biomass	Fibres and other materials from cultivated plants, fungi, algae and bacteria for direct use or processing	1.2.1.1
	Biomass	Fibres and other materials from reared animals for direct use or processing	1.2.1.2
	Biomass	Genetic materials from all biota	1.2.1.3
	Biomass	Fibres and other materials from wild plants, fungi, algae and bacteria for direct use or processing	1.2.1.4
	Biomass	Fibres and other materials from wild animals for direct use or processing	1.2.1.5
Energy	Biomass	Cultivated plant-based materials used as an energy source (including materials derived from algae)	1.3.1.1
	Biomass	Reared Animal-based materials used as an energy source	1.3.1.2
	Biomass	Mechanical energy provided by animals	1.3.1.3
	Biomass	Wild plants, fungi, algae used as an energy source [both terrestrial and aquatic]	1.3.1.4
	Biomass	Material derived from wild animals used as an energy source	1.3.1.5

Regulation & Maintenance services

Division	Group	Class	Code
Transformation of biochemical or physical inputs to ecosystems	Mediation of wastes or toxic substances of anthropogenic origin by living processes	Bio-remediation by micro-organisms, algae, plants, and animals	2.1.1.1
		Filtration/sequestration/storage/accumulation by micro-organisms, algae, plants, and animals	2.1.1.2
	Mediation of nuisances of anthropogenic origin	Smell reduction	2.1.2.1
		Noise attenuation	2.1.2.2
		Visual screening	2.1.2.3
Regulation of physical, chemical, biological conditions	Regulation of baseline flows and extreme events	Mass stabilisation and control of erosion rates	2.2.1.1
		Buffering and attenuation of mass flows	2.2.1.2
		Hydrological cycle and water flow regulation (Including flood control)	2.2.1.3
		Storm protection	2.2.1.4
		Fire protection	2.2.1.5
	Lifecycle maintenance, habitat and gene pool protection	Pollination (or 'gamete' dispersal in a marine context)	2.2.2.1
		Seed dispersal	2.2.2.2
		Maintaining nursery populations and habitats (Including gene pool protection)	2.2.2.3
	Pest and disease control	Pest control (including invasive species)	2.2.3.1
		Disease control	2.2.3.2
	Regulation of soil quality	Weathering processes and their effect on soil quality	2.2.4.1
		Decomposition and fixing processes and their effect on soil quality	2.2.4.2
	Water conditions	Regulation of the chemical condition of freshwaters by living processes	2.2.5.1
		Regulation of the chemical condition of salt waters by living processes	2.2.5.2
	Atmospheric composition and conditions	Regulation of chemical composition of atmosphere	2.2.6.1
		Regulation of temperature and humidity, including ventilation and transpiration	2.2.6.2

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Cultural services

Division	Group	Class	Code
Direct, in-situ and outdoor interactions with living systems that depend on presence in the environmental setting	Physical and experiential interactions with natural environment	Characteristics of living systems that that enable activities promoting health, recuperation or enjoyment through active or immersive interactions	3.1.1.1
		Characteristics of living systems that enable activities promoting health, recuperation or enjoyment through passive or observational interactions	3.1.1.2
	Intellectual and representative interactions with natural environment	Characteristics of living systems that enable scientific investigation or the creation of traditional ecological knowledge	3.1.2.1
		Characteristics of living systems that enable education and training	3.1.2.2
		Characteristics of living systems that are resonant in terms of culture or heritage	3.1.2.3
		Characteristics of living systems that enable aesthetic experiences	3.1.2.4
Indirect, remote, often indoor interactions with living systems that do not require presence in the environmental setting	Spiritual, symbolic and other interactions with natural environment	Elements of living systems that have symbolic meaning	3.2.1.1
		Elements of living systems that have sacred or religious meaning	3.2.1.2
		Elements of living systems used for entertainment or representation	3.2.1.3
	Other biotic characteristics that have a non-use value	Characteristics or features of living systems that have an existence value	3.2.2.1
		Characteristics or features of living systems that have an bequest value	3.2.2.2

Summary

Characteristic	CICES	FEGS-CS	NESCS
Origin / custodian	EEA & University of Nottingham	US-EPA - ORD	US-EPA – ORD, OW, OAR
Purpose & use context	'Multi-purpose classification' of potential final ESS for accounting, assessment etc.	Classification system focused on final ecosystem goods and services (FEGS) (for measuring) stocks	Classification system focused on final flows of ESS by flexible "Use-User" combinations
Main conceptual model	Cascade model	Environment-FEGS-Beneficiary matching	'Blue-green' diagram; Four-Group structure
Structure / design	Hierarchical, developed on basis of MA ESS categories	Matching hierarchies of Environments and Beneficiaries yields a matrix of feasible types of FEGS	Nested hierarchies in each Group; linking across Four-Group structure essential
Current use / users	Adopted for EU ecosystem accounting work; used by many research teams, mainly in Europe	EPA pursuing metrics and indicators for ecological measures using FEGS-CS; US NSF-funded Air Quality & ESS work across many envts.	Developed for work by US-EPA, proposed / adopted by current USGS-led research initiative on natural capital accounting
Links to other classifications	Inspired by work under MA & TEEB, a translation tool exists to those classifications	Embedded land and beneficiary classifications	Embedded land and beneficiary classifs (NAICS "plus"), intentionally modular

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Source: Draft technical notes for the expert workshop "Developing ecosystem service classification(s) for ecosystem accounting – taking stock & moving forward" in Wageningen, NetherlandsNov 2016

Key requirements of ES Classification for SEEA EEA

- The measurement scope and definition of ecosystem services in the SEEA EEA is defined in the context of the SNA production boundary.
- Distinction between ecosystem services and the benefits to which they contribute.
- Focus on final ecosystem services as contributions to the production of benefits.
- For each (final) ecosystem service there must be an associated (and distinct) benefit and a corresponding beneficiary.
- Individual services are mutually exclusive and can be aggregated.
- The three distinct classifications that are relevant for ecosystem accounting can be linked
  - > Ecosystem types (presently missing/not well developed)
  - > Ecosystem services
  - > User/recipient/beneficiary (presently missing/not well developed)

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