



Advancing the SEEA Experimental Ecosystem Accounting

Extent Account (Levels 1 and 2)



Convention on
Biological Diversity





Overview: The Extent Account

1. Learning objectives

2. Review of Level 0 (5m)

- What is it?
- Why do we need it?
- What does it look like?
- Expertise & data required
- Links to related training materials

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)



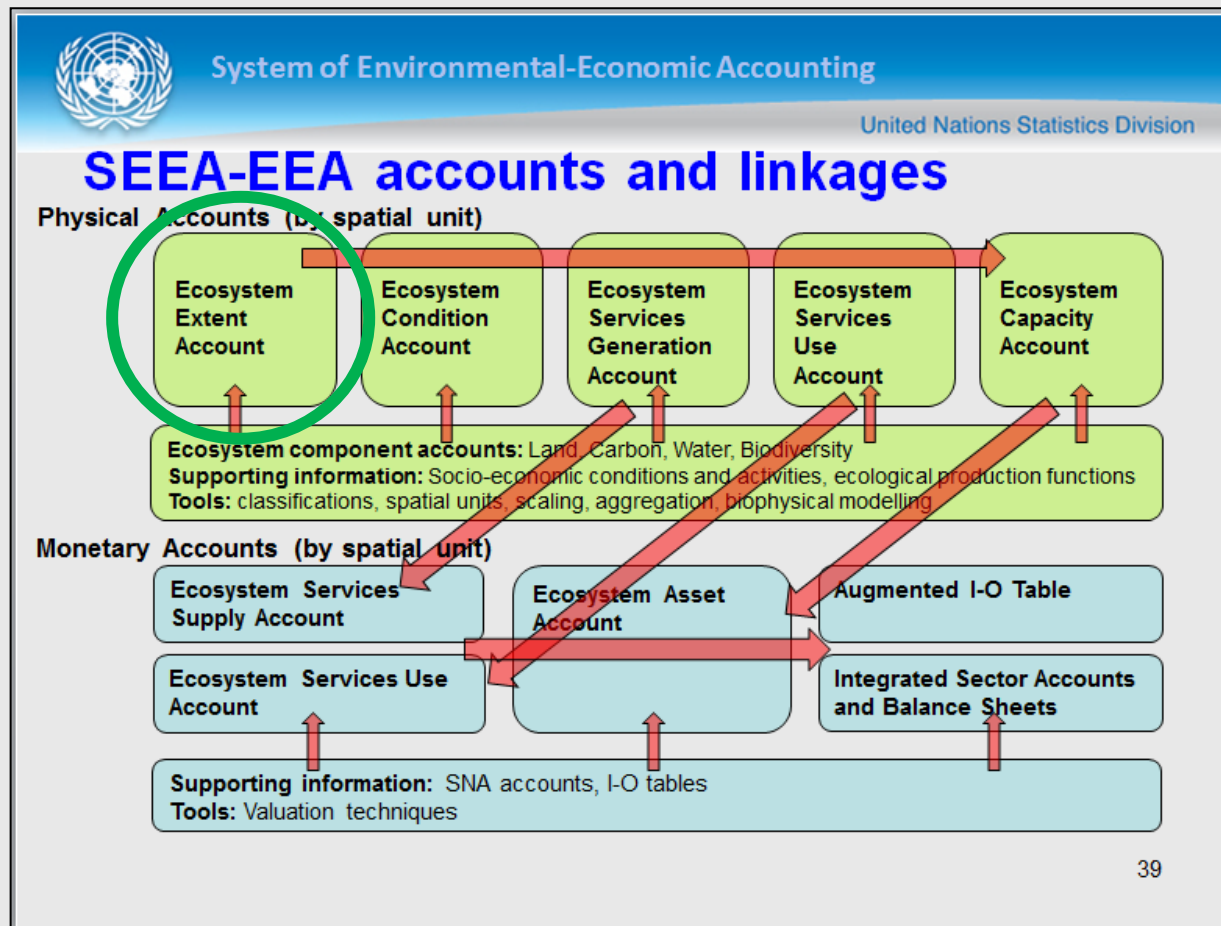


SEEA-EEA Training Levels 1 and 2

- **Learning objectives**
 - Level 1:
 - Understand the basic concepts of The Extent Account
 - Learn the steps of compiling an Extent Account
 - Level 2
 - Understand the data options and sources
 - Understand the important conceptual issues
 - Be aware of how other countries have approached measuring Extent



Account 1: Extent





Level 0: Account 1: Extent

- **What?**

- ***Ecosystem assets** are spatial areas containing a combination of biotic and abiotic components and other characteristics that function together (SEEA-EEA Sections 2.31, 4.1)*
- **National** coverage of land cover, land use, ownership (terrestrial, freshwater, coastal and marine areas)

- **Why?**

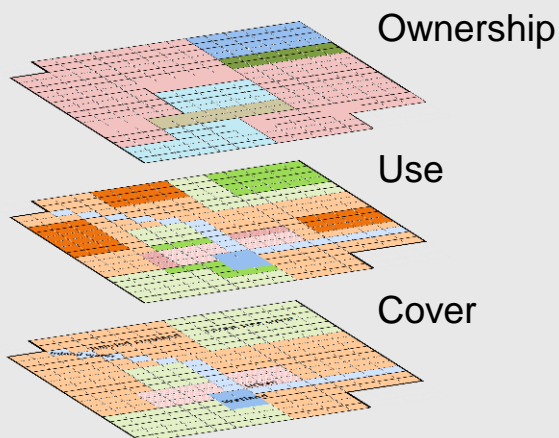
- Land management and conservation policies
- Spatial foundation for other accounts
 - basis for allocating macro data to spatial units
- Builds on SEEA-CF (land, forest, water)
- Indicators:
 - Land cover change → where changes occurring
 - Land cover/use intensity → who owns it



Level 0: Account 1: Extent

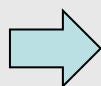
What does an Extent Account look like?

Maps



Tables

Cover	Urban and associated		Rainfed herbaceous cropland		Forest tree cover		Inland water bodies		Open wetlands	Total
Use	Infrastructure	Residential	Permanant crops	Maintenance	Forestry	Protected	Infrastructure	Aquaculture	Maintenance	
Ownership	Government	Private	Private	Private	Private	Government	Government	Private	Government	
Units	hectares									
Opening Stock										
Additions to Stock										
Managed expansion										
Natural expansion										
Reductions to stock										
Managed regression										
Natural regression										
Closing stock										



Spatial units
Classifications





Level 0: Account 1: Extent

- **What does an Extent Account look like?**
 - An integrated spatial (GIS) database that overlays:
 - Cover: forest, wetland, lake...
 - Use and intensity of use: agriculture, forestry, protected...
 - Ownership: business, private, government
 - Classified into **Spatial units**
 - At high resolution (30m to 100m, maximum 500m) with national coverage
 - For two or more periods (change over time)
 - Based on comparable **Classifications, Quality, Methods** and **Spatial units**
 - Units: hectares
 - Records: opening stock, closing stock, additions, reductions



Level 0: Account 1: Extent

- **What do you need to compile an Extent Account?**
 - GIS platform: software, protocols, **spatial units**
 - **Classifications**: land cover, land use, ownership
 - National level data:
 - Existing land account would be useful
 - Satellite land cover, aerial photography
 - Census: agriculture, population, settlements
 - Forest inventories
 - Hydrological, topographic (rivers, drainage areas, elevation, coastlines)
 - Cadastral (ownership, tax)
 - Expertise:
 - Land managers, ecologists, geographers (GIS, satellite imagery, integration)



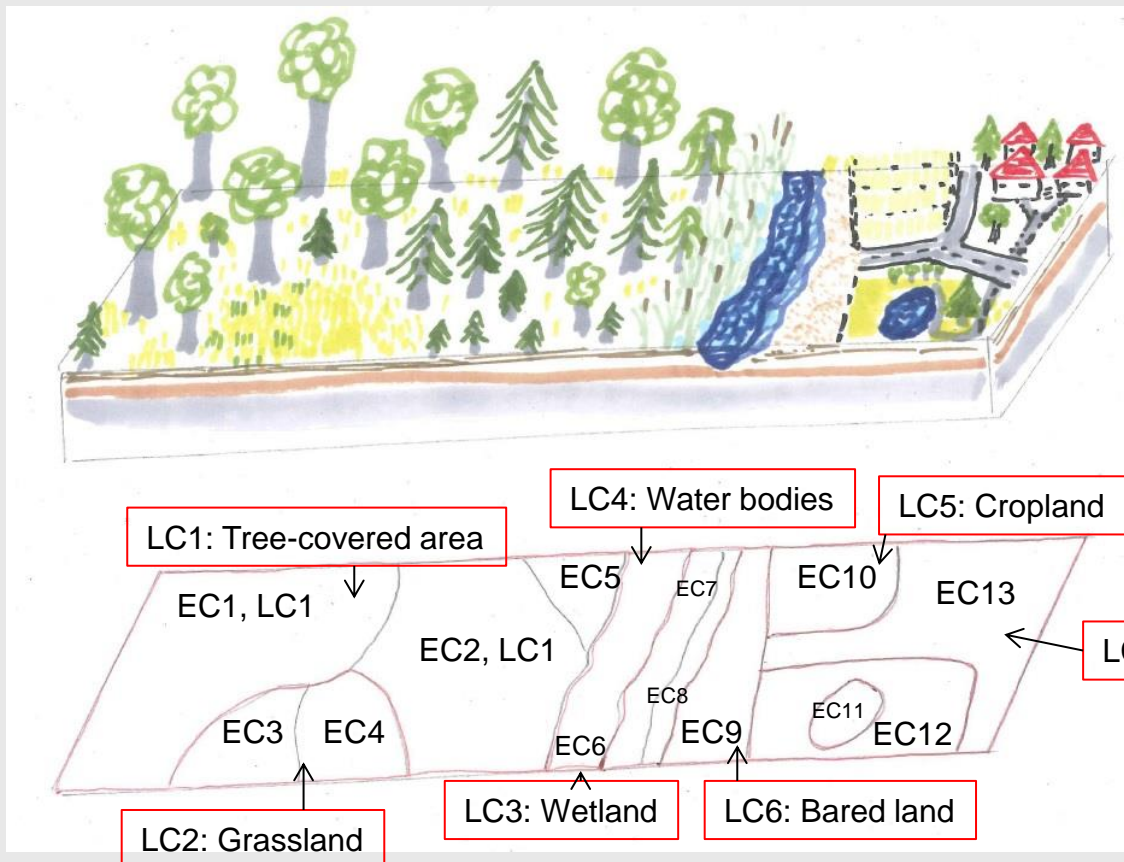
Level 1: Account 1: Extent

- Concepts:
 - Typology of ecosystems and their coverage:
Extent measures
 - Land cover, land use and land ownership:
Classification nomenclatures in SEEA
 - Compiling extent accounts:
Opening stocks
- Reductions
+ Additions
= Closing stock



Level 1: Account 1: Extent

- Typology of ecosystems and their coverage



Ecosystem = EC
Land cover = LC



Level 1: Account 1: Extent

- Land cover, land use and land ownership

Land cover classification (SEEA-CF, Table 5.12, p.178)

- 1 Artificial surfaces (incl. urban and assoc. areas)
- 2 Herbaceous crops
- 3 Woody crops
- 4 Multiple or layered crops
- 5 Grassland
- 6 Tree-covered areas
- 7 Mangroves
- 8 Shrub-covered areas
- 9 Shrubs and/or herb. veg., aquatic or reg. 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

Land use classification (SEEA-CF, Table 5.11, p. 176)

- 1.1 Agriculture
- 1.2 Forestry
- 1.3 Land used for aquaculture
- 1.4 Use of built-up and related areas
- 1.5 Land used for maintenance and restoration of environmental functions
- 1.6 Other uses of land n.e.c.
- 1.7 Land not in use
- 2.1 Inland waters used for aquaculture or holding facilities
- 2.2 Inland waters used for maintenance and restoration of environmental functions
- 2.3 Other uses of inland waters n.e.c.
- 2.4 Inland waters not in use

Land ownership: by industry (e.g. agriculture, mining) or by sector (e.g. public or private)



Level 1: Account 1: Extent

- Compiling Extent Accounts (hectares)

	1 Artificial surfaces (including urban and	2 Herbaceous crops	3 Woody crops	4 Multiple or layered crops	5 Grassland	6 Tree-covered areas	7 Mangroves	8 Shrub-covered areas	9 Shrubs and/or herbaceous vegetation,	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	TOTALS
Opening Stock of Resources	14859	193019	0	14	135772	16830	0	11	504	0	0	0	9859	0	370868
Additions to stock															
Managed expansion						3408									3408
Natural Expansion															0
Upward reappraisals						120									120
<i>Total additions to stock</i>															0
Reductions in stock															
Managed regression		3408													3408
Natural Regression															0
Downward reappraisals	112												8		120
<i>Total reductions in stock</i>															0
Closing stock	14747	189611	0	14	135772	20358	0	11	504	0	0	0	9851	0	370868

Source: UNSD, Special tabulation.



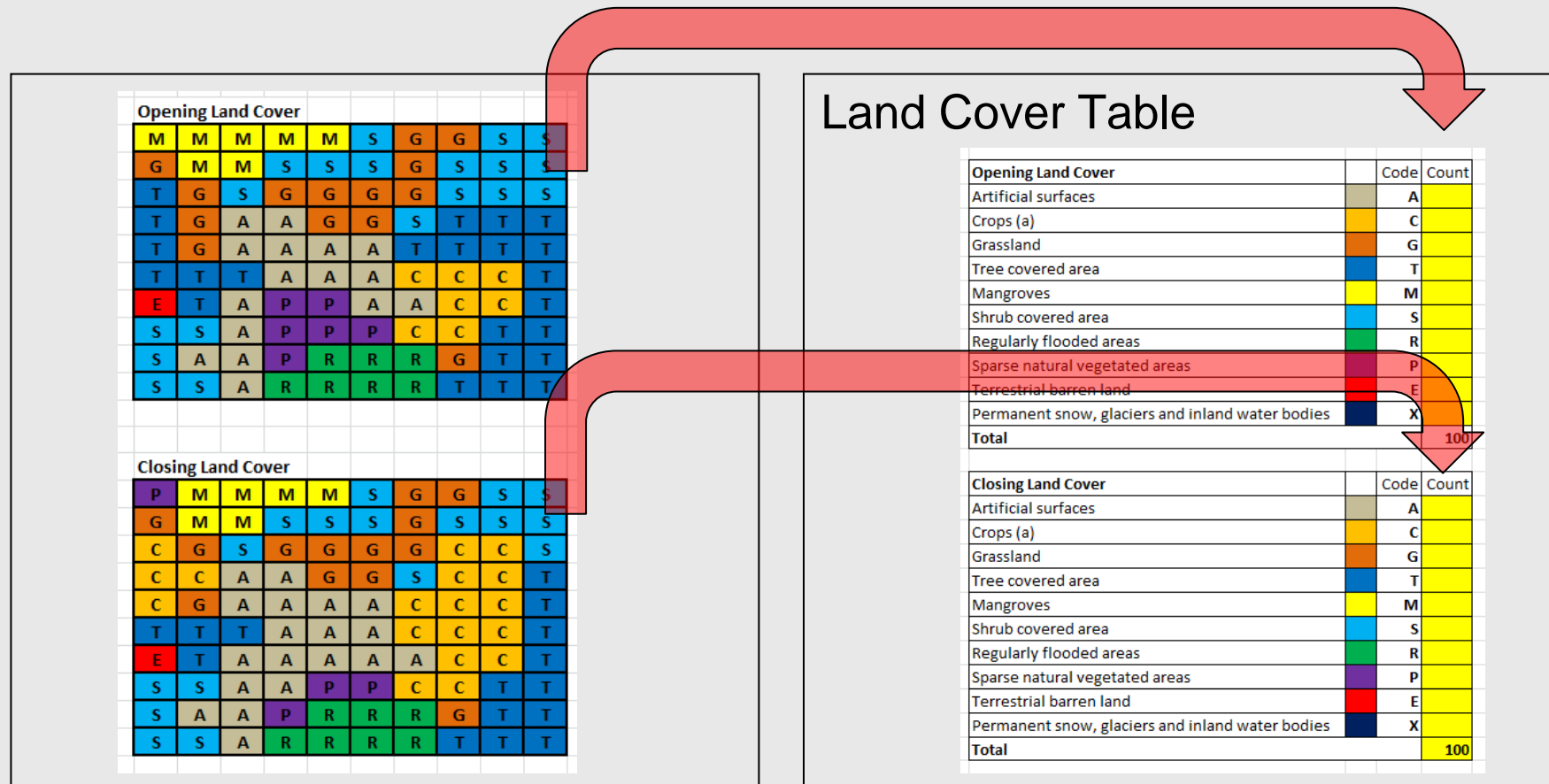
Level 1: Account 1: Extent

- **Compilation Group Exercise (30m)**
 - **Situation:**
 - Land cover units defined for two periods (Opening and Closing)
 - Need to calculate:
 - Land Cover Opening and Closing stocks,
 - Land Cover Change per class (with additions and reductions)
 - Physical Account for Land Cover
 - **Objective (Groups of 3-5):**
 1. Transfer Land Cover from map to table
 2. Calculate Land Cover Change Matrix
 3. Calculate Physical Account for Land Cover
 4. Report and discuss results



Level 1: Account 1: Extent

Group Exercise: Step 1 – Calculate Land Cover





Level 1: Account 1: Extent

Group Exercise: Step 2 – Calculate Land Cover Change

Land Cover Table

Opening Land Cover	Code	Count (ha)
Artificial surfaces	A	
Crops	C	
Grassland	G	
Tree covered area	T	
Mangroves	M	
Shrub covered area	S	
Regularly flooded areas	R	
Sparse natural vegetated areas	P	
Terrestrial barren land	E	
Permanent snow, glaciers and inland water bodies	X	
Total		100

Closing Land Cover	Code	Count (ha)
Artificial surfaces	A	
Crops	C	
Grassland	G	
Tree covered area	T	
Mangroves	M	
Shrub covered area	S	
Regularly flooded areas	R	
Sparse natural vegetated areas	P	
Terrestrial barren land	E	
Permanent snow, glaciers and inland water bodies	X	
Total		100

Land Cover Change Matrix

Table 1: Net Land Cover Change Matrix (hectares)

		Closing Land Cover											Opening
		Artificial surfaces	Crops	Grassland	Tree covered area	Mangroves	Shrub covered area	Regularly flooded areas	Sparse natural vegetated areas	Terrestrial barren land	Permanent snow, glaciers and inland water bodies		
Opening Land Cover	Code	A	C	G	T	M	S	R	P	E	X		
Artificial surfaces	A												
Crops	C												
Grassland	G												
Tree covered area	T												
Mangroves	M												
Shrub covered area	S												
Regularly flooded areas	R												
Sparse natural vegetated areas	P												
Terrestrial barren land	E												
Permanent snow, glaciers and inland water bodies	X												
Closing													

Note: Rows represent reductions in stock; columns represent deletions in stock

Record "No change" in diagonal
Rows = No change + Reductions
Columns = No change + Additions



Level 1: Account 1: Extent

Group Exercise: Step 3 – Calculate Physical Land Cover

Land Cover Change Matrix

Table 1: Net Land Cover Change Matrix (hectares)

		Closing Land Cover											Opening
		Artificial surfaces	Crops	Grassland	Tree covered area	Mangroves	Shrub covered area	Regularly flooded areas	Sparse natural vegetated areas	Terrestrial barren land	Permanent snow, glaciers and inland water bodies		
Opening Land Cover	Code	A	C	G	T	M	S	R	P	E	X		
Artificial surfaces	A												
Crops	C												
Grassland	G												
Tree covered area	T												
Mangroves	M												
Shrub covered area	S												
Regularly flooded areas	R												
Sparse natural vegetated areas	P												
Terrestrial barren land	E												
Permanent snow, glaciers and inland water bodies	X												
Closing													

Note: Rows represent reductions in stock; columns represent deletions in stock

Additions to (A) Artificial surfaces

Physical Land Cover Account

Table 2: Physical Account for Land Cover

		Artificial surfaces	Crops	Grassland	Tree covered area	Mangroves	Shrub covered area	Regularly flooded areas	Sparse natural vegetated areas	Terrestrial barren land	Permanent snow, glaciers and inland water bodies	Total
Opening Stock												
Additions to Stock												
Reductions in Stock												
Closing Stock												

Note: Reductions are sum of row, excluding areas that remained the same

Additions = Column total – no change
Reductions = Row total – no change



Level 1: Account 1: Extent

- Is everyone clear on the objectives?
- 30 minutes group work
- Please ask questions!
- Results:
 - Each group report:
 - Additions to Stock →
 - Reductions in Stock →
 - What were the largest sources of change?

Table 2: Physical Account for Land Cover

	Artificial surfaces	Crops	Grassland	Tree covered area	Mangroves	Shrub covered area	Regularly flooded areas	Sparse natural vegetated areas	Terrestrial barren land	Permanent snow, glaciers and inland water bodies	Total
Opening Stock											
Additions to Stock											
Reductions in Stock											
Closing Stock											
Note: Reductions are sum of row, excluding areas that remained the same											



Level 2: Account 1: Extent

- **Learning objectives (Level 2)**

- Understand the important conceptual issues:

More detail (than Land Cover) may be needed

Introduction to the FEU (Functional Ecosystem Unit)

- Understand the data options and sources

In relation to scale of analysis, pilot project objectives,
available resources

- Be aware of how other countries have approached measuring extent

EU's MAES process, Canada's MEGS, Australian land
accounts



Level 2: Account 1: Extent

- Functional ecosystem units, FEU
 - Are defined by the distinguishable structural elements of terrestrial and aquatic ecosystems
 - Terrestrial – plant community associations (or vegetation complexes), following Brown-Blanquet classification model
 - Aquatic – habitat or biotic communities (such as corals, mussel banks, kelp, reefs etc.)
 - Can be aggregated into Land Cover classes in a nested hierarchy



Level 2: Account 1: Extent

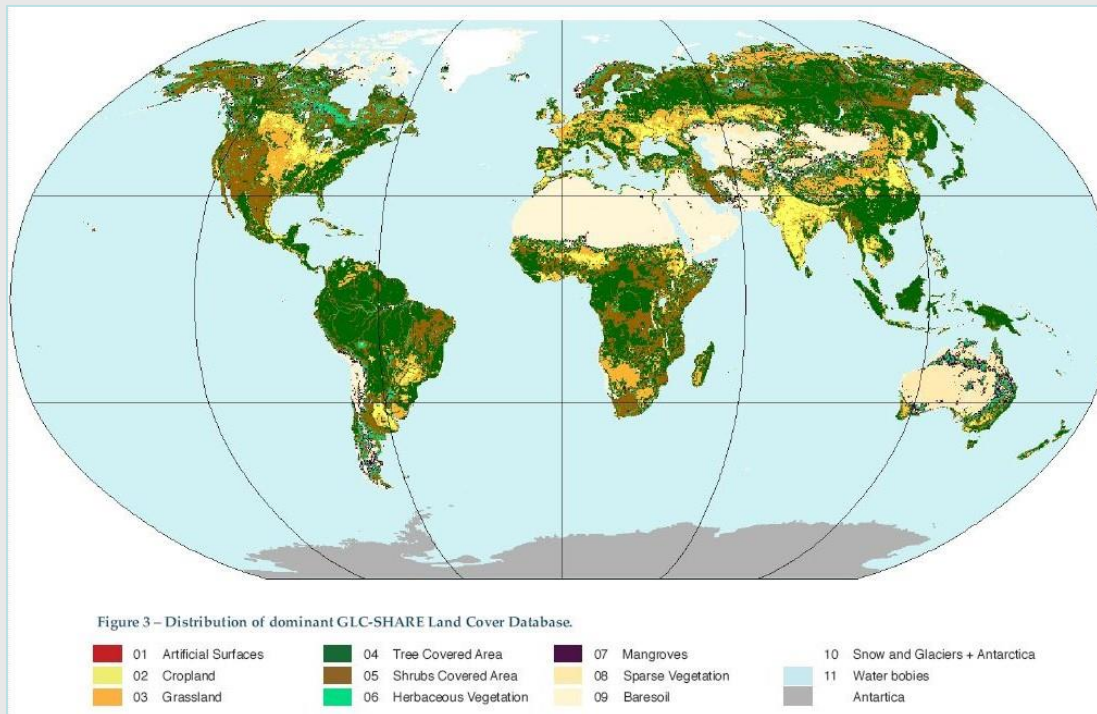
- Data Options for FEU mapping
 - Detailed mapping of habitats and vegetation complexes would be best completed through in-situ inventories (once a base map is completed, remote sensing can be easily applied to update it)
 - Very-high resolution remote sensing imagery (such as QuickBird and Ikonos) and aerial imagery can be applied to facilitate the process.
 - Intermediate solutions may be to produce detailed land cover and use maps, which are able to distinguish vegetation types at the level of community (e.g. with dominant species)
 - High- and medium- resolution imagery such as Landsat, SPOT, etc. would be suitable for the purpose



Level 2: Account 1: Extent

- Global land cover datasets

FAO Global Land Cover-SHARE



The FAO product [Global Land Cover-SHARE](#) (year 2014 Beta-Release 1.0) is constructed using the best quality national and international data sources.

11 land cover classes were harmonized and reclassified according to the SEEA-CF land cover classification



Level 2: Account 1: Extent

- Global land cover datasets

MODIS Land Cover

Modis Land Cover is a set of annual products based on NASA's MODIS imagery, and available at 500m x 500m spatial resolution. The product name is '[Land Cover Type Yearly L3](#)' (version 51 is the latest)

Land Cover Type 1: IGBP global vegetation classification scheme

Land Cover Type 2: University of Maryland (UMD) scheme

Land Cover Type 3: MODIS-derived LAI/fPAR scheme

Land Cover Type 4: MODIS-derived Net Primary Production (NPP) scheme

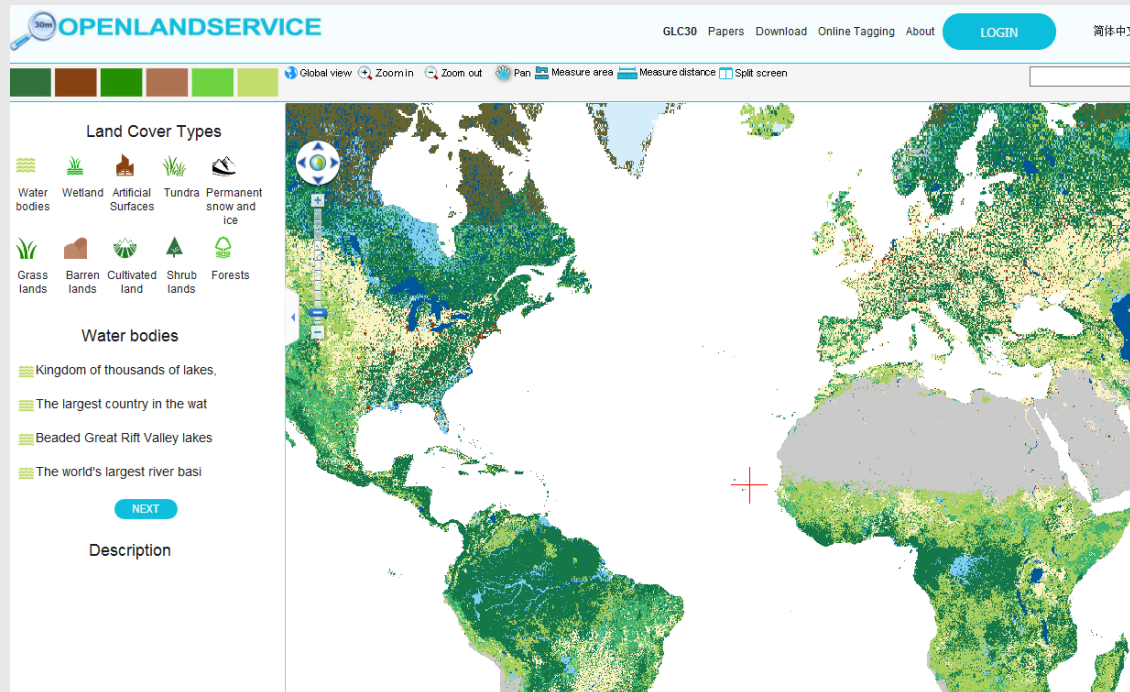
Land Cover Type 5: Plant Functional Type (PFT) scheme



Level 2: Account 1: Extent

- Global land cover datasets

GlobeLand30 (new product)

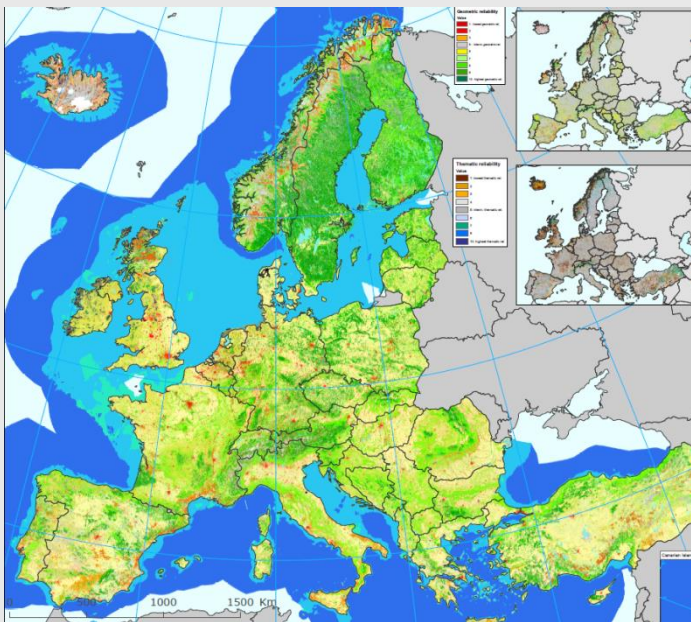


Very high resolution global land cover maps were produced by China, known as [GlobeLand30](#), for years 2000 and 2010, with 10 classes and 30 m resolution, based on the freely available imagery from [NASA's Landsat satellite](#) instruments.



Level 2: Account 1: Extent

EU (MAES) Ecosystem types:



Source: European Environment Agency

spatial resolution: * 100*100 m

data sources:

* CLC 2006, HRL sealing 2006, JRC-Forest 2006, OSM 2013

* CLC 2000 (Greece)

* EU-DEM

* ESDB, Art. 17 (2006), pot. nat. vegetation ((c) BfN),

* env- strata (Metzger)

* HANTS-MODIS (Alterra, GISAT)

crosswalk

* CLC-EUNIS crosswalk

* method: ETC-SIA (c) 2013

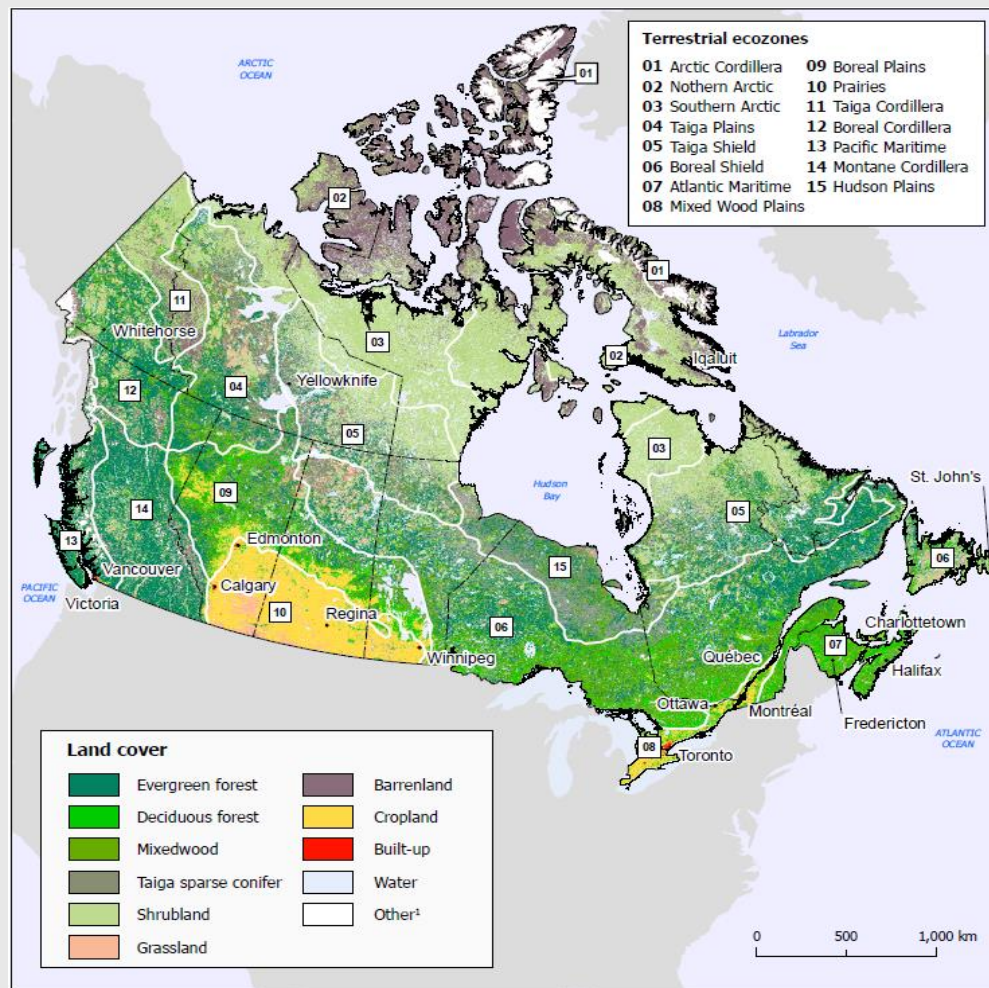
DRAFT Map of ecosystem types V 1.4

A - Marine habitats		F - Heathland, scrub and tundra	
	A1 Littoral rock and other hard substrata		F1 Tundra
	A2 Littoral sediment		F2 Arctic, alpine and subalpine scrub
	A3 Infralittoral rock and other hard substrata		F3 Temperate and mediterranean-montane scrub
	A4 Circalittoral rock and other hard substrata		F4 Temperate shrub heathland
	A5 Sublittoral sediment		F5 Maquis, arborescent matorral and thermo-Mediterranean bushes
	A6 Deep-sea bed		F6 Garrigue
	A7 Pelagic water column*		F7 Spiny Mediterranean heaths (phygana, hedgehog-heaths and related coastal cliff vegetation)
	A8 Ice-associated marine habitats		F8 Thermo-Atlantic xerophytic scrub
B - Coastal habitats			F9 Riverine and fen scrubs
	B1 Coastal dunes and sandy shores		X FA Hedgerows*
	B2 Coastal shingle		FB Shrub plantations
	B3 Rock cliffs, ledges and shores, including the supralittoral	G - Woodland, forest and other wooded land	
	X1 Estuaries		G1 Broadleaved deciduous woodland
	X2_3 Coastal lagoons		G2 Broadleaved evergreen woodland
C - Inland surface waters			G3 Coniferous woodland
	C1 Surface standing waters		G4 Mixed deciduous and coniferous woodland
	C2 Surface running waters		G5 Lines of trees, small anthropogenic woodlands, recently felled woodland, early-stage woodland and coppice
	C3 Littoral zone of inland surface waterbodies	H - Inland unvegetated or sparsely vegetated habitats	
D - Mires, bogs and fens			X H1 Terrestrial underground caves, cave systems, passages and waterbodies*
	D1 Raised and blanket bogs		H2 Scree
	D2 Valley mires, poor fens and transition mires		H3 Inland cliffs, rock pavements and outcrops
	D3 Aapa, palae and polygon mires		H4 Snow or ice-dominated habitats
	D4 Base-rich fens and calcareous spring mires		H5 Miscellaneous inland habitats with very sparse or no vegetation
	D5 Sedge and reedbeds, normally without free-standing water		X H6 Recent volcanic features*
	D6 Inland saline and brackish marshes and reedbeds	I - Regularly or recently cultivated agricultural, horticultural and domestic habitats	
E - Grasslands and land dominated by forbs, mosses or lichens			I1 Arable land and market gardens
	E1 Dry grasslands		I2 Cultivated areas of gardens and parks
	E2 Mesic grasslands	J - Constructed, industrial and other artificial habitats	
	E3 Seasonally wet and wet grasslands		J1 Buildings of cities, towns and villages
	E4 Alpine and subalpine grasslands		J2 Low density buildings
	X E5 Woodland fringes and clearings and tall forb stands*		J3 Extractive industrial sites
	E6 Inland salt steppes		J4 Transport networks and other constructed hard-surfaced areas
	E7 Sparsely wooded grasslands		J5 Highly artificial man-made waters and associated structures
			J6 Waste deposits



Level 2: Account 1: Extent

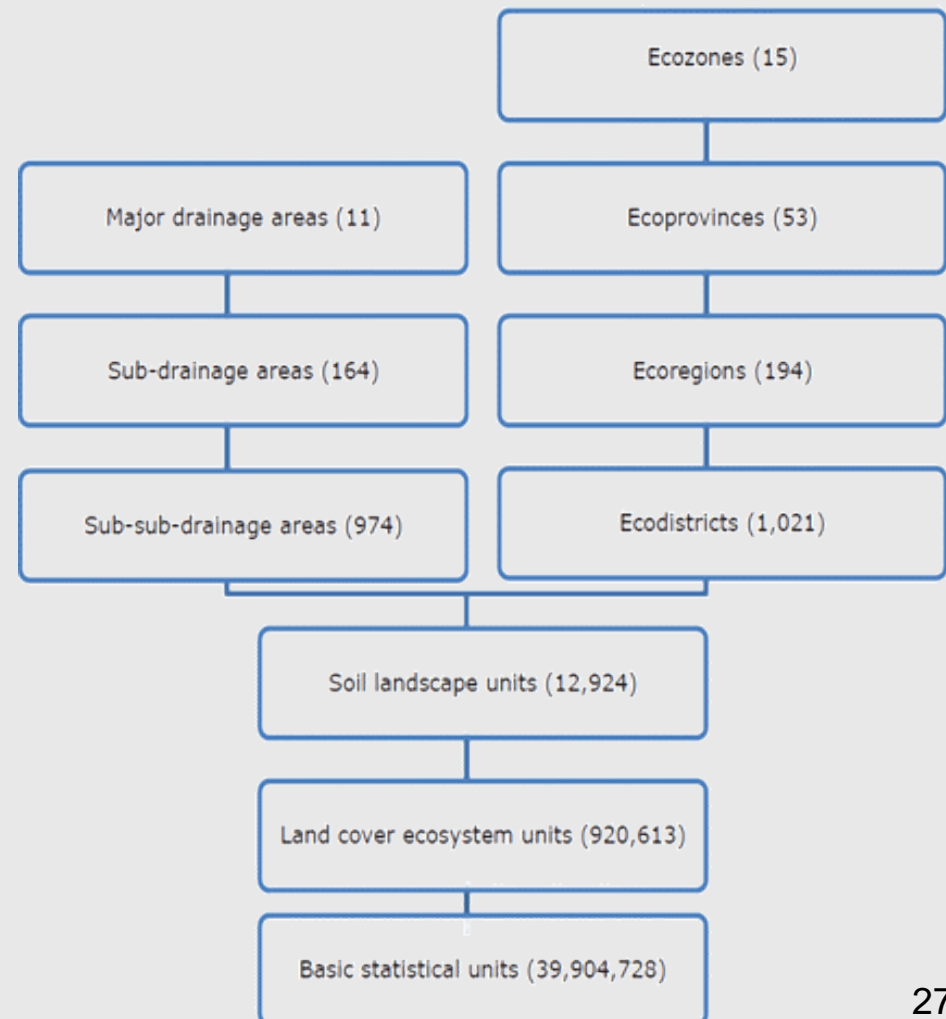
- Statistics Canada (Measuring Ecosystem Goods and Services – MEGS)
- Based Extent Account on existing National Ecological Classification
- Further sub-divided Ecodistricts and Soil Landscape Units to LCEUs (See [Spatial Units](#))
- Using MODIS (at 250m resolution), hydrology, topography, roads...





Level 2: Account 1: Extent

- Statistics Canada
MEGS Spatial Infrastructure
- Developed a hierarchy of spatial units that was consistent with the SEEA-EEA classification





Level 2: Account 1: Extent

- Australia's Land Accounts
- Based on MODIS 250m Land Cover, aggregating 25 classes to seven categories

Australian Dynamic Land Cover	AEEA presentation
Built Up Areas	Built Up Areas
Rainfed Cropping	Rainfed cropping and pasture
Rainfed Pasture	
Alpine Grasses - Open	Grasses and Sedges
Hummock Grasses - Open	
Sedges - Open	
Tussock Grasses - Open	
Hummock Grasses - Sparse	
Tussock Grasses - Sparse	
Trees - Closed	Trees
Trees - Open	
Trees - Scattered	
Trees - Sparse	
Irrigated Cropping	Irrigated cropping and pasture
Irrigated Pasture	
Shrubs - Closed	Shrubs
Shrubs - Open	
Chenopod Shrubs - Open	
Shrubs - Scattered	
Shrubs - Sparse	
Chenopod Shrubs - Sparse	
Extraction Sites	Other
Inland Water bodies	
Salt Lakes Wetlands	





Level 2: Account 1: Extent

- Concepts group Exercise (15m) (Groups of 3-5)
 1. What national data and classifications for Ecosystem Extent are already available for your country?
 2. If there are no national classifications, what data could you use to create an Ecosystem Extent Account?
 3. Report your results



Level 2: Account 1: Extent

- Concepts group Exercise (15m)
- Group reports:
 - National **data and classifications** for Ecosystem Extent already available for your country
 - Alternative sources of data for Ecosystem Extent Accounts?
- Discussion
 - Who would need to participate in creating a pilot Ecosystem Extent Account?



Level 2: Account 1: Extent

- Discussion and questions
- Take home points
 - Land Cover data, classified by the recommended SEEA-EEA classification is a useful starting point for creating Ecosystem Extent Accounts
 - Data need to be national and consistent
 - Alternatives exist to create more “optimal” units (such as the FEU, based on ecological classifications)
 - These can fit into the SEEA-EEA Land Cover classification
 - Global for Land Cover may be used if there is no national alternative



Level 2: Account 1: Extent

■ References

- EUROPEAN ENVIRONMENTAL AGENCY (EEA) (2006): Land accounts for Europe 1990–2000. Towards integrated land and ecosystem accounting. EEA report 11/2006, 107p, Copenhagen. (Authors: R. Haines-Young and Jean-Louis Weber)
- STATISTICS CANADA, 2013. Human Activity and the Environment: Measuring Ecosystem Goods and Services 2013. 16-201-XWE. Ottawa: Government of Canada
- AUSTRALIAN BUREAU OF STATISTICS, 2013. Land Account: Queensland, Experimental Estimates, 2013

■ Further Information

- SEEA Experimental Ecosystem Accounting (2012)
- SEEA-EEA Technical Guidance (forthcoming)
 - Detailed supporting document on “Land inputs for ecosystem accounting” by UNSD



Evaluation of the training module

- Please complete the evaluation form for this module
- 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

- This project is a collaboration of The United Nations Statistics Division, United Nations Environment Programme and the Secretariat of the Convention on Biological Diversity and is supported by the Government of Norway.

