



System of  
Environmental  
Economic  
Accounting

# Ecosystem extent accounts in the SEEA Ecosystem Accounting

9 September 2025

Jakarta, Indonesia

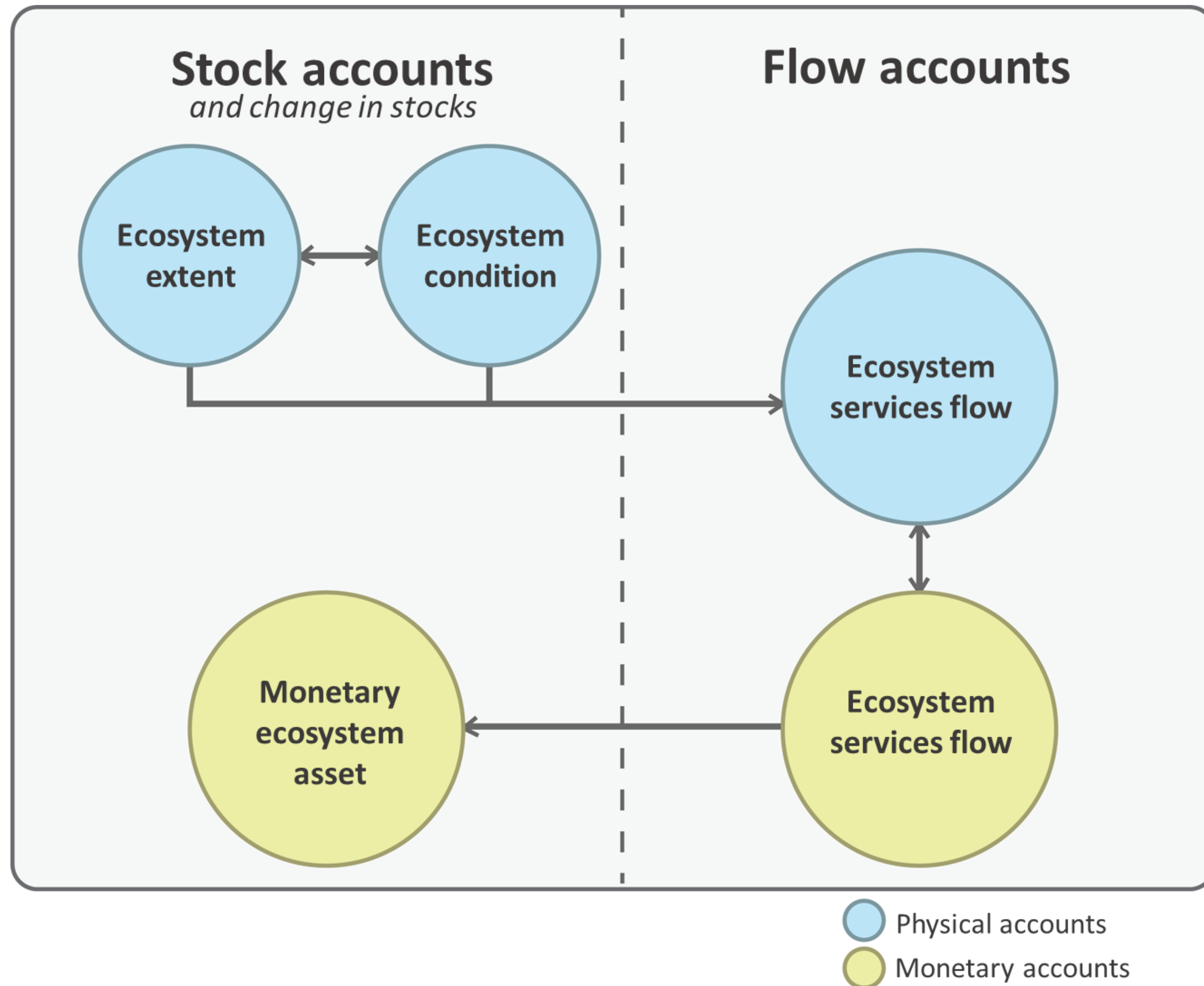
Sokol Vako (SIAP)

With thanks to Marko and other colleagues for their inputs



United Nations

# Ecosystem accounts – core accounts



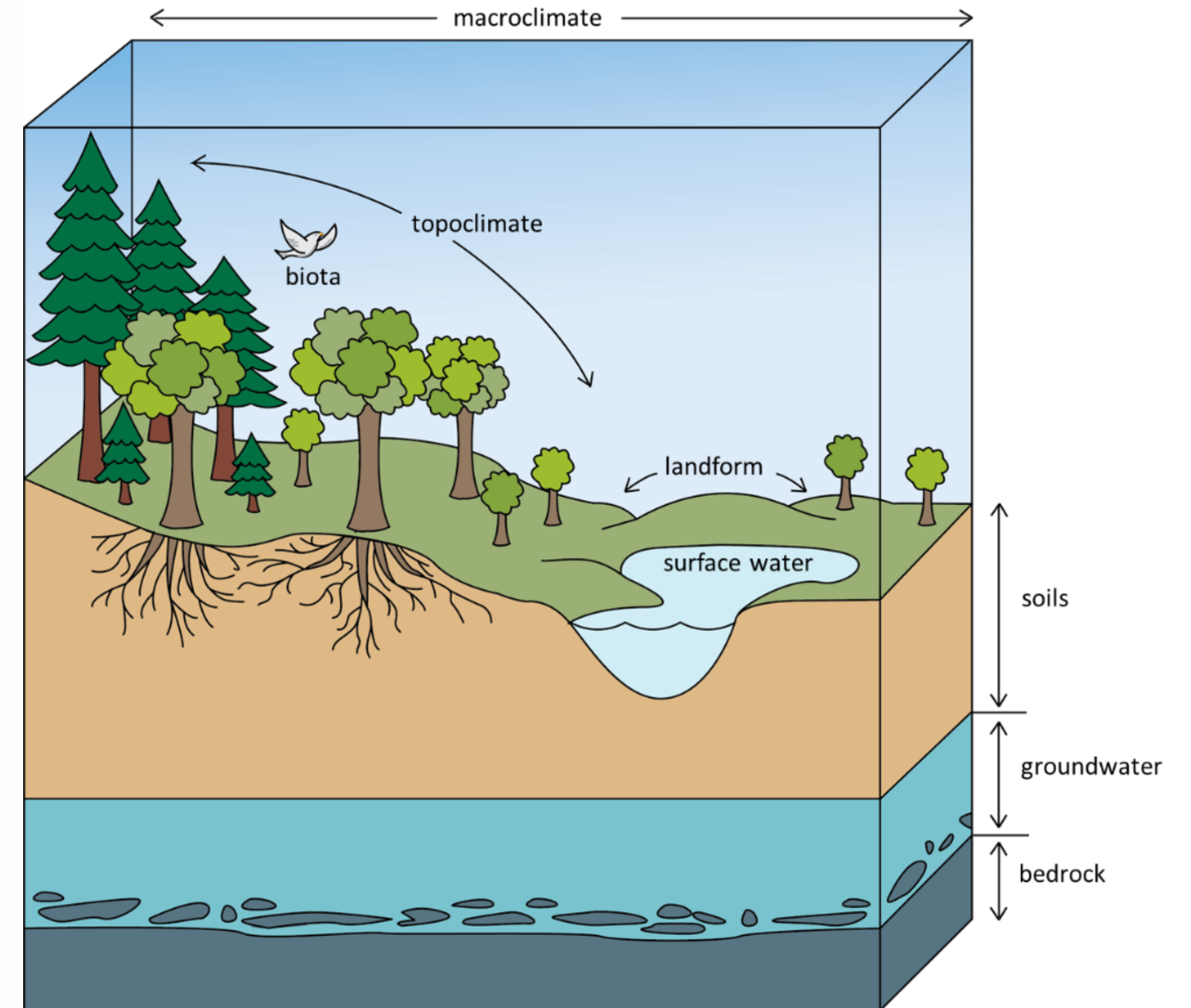
# Ecosystem extent account - overview

- What?
  - > Starting point for ecosystem accounting
  - > Records the areas of different ecosystems, and changes in the areas
  - > National coverage of terrestrial, freshwater, coastal and marine areas
  - > Mutually exclusive and exhaustive coverage
  - > In physical units – i.e., ha, km<sup>2</sup>, etc.
- Why?
  - > Input for land management, conservation policies
  - > Supports the derivation of coherent indicators of deforestation, desertification, agricultural conversion, urbanization, ecosystem diversity etc.
  - > Spatial foundation for other accounts → basis for allocating macro data to spatial units

# Ecosystem assets

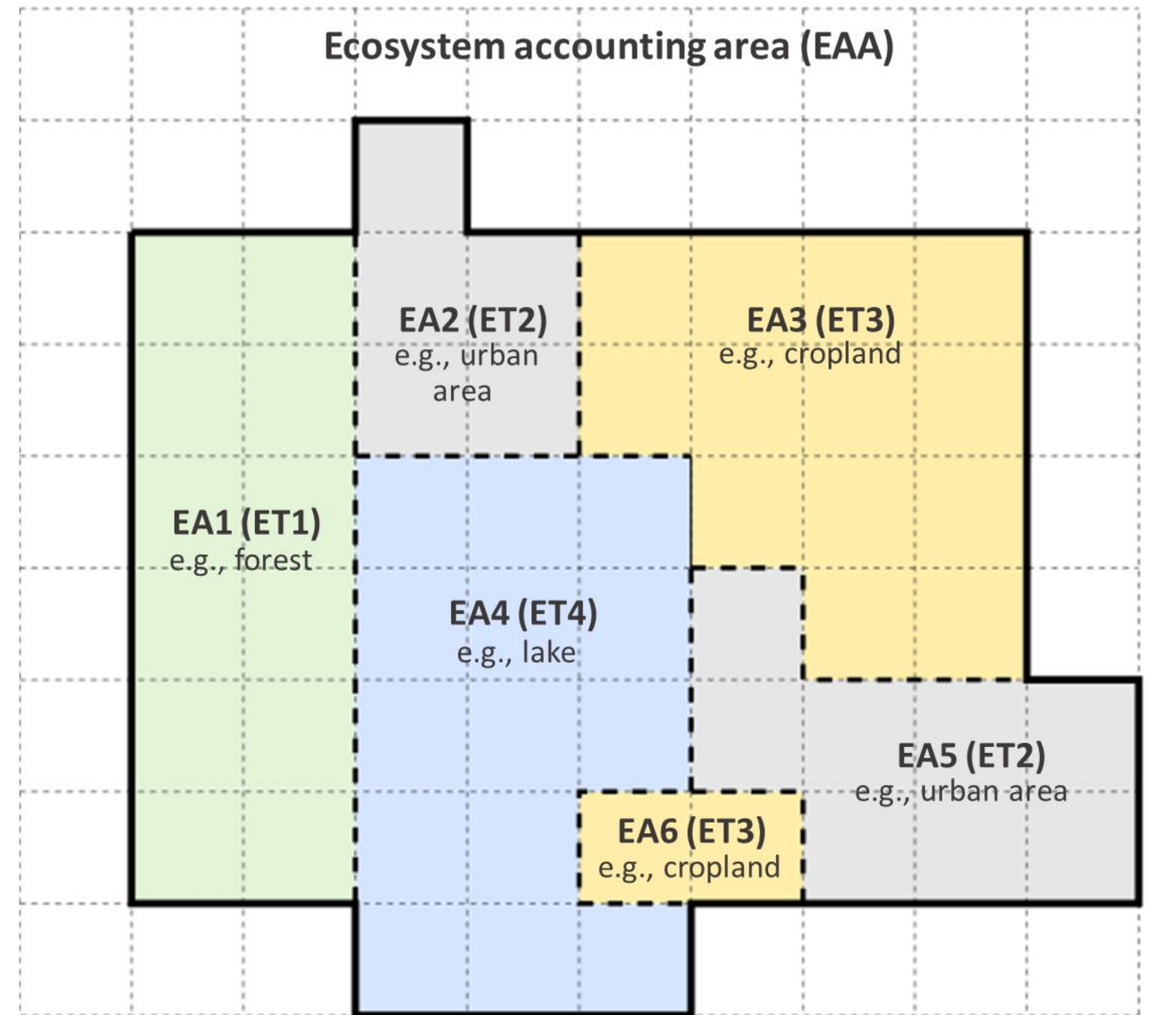
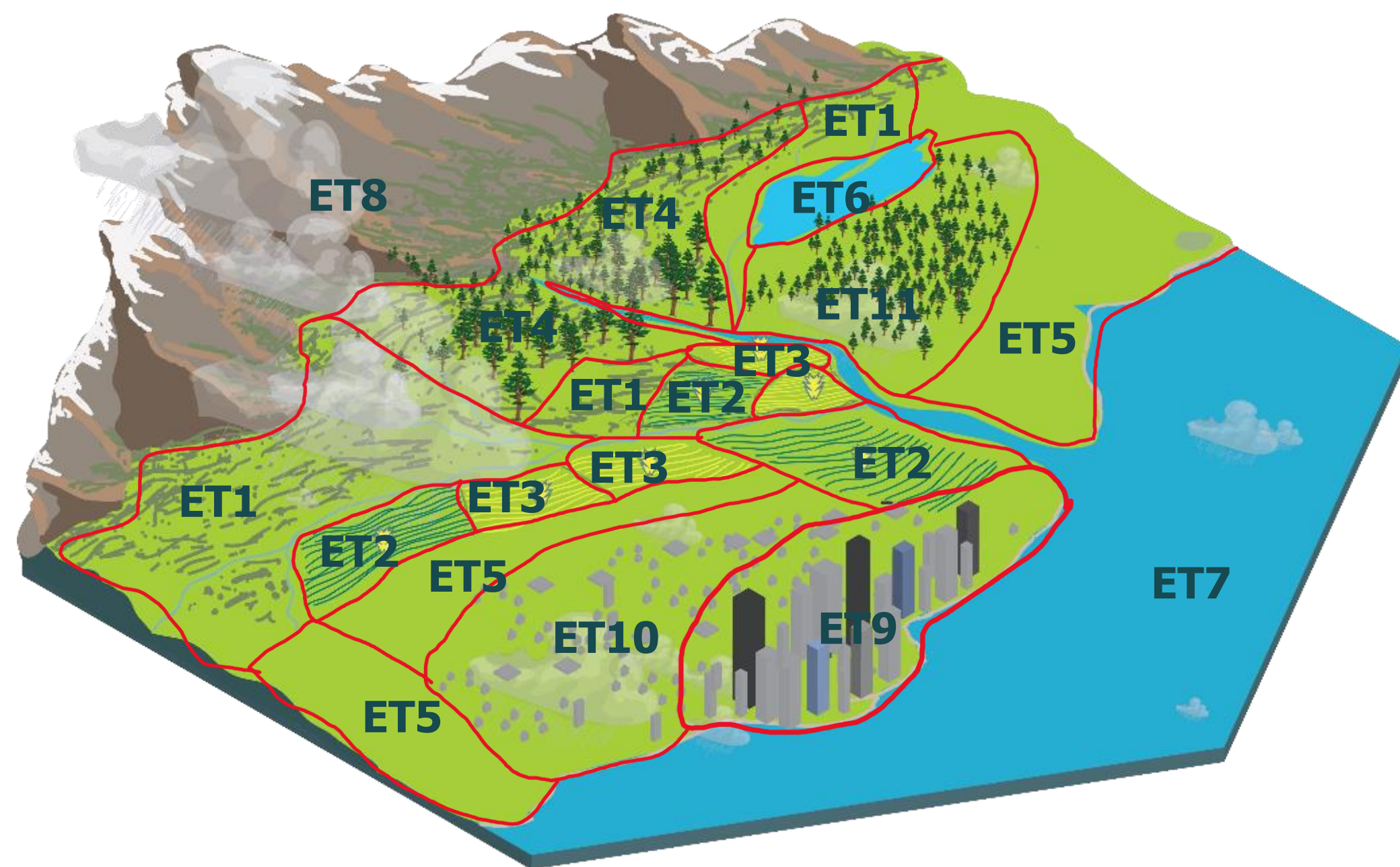
Types of spatial units:

- **Ecosystem assets (EAs)** are contiguous spaces of a specific ecosystem type characterized by a distinct set of biotic and abiotic components and their interactions
- Ecosystem assets are classified by **ecosystem type (ET)**
- **Ecosystem accounting area (EAA)** is the geographical territory for which an ecosystem account is compiled
- **IUCN Global Ecosystem Typology** is the SEEA Ecosystem Type reference classification
  - > UN Statistical Commission endorsed it as an international statistical classification, and recommended it be included in the international family of classifications





# Spatial units in SEEA EA

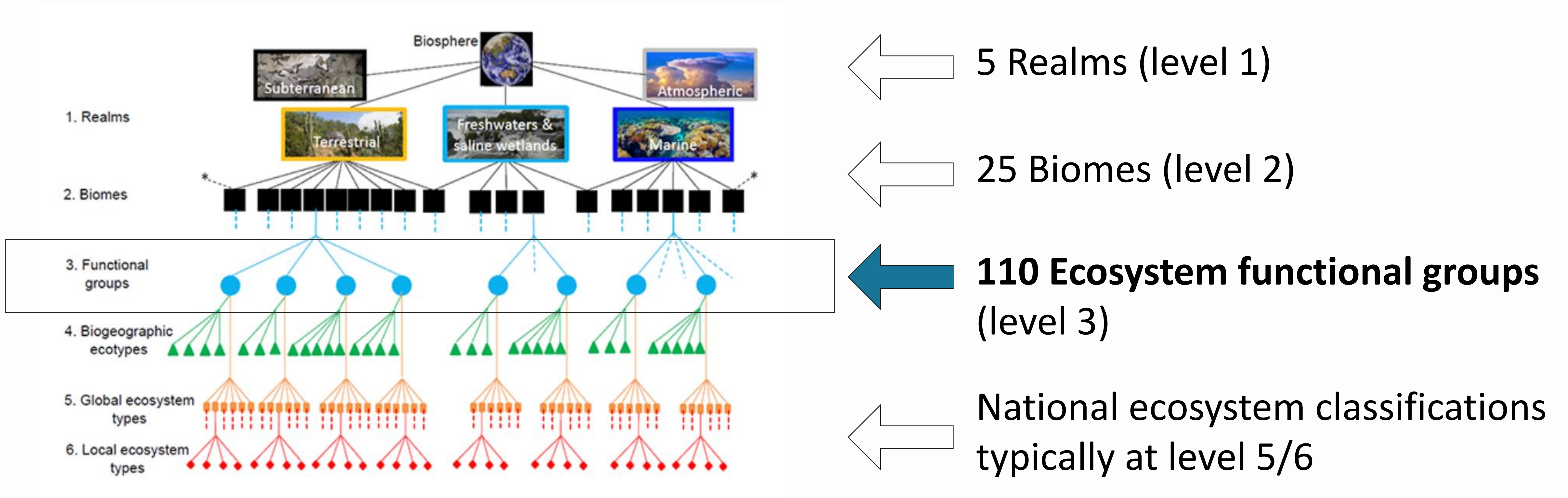


# Linking land cover and ecosystem extent

- Both are spatially explicit
- Land accounts, particularly land cover, are a basis for ecosystem accounting
  - > Land cover is a fundamental layer, but extent requires more
- For terrestrial and freshwater areas, should be a reasonable concordance between land cover and ecosystem extent
- But key differences between land cover and ecosystems
  - > Definition of ecosystems in SEEA EA: a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit
  - > vs. definition of land cover: the observed physical and biological cover of the Earth's surface and includes natural vegetation and abiotic (non-living) surfaces



# IUCN Global Ecosystem Typology



Of the 110 ecosystem functional groups,  
98 are natural and 12 are anthropogenic

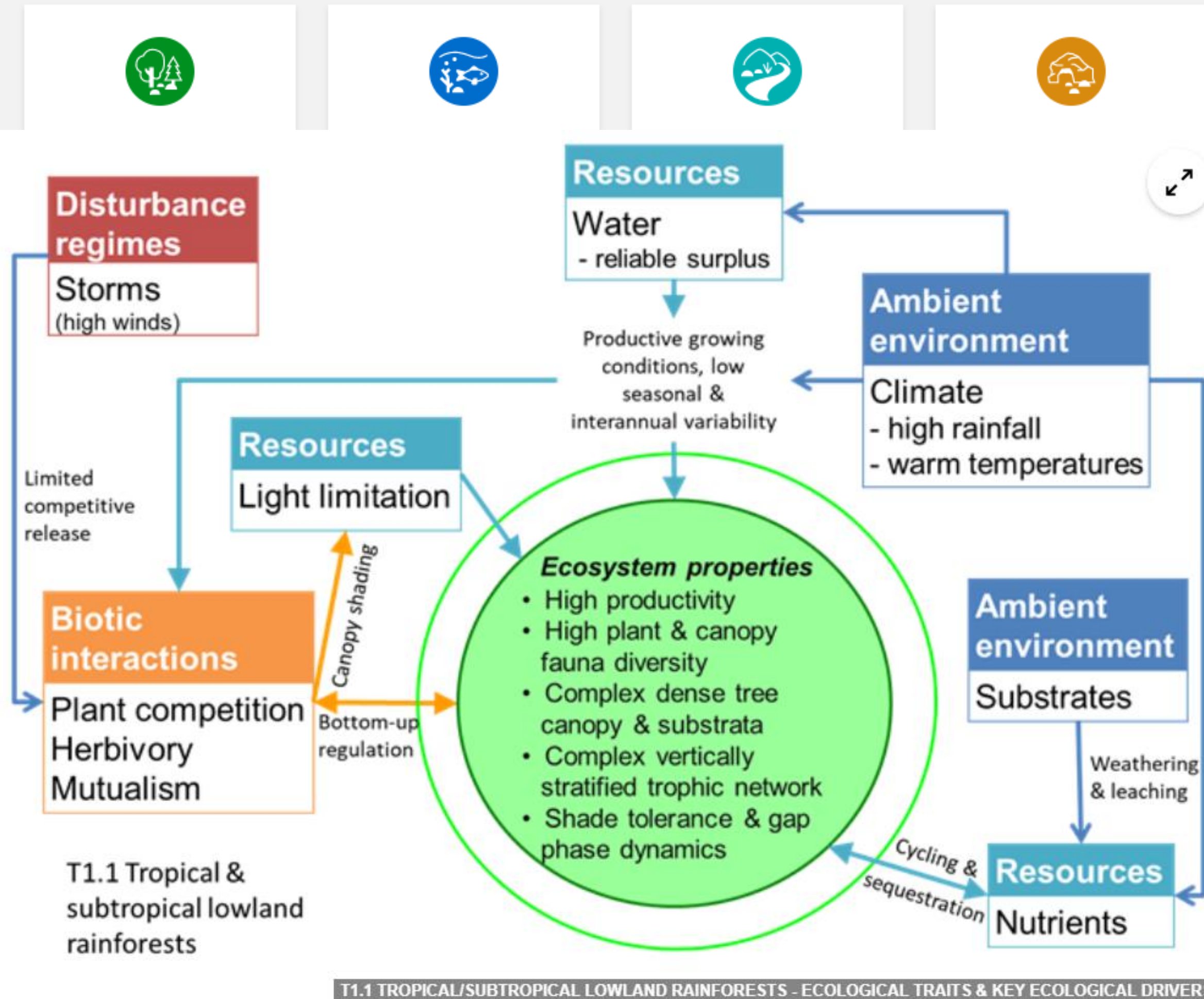


# Ecosystem types <https://global-ecosystems.org/explore>

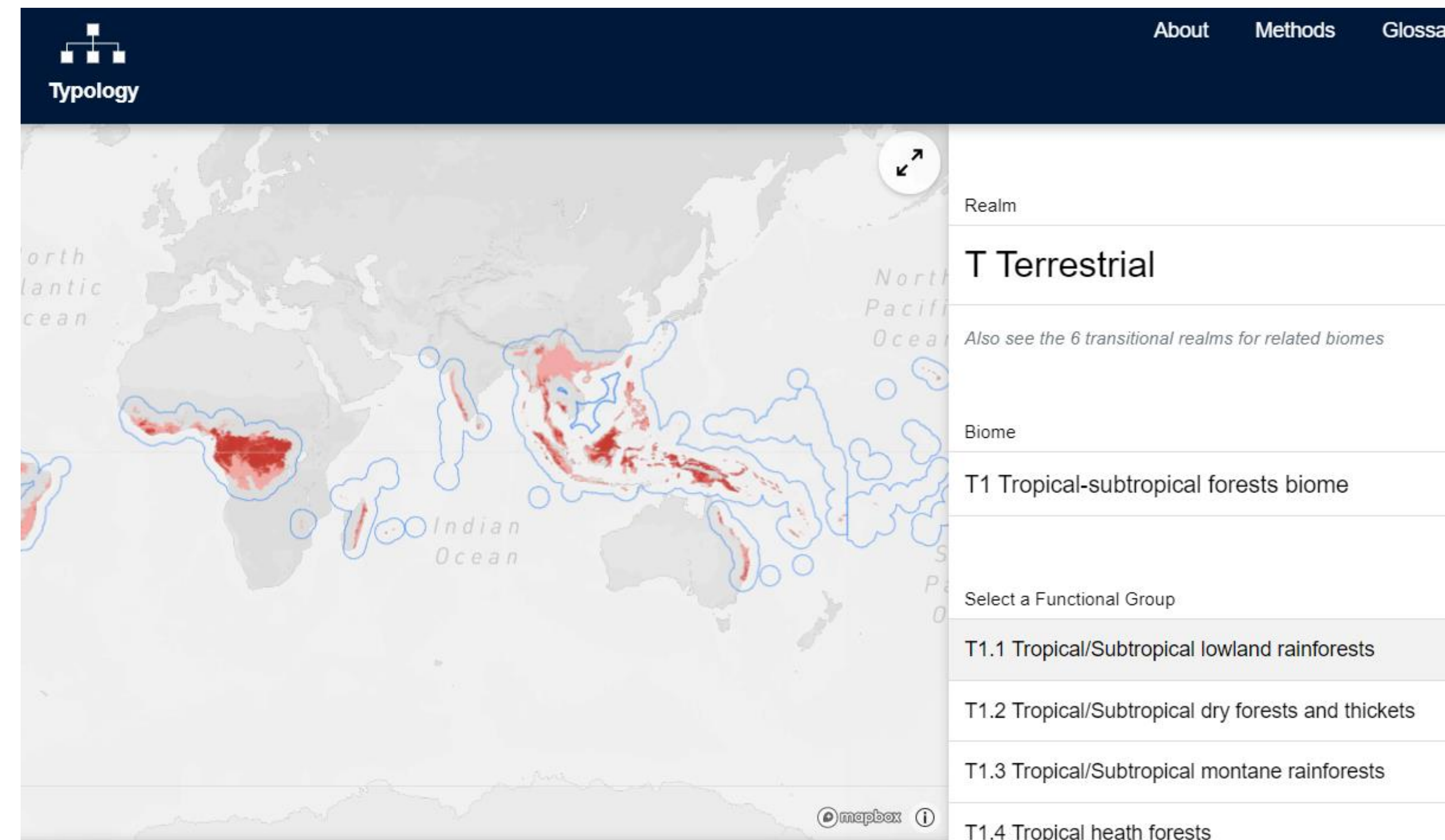
## Explore the Global Ecosystem Typology

Start by selecting a Realm of interest, then drill down to learn more about its Biomes and Ecosystem Functional Groups

4 CORE REALMS



- Probabilistic maps with major and minor occurrences
- Can show if an ecosystem is **likely** found in your country
- Description of ecosystem properties, ecological drivers, global distribution





# Principles of ecosystem asset delineation

- Ecosystem assets should **represent ecosystems**
  - > Alignment with CBD ecosystem definition (consideration of organisms, their environmental setting and ecosystem processes)
  - > Keep it realistic: perfect is the enemy of good
- Ecosystem assets should be **capable of being mapped**
  - > Location; size; shape
- Ecosystem assets should be **geographically and conceptually exhaustive** across ecological realms
  - > Spatially comprehensive (no gaps)
  - > Conceptually comprehensive
- Ecosystem assets should be **mutually exclusive**
  - > Conceptually (single ecosystem type)
  - > Geographically (no overlaps between e.g. land and ocean).

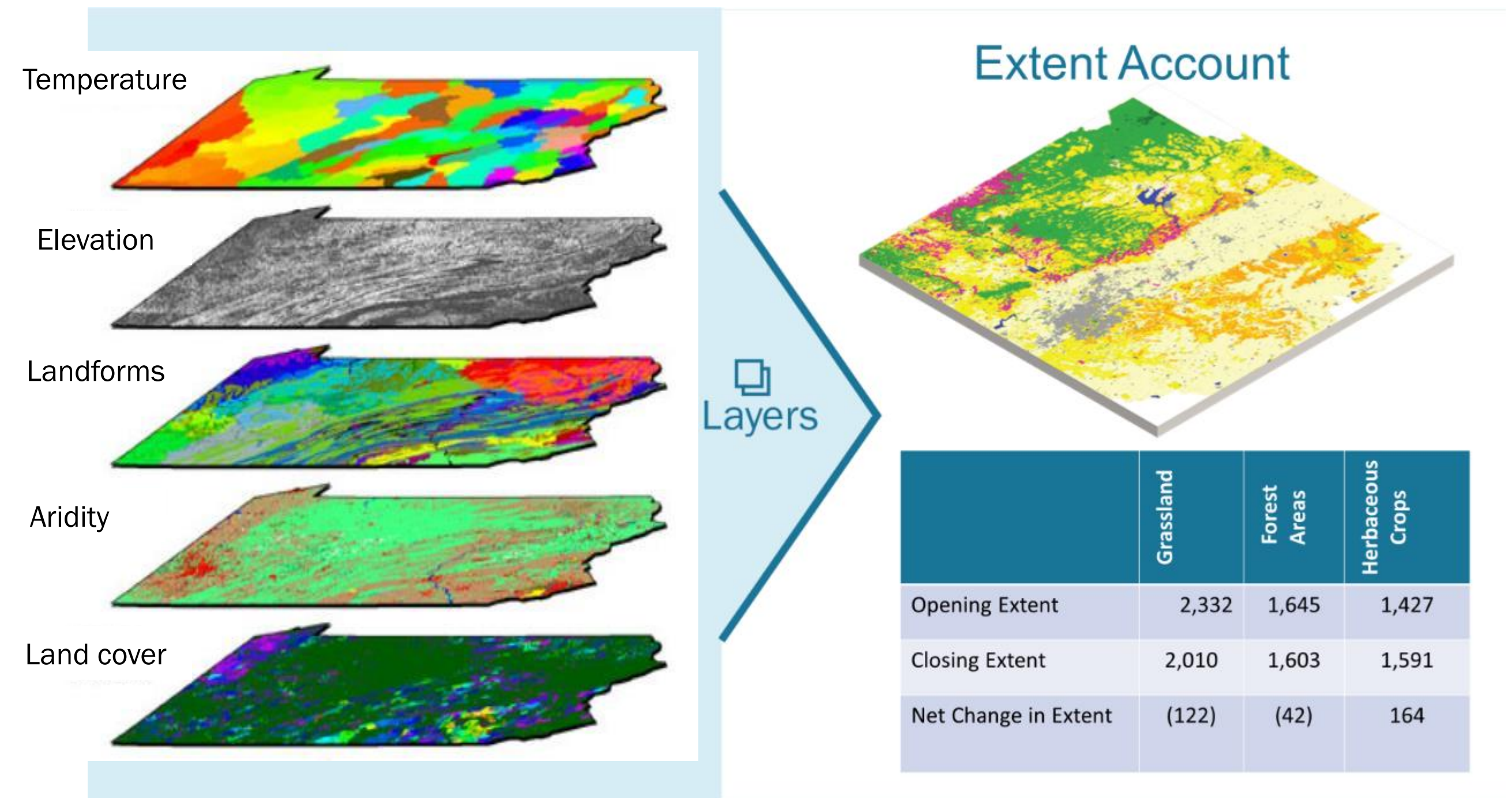
# Three ways to to compile ecosystem maps

- Use existing national ecosystem classification / maps
  - > Cross walk to IUCN classification
- Use existing global maps & tools
  - > GeoAtlas, ARIES, WES, IUCN, etc.
- Construct your own ecosystem classification / maps
  - > Based on combining different maps, such as land cover, elevation, rainfall, temperature, etc.
  - > Based on historical ecosystem (vegetation) types overlaying with anthropogenic changes



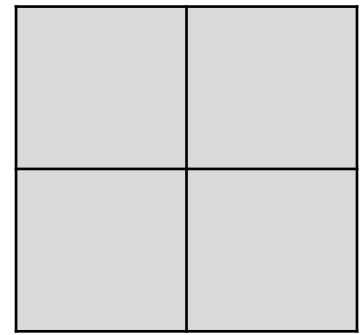
# Compiling extent accounts

- Maps based on ecological ground-truthing would be ideal, but probably not practical/feasible
- Model extent on the basis of a multi-dimensional look-up table
  - > Inputs: land cover map, digital elevation model, temperature and landforms, etc.
    - Time series of land cover maps
    - Comparable maps (i.e. same classification; preferably also same techniques)
  - > Model derives which ecosystem type is to be found, where.

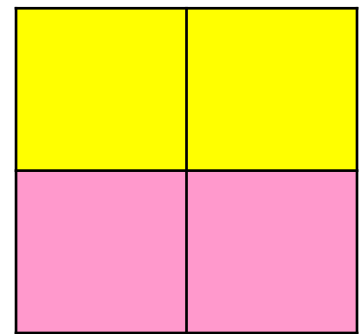


# Compiling extent accounts

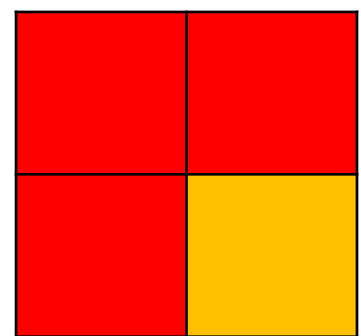
- Combining maps--simple example for illustration purposes only!



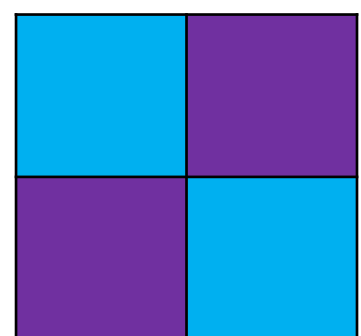
- Land cover
  - > Grey = tree-covered area
  - > Green = non tree-covered area



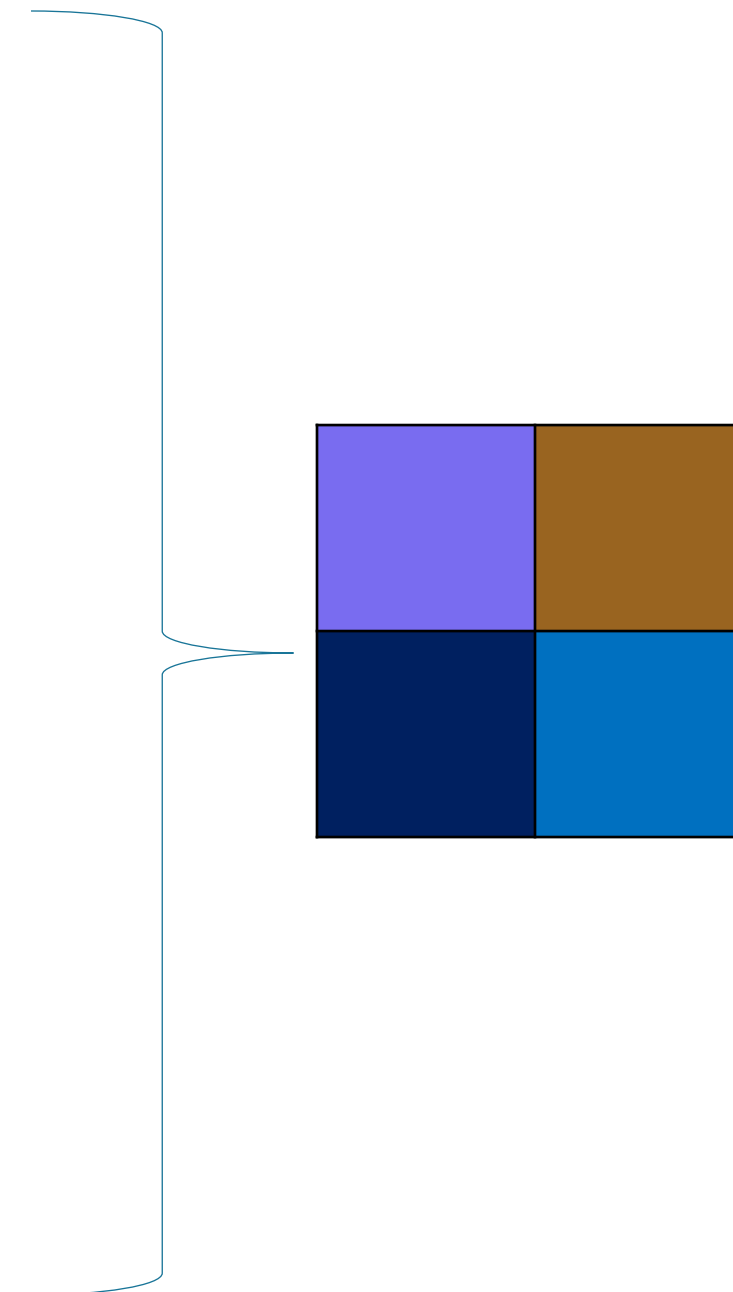
- Temperature
  - > Yellow = annual mean temperature > 18 C
  - > Pink = annual mean temperature <= 18 C



- Aridity
  - > Red = aridity index >.65 (moist)
  - > Orange = aridity index <= .65 (dry)



- Elevation
  - > Purple = elevation < 300m
  - > Blue = elevation >= 300m



- Hot, humid, elevated forest
  - > T1.3 Tropical/subtropical montane rainforests
- Hot, humid, low-lying forest
  - > T1.1 Tropical/subtropical lowland rainforests
- Temperate, humid, low-lying forest
  - > T2.5 Temperate pyric humid forests
- Temperate, dry, elevated forest
  - > T2.6 Temperate pyric sclerophyll forests and woodlands



# ARIES for SEEA extent model

Methods
Maps <b>29 ecosystem functional groups</b> (EFGs, primarily terrestrial & wetland) based on IUCN GET 2.0 methods. <sup>1</sup> Consulted virtually with D. Keith & colleagues.

Outputs
Net change, additions & reductions, change matrix for ecosystems & land cover types


Data
Lookup table to model <b>IUCN EFGs</b> , based on: <b>temperature, landform, elevation, aridity, land cover</b>

Current work
<b>Expanding to 39 terrestrial/wetland EFGs, including all forest EFGs</b> , collaborating with IUCN GET team, expand to further freshwater/marine EFGs in future

**1: Keith, D. et al. 2020.** IUCN Global Ecosystem Typology 2.0. IUCN: Gland, Switzerland. - **2: Using thresholds from Sayre, R., et al. 2020.** An assessment of the representation of ecosystems in global protected areas using new maps of World Climate Regions and World Ecosystems. Global Ecology and Conservation 21:e00860.

- Vegetation
- Hydrology
- Pedology
- Elevation
- Bio-climate
- Etc.

A 3D visualization of a 2D grid. The grid is composed of cells colored in orange, green, and blue. A path is highlighted in blue, starting from a blue cell in the lower-left and moving towards the upper-right. The grid is shown from an isometric perspective, giving it a three-dimensional appearance.

[illegible]



# Extent account - structure

Ecosystem types (based on the EFG level 3 of IUCN GET)																				
Terrestrial													Freshwater			Marine				
T1 Tropical-subtropical forests				T2 Temperate-boreal forests and woodlands				...		T7		F1	...	FM1	M1	...	MFT1			
Tropical lowland rainforests	Tropical dry forests and scrubs	Tropical montane rainforests	Tropical hardwood forests	Boreal and temperate forests	Deciduous forests	...	Temperate forests	...	...	...	Derived forest types	Permanent wetlands	...	Intermittent wetlands and open lakes	Seagrass meadows	...	Coastal salt marshes and reed beds			
T1.1	T1.2	T1.3	T1.4	T2.1	T2.2	...	T2.6	...	...	...	T7.5	F1.1	...	FM1.3	M1.1	...	MFT1.3	TOTAL		
Opening extent																				
Additions to extent				Additions to extent																
Managed expansion																				
Unmanaged expansion																				
Reduction in extent				Reductions in extent																
Managed reductions																				
Unmanaged reductions																				
Net change in extent																				
Closing																				

# Ecosystem type change matrix

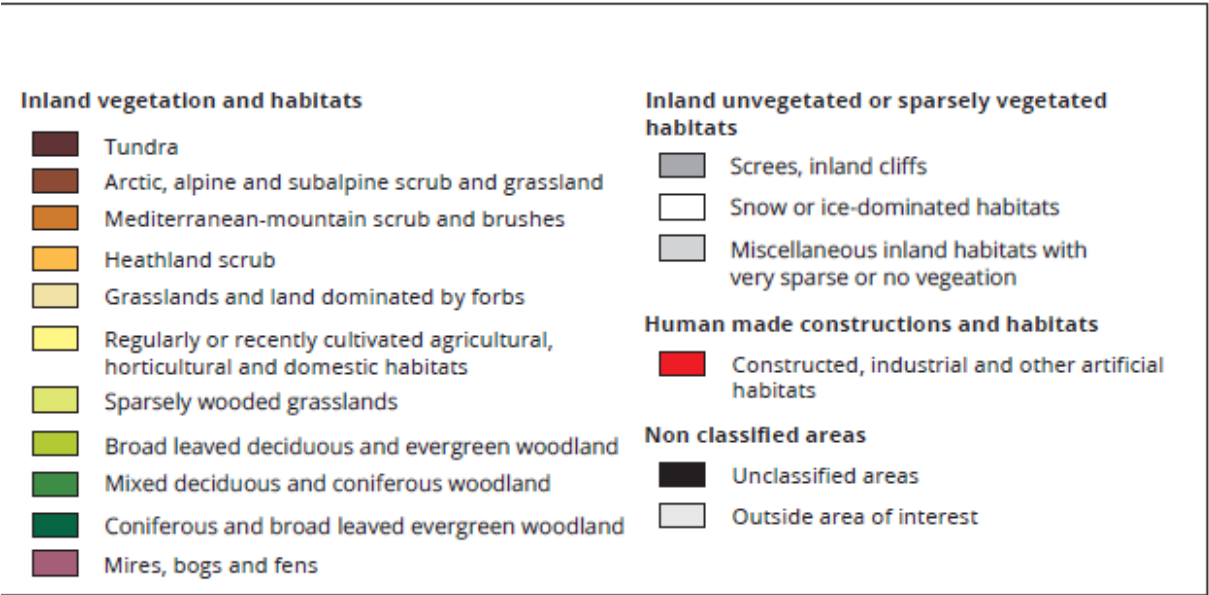
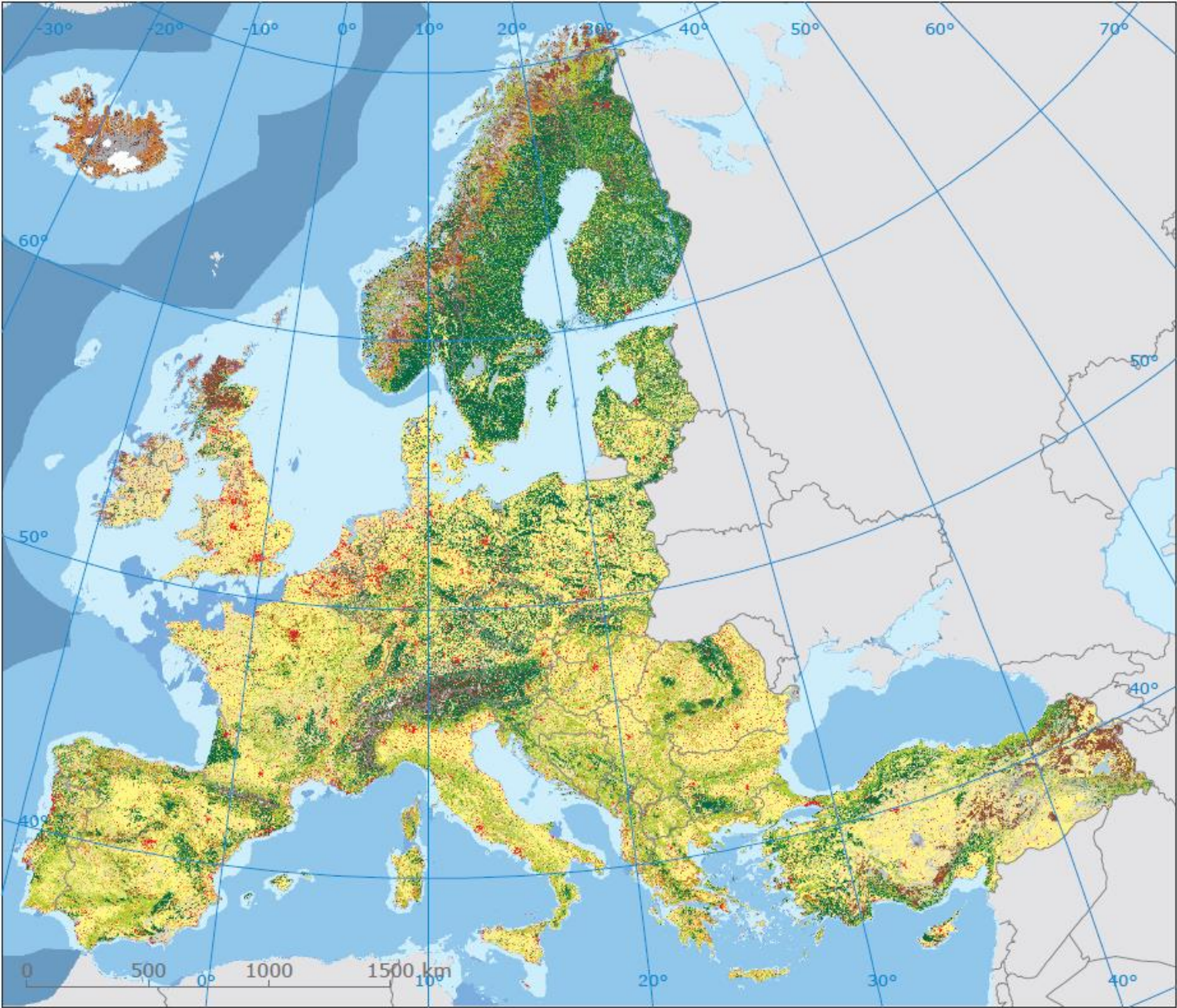
The ET change matrix shows :

- the area of different ecosystem types at the beginning of the accounting period;
- the increases and decreases in this area according to the ecosystem type it was converted from or to;
- the area covered by different ecosystem types at the end of the accounting period.

Ecosystem types (based on the EFG level 3 of IUCN GET)																													
Closing extent																													
						Terrestrial								Freshwater			Marine												
						T1 Tropical-subtropical forests				T2 Temperate-boreal forests and woodlands				...		T7		F1	...	FM1	M1	...	MFT1						
						Tropical/subtropical lowland rainforests	Tropical/subtropical dry forests and scrubs	Tropical/subtropical montane rainforests	Tropical heath forests	Boreal and temperate high montane forests and woodlands	Deciduous temperate forests	...	Temperate pyric sclerophyll forests and woodlands	...	...	...	Derived semi-natural pastures and old fields	Permanent upland streams	...	Intermittently closed and open lakes and lagoons	Seagrass meadows	...	Coastal saltmarshes and reedbeds						
						T1.1	T1.2	T1.3	T1.4	T2.1	T2.2	...	T2.6	...	...	...	T7.5	F1.1	...	FM1.3	M1.1	...	MFT1.3						
Ecosystem types (based on the ecosystem functional group EFG level 3 of IUCN GET) Opening extent						Terrestrial				T1 Tropical-subtropical forests				T2 Temperate-boreal forests and woodlands				...	Freshwater				Marine						
						T1 Tropical-subtropical forests				T2 Temperate-boreal forests and woodlands				T2.6				T7.5				F1.1				FM1.3			
						Tropical-subtropical lowland rainforests				Tropical-subtropical dry forests and scrubs				Tropical-subtropical montane rainforests				Tropical heath forests				Boreal and temperate high montane forests and woodlands				Deciduous temperate forests			
						Tropical-subtropical lowland rainforests				Tropical-subtropical dry forests and scrubs				Tropical-subtropical montane rainforests				Tropical heath forests				Boreal and temperate high montane forests and woodlands				Deciduous temperate forests			
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Selected ecosystem types (based on the EFG level 3 of IUCN GET) Opening extent						Terrestrial				T1 Tropical-subtropical forests				T2 Temperate-boreal forests and woodlands				...	Freshwater				Marine						
						T1 Tropical-subtropical forests				T2 Temperate-boreal forests and woodlands				T2.6				T7.5				F1.1				FM1.3			
						Tropical-subtropical lowland rainforests				Tropical-subtropical dry forests and scrubs				Tropical-subtropical montane rainforests				Tropical heath forests				Boreal and temperate high montane forests and woodlands				Deciduous temperate forests			
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Closing																													



# Example from the EU: Ecosystem extent account



Source: EEA, 2015a, *European ecosystem assessment: Concept, data, and implementation*, EEA Technical Report No 6/2015, European Environment Agency



# Ecosystem extent account for the Netherlands

	Extent (km <sup>2</sup> )	Increase (km <sup>2</sup> ) 2013- 2015	Decrease (km <sup>2</sup> ) 2013- 2015	Net change (km <sup>2</sup> ) 2013-2015	Extent (km <sup>2</sup> ) 2015	Increase (km <sup>2</sup> ) 2015- 2018	Decrease (km <sup>2</sup> ) 2015- 2018	Net change (km <sup>2</sup> ) 2015-2018	Extent (km <sup>2</sup> ) 2018
Total	41.542	3.357	3.357	0	41.542	3.629	3.629	0	41.542
Forest	3.475	74	106	-32	3.443	84	106	-22	3.422
Open nature	1.892	230	246	-17	1.876	240	235	5	1.881
Wetlands	612	42	29	13	625	44	38	6	631
Dunes, beach	497	18	20	-3	494	32	27	5	499
Water	7.861	64	47	17	7.879	86	45	41	7.920
Cropland	8.719	938	1.271	-332	8.386	1.238	1.208	30	8.416
Grassland	9.697	1.467	1.124	343	10.040	1.347	1.471	-123	9.917
Horticulture	203	12	19	-7	196	15	13	2	198
Other agr.	61	27	44	-18	43	34	31	2	46
Build up	7.636	382	373	9	7.645	399	370	29	7.674
Public green	888	104	78	27	915	111	86	25	940



# Ecosystem extent account for South Africa

## Natural or semi-natural biomes

## Intensively modified biomes

Biomes	Albany Thicket	Desert	Forest	Fynbos	Grassland	IOCB	Nama-Karoo	Savanna	Succulent Karoo	Azonal vegetation	Cultivated*	Built-up*	Water-bodies**	TOTAL
<b>Historical extent</b>	3 531 231	626 207	462 518	8 165 366	33 090 325	1 171 284	24 936 548	39 418 522	7 821 579	2 742 873	-	-	-	121 966 453
<b>Additions to extent</b>	0	0	0	0	0	0	0	0	0	0	16 156 026	3 003 883	2 096 528	21 256 437
<b>Reductions in extent</b>	230 091	8 237	70 673	2 253 375	11 330 606	619 656	420 995	5 396 119	251 373	675 312	-	-	-	21 256 437
<b>Net change in extent</b>	(230 091)	(8 237)	(70 673)	(2 253 375)	(11 330 606)	(619 656)	(420 995)	(5 396 119)	(251 373)	(675 312)	-	-	-	
<i>Net change as % of historical</i>	-6,5%	-1,3%	-15,3%	-27,6%	-34,2%	-52,9%	-1,7%	-13,7%	-3,2%	-24,6%	-	-	-	
<b>Closing extent 1990</b>	3 301 140	617 970	391 845	5 911 991	21 759 719	551 628	24 515 553	34 022 403	7 570 206	2 067 561	16 156 026	3 003 883	2 096 528	121 966 453
<b>Opening extent 1990</b>	3 301 140	617 970	391 845	5 911 991	21 759 719	551 628	24 515 553	34 022 403	7 570 206	2 067 561	16 156 026	3 003 883	2 096 528	121 966 453
<b>Additions to extent</b>	44 432	1 142	24 900	241 184	1 444 446	75 114	146 910	1 160 055	38 422	189 954	1 991 959	597 238	288 754	6 244 510
<b>Reductions in extent</b>	36 008	1 260	7 689	196 035	1 180 183	63 783	78 038	885 303	33 631	58 021	2 339 226	400 503	964 606	6 244 286
<b>Net change in extent</b>	8 424	(118)	17 211	45 149	264 263	11 331	68 872	274 752	4 791	131 933	(347 267)	196 735	(675 852)	
<i>Net change as % of opening</i>	0,3%	0,0%	4,4%	0,8%	1,2%	2,1%	0,3%	0,8%	0,1%	6,4%	-2,1%	6,5%	-32,2%	
<b>Net change in relation to historical extent</b>	(221 667)	(8 355)	(53 462)	(2 208 226)	(11 066 343)	(608 325)	(352 123)	(5 121 367)	(246 582)	(543 379)	-	-	-	
<i>Net change as % of historical</i>	-6,3%	-1,3%	-11,6%	-27,0%	-33,4%	-51,9%	-1,4%	-13,0%	-3,2%	-19,8%	-	-	-	
<b>Closing extent 2014</b>	3 309 564	617 852	409 056	5 957 140	22 023 982	562 959	24 584 425	34 297 155	7 574 997	2 199 270	15 808 759	3 200 618	1 420 676	121 966 453

\* Cultivated areas, built-up areas and waterbodies are treated as biomes for the purpose of the ecosystem extent account table. There is no reliable spatial information on the historical extent of waterbodies, subsistence cultivation or habitation.

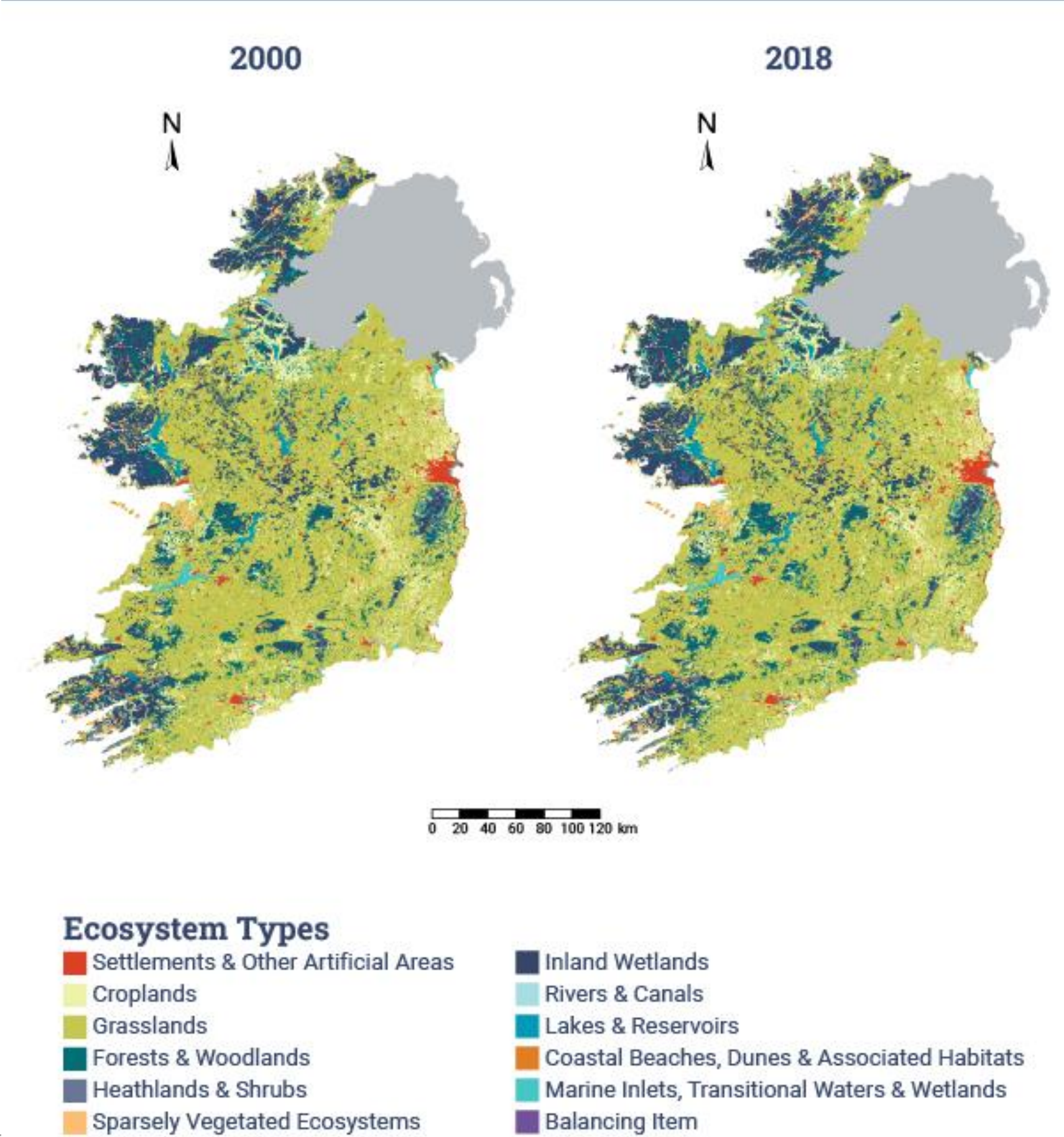
\*\* The large net decrease in the extent of waterbodies reflects primarily that 1990 was a much wetter year than 2014. Waterbodies include both natural and artificial water bodies (such as dams).

# Ecosystem extent account for Ireland



Map  
2.2

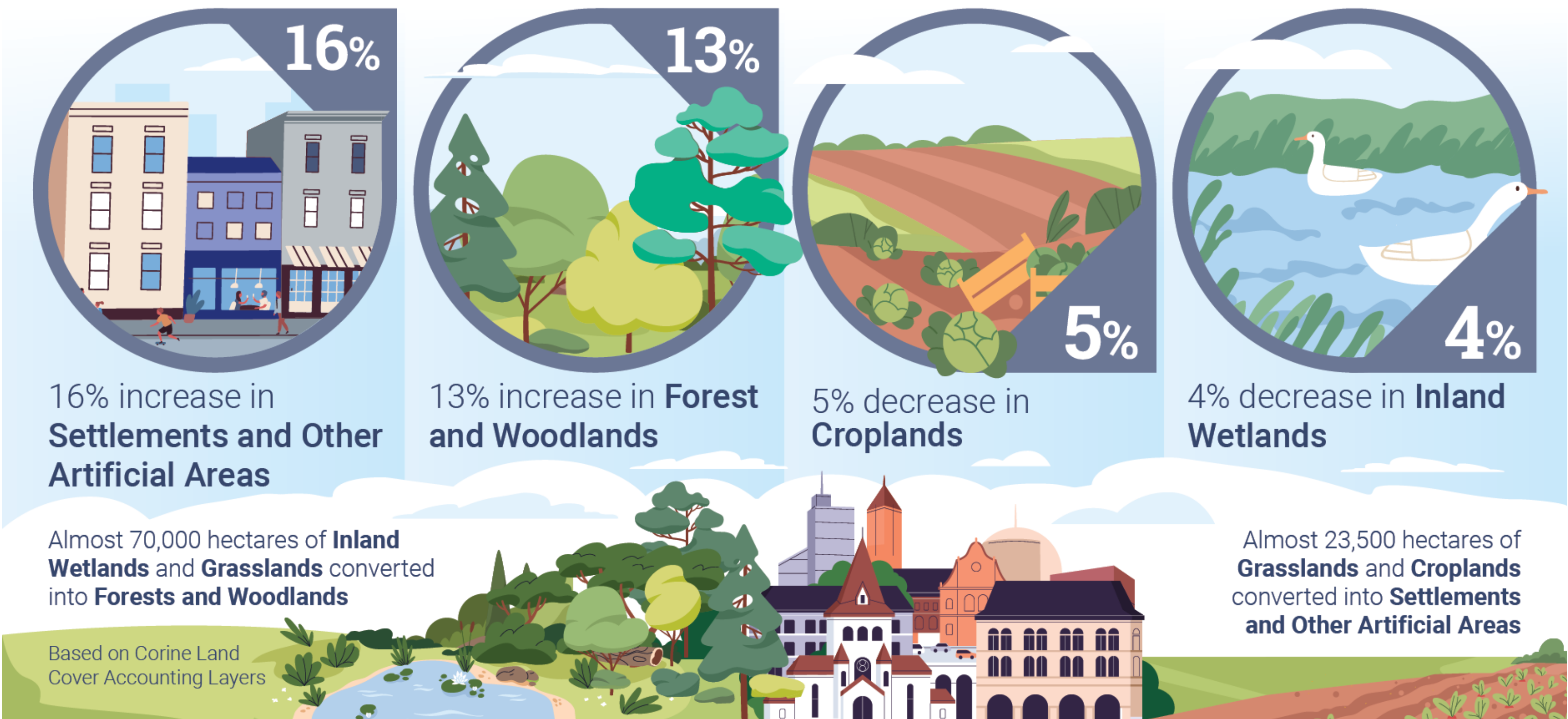
Ireland's transitional and terrestrial ecosystem types in 2000 and 2018





# Ecosystem extent account for Ireland

## Ecosystem Extent Accounts 2000–2018



# Ecosystem extent account for Australia

Extent of terrestrial ecosystems over time, by biome

Graph

Table

Download

Biome	2010-11 (million ha)	2015-16 (million ha)	2020-21 (million ha)
Deserts and semi-deserts	384.46	384.18	383.82
Savannas and grasslands	177.45	176.54	176.53
Intensive land-use	113.21	115.47	116.06
Palustrine wetlands	35.50	35.12	35.04
Temperate-boreal forests and woodlands	24.86	24.54	24.52
Lakes	16.35	16.13	16.11
Shrublands and shrubby woodlands	7.46	7.43	7.38
Unclassified	5.16	5.15	5.15
Semi-confined transitional waters	3.80	3.80	3.80
Tropical-subtropical forests	3.05	3.00	2.93
Brackish tidal	0.00	0.00	1.64
Artificial wetlands	1.21	1.20	1.20
Shorelines	0.83	0.82	0.83
Polar/alpine (cryogenic)	0.33	0.33	0.33
Supralittoral coastal	0.22	0.21	0.21

Source: Australia Bureau of Statistics  
(<https://www.abs.gov.au/statistics/environment/environmental-accounts/national-ecosystem-accounts-experimental-estimates/latest-release#terrestrial-realm>)



# THANK YOU

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