System of Environmental Economic Accounting

# Introduction to land, ecosystem extent and forest accounts

Regional Training Workshop on SEEA Asset Accounts for Sustainable Development

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United Nations

# Why these accounts?

- Answers wide range of policy questions→ from urban planning, to conservation and beyond
- Spatial basis for policies → informs land and resource management, conservation policies, land ownership, resource management
- Forests cover one-third of the Earth's land mass, serving as critical pillars for both environmental health and human well-being
- They can inform multiple (inter)national initiatives, for example:
  - > Sustainable Development Goals: Forest (and land) accounts inform indicator 15.3.1: Proportion of land that is degraded over total land area
  - > Global Biodiversity Framework: Extent accounts inform indicator A.2 on extent of natural ecosystems

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# Land accounts

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# Accounting for land

- **Land** is a "*unique environmental asset that delineates the space in which economic activities and environmental processes take place and within which environmental assets and economic assets are located*"
- Physical asset accounts for land
  - > Land cover
  - > Land use
  - > Land ownership
- Monetary asset account for land
  - > Focus on physical asset accounts

# Land cover

- ***Land cover*** *is the observed physical and biological cover of the Earth's surface and includes natural vegetation and abiotic (non-living) surfaces*
- Current land cover is a function of natural changes in the environment and of previous and current land use
- Interim land cover classification based on FAO Land Cover Classification System (LCCS)
- Often misinterpreted or combined with land use

| | Category |
|---|---|
| 1 | Artificial surfaces (including urban and associated 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 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 |

# Land use

- Land use
  - > *reflects both (i) the activities undertaken and (ii) the institutional arrangements put in place; for a given area for the purposes of economic production, or the maintenance and restoration of environmental functions*
- Accounts include land in use (human intervention) and land not in use
- Categories not defined on economic activity, but rather general purpose and role of the user of the area
  - > Often aligns with scope of economic activity, but not always
  - > If multiple uses, go with primary/dominant use

| | |
|---|---|
| **1** | **Land** |
| 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** | **Inland waters** |
| 2.1 | Inland waters used for aquaculture or holding facilities |
| 2.2 | Inland waters used for maintenance and restoration of environmental |
| 2.3 | Other uses of inland waters n.e.c. |
| 2.4 | Inland waters not in use |

# Land cover versus land use

- **Land use focuses on social and economic function while land cover focuses on physical and biological surface features**
- Q: Example where land use and land cover may not align?

  - Grazing land
    - > Land cover: grasslands
    - > Land use: agriculture

  - Tree-covered park in the middle of a city
    - > Land cover: tree-covered area
    - > Land use: built-up and related area

# Physical asset account for land cover

- Managed→ due to human activity
- Natural→ resulting from natural processes
- Reappraisals→ reflect changes due to use of updated information (e.g. new satellite imagery)

- Monetary asset accounts for land are also possible
  - > Valuation of land?

| | 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 | Coastal water and inter-tidal areas |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Opening stock of resources** | 12 292.5 | 445 431.0 | 106 180.5 | 338 514.0 | 214.5 | 66 475.5 | 73.5 | 1 966.5 | | 12 949.5 | 19 351.5 |
| **Additions to stock** | | | | | | | | | | | |
| Managed expansion | 183.0 | 9 357.0 | | | | | | | | | |
| Natural expansion | | | 64.5 | | | | | | | | 1.5 |
| Upward reappraisals | | | 4.5 | | | | | | | | |
| *Total additions to stock* | 183.0 | 9 357.0 | 69.0 | | | | | | | | 1.5 |
| **Reductions in stock** | | | | | | | | | | | |
| Managed regression | | 147.0 | 4 704.0 | 3 118.5 | 9.0 | 1 560.0 | 1.5 | | | | |
| Natural regression | | | | | 1.5 | 64.5 | | | | | |
| Downward reappraisals | | | | | | 4.5 | | | | | |
| *Total reductions in stock* | | 147.0 | 4 704.0 | 3 118.5 | 10.5 | 1 629.0 | 1.5 | | | | |
| **Closing stock** | 12 475.5 | 454 641.0 | 101 545.5 | 335 395.5 | 204.0 | 64 846.5 | 72.0 | 1 966.5 | | 12 949.5 | 19 353.0 |

# Land cover change matrix

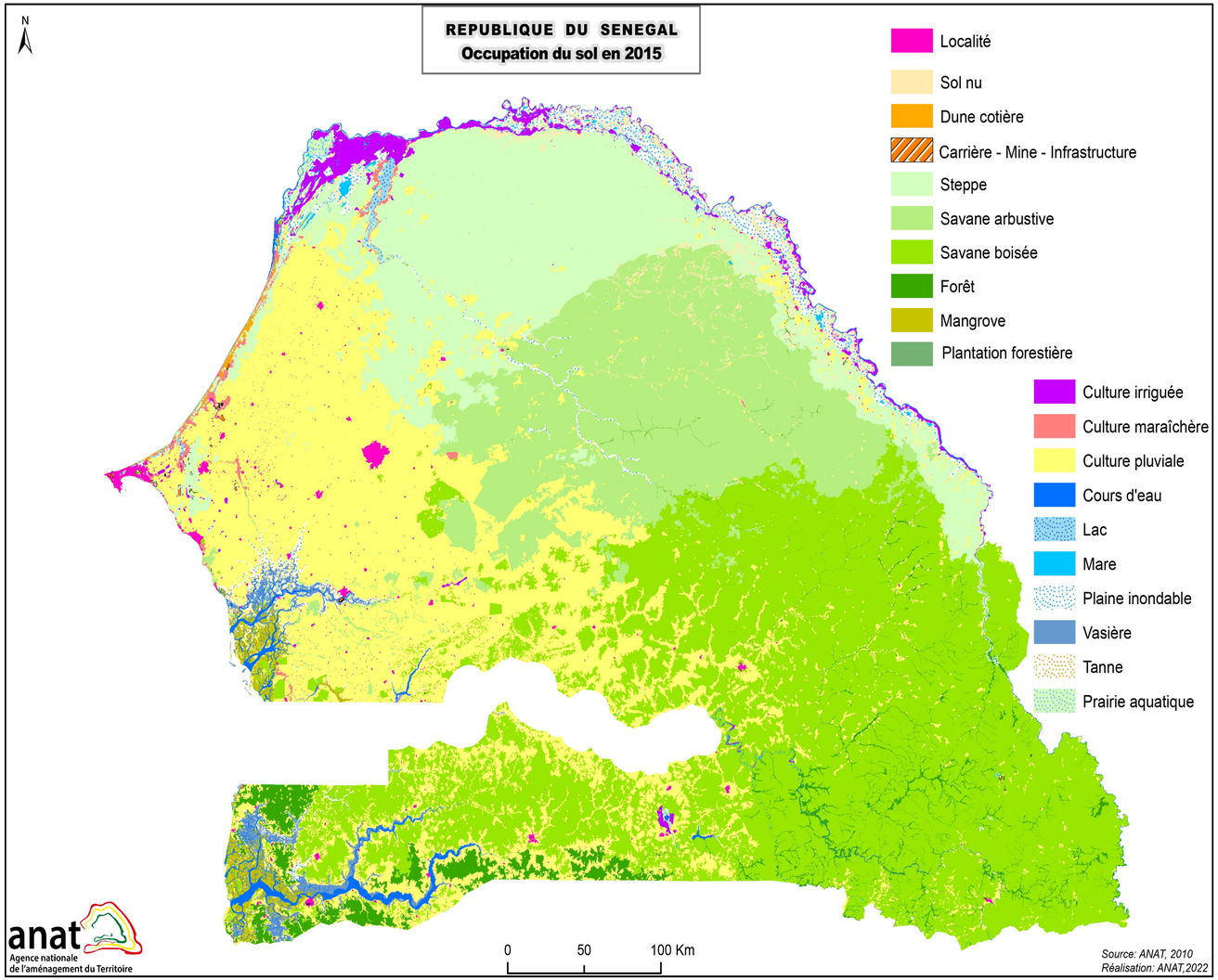
Land cover change matrix (hectares)

| Opening land cover | Closing land cover: Artificial surfaces (urban) | Herbaceous crops | Grassland | Inland water bodies | Shrubs..regularly flooded (v | Opening stock |
|---|---|---|---|---|---|---|
| Artificial surfaces (urban) | 20 | 0 | 0 | 0 | 0 | **20** |
| Herbaceous crops | 3 | 142 | 8 | 0 | 0 | **153** |
| Tree-covered areas | 0 | 2 | 88 | 0 | 0 | **90** |
| Inland water bodies | 0 | 0 | 0 | 19 | 0 | **19** |
| Shrubs..regularly flooded (wetlan | 0 | 1 | 0 | 0 | 5 | **6** |
| **Closing stock** | **23** | **145** | **96** | **19** | **5** | **288** |

# Example: Senegal

| N° | Classes retenues | Thèmes |
|---|---|---|
| 1 | Localité | SURFACE ARTIFICIALISEE |
| 2 | Carrière - Mine - Infrastructure | |
| 3 | Dune côtière | ZONE DENUDEE |
| 4 | Sol nu | |
| 5 | Culture pluviale | SURFACE CULTIVEE |
| 6 | Culture irriguée | |
| 7 | Culture maraîchère | |
| 8 | Forêt | SURFACE BOISEE |
| 9 | Savane | |
| 10 | Savane arbustive | |
| 11 | Steppe | |
| 12 | Mangrove | |
| 13 | Plantation forestière | |
| 14 | Cours d'eau | REGION HYDRIQUE |
| 15 | Lac | |
| 16 | Mare | |
| 17 | Plaine inondable | |
| 18 | Tanne | |
| 19 | Vasière | |
| 20 | Prairie marécageuse | |

## Carte de l'occupation du sol en 2015



## Superficie en km² des cinq thématiques

| Classes | Superficie 2010 | Superficie 2015 | Part 2010 | Part 2015 | Evolution 2010-2015 |
|---|---|---|---|---|---|
| **SURFACE BOISEE** | 137 313 | 129 569 | 69,8% | 65,8% | **-5,6%** |
| **SURFACE CULTIVEE** | 48 022 | 54 518 | 24,4% | 27,7% | **13,5%** |
| **REGION HYDRIQUE** | 7 424 | 8 643 | 3,8% | 4,4% | **16,4%** |
| **ZONE DENUDEE** | 2 890 | 2 680 | 1,5% | 1,4% | **-7,2%** |
| **SURFACE ARTIFICIALISEE** | 1 087 | 1 325 | 0,6% | 0,7% | **21,9%** |
| **Erreur statistique** | 32 | 32 | 0,0% | 0,0% | **0,0%** |
| **Total** | **196 767,5** | **196 767,5** | **100%** | **100%** | |

*Annexes-Tableau 4: Compte physique de l'occupation du sol 2010-2015, résolution 50mt*

| | Sol nu | Dune côtière | Savane | Carrière[1] | Plaine inondable | Tanne/ Vasière | Culture maraîchère | Mangrove | Culture pluviale | Forêt | Savane arbustive | Plantation forestière | Culture irriguée | Mare | Steppe | Lac | Localité | Prairie aquatique | Cours d'eau | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Superficie 2010 | 2 786,7 | 102,9 | 66 769,3 | 71,7 | 1 790,2 | 2 268,4 | 289,4 | 1 543,7 | 46 421,6 | 7 507,8 | 31 160,8 | 50,4 | 1 311,0 | 628,8 | 30 280,6 | 276,8 | 1 015,0 | 519,2 | 1 940,9 | 196 767,5 |
| Expansions | 734,1 | 27,2 | 3 338,4 | 27,0 | 1 418,8 | 319,9 | 452,6 | 38,1 | 8 345,8 | 34,2 | 209,3 | 0,1 | 1 052,9 | 32,0 | 797,2 | 8,4 | 230,4 | 48,9 | 2,9 | 20 219,32 |
| Régressions | 962,3 | 8,3 | 4 783,7 | 14,8 | 246,2 | 65,8 | 31,1 | 2,9 | 3 232,0 | 1 566,7 | 2 279,7 | 5,5 | 92,4 | 155,4 | 3 522,2 | 12,5 | 4,6 | 122,7 | 9,5 | 20 219,32 |
| Changement net | -228,2 | 18,9 | -1 445,3 | 12,3 | 1 172,6 | 254,1 | 421,5 | 35,2 | 5 113,9 | -1 532,5 | -2 070,5 | -5,3 | 960,5 | -123,4 | -2 725,1 | -4,1 | 225,8 | -73,8 | -6,6 | 0 |
| Superficie 2015 | 2 558,5 | 121,8 | 6 5324,0 | 84,0 | 2 962,9 | 2 522,5 | 710,9 | 1 578,9 | 51 535,5 | 5975,3 | 29 090,4 | 45,1 | 2 271,5 | 505,4 | 27 555,6 | 272,7 | 1 240,8 | 445,4 | 1 934,3 | 196 767,5 |

REDUCTION

ADDITION

# Matrice de changement 2010- 2015

| | Sol nu | Dune côtière | Savane | Carrière | Plaine inondable | Tanne /Vasière | Culture maraîchère | Mangrove | Culture pluviale | Forêt | Savane arbustive | Plantation forestière | Culture irriguée | Mare | Steppe | Lac | Localité | Prairie aquatique | Cours d'eau | Erreur statistique | Total 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sol nu** | **1 824,38** | - | 6,42 | - | 523,98 | 1,24 | 6,05 | - | 20,34 | 1,18 | 32,31 | 0,04 | 333,55 | 5,29 | 10,11 | 0,09 | 3,24 | 18,47 | - | - | **2 786,69** |
| **Dune cotière** | 0,49 | **94,62** | - | 0,67 | 0,03 | - | 5,90 | - | 0,03 | - | - | - | - | - | 0,37 | - | 0,82 | - | - | - | **102,93** |
| **Savane** | 42,54 | - | **61 985,62** | 8,46 | 43,33 | 15,52 | 10,65 | 0,32 | **4 565,24** | 9,63 | 30,15 | - | 14,32 | 1,81 | 32,46 | - | 7,49 | 1,73 | - | - | **66 769,27** |
| **Carrière** | - | - | 0,09 | **56,94** | 0,91 | - | 10,57 | - | 0,48 | - | - | - | - | 0,06 | 1,34 | - | 1,30 | - | - | - | **71,69** |
| **Plaine inondable** | 64,99 | - | 2,46 | - | **1 544,06** | 11,12 | 8,33 | - | 3,88 | - | 0,04 | - | 128,51 | 8,12 | 13,16 | 3,39 | 0,42 | 1,01 | 0,72 | - | **1 790,21** |
| **Tanne/Vasière** | 6,51 | - | 0,17 | 0,11 | 1,01 | **2 202,60** | 0,09 | 37,58 | 14,39 | 0,07 | 0,51 | - | 0,26 | 0,60 | 0,01 | 2,27 | 1,12 | 0,36 | 0,75 | - | **2 268,41** |
| **Culture maraîchère** | 0,42 | 0,91 | 0,35 | 1,06 | 4,16 | - | **258,30** | - | 8,58 | - | - | 0,08 | 1,78 | 0,06 | 10,34 | 0,03 | 3,30 | - | - | - | **289,37** |
| **Mangrove** | 0,14 | - | 0,19 | - | 0,58 | 1,14 | - | **1 540,86** | 0,02 | - | - | - | 0,01 | - | - | - | - | 0,58 | 0,20 | - | **1 543,72** |
| **Culture pluviale** | 6,18 | 0,09 | 1 704,82 | 6,22 | 197,97 | 276,82 | 140,20 | 0,02 | **43 189,63** | 20,49 | 145,61 | 0,01 | 43,63 | 2,98 | 516,21 | 0,13 | 168,20 | 1,92 | 0,46 | - | **46 421,59** |
| **Forêt** | 0,35 | - | 584,91 | - | - | 0,68 | 1,55 | 0,08 | **975,07** | **5 941,05** | 0,01 | - | - | 0,05 | 0,05 | - | 3,98 | - | 0,01 | - | **7 507,79** |
| **Savane arbustive** | 17,86 | - | 1 013,73 | 0,14 | 6,24 | 3,85 | 21,73 | - | 1 009,89 | - | **28 881,09** | - | 0,94 | 0,32 | 204,17 | - | 0,85 | - | - | - | **31 160,81** |
| **Plantation forestière** | 2,51 | 0,10 | - | - | 0,21 | - | 1,99 | - | - | - | - | **44,94** | - | - | 0,63 | - | 0,02 | 0,01 | - | - | **50,41** |
| **Culture irriguée** | 5,58 | - | 2,40 | - | 14,29 | - | 50,39 | - | 5,44 | - | - | - | **1 218,63** | 0,46 | 5,05 | - | 0,52 | 8,22 | - | - | **1 310,98** |
| **Mare** | 4,52 | - | 20,76 | - | 112,33 | 0,07 | 0,20 | - | 0,37 | - | 0,06 | - | 12,06 | **473,38** | 1,26 | 2,27 | 0,01 | 1,45 | - | - | **628,74** |
| **Steppe** | **580,72** | 26,10 | 0,18 | 10,37 | 447,86 | 3,51 | 185,66 | - | **1 736,30** | 2,30 | 0,57 | - | 477,92 | 4,09 | **26 758,41** | 0,15 | 36,74 | 9,09 | 0,64 | - | **30 280,61** |
| **Lac** | 0,03 | - | - | - | 5,96 | - | 0,28 | - | 0,03 | - | - | - | - | 0,14 | - | **264,32** | 0,11 | 5,90 | - | - | **276,77** |
| **Localité** | 0,35 | - | 0,16 | - | 0,06 | 0,10 | 0,06 | - | 1,85 | - | - | - | 0,23 | 0,01 | 1,66 | - | **1 010,39** | 0,05 | - | - | **1 014,92** |
| **Prairie aquatique** | 0,60 | - | 0,48 | - | 58,69 | 0,20 | 8,89 | 0,04 | 3,57 | - | - | - | 39,61 | 8,00 | 0,27 | 0,01 | 2,24 | **396,49** | 0,07 | - | **519,16** |
| **Cours d'eau** | 0,31 | - | 1,23 | - | 1,19 | 5,65 | - | 0,01 | 0,32 | 0,53 | - | - | 0,05 | - | 0,05 | - | - | 0,09 | **1 931,45** | - | **1 940,88** |
| **Erreur statistique** | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | **32,35** | **32,35** |
| **Total 2015** | **2 558,48** | **121,82** | **65 323,97** | **83,97** | **2 962,86** | **2 522,50** | **710,84** | **1 578,91** | **51 535,43** | **5 975,25** | **29 090,35** | **45,07** | **2 271,50** | **505,37** | **27 555,55** | **272,66** | **1 240,75** | **445,37** | **1 934,30** | **32,35** | **196 767,30** |

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# Ecosystem extent accounts

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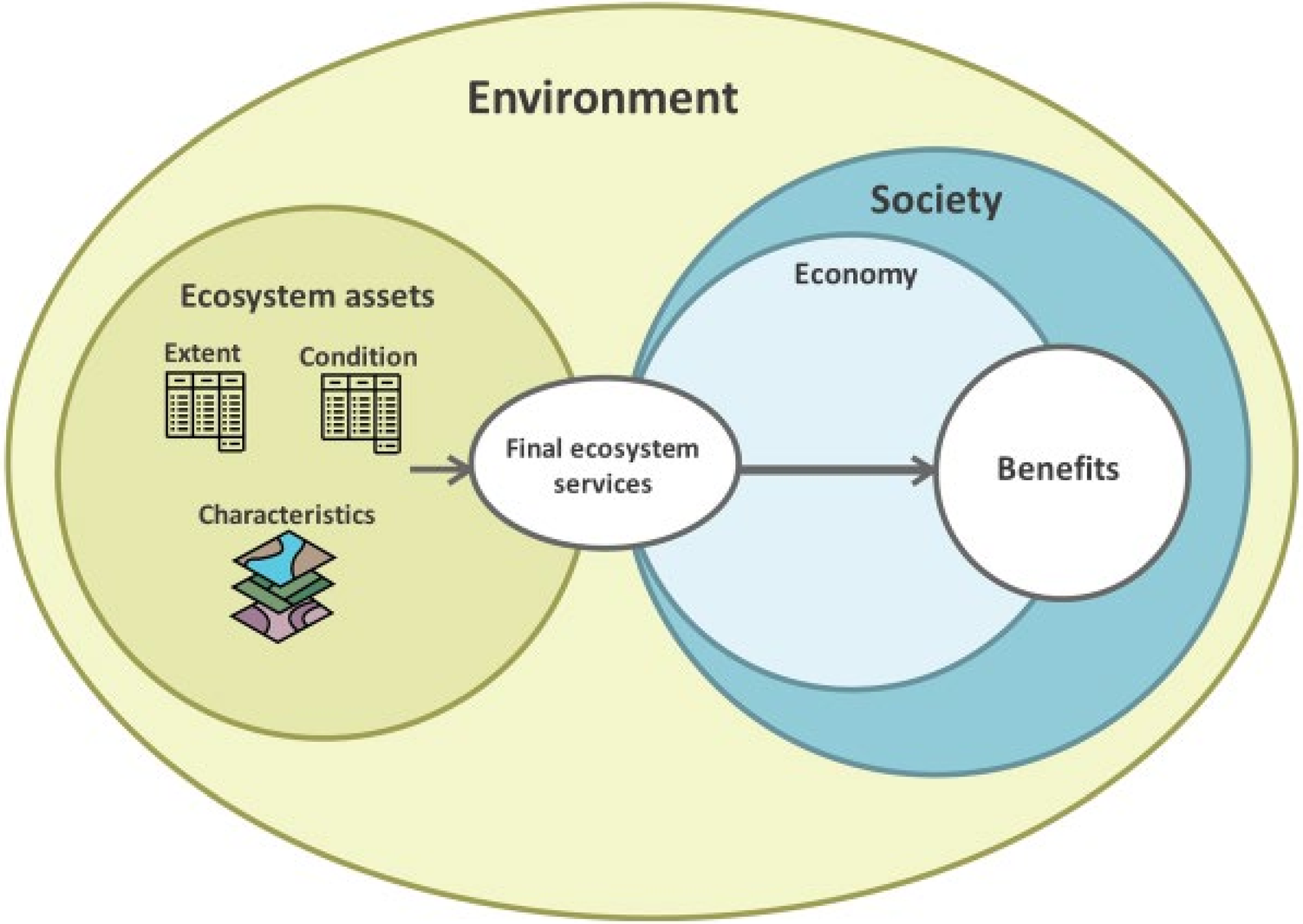
# SEEA EA: Conceptual Framework

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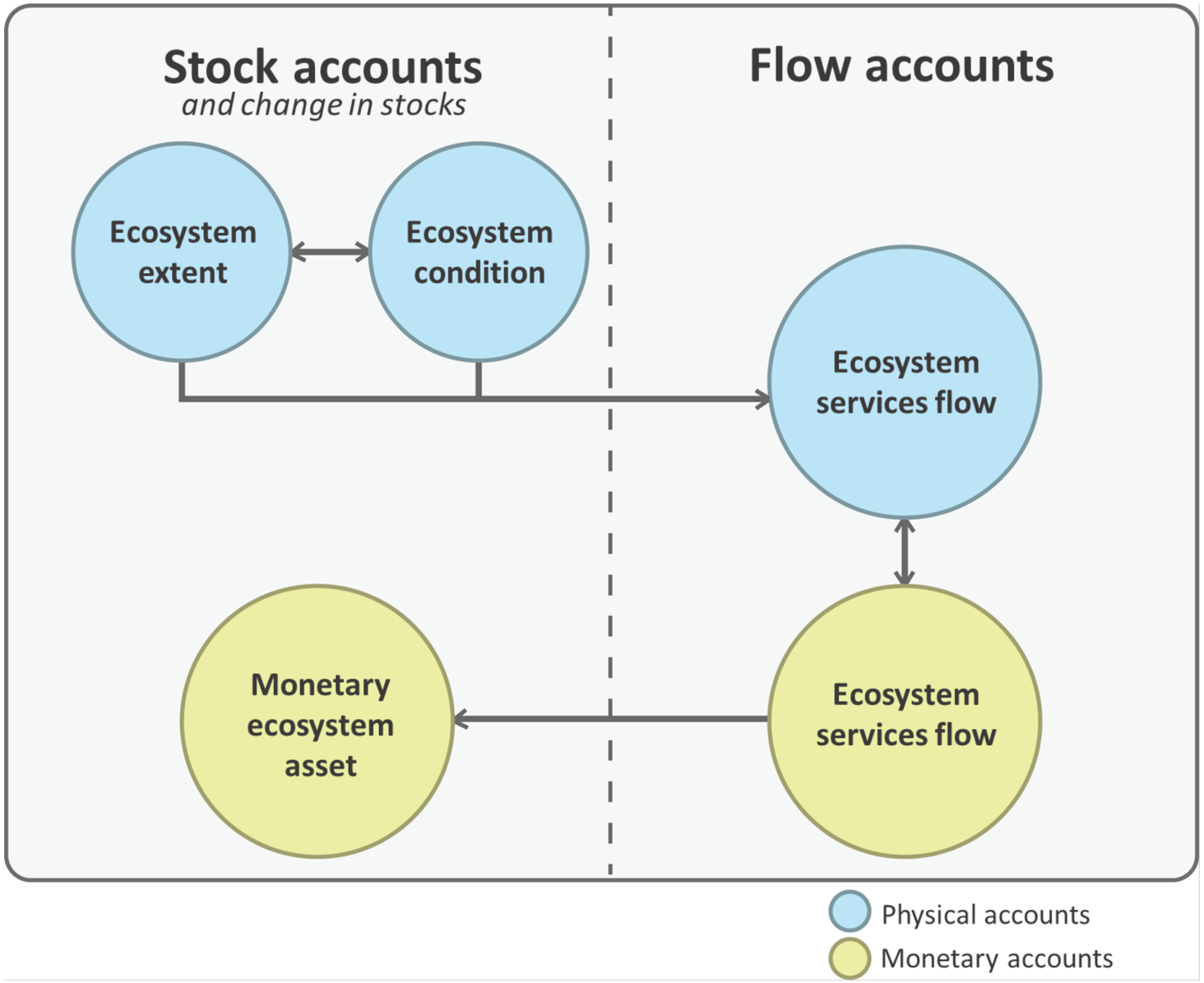
# Ecosystem accounts – core accounts



# 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, $km^2$, etc.

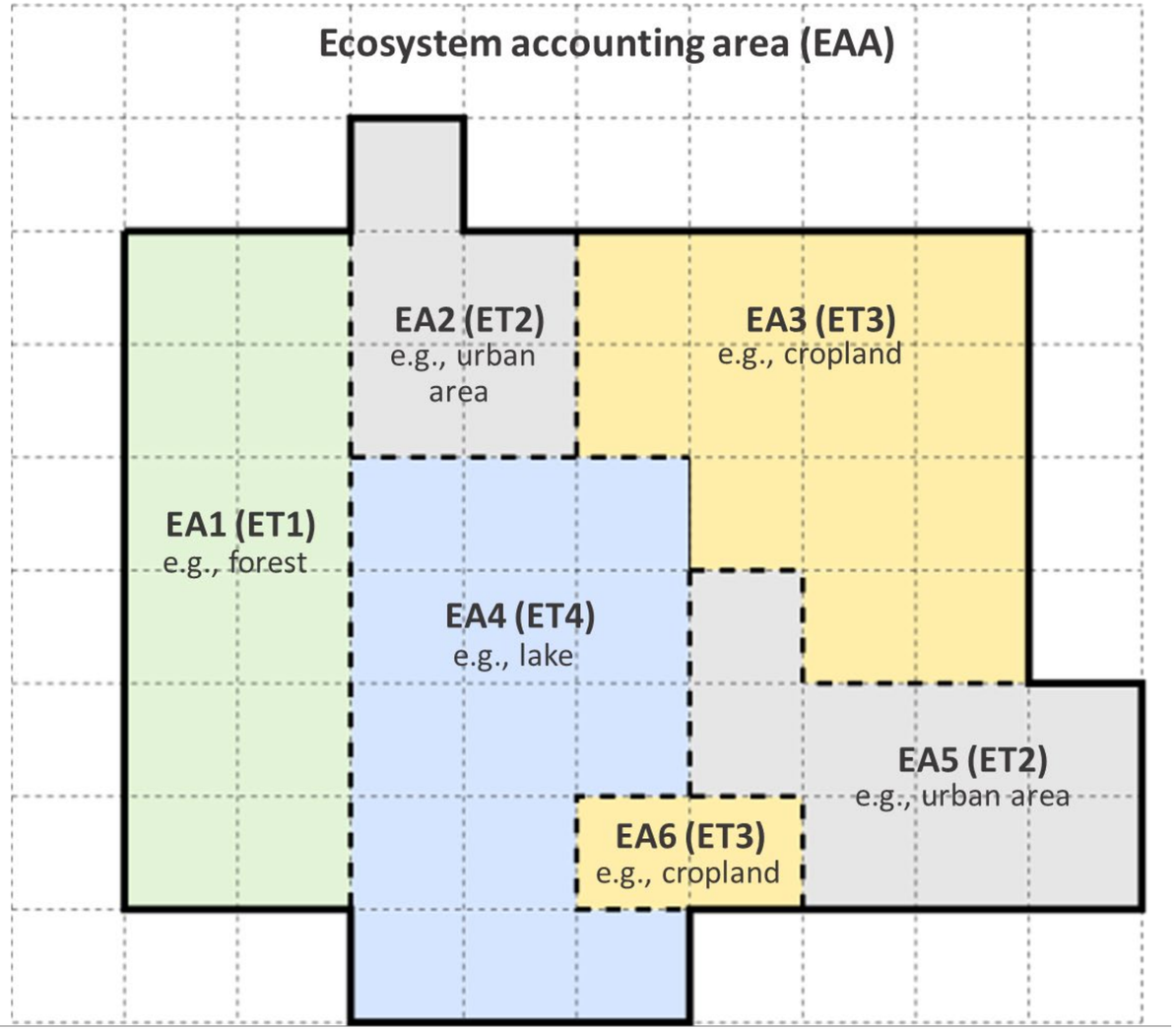
- Why?
  - Input for land management, conservation policies
  - Supports the derivation of coherent indicators of deforestation, desertification, agricultural conversion, urbanization, ecosystem diversity etc.
  - Spatial foundation for other accounts → basis for allocating macro data to spatial units

# Spatial units in SEEA EA

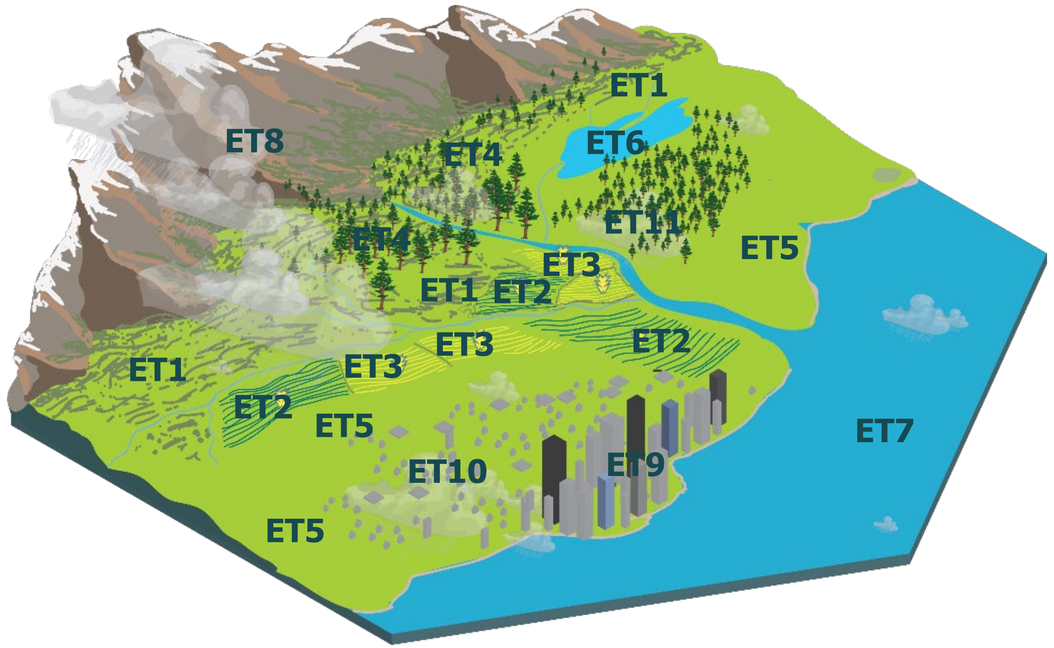
Types of spatial units:

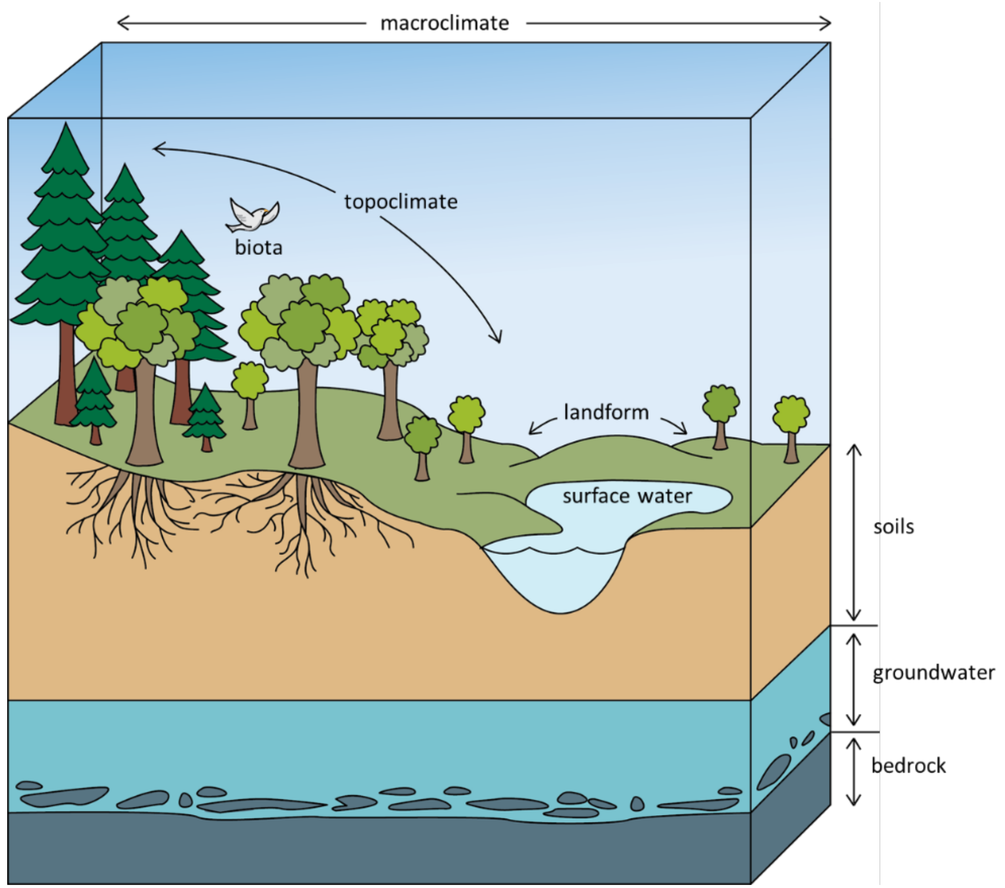
- **Ecosystem assets (EAs)** are contiguous spaces of a specific ecosystem type characterized by a distinct set of biotic and abiotic components and their interactions
- **Ecosystem assets** are classified by **ecosystem type (ET)**
- **Ecosystem accounting area (EAA)** is the geographical territory 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 classifications, and recommended it be included in the international family of classifications

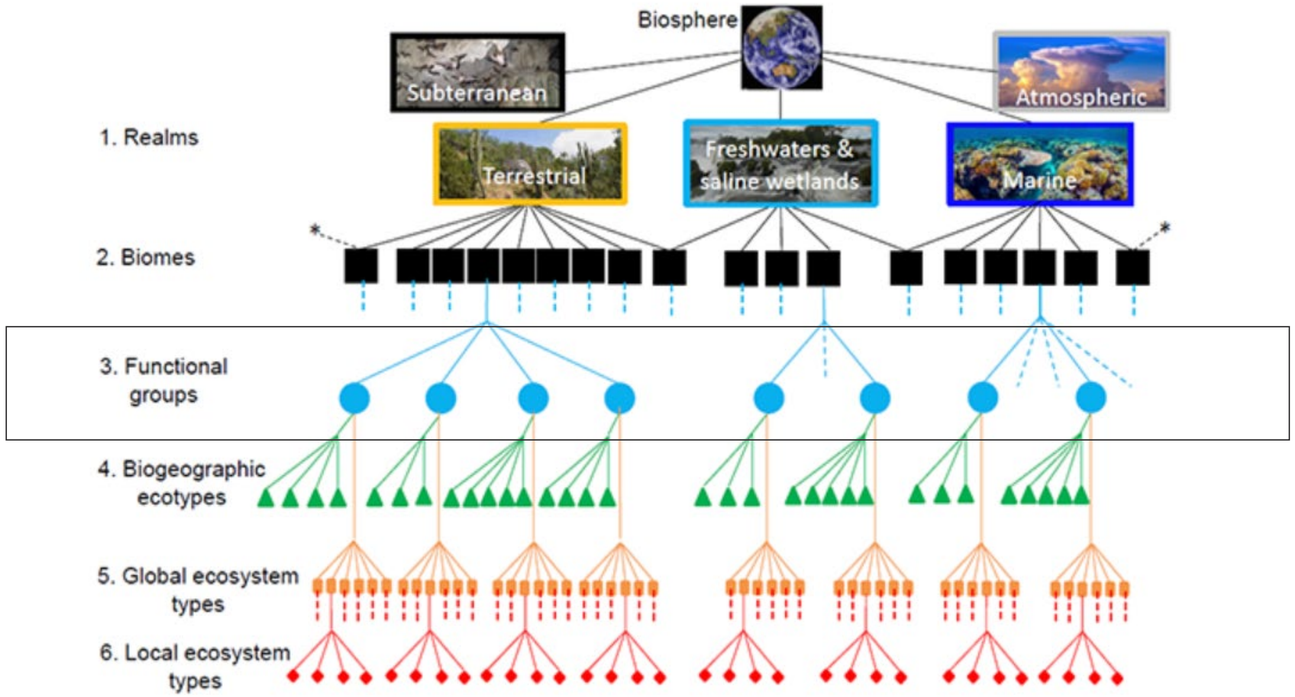


# Spatial units in SEEA EA



# IUCN Global Ecosystem Typology




5 Realms (level 1)

25 Biomes (level 2)

**110 Ecosystem functional groups** (level 3)

National ecosystem classifications typically at level 5/6

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

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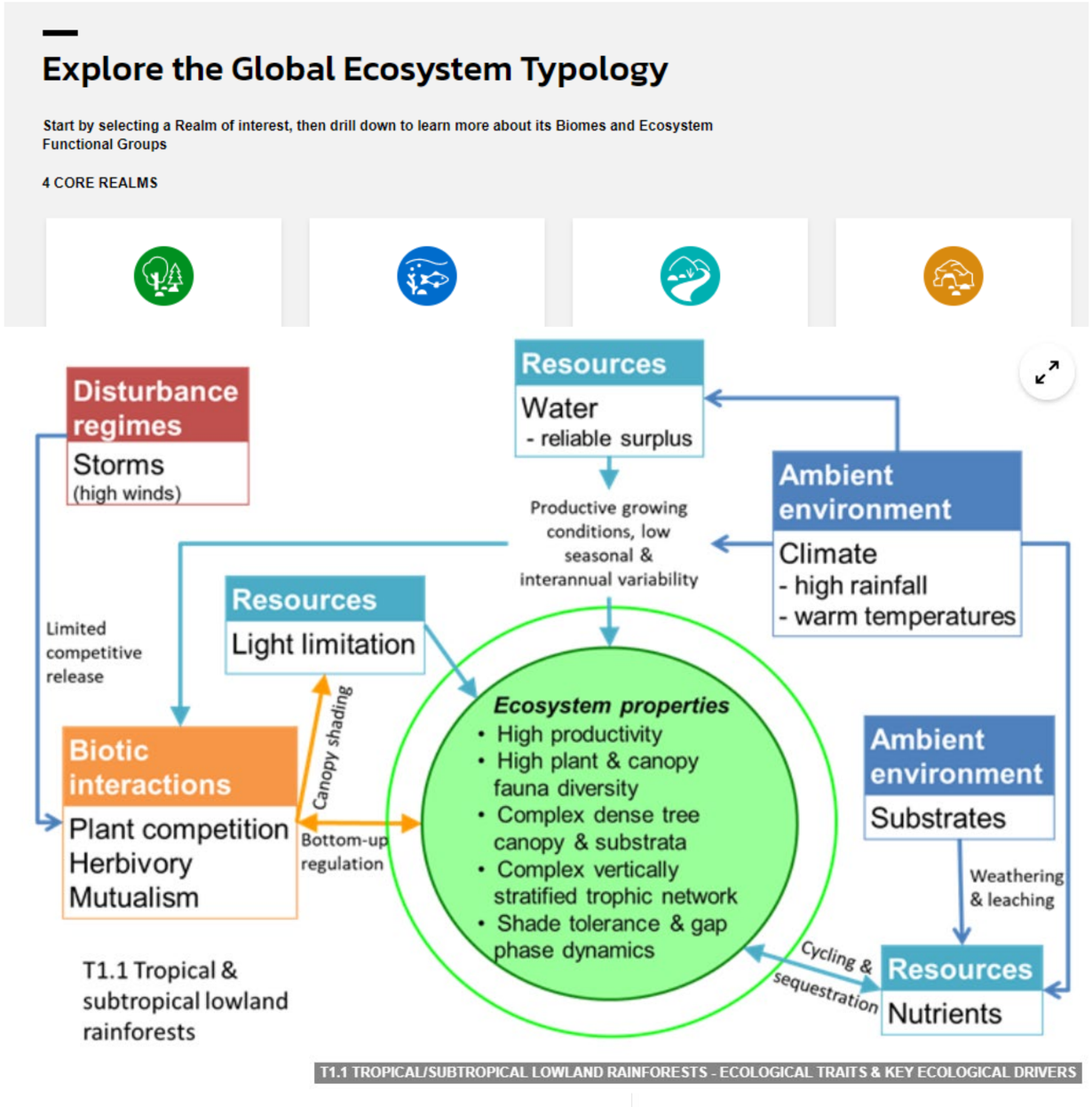
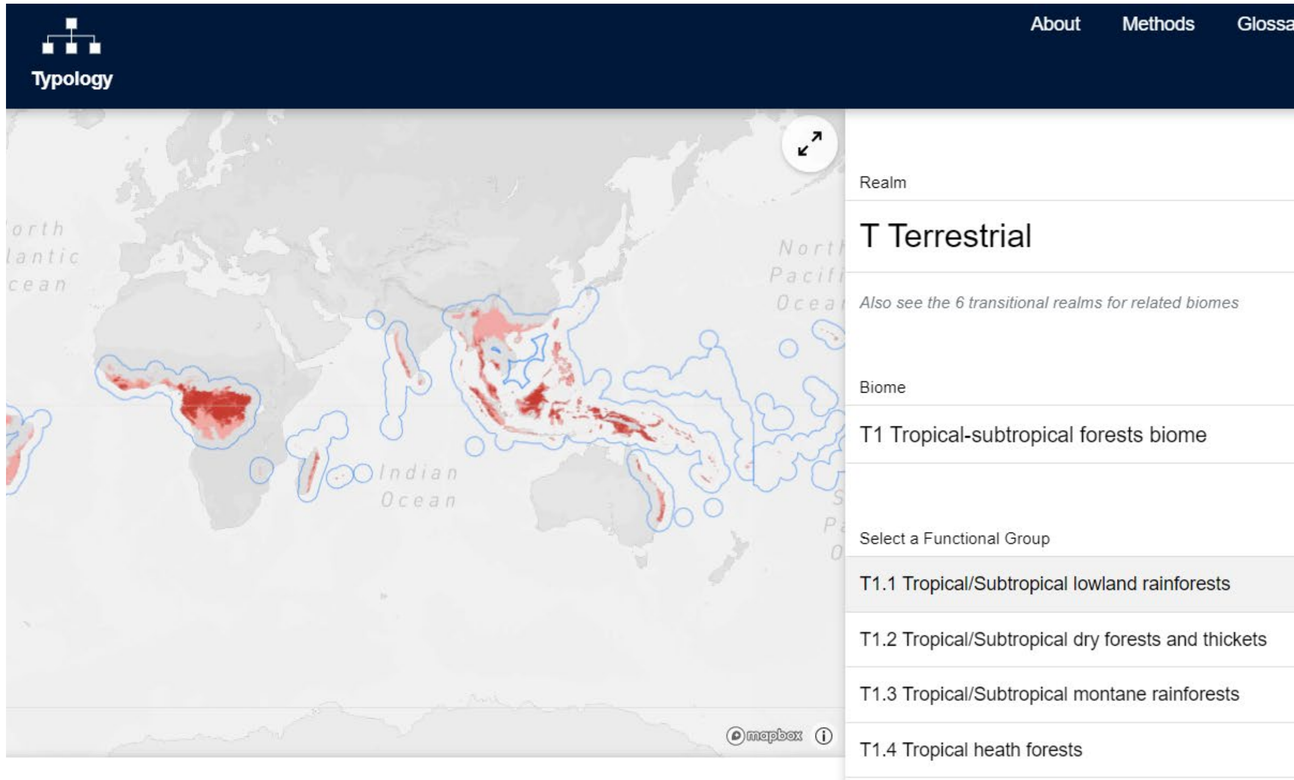
# Ecosystem types https://global-ecosystems.org/explore




- 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

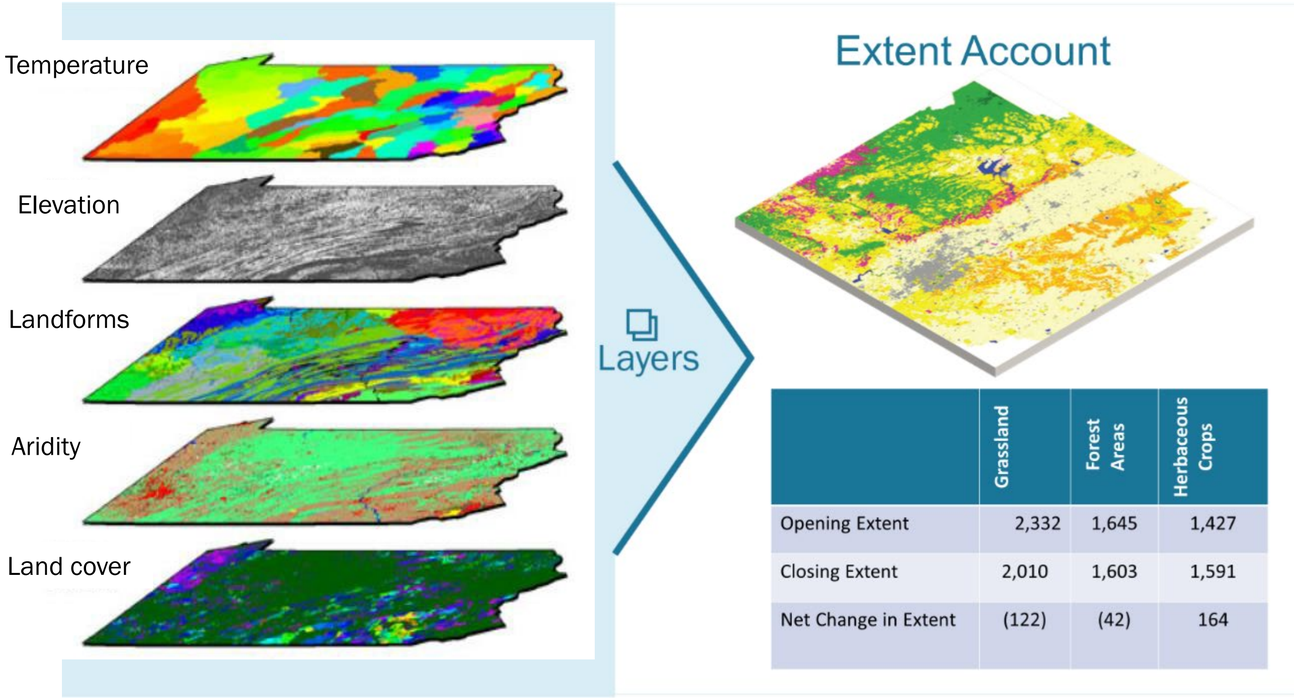


# Linking land cover and ecosystem extent

- 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

# 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.




| | Grassland | Forest Areas | Herbaceous Crops |
|---|---|---|---|
| Opening Extent | 2,332 | 1,645 | 1,427 |
| Closing Extent | 2,010 | 1,603 | 1,591 |
| Net Change in Extent | (122) | (42) | 164 |

# 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/subtropical lowland rainforests | Tropical/subtropical dry forests and scrubs | Tropical/subtropical mon-tane rainfor… | Tropical h… | Boreal a… tane for… | Decidu… rests | … | Tempe… forests | … | … | … | Derive… tures a… | Perma… ms | … | Intermitte… and open la kes | 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 |
| Opening extent | | | | | | | | | | | | | | | | | | |
| Additions to extent | | | | | | | | | | | | | | | | | | |
| Managed expansion | | | | | | | | | | | | | | | | | | |
| Unmanaged expansion | | | | | | | | | | | | | | | | | | |
| Reduction in extent | | | | | | | | | | | | | | | | | | |
| Managed reductions | | | | | | | | | | | | | | | | | | |
| Unmanaged reductions | | | | | | | | | | | | | | | | | | |
| Net change in extent | | | | | | | | | | | | | | | | | | |
| Closing extent | | | | | | | | | | | | | | | | | | |

Ecosystem classification

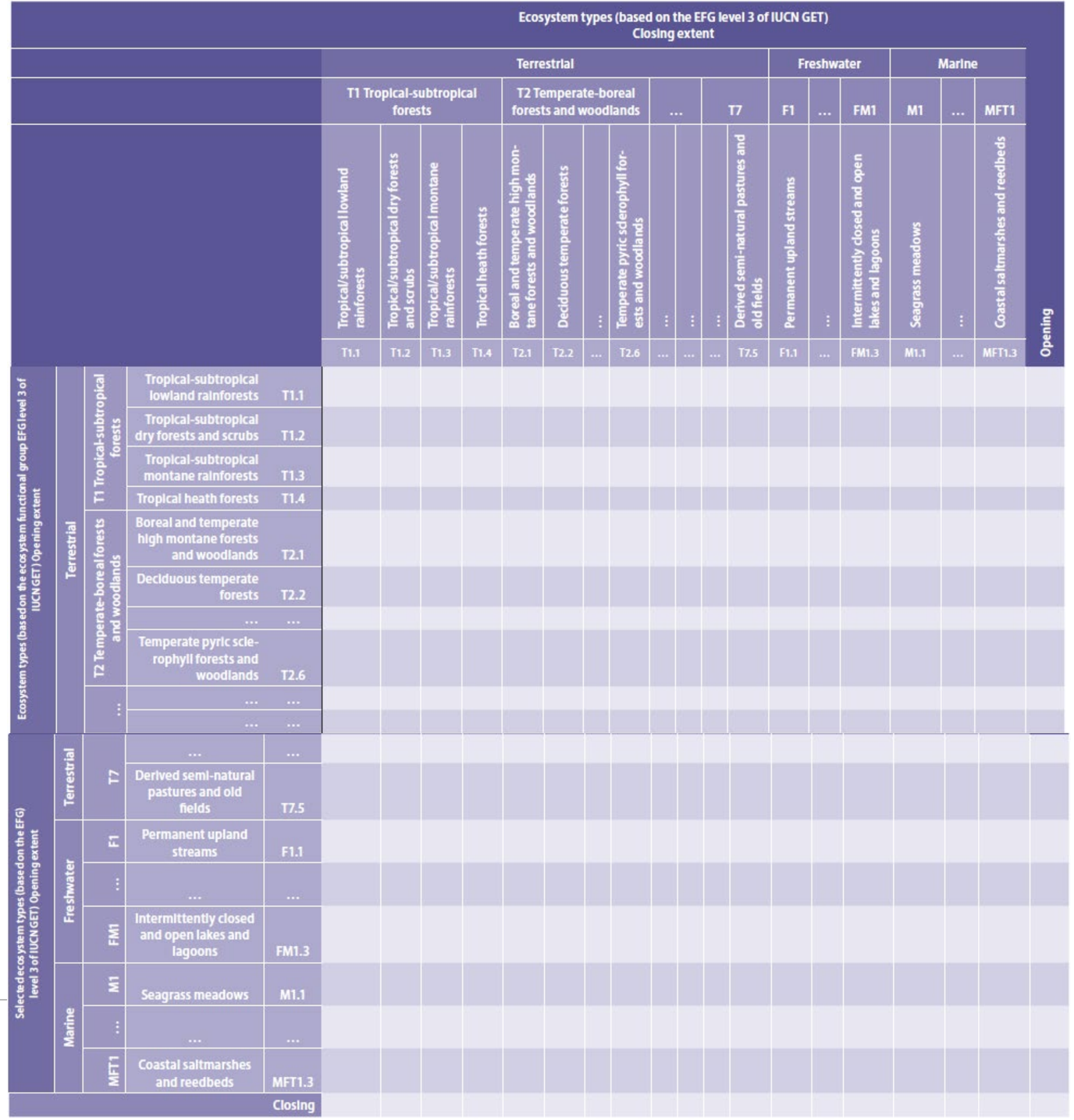
Additions to extent

Reductions in extent

# 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.

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# 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Historical extent** | **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** |
| **Additions to extent** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 16 156 026 | 3 003 883 | 2 096 528 | 21 256 437 |
| **Reductions in extent** | 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 |
| **Net change in extent** | (230 091) | (8 237) | (70 673) | (2 253 375) | (11 330 606) | (619 656) | (420 995) | (5 396 119) | (251 373) | (675 312) | - | - | - | |
| *Net change as % of historical* | -6,5% | -1,3% | -15,3% | -27,6% | -34,2% | -52,9% | -1,7% | -13,7% | -3,2% | -24,6% | - | - | - | |
| **Closing extent 1990** | **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** |
| **Opening extent 1990** | **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** |
| **Additions to extent** | 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 |
| **Reductions in extent** | 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 |
| **Net change in extent** | 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) | |
| *Net change as % of opening* | 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% | |
| **Net change in relation to historical extent** | (221 667) | (8 355) | (53 462) | (2 208 226) | (11 066 343) | (608 325) | (352 123) | (5 121 367) | (246 582) | (543 379) | - | - | - | |
| *Net change as % of historical* | -6,3% | -1,3% | -11,6% | -27,0% | -33,4% | -51,9% | -1,4% | -13,0% | -3,2% | -19,8% | - | - | - | |
| **Closing extent 2014** | **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: Example from Brazil

## Ecosystem extent accounts in Brazil (2000-2018)


| Variáveis | Total | | Bioma | | | |
|---|---|---|---|---|---|---|
| | | | Amazônia | | Cerrado | |
| | Áreas naturais | Áreas antro-pizadas | Áreas naturais | Áreas antro-pizadas | Áreas naturais | Áreas antro-pizadas |
| **2000** | | | | | | |
| **Extensão de abertura** | **5 877 298** | **2 510 306** | **3 684 512** | **450 865** | **1 185 192** | **790 693** |
| Adições | 2 955 | 460 530 | 1 282 | 248 427 | 509 | 135 983 |
| Reduções | 326 066 | 137 419 | 193 539 | 56 170 | 96 274 | 40 218 |
| **2010** | | | | | | |
| Extensão | 5 554 187 | 2 833 417 | 3 492 255 | 643 122 | 1 089 427 | 886 458 |
| Adições | 1 509 | 107 787 | 385 | 39 064 | 284 | 37 357 |
| Reduções | 69 316 | 39 980 | 27 376 | 12 073 | 23 068 | 14 573 |
| **2012** | | | | | | |
| Extensão | 5 486 380 | 2 901 224 | 3 465 264 | 670 113 | 1 066 643 | 909 242 |
| Adições | 3 592 | 93 615 | 2 043 | 39 654 | 320 | 35 913 |
| Reduções | 49 030 | 48 177 | 21 123 | 20 574 | 18 392 | 17 841 |
| **2014** | | | | | | |
| Extensão | 5 440 942 | 2 946 662 | 3 446 184 | 689 193 | 1 048 571 | 927 314 |
| Adições | 2 118 | 60 715 | 644 | 36 413 | 314 | 16 599 |
| Reduções | 36 435 | 26 398 | 23 541 | 13 516 | 8 417 | 8 496 |
| **2016** | | | | | | |
| Extensão | 5 406 625 | 2 980 979 | 3 423 287 | 712 090 | 1 040 468 | 935 417 |
| Adições | 12 894 | 74 296 | 8 185 | 38 566 | 2 706 | 25 583 |
| Reduções | 32 098 | 55 245 | 16 761 | 30 057 | 10 688 | 17 671 |
| **2018** | | | | | | |
| **Extensão final** | **5 387 421** | **3 000 030** | **3 414 711** | **720 599** | **1 032 486** | **943 329** |
| Saldo das mudanças | | | | | | |
| Absoluto (km²) | (-) 489 877 | 489 724 | (-) 269 801 | 269 734 | (-) 152 706 | 152 636 |
| Percentual (%) | (-) 8,34 | 19,51 | (-) 7,32 | 59,83 | (-) 12,88 | 19,30 |
| Movimentação | | | | | | |
| Absoluto (km²) | 536 013 | 1104 162 | 294 879 | 534 514 | 160 972 | 350 234 |
| Percentual (%) | 9,12 | 43,99 | 8,00 | 118,55 | 13,58 | 44,29 |

SEEA

Source: IBGE (2020). Ecosystem Accounts: Land Use in Brazilian Biomes, 2000-2018.

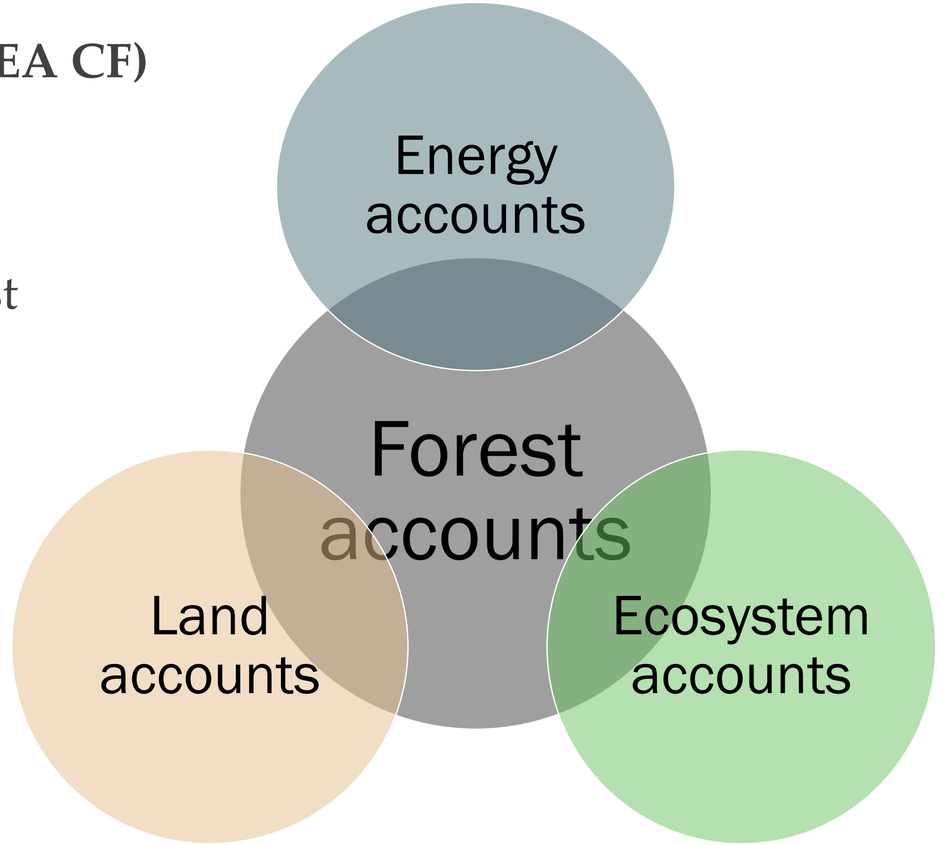
System of
Environmental
Economic
Accounting

# Forest accounts

United Nations

# Different components of forest accounts

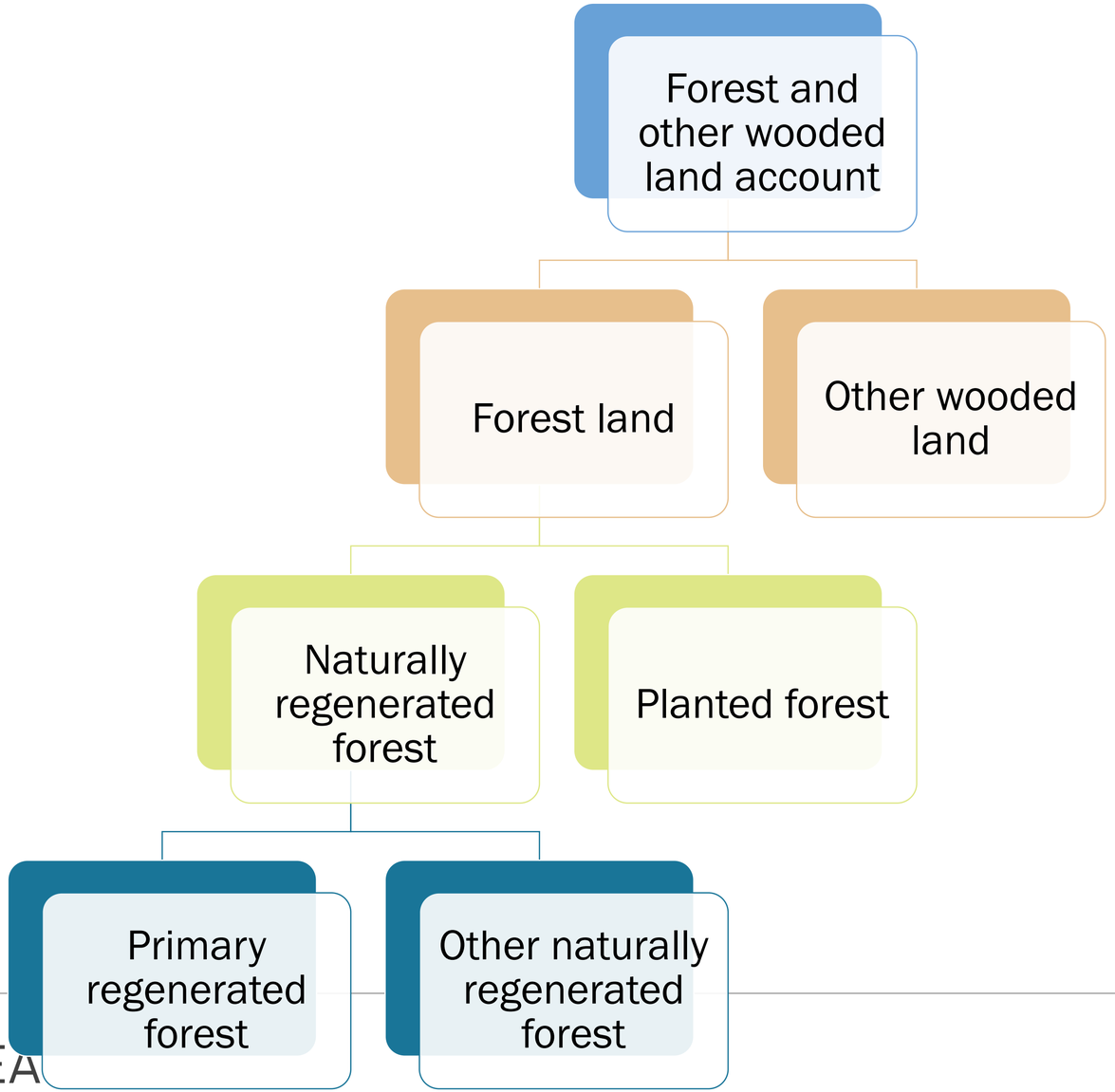
- Forest accounts encompass various accounts, including:
  - **asset accounts for forest land and other wooded land (SEEA CF)**
  - **asset accounts for timber resources (SEEA CF)**
  - flow accounts for timber resources (SEEA AFF)
  - ecosystem extent, condition and services accounts for forest ecosystems (SEEA EA)
- As a result, just saying “forest accounts” is not sufficient



# Forest land definitions

- The scope of the forest and other wooded land account is defined consistent with the definition in the **FAO Global Forest Resources Assessment (FRA)**
- Definitions:
  - **Forest land** is defined as land spanning more than 0.5 hectares with trees higher than 5 metres and a canopy cover of more than 10 per cent, or trees able to reach these thresholds in situ
  - **Other wooded land** is land:
    - not classified as forest land, spanning more than 0.5 hectares;
    - with trees higher than 5 metres and a canopy cover of 5-10 per cent, or trees able to reach these thresholds in situ;
    - or with a combined cover of shrubs, bushes and trees above 10 per cent.
  - It does not include land that is predominantly under agricultural or urban land use.
- However, it is important to note that there are different international and national definitions that could be taken into consideration.

# Scope of the forest and other wooded land account




- Where possible, accounts should be compiled reflecting these distinctions between types of forest and other wooded land

- In addition, countries may be interested in compiling accounts based on the total area of different species of trees

# Physical asset accounts for forest and other wooded land

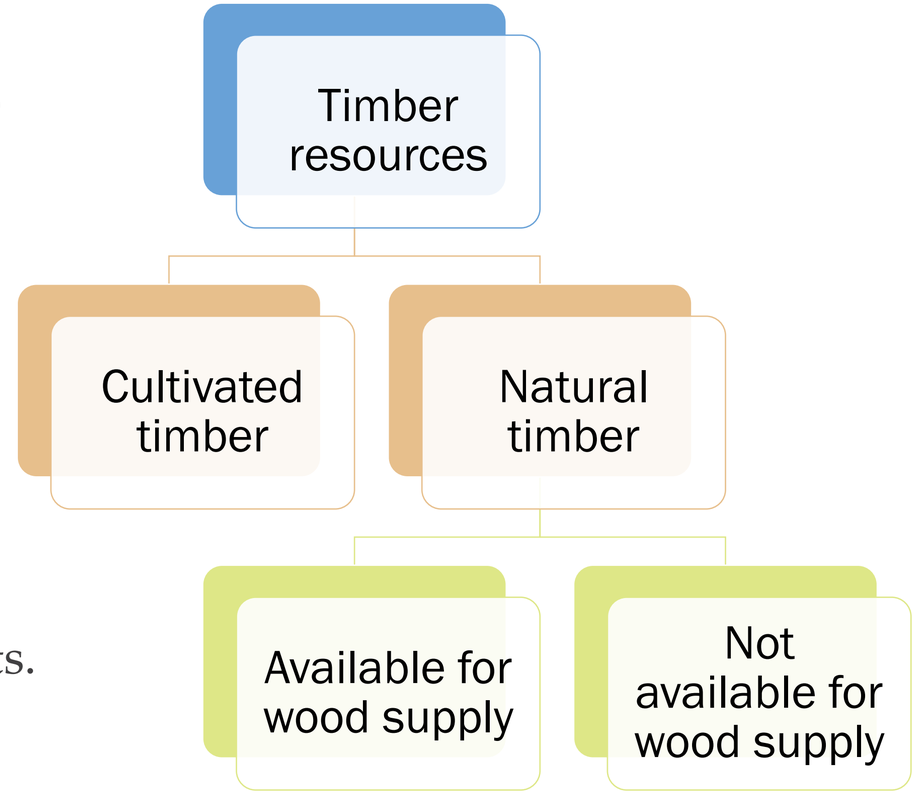
- Units: ha, $km^2$, …
- Additions:
  - > Afforestation
  - > Natural expansion
- Reductions:
  - > Deforestation
  - > Natural regression

**Physical asset account for forest and other wooded land** (*hectares*)

| | Type of forest and other wooded land | | | | |
|---|---|---|---|---|---|
| | Primary forest | Other naturally regenerated forest | Planted forest | Other wooded land | Total |
| **Opening stock of forest and other wooded land** | 20 | 100 | 150 | 130 | 400 |
| **Additions to stock** | | | | | |
| Afforestation | | 2 | 5 | | 7 |
| Natural expansion | | 3 | | | 3 |
| *Total additions to stock* | | 5 | 5 | | 10 |
| **Reductions in stock** | | | | | |
| Deforestation | 2 | 10 | | 5 | 17 |
| Natural regression | | | | 3 | 3 |
| *Total reductions in stock* | 2 | 10 | 0 | 8 | 20 |
| **Closing stock of forest and other wooded land** | 18 | 95 | 155 | 122 | 390 |

# Accounting for timber resources

- **Timber resources** are defined by the volume of trees, living or dead, and include all trees regardless of diameter, tops of stems, large branches and dead trees lying on the ground that can still be used for timber or fuel
- Timber resources **not available for wood supply**:
  - In scope for physical accounts
  - Not recorded for monetary accounts (no economic value)




- The **growth in cultivated timber resources**: a process under the direct control, responsibility and management of institutional units.
- The **growth of natural timber resources**: not considered to take place within the production boundary and is recorded as entering the production boundary only at the time the tree is removed.

# Asset accounts for timber resources

- Distinguishes between different types of timber resources
- Units: $m^3$ over bark
- Additions:
  - > Natural growth
  - > Reclassification
- Reductions:
  - > Removals
  - > Felling residues
  - > Natural and catastrophic losses
- Depending on the purpose of analysis and available data, accounts by species of tree may be compiled

**Physical asset account for timber resources** (*thousands of cubic metres over bark*)

| | Type of timber resource | | |
|---|---|---|---|
| | Cultivated timber resources | Natural timber resources | |
| | | Available for wood supply | Not available for wood supply |
| **Opening stock of timber resources** | 8 400 | 8 000 | 1 600 |
| **Additions to stock** | | | |
| Natural growth | 1 200 | 1 100 | 20 |
| Reclassifications | 50 | 150 | |
| *Total additions to stock* | 1 250 | 1 250 | 20 |
| **Reductions in stock** | | | |
| Removals | 1 300 | 1 000 | |
| Felling residues | 170 | 120 | |
| Natural losses | 30 | 30 | 20 |
| Catastrophic losses | | | |
| Reclassifications | 150 | | 150 |
| *Total reductions in stock* | 1 650 | 1 150 | 170 |
| **Closing stock of timber resources** | 8 000 | 8 100 | 1 450 |
| **Supplementary information** | | | |
| *Fellings* | 1 250 | 1 050 | |