System of Environmental Economic Accounting

Headline Indicators of the Global Biodiversity Framework based on SEEA Ecosystem Accounting

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UNCEEA Webinar Series

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Overview

- Introducing Indicators A.2 and B.1
- A closer look at Indicator A.2 Extent of natural ecosystems
- A closer look at Indicator B.1 Services provided by ecosystems
- Four take-homes

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Introducing Indicators A.2 and B.1

GBF Goal A: Protect and Restore

Three elements:

Headline indicators:

Ecosystems

The integrity, connectivity and resilience of all **ecosystems** are maintained, enhanced, or restored, *substantially increasing the area of natural ecosystems by 2050*;

A.1 Red List of Ecosystems

A.2 Extent of natural ecosystems
(based on SEEA Ecosystem Accounting)

Species

Human induced extinction of known threatened **species** is halted, and, by 2050, the extinction rate and risk of all species are reduced tenfold and the abundance of native wild species is increased to healthy and resilient levels;

A.3 Red List Index for Species

Genetic diversity

The **genetic diversity** within populations of wild and domesticated species, is maintained, safeguarding their adaptive potential.

A.4 The proportion of populations within species with an effective population size > 500

GBF Goal B: Prosper with Nature

Biodiversity is sustainably used and managed and nature's contributions to people, including ecosystem functions and services, are valued, *maintained and enhanced, with those currently in decline being restored*, supporting the achievement of sustainable development for the benefit of present and future generations by 2050.

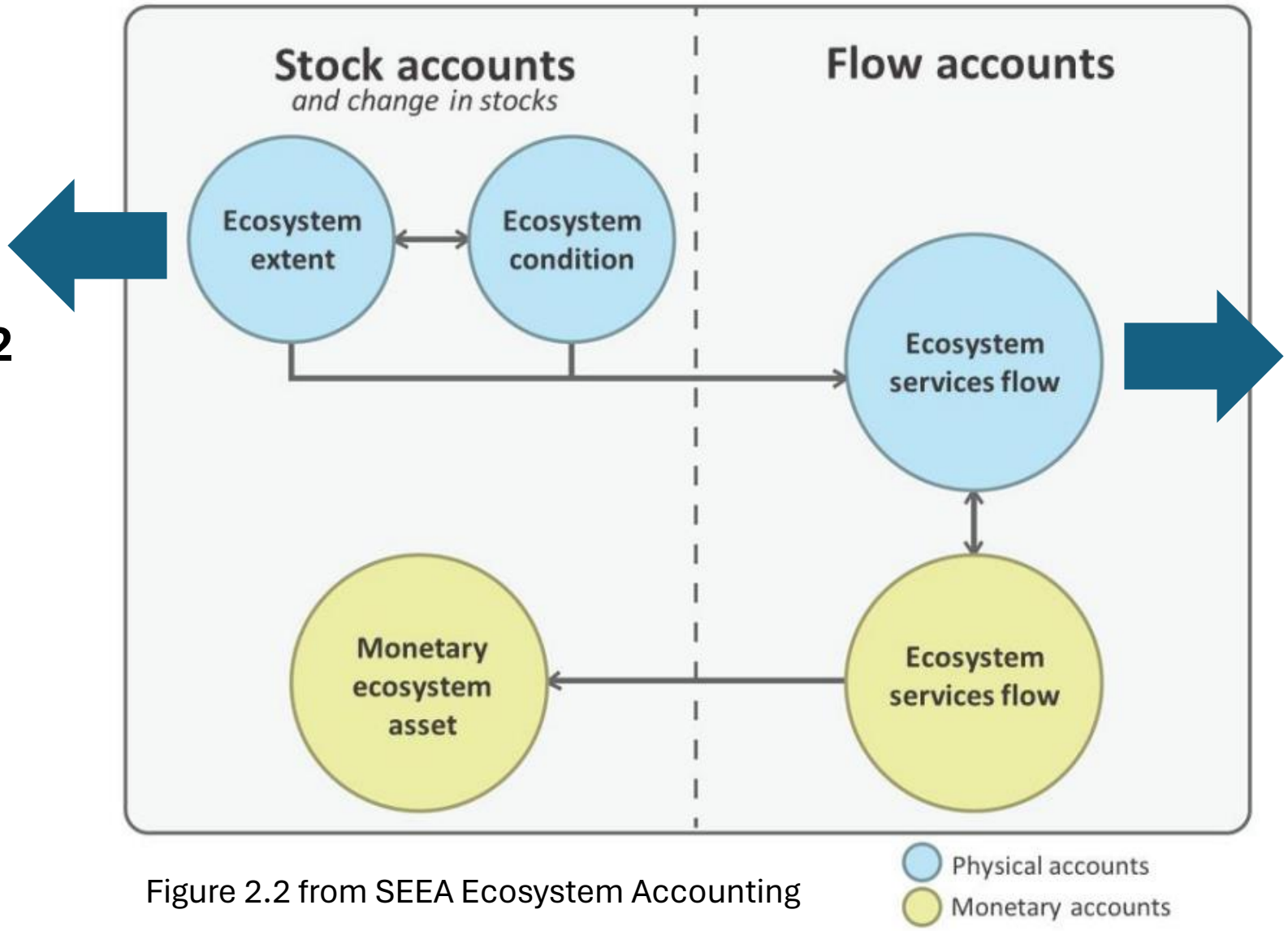
Headline indicator

B.1 Services provided by ecosystems

(based on SEEA Ecosystem Accounting)

Five core ecosystem accounts in SEEA

Ecosystem extent account provides the basis for **Indicator A.2 Extent of natural ecosystems**



Ecosystem services account (physical) provides the basis for **Indicator B.1 Services from ecosystems**

Figure 2.2 from SEEA Ecosystem Accounting

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Why is an accounting approach useful for these indicators?

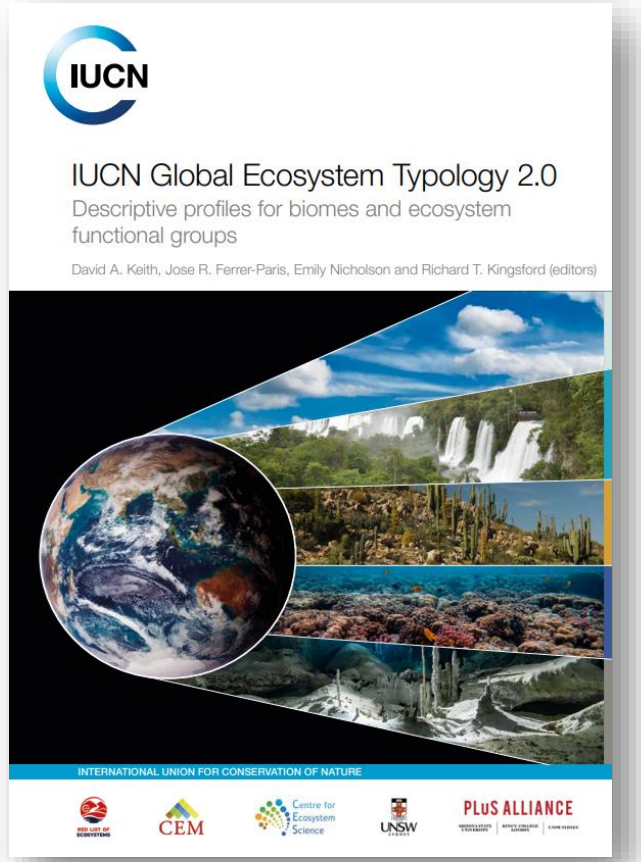
- Accounting tables have a standard **structure** and are based on standard **definitions** and **classifications**

  → Provides consistent information that allows for comparison across time periods and between countries

Global Ecosystem Typology

IUCN Global Ecosystem Typology is the **reference classification for ecosystems** in SEEA

www.global-ecosystems.org



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Why is an accounting approach useful for these indicators?

- Consistency between measurement of ecosystems and ecosystem services
- Organising spatial data in an accounting framework allows consistency from local to national to global levels

  → Supports coherence in planning and decision-making across different scales
- Allows for integration of information about ecosystems with information about the economy

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For both indicators A.2 and B.1

- Metadata was discussed and further developed through a task team (one for each indicator), consisting of:
  - Members of the AHTEG
  - Members of the UN Technical Committee on SEEA Ecosystem Accounting
  - Additional experts

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A closer look at Indicator A.2

Indicator A.2 Extent of natural ecosystems

- Rationale for the indicator
- What are “natural ecosystems”?
- How to get from the ecosystem extent *account* (which contains a lot of information) to a single *indicator*

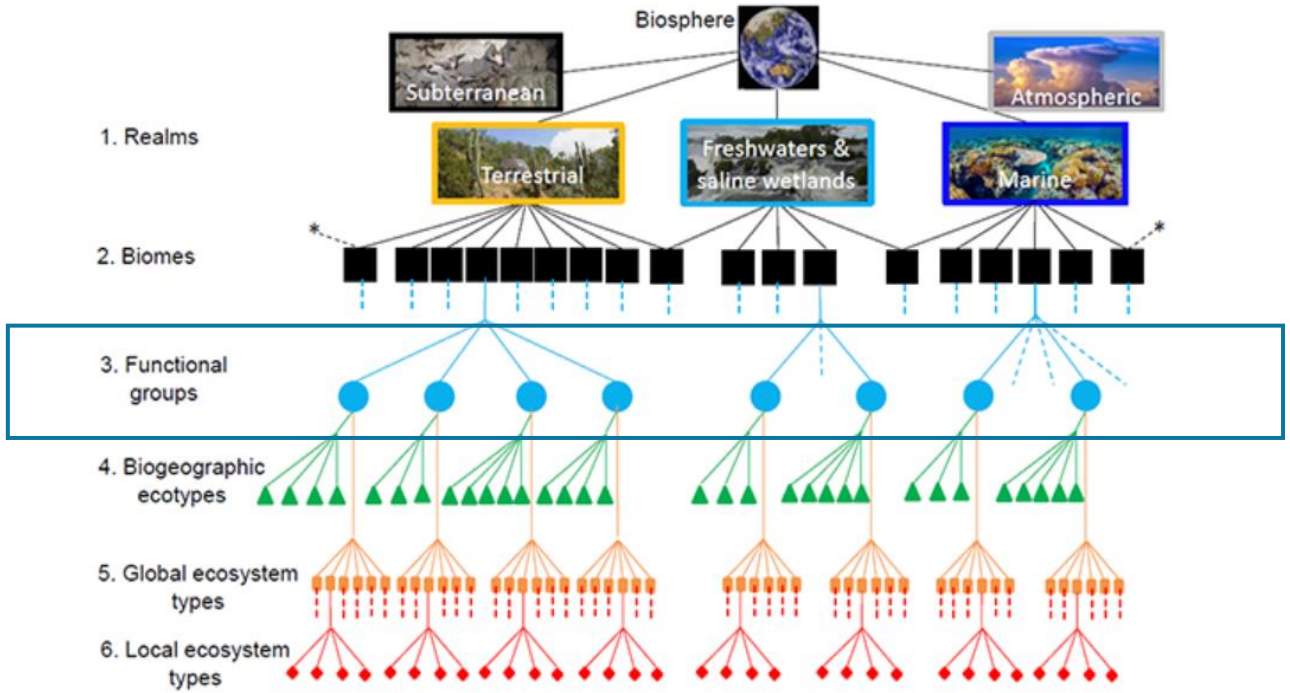
Rationale for Indicator A.2

- Natural ecosystems are the foundation of biodiversity
- Conversion of natural ecosystems to anthropogenic or intensively modified ecosystems is one of the main drivers of biodiversity loss
  - →Through human activities such as urban development, cultivation, and infrastructure development
  - →Reflected in *reduction of the area* of natural ecosystems
- Conversely, ecological restoration efforts can result in *increases in the area* of natural ecosystems
- Indicator aims to show the extent of natural ecosystems as a proportion of overall area, and to track changes in this proportion over time
  - → Responding to the element of Goal A that refers to "*substantially increasing the area of natural ecosystems by 2050*"
- **NB**: Not aiming to capture the ecological condition of natural ecosystems, which is captured in other indicators such as A.1 Red List of Ecosystems

What are “natural ecosystems” in the context of this indicator?

- **Broad definition – including “strictly” natural, near-natural and semi-natural ecosystems**
- Semi-natural ecosystems often retain substantial biodiversity and are thus important from a biodiversity perspective, along with natural ecosystems
  - This contrasts with anthropogenic (intensively modified) ecosystems, which are of far less importance from a biodiversity perspective
- If semi-natural ecosystems were excluded, this may have the unintended consequence of reducing attention to their management, conservation and in some cases restoration
- There is no agreed scientific basis for making firm distinctions between natural, near-natural and semi-natural ecosystems, which exist on a continuum, so a narrow definition of natural ecosystems would make the indicator difficult to operationalise

The scope of natural ecosystems is defined based on level 3 of the 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

Of the 110 ecosystem functional groups in the GET, **12 are anthropogenic**:

Realm	Biome	Ecosystem functional group
Terrestrial	T7 Intensive land-use systems[6]	T7.1 Annual croplands
		T7.2 Sown pastures and fields
		T7.3 Plantations
		T7.4 Urban and industrial ecosystems
Freshwater	F3 Artificial fresh waters	F3.1 Large reservoirs
		F3.2 Constructed lacustrine wetlands
		F3.3 Rice paddies
		F3.4 Freshwater aquafarms
		F3.5 Canals, ditches and drains
Marine	M4 Anthropogenic marine systems	M4.1 Submerged artificial structures
		M4.2 Marine aquafarms
Marine-terrestrial	MT3 Anthropogenic shorelines	MT 3.1 Artificial shorelines

Anthropogenic or intensively modified ecosystems are *predominantly* influenced by human activities → determines ecosystem properties

In contrast: **Natural ecosystems** (not shown here) are ecosystems in which the impacts of humans on ecosystem composition, structure and function are low compared to natural factors

What is an ecosystem extent account?

- Tracks the area of different **ecosystem types** within an ecosystem accounting area (such as a country) for successive **accounting periods**
- Provides an **opening extent** and **closing extent** for each ecosystem type in each accounting period

Stylised example of an ecosystem extent account for one accounting period:

Accounting entries	Ecosystem functional groups (examples)						Total
	T2.6 Temperate forests and woodlands	T4.5 Temperate subhumid grasslands	F2.3 Seasonal freshwater lakes	T7.1 Annual croplands	T7.4 Urban and industrial ecosystems	…	
Opening extent							
Additions to extent							
Reduction to extent							
Closing extent							

Values for opening and closing extent and change in extent can be used to derive a range of indicators and presented in a range of forms (e.g., summary tables, maps, graphs)

South Africa's terrestrial ecosystem extent account, summarised by biome

Two accounting periods:

- Historical extent – 1990
- 1990 – 2014

Natural or semi-natural biomes **Intensively modified biomes**

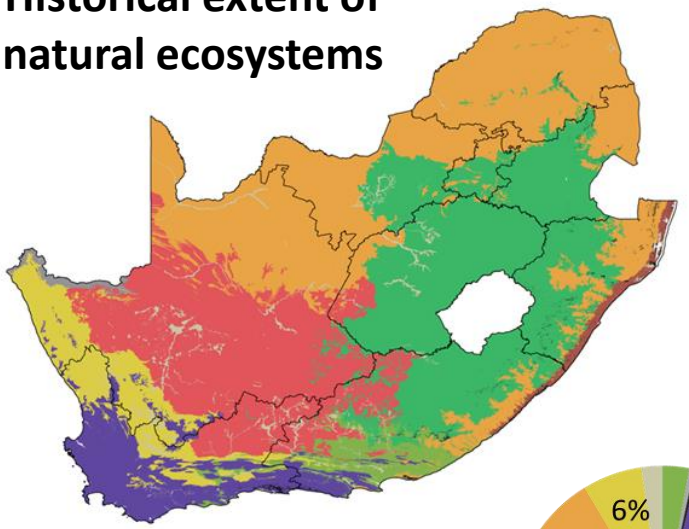
Biomes	Albany Thicket	Desert	Forest	Fynbos	Grassland	IOCB	Nama-Karoo	Savanna	Succulent Karoo	Azonal vegetation	Cultivated*	Built-up*	Water-bodies**	TOTAL
Historical extent	**3 531 231**	**626 207**	**462 518**	**8 165 366**	**33 090 325**	**1 171 284**	**24 936 548**	**39 418 522**	**7 821 579**	**2 742 873**	-	-	-	**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.

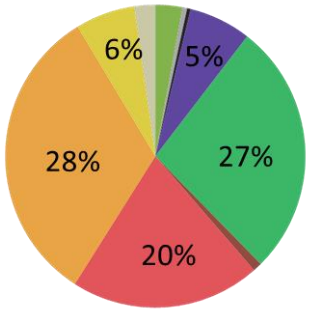
** The large net decrease in the extent of waterbodies reflects primarily that 1990 was a much wetter year than 2014. Waterbodies include both natural and artificial water bodies (such as dams).

South Africa's terrestrial ecosystem extent account, 1990 to 2014

Historical extent of natural ecosystems

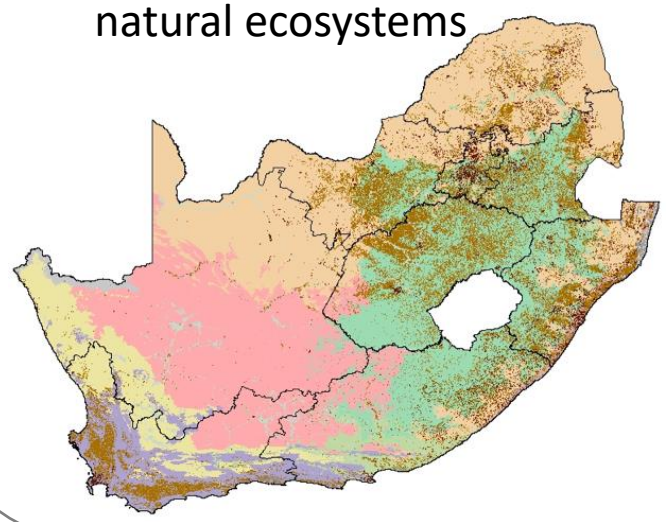


Biomes
- Albany Thicket
- Desert
- Forests
- Fynbos
- Grassland
- Indian Ocean Coastal Belt
- Nama-Karoo
- Savanna
- Succulent Karoo



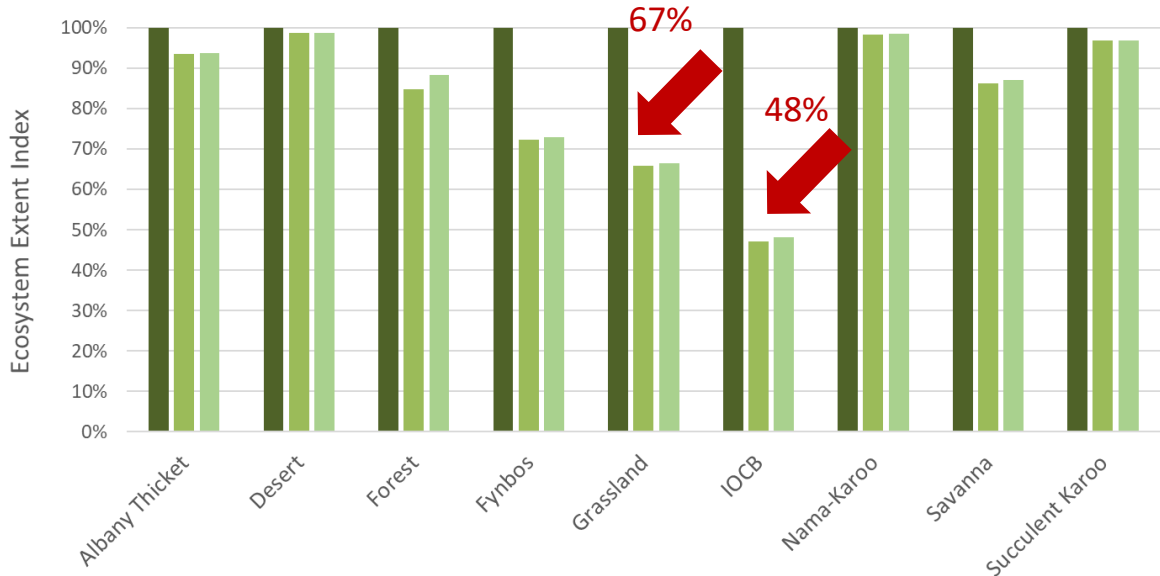
458 terrestrial ecosystem types are grouped into **9 biomes**

Extent of ecosystems in 2014 – showing where anthropogenic ecosystems uses have replaced natural ecosystems



Intensively modified "biomes"
- Built-up
- Cultivated
- Waterbodies

Natural or semi-natural biomes
- Albany Thicket
- Desert
- Forest
- Fynbos
- Grassland
- Indian Ocena Coastal Belt
- Nama-Karoo
- Savanna
- Succulent Karoo
- Azonal Vegetation
- Provincial boundary



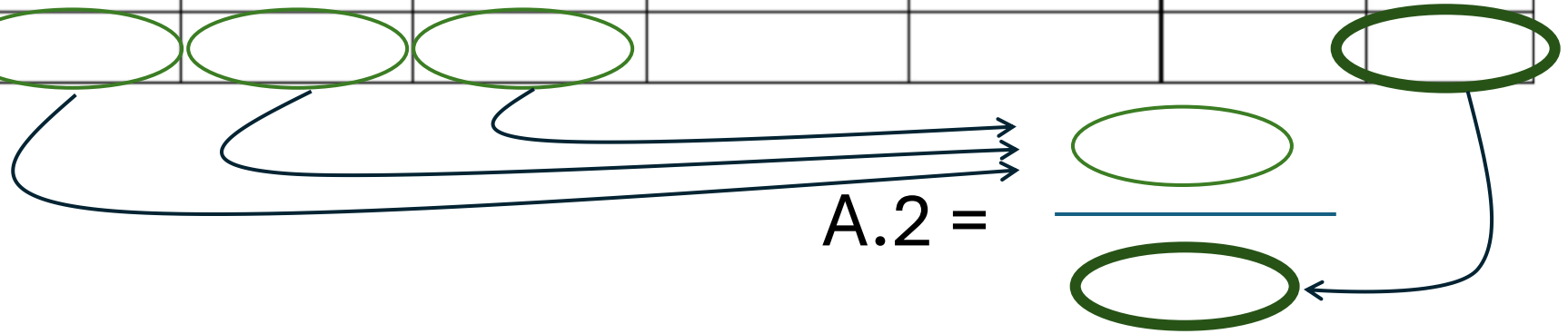
Indicator: **Ecosystem Extent Index** →

Measures remaining contemporary extent of natural ecosystems relative to historical extent

How to get from the account to a single indicator?

→ Extent of natural and semi-natural ecosystems as a proportion of total area

Accounting entries	Ecosystem functional groups (examples)						Total
	T2.6 Temperate forests and woodlands	T4.5 Temperate subhumid grasslands	F2.3 Seasonal freshwater lakes	T7.1 Annual croplands	T7.4 Urban and industrial ecosystems	…	
Opening extent							
Additions to extent							
Reduction to extent							
Closing extent							



Mock-up of Indicator A.2

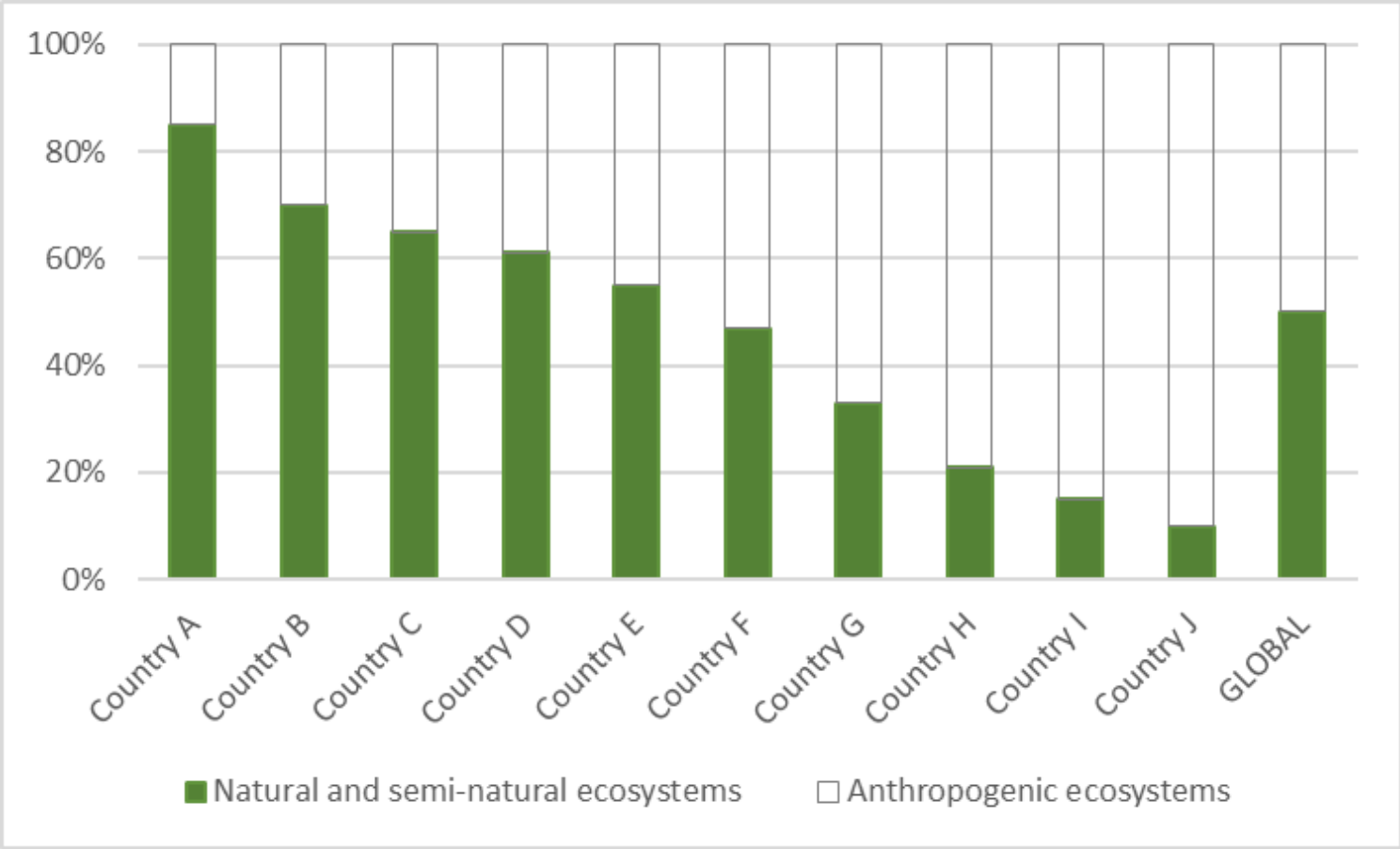


Figure 1. Proportion of natural ecosystems as at [end of accounting period]

- Easy to understand snapshot of the relative area of natural ecosystems at national and global level
- Can be done for all natural ecosystems combined, OR disaggregated by realm, biome, EFG (or more detail at national level)
- Changes in this proportion show whether ecosystem areas are increasing or not

Indicator A.2 methodology

Steps

- Compile ecosystem extent account using national ecosystem classification
- Cross-walk to ecosystem functional groups in the GET
- Calculate indicator by summing the area of natural ecosystems and dividing by total area of the country, expressed as a percentage
- Report indicator, but also the absolute extent (ha/km^2) per EFG, allowing for global aggregation based on the absolute values

A closer look at Indicator B.1

Indicator B.1 Services provided by ecosystems

- Rationale for the indicator
- Which ecosystem services to include?
- How to get from ecosystem services *accounts* (which contains a lot of information) to a single *indicator*

Rationale for Indicator B.1

- Aim to track trends in the provision of ecosystem services, responding to the wording in Goal B that ecosystem services should be *"maintained and enhanced, with those currently in decline being restored"*
- Want to show whether the provision of ecosystem services is, on average, increasing, stable or decreasing, with the ability to disaggregate by different ecosystem services
- Ideally disaggregated by ecosystem type → valuable information to direct conservation, management and restoration efforts to enhance ecosystem service provision
- Not aiming to capture information about the state of ecosystems that underpin the provision of services, as this is captured in Indicators A.1 and A.2

Which ecosystem services to include?

Blended approach

- Designed to enable countries to select ecosystem services that they consider important and policy relevant
- As well as reflecting ecosystem services that are of global importance (such as global climate regulating services)

This means

- One or more of the ecosystem services will be **required** (common across all countries)
- There will be a list of **recommended** ecosystem services
- With the option for countries to choose **alternatives** to these recommended ecosystem services

Additional requirements

- Use the SEEA Ecosystem Accounting **reference list of ecosystem services** as a starting point
- Must include ecosystem services from **all three broad categories** (provisioning, regulating, cultural)

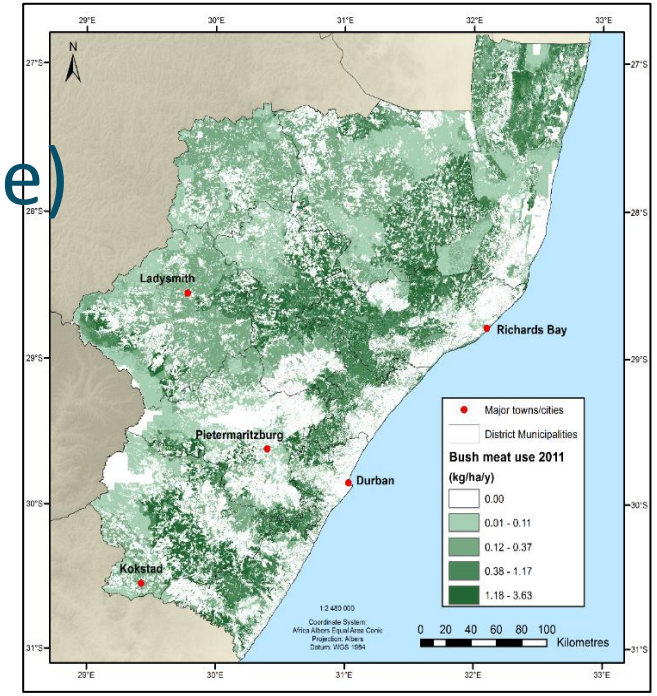
Considerations for selecting ecosystem services to include in the indicator

- Importance and policy relevance in the national context
- Importance for vulnerable communities (e.g. low-income households, children and youth, women and girls)
- Importance for indigenous peoples and local communities
- Cautious approach required for *provisioning* services from anthropogenic ecosystem types (e.g. croplands, plantations) – several reasons for this
- Ideal to flag services where sustainability thresholds may have been crossed
- Overall: **Consider alignment and compatibility of the ecosystem service with the intent of the GBF**

What is an ecosystem services account?

- Records the **flows of ecosystem services** supplied by ecosystem assets and used by economic units (households, businesses, government) during an accounting period
  - i.e. the **amount** of each ecosystem service supplied and used in the accounting period (such as one year)
- There must be **alignment between supply and use** (i.e. supply needs to match use of a particular service)
  - Only ecosystem services that are *actually used* are included in the account, while ecosystem services that could potentially be used are excluded
- Includes as wide a **range of ecosystem services** as possible
- Disaggregates supply of each service by **ecosystem type**

Ecosystem services account: Example from South Africa (KwaZulu-Natal province)



Note range of **different units of measurement**, such as:

- Cubic metres (e.g. of wood, water)
- Tonnes (e.g. of sediment, crops)
- Tg Carbon
- Large Stock Units (number of animals)

Supply table for 2005, summarised by biome (Use table not shown)

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

Source: Turpie et al., 2021

How to get from the account to a single indicator?

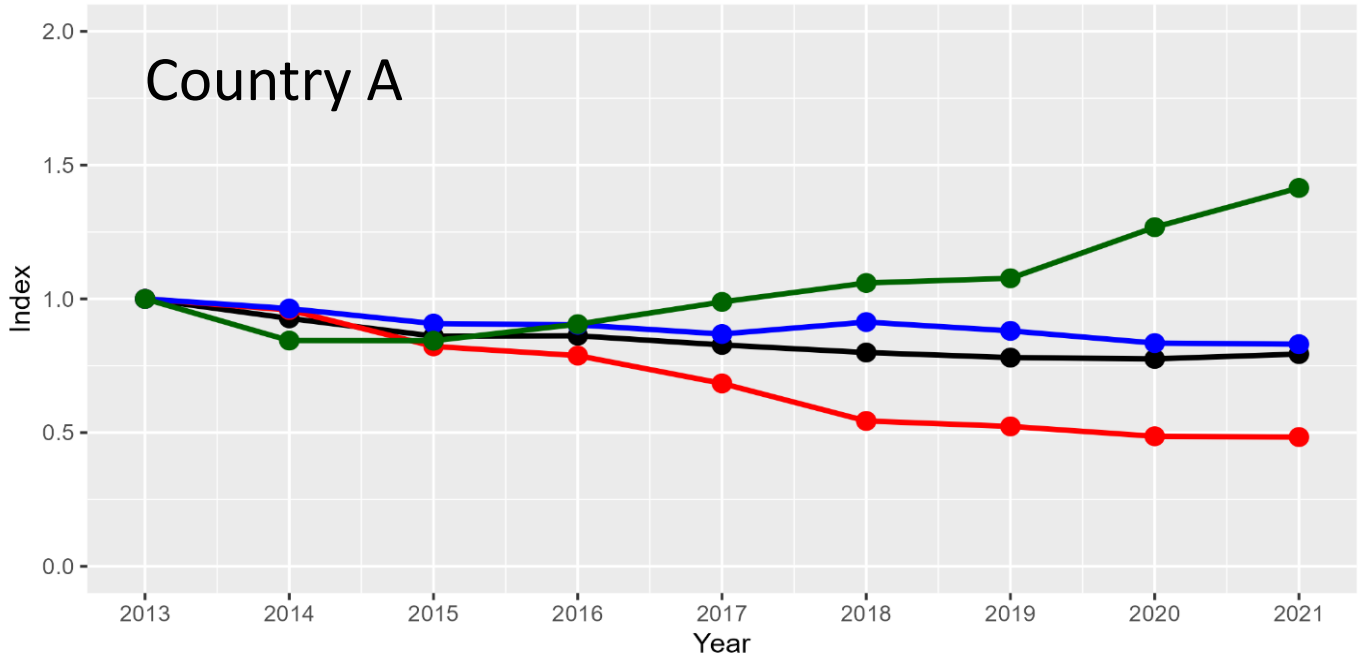
- Challenge to aggregate across different ecosystem services in biophysical terms – different units of measurement

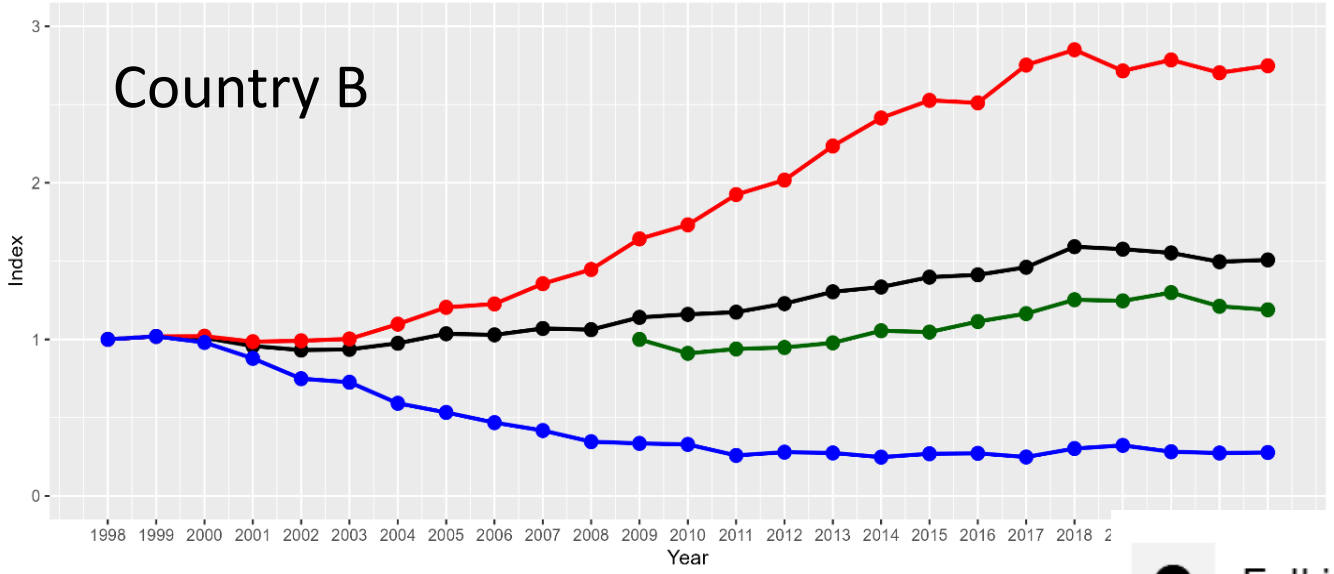
- Average of *trends* in ecosystem service provision
  - For each ecosystem service, calculate the percentage change relative to the previous accounting period
  - Calculate a geometric mean of the changes for all ecosystem services

  →An **overall index** of change

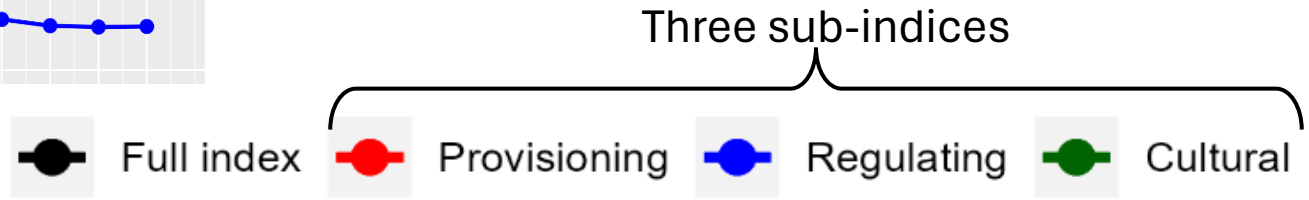
  →With **three sub-indices** for provisioning, regulating and cultural ecosystem services

Some testing results for Indicator B.1 based on existing national ecosystem services accounts





Shows trend in provision of ecosystem services relative to a base year represented by the value 1



Indicator B.1 methodology

Steps

- Select ecosystem services to be included in the indicator
- Compile accounts for those services
- Calculate the indicator (index and sub-indices) based on information from the accounts
- Report indictor, but also the absolute values for each ecosystem service to allow flexibility in global aggregation

Four take-homes

Take-homes

1. Ecosystem accounts are a powerful basis for deriving ecosystem indicators

- Ecosystem accounts can provide a range of indicators for national planning, decision-making and monitoring
- The account itself is not an indicator → further work needed to derive indicators from accounts

Take-homes

2. The ecosystem-related headline indicators of the GBF (A.1, A.2, B.1, 2.1, 3.1) should be considered together, as a **suite of complementary indicators**
   - **A.1** Red List of Ecosystems
   - **A.2** Extent of natural ecosystems
   - **B.1** Services provided by ecosystems
   - **2.1** Area under restoration
   - **3.1** Coverage of protected areas and OECMs

All disaggregated by ecosystem type → well-rounded picture for each ecosystem type

- **A.1** Is it threatened?
- **A.2** How much of it still exists?
- **B.1** What services does it provide and are they increasing or decreasing?
- **2.1** How much of it is being restored?
- **3.1** How much of it is protected?

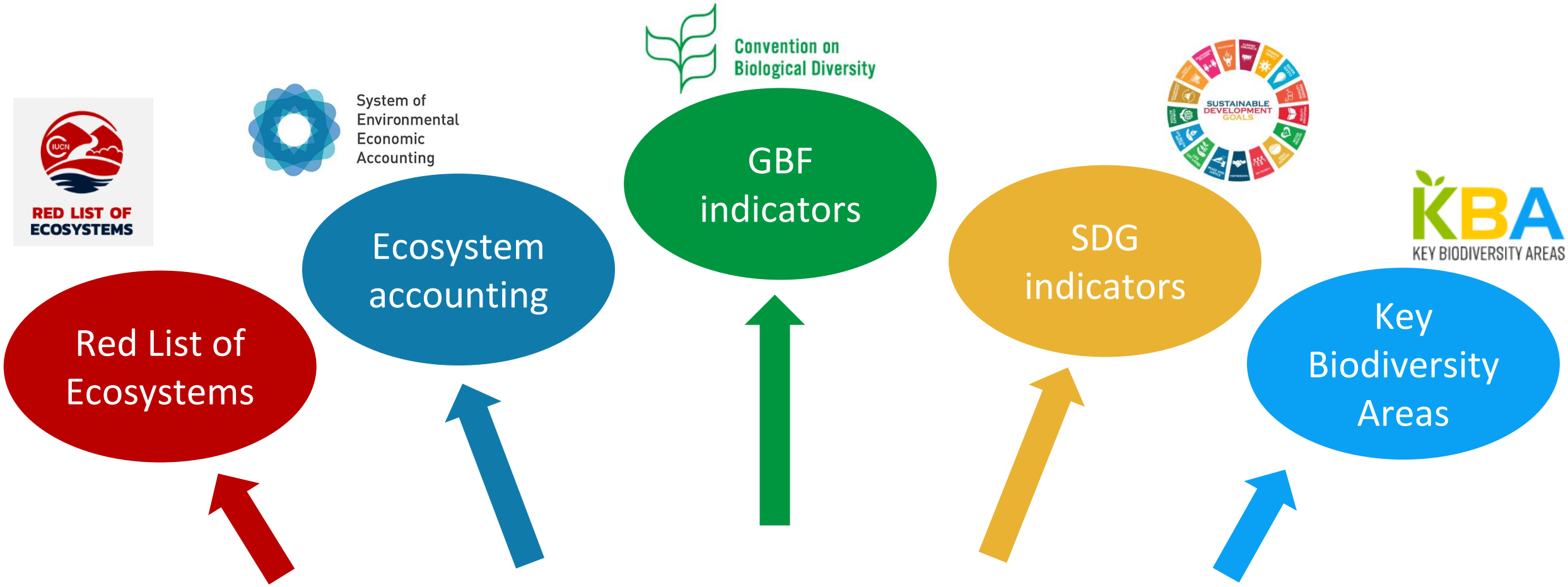
Powerful set of information for informing conservation action

Take-homes

3. Investing in foundational spatial data on ecosystems at the national level is worth the effort
   - First and foremost: a good **wall-to-wall national map of ecosystem types** at a baseline date
   - Spatial datasets on changes in the distribution of ecosystem types at subsequent dates

4. Aligning national ecosystem classifications with the Global Ecosystem Typology helps to achieve global comparability and coherence across GBF indicators

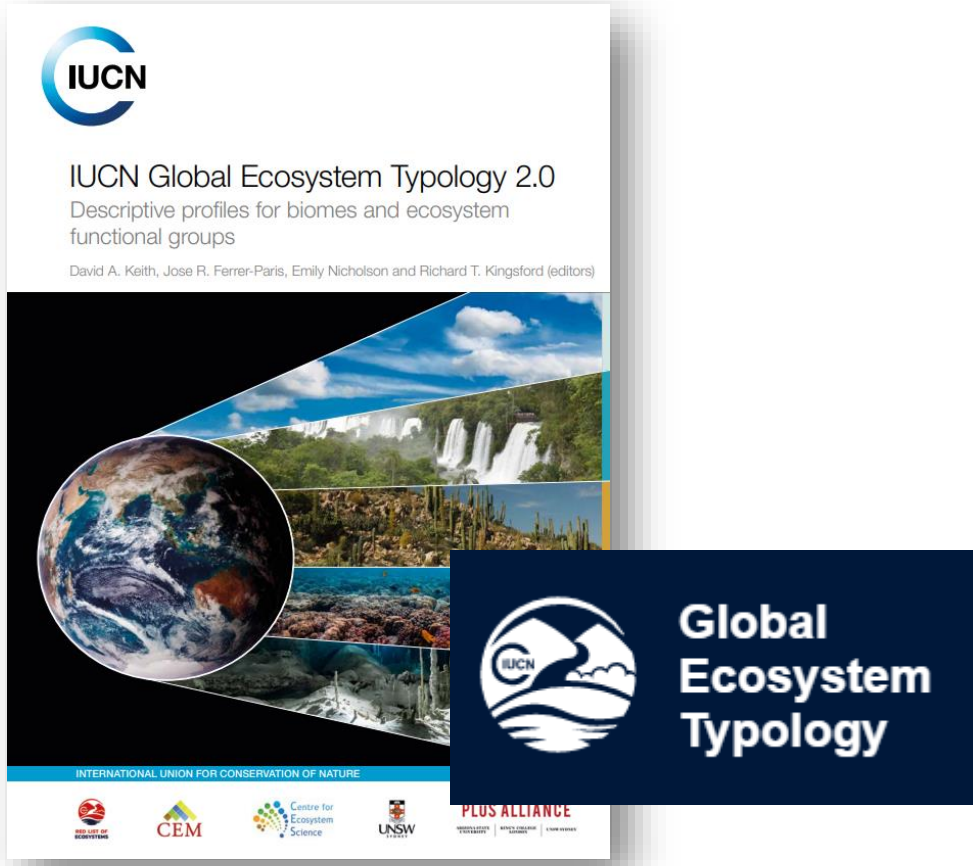
Investing in foundational spatial data on ecosystems pays dividends



Foundational data on ecosystems

Including maps of ecosystem types and spatial assessment of ecosystem condition

Several of these applications of maps of ecosystem types use the IUCN's Global Ecosystem Typology



www.global-ecosystems.org

RED LIST OF ECOSYSTEMS

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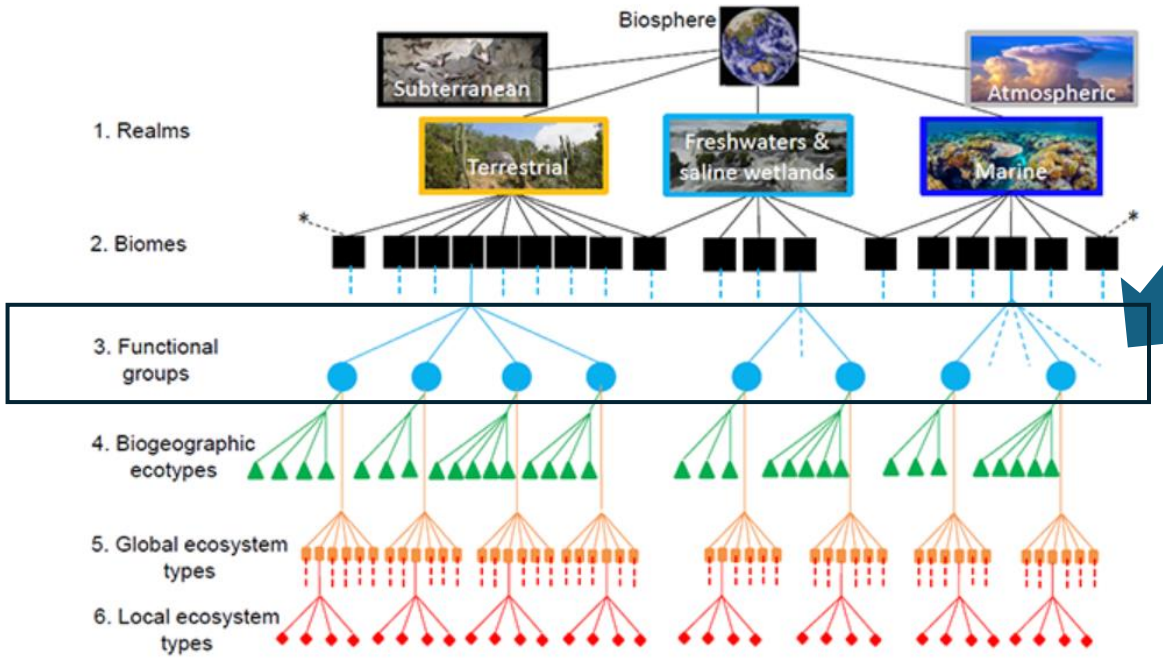
Convention on Biological Diversity

Monitoring framework for the Global Biodiversity Framework



Ecosystem functional groups (level 3) are an important level from a global perspective

- Allow for harmonised global reporting and comparison that is "manageable"…
- …while still providing enough detail to be meaningful from a biodiversity perspective
- 110 EFGs, with an average of around 10 to 12 per country

- Countries generally need ecosystem information at a finer scale than EFGs to inform national policy, planning, decision making and monitoring
- EFGs should *not* replace more detailed national ecosystem types
- For global reporting, national ecosystem types need to be cross-walked to EFGs