

Monitoring biodiversity change

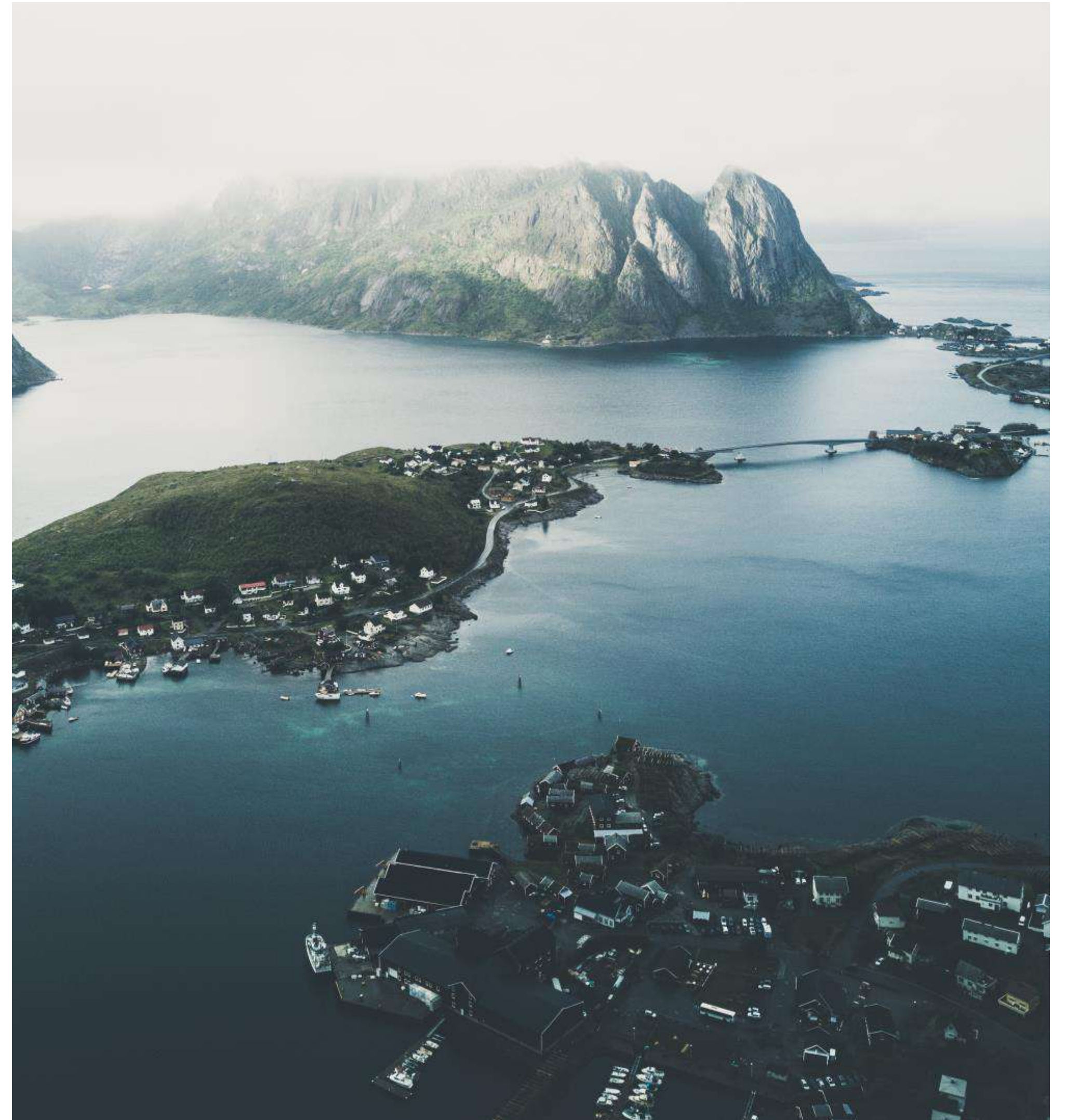
GEO Data Technology Workshop

4. Data and Information Needs and Challenges for GEO Work Programme Activities

Dr. Laetitia Navarro, GEO BON Executive Secretary

23.04.19 / Vienna, Austria

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The biodiversity crisis

Has the Earth's sixth mass extinction already arrived?

Anthony D. Barnosky^{1,2,3}, Nicholas Matzke¹, Susumu Tomiya^{1,2,3}, Guinevere O. U. Wogan^{1,3}, Brian Swartz^{1,2}, Tiago B. Quental^{1,2,†}, Charles Marshall^{1,2}, Jenny L. McGuire^{1,2,3,†}, Emily L. Lindsey^{1,2}, Kaitlin C. Maguire^{1,2}, Ben Mersey^{1,4} & Elizabeth A. Ferrer^{1,2}

Palaeontologists characterize mass extinctions as times when the Earth loses more than three-quarters of its species in a geologically short interval, as has happened only five times in the past 540 million years or so. Biologists now suggest that a sixth mass extinction may be under way, given the known species losses over the past few centuries and millennia. Here we review how differences between fossil and modern data and the addition of recently available palaeontological information influence our understanding of the current extinction crisis. Our results confirm that current extinction rates are higher than would be expected from the fossil record, highlighting the need for effective conservation measures.

Warning of 'ecological Armageddon' after dramatic plunge in insect numbers

Three-quarters of flying insects in nature reserves across Germany have vanished in 25 years, with serious implications for all life on Earth, scientists say



▲ Flying insects caught in a malaise trap, used by entomologists to collect samples. Photograph: Courtesy of Entomologischer Verein Krefeld

World on track to lose two-thirds of wild animals by 2020, major report warns

Living Planet Index shows vertebrate populations are set to decline by 67% on 1970 levels unless urgent action is taken to reduce humanity's impact



Commitment for Biodiversity: Increasing Demand for Relevant and Accessible Biodiversity Data



Convention on Biological Diversity



SUSTAINABLE DEVELOPMENT GOALS

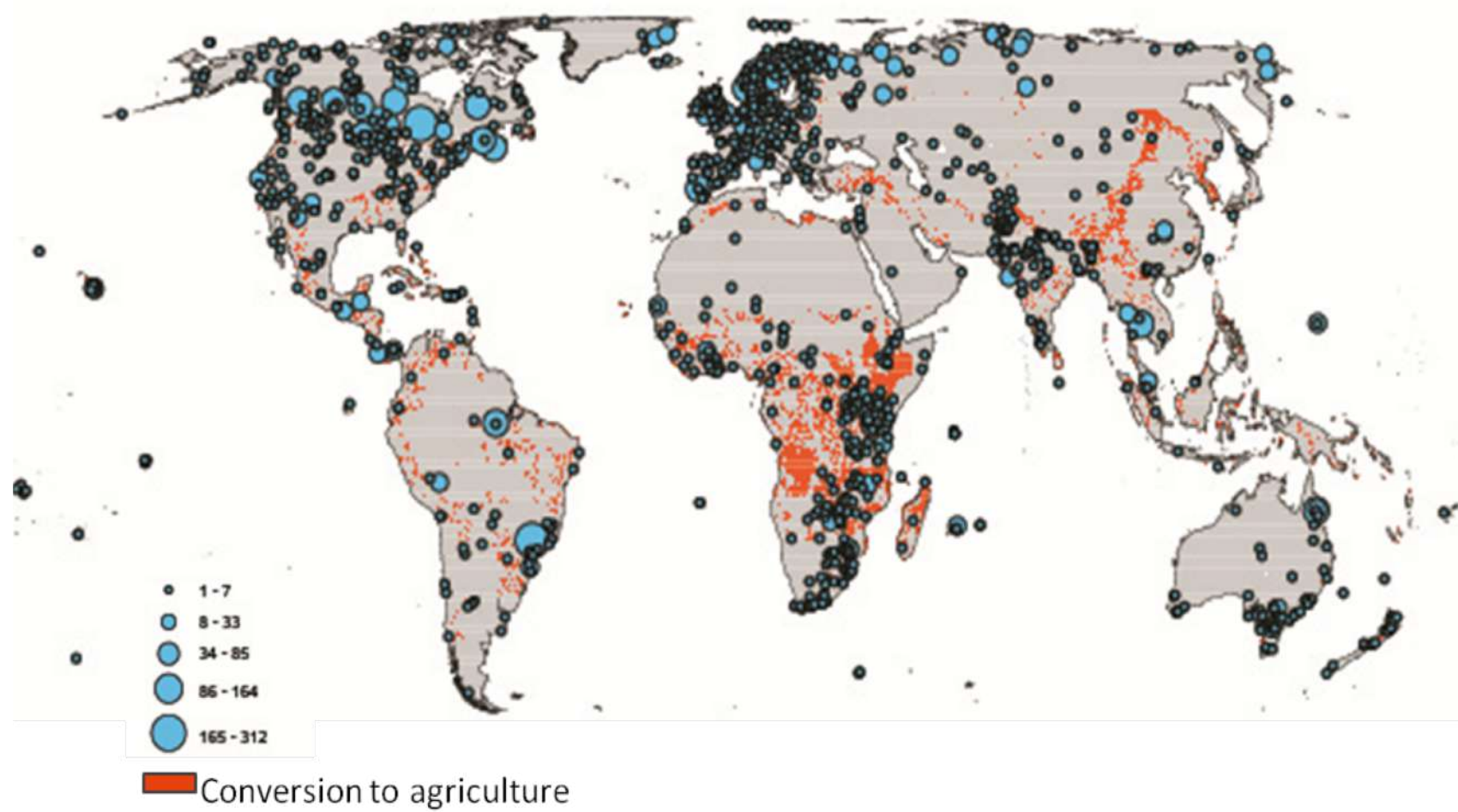


Environmental Impact Assessment



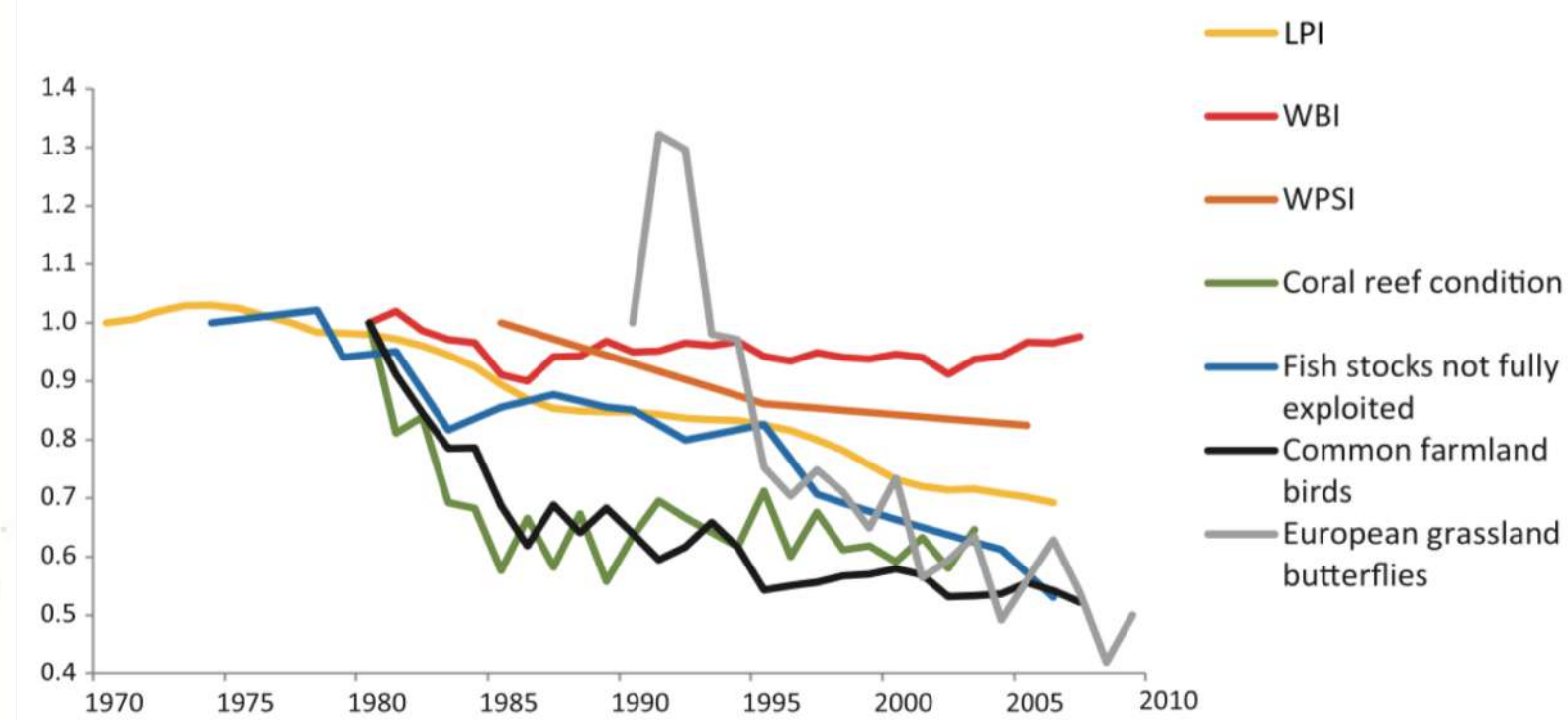
One challenge of biodiversity change: Knowledge gaps

Spatial gaps



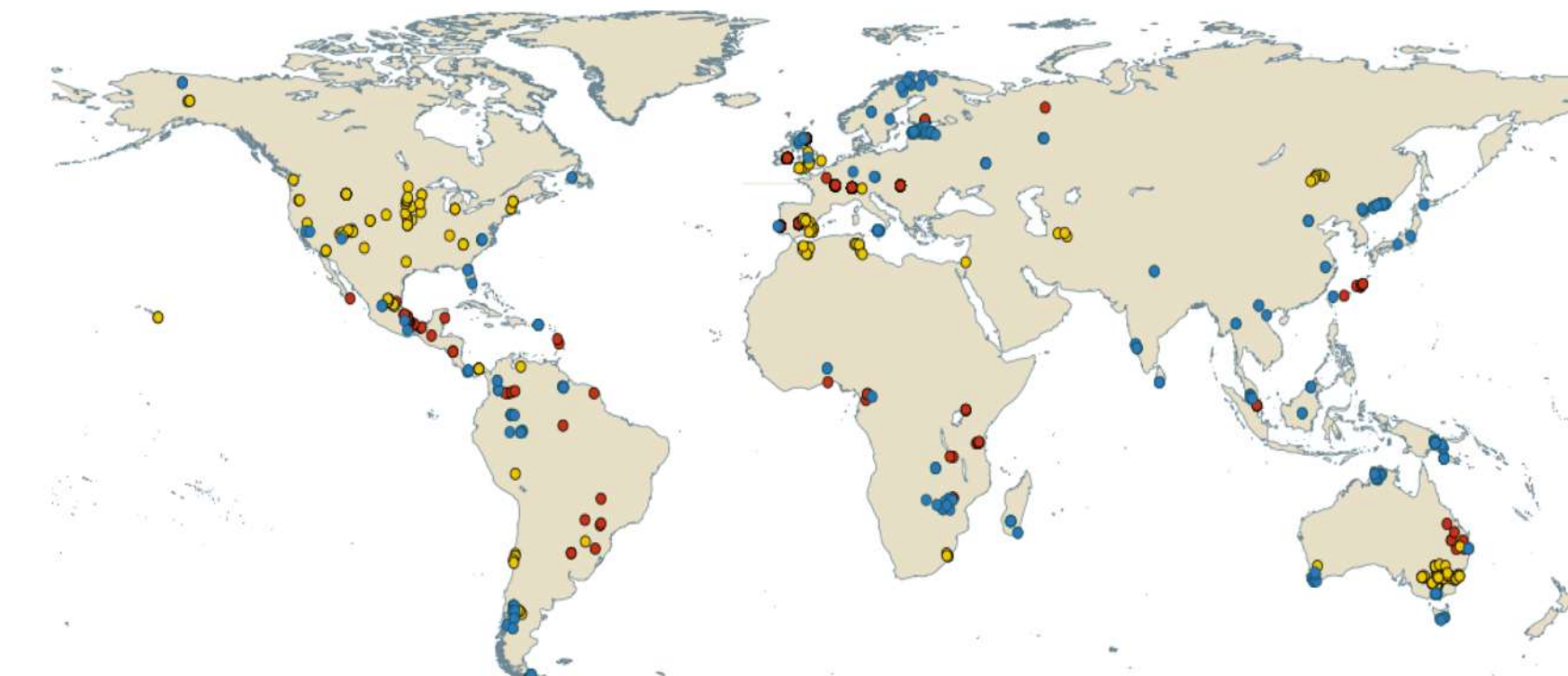
Living Planet Index Populations

Temporal gaps



Temporal trends in biodiversity indicators

Taxonomic gaps

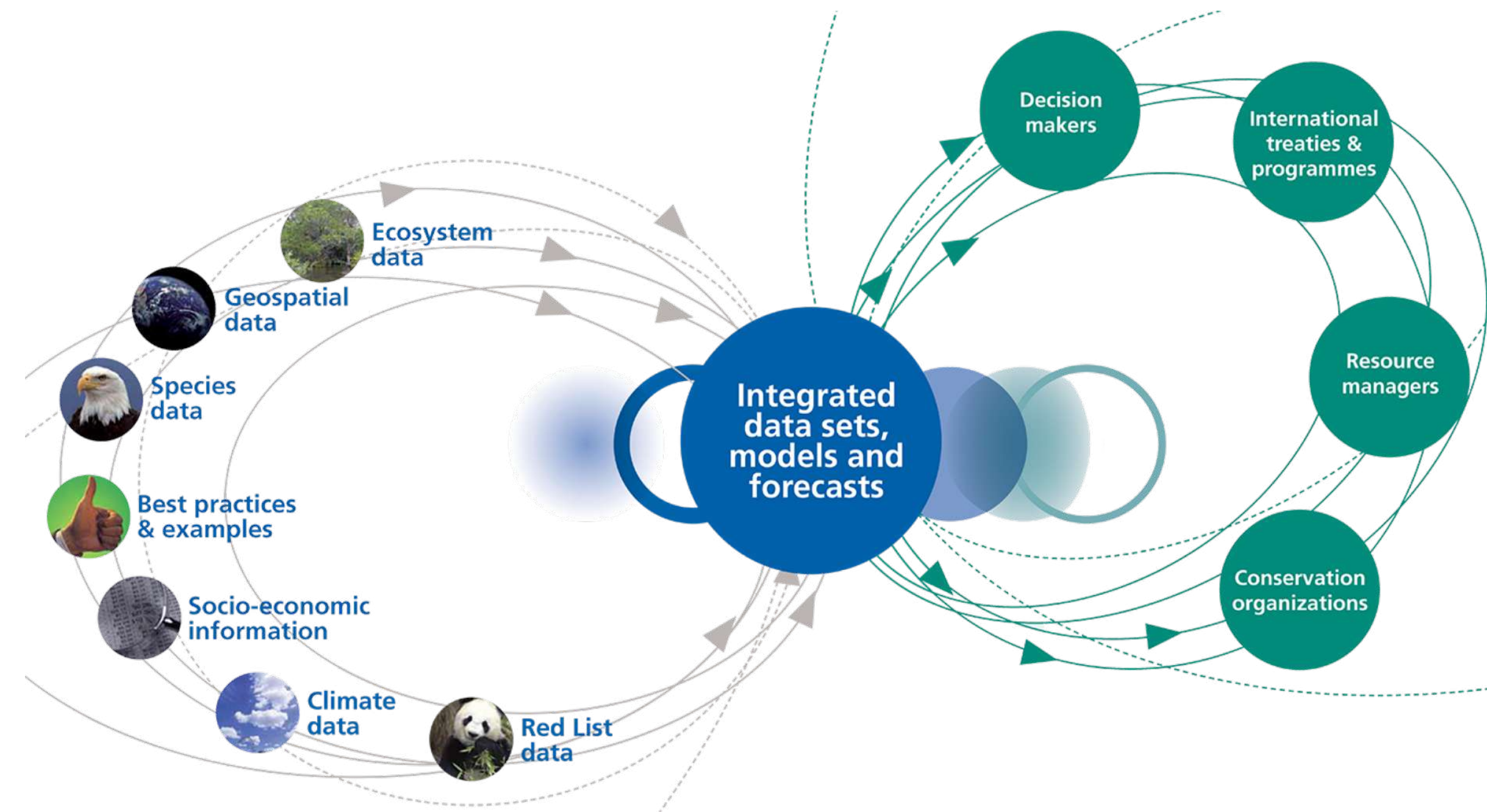


Distribution of sampling sites for soil bacterias, macrofauna and fungi

Pereira, H.M., Navarro L.M and Martins I.S. (2012) *Annual Review of the Environment and Resources*.
Cameron et al., (2018) *Nature Ecology & Evolution*

The Group on Earth Observations Biodiversity Observation Network

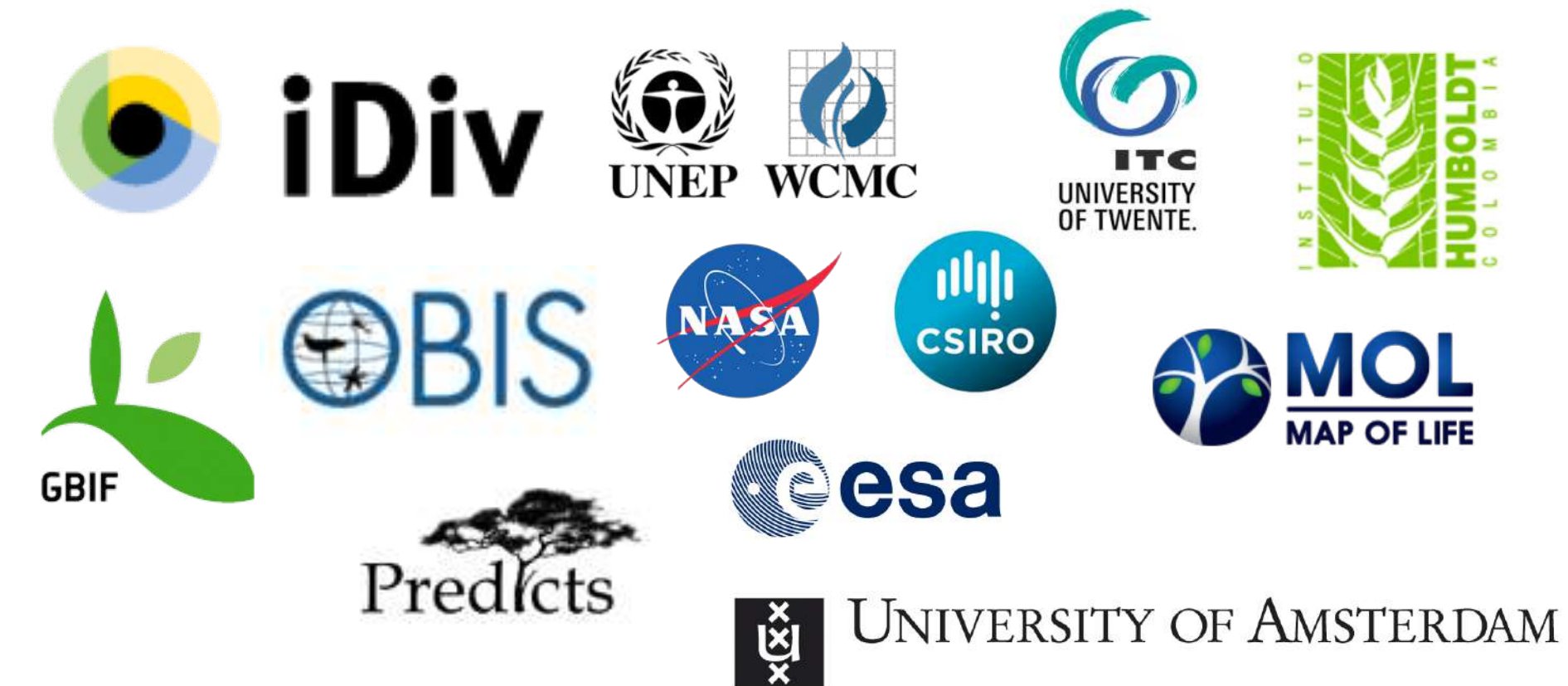
Mission: Improve the **acquisition, coordination** and **delivery** of biodiversity observations and related services to users including decision makers and the scientific community.



Vision: A **global biodiversity observation network** that contributes to effective **management policies** for the world's biodiversity and ecosystem services.

GEO BON in numbers

8 Working Groups, 8 Observation Networks and 4 Task Forces
672 registered members from 81 countries and 461 institutions



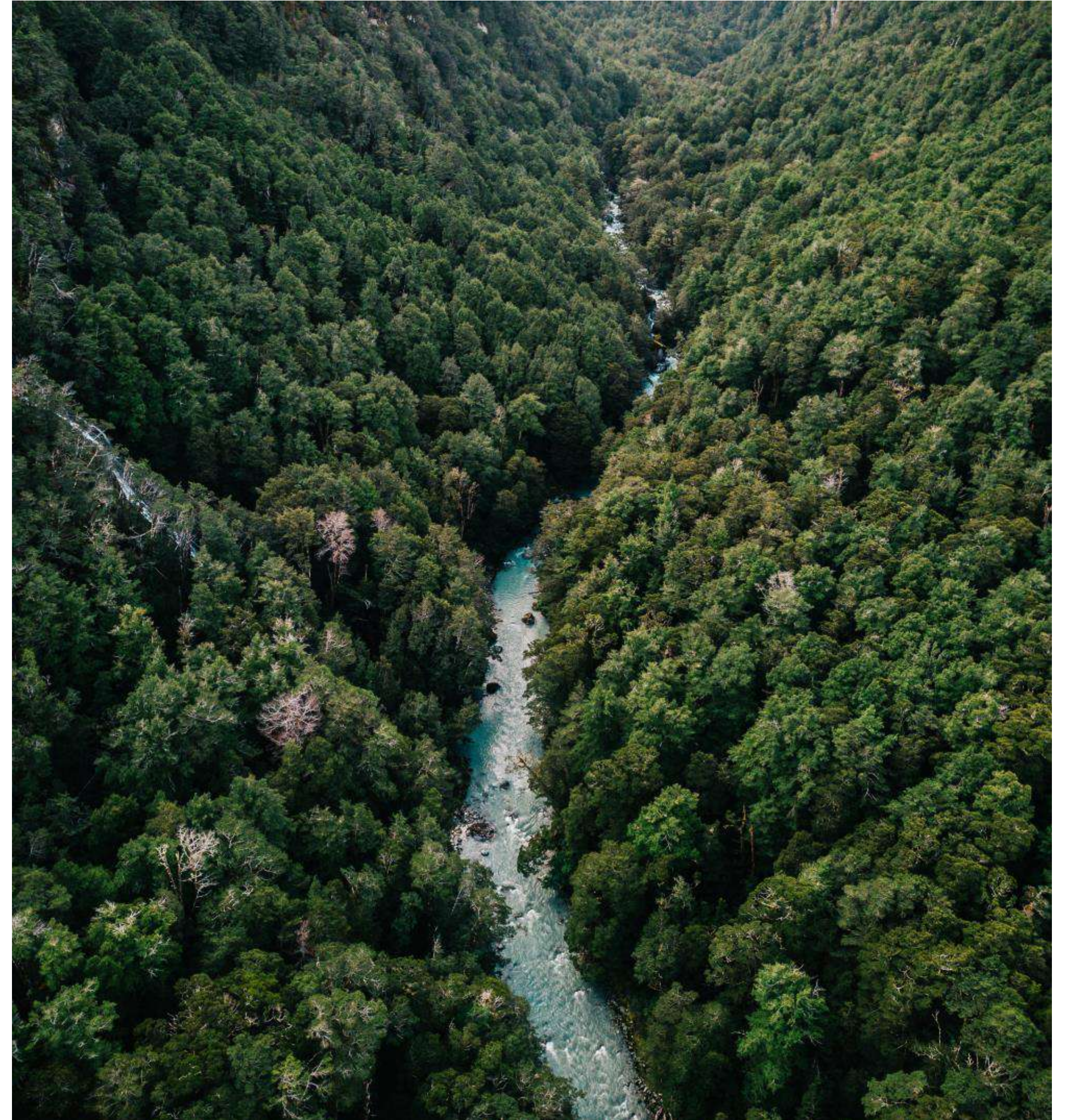
- Volunteer-based
- Small secretariat
- Biodiversity monitoring



GEO BON Core Activities

- 1. Developing the Essential Biodiversity Variables**
- 2. Developing the Biodiversity Observation Networks**
- 3. Producing policy relevant outputs**

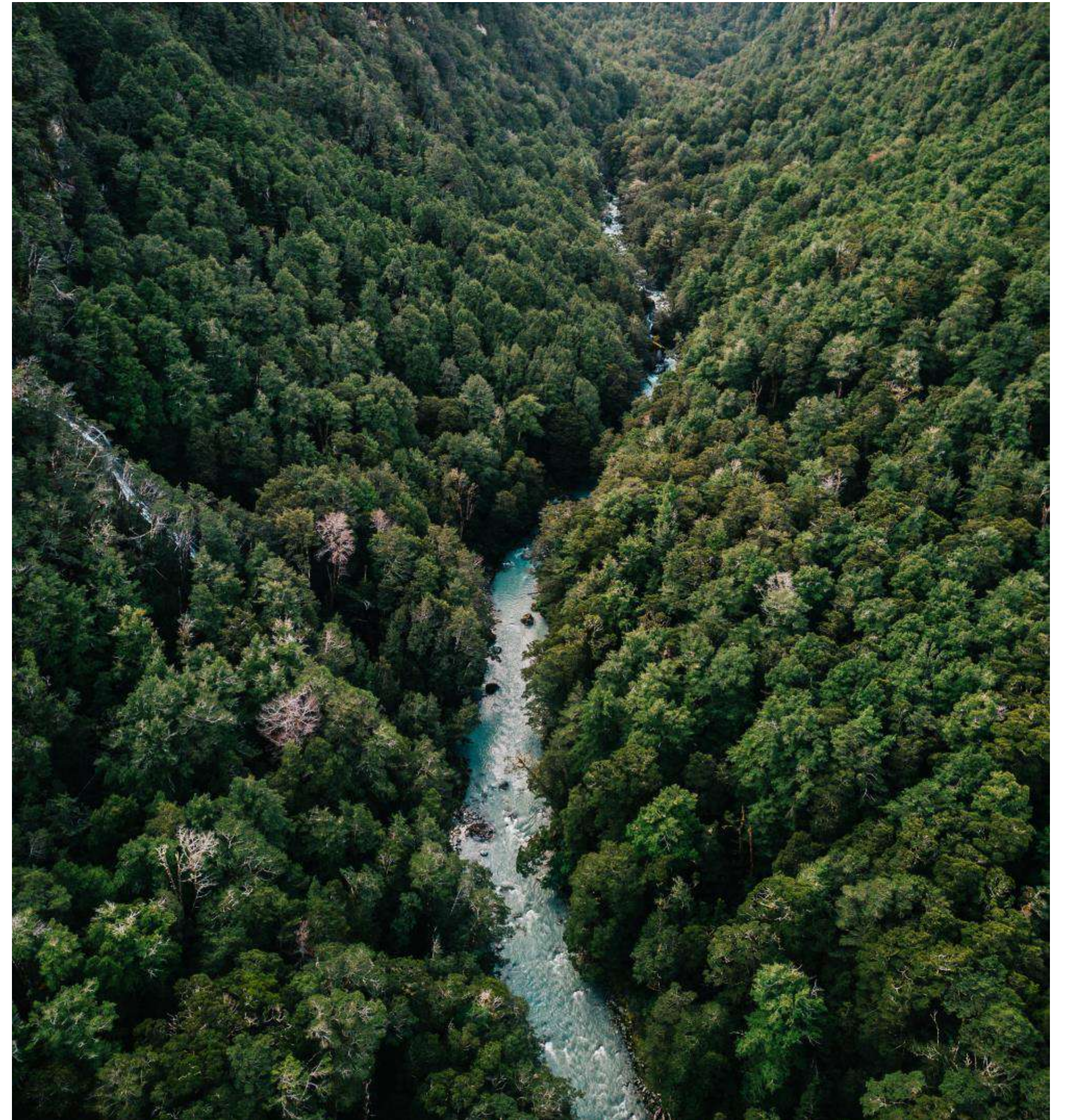
Data, Information Needs and Challenges



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Data, Information Needs and Challenges

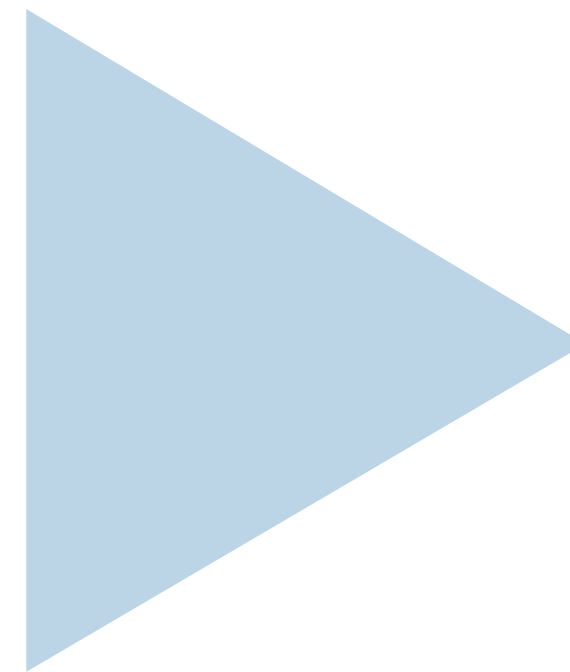


Developing the Essential Biodiversity Variables

EBVs: Minimum set of measurements, **complementary** to one another, that can capture major dimensions of biodiversity **change**.

EBVs are:

- ✓ Biological and policy relevant
- ✓ Sensitive to change
- ✓ Biological state variables
- ✓ Generalizable across realms
- ✓ Scalable
- ✓ Feasible



Genetic Composition

e.g. Allelic diversity



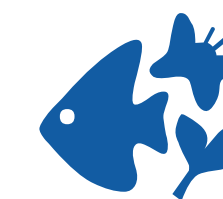
Species Populations

e.g. Species distribution



Species Traits

e.g. Body size, phenology



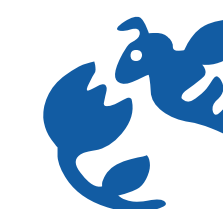
Community Composition

e.g. Species interactions



Ecosystem Structure

e.g. Ecosystem extent



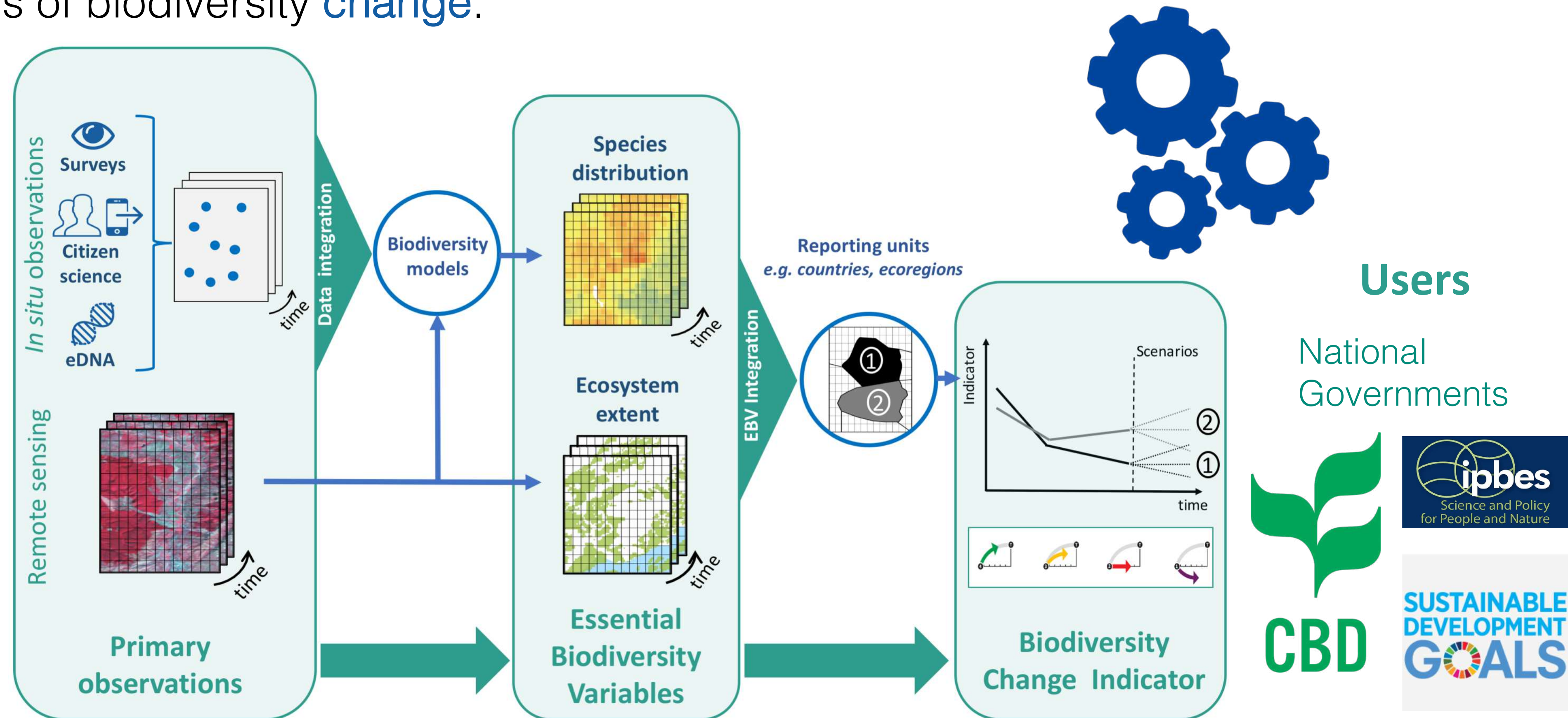
Ecosystem Functions

e.g. Disturbance



Developing the Essential Biodiversity Variables

EBVs: Minimum set of measurements, complementary to one another, that can capture major dimensions of biodiversity change.



Navarro et al., (2017) Current Opinion in Environmental Sustainability

Developing the Essential Biodiversity Variables – EBV Data portal

EBV catalogue and visualizer

The screenshot shows the EBV Data Portal search results page. The top navigation bar includes 'EBV Data Portal', 'SEARCH', 'MAP', and 'Contribute'. A search bar contains 'Search EBV Datasets...'. Below the search bar, there are filters for 'EBV classes' (Community Composition, Ecosystem Structure) and 'Keywords' (Diversity, local terrestrial diversity). The search results are displayed in a list format, showing 'Forest Cover' and 'Changes in local terrestrial diversity (PREDICTS)'. The 'Changes in local terrestrial diversity (PREDICTS)' entry is highlighted, showing a world map thumbnail and a description: 'Changes in average local terrestrial diversity for each grid cell caused by land-use, land-use intensity, and human population density, estimated by the PREDICTS model (Purvis et al., 2018). It reports number of species in each cell relative to a pristine baseline (percentage) and changes in species number (percentage) relative to 1900. Uses the LUH 2.0 projections for land-use and the PREDICTS database with 767 studies from over 32 000 sites on over 51 000 species from all taxa.'

The screenshot shows the EBV Data Portal visualizer. The top navigation bar includes 'GEO BON powered by UCT'. The main content area features a world map with a color scale from -1 (red) to 1 (green) relative to 1900. The map shows significant red areas in Africa, Asia, and South America, indicating a decrease in diversity. A legend in the bottom right corner of the map area shows the color scale: -1 relative to 1900 (red), 0 (white), and 1 (green). The right sidebar contains a detailed description of the 'Changes in local terrestrial diversity (PREDICTS)' dataset, including the title, description, and plot options. The plot options include 'Country', '2001', '2020', and 'sum'. A 'Calculate' button is located at the bottom of the sidebar.

Changes in aver... relative changes ...

EBV class: Community Composition
EBV: Alpha Diversity

Title: Changes in local terrestrial diversity (PREDICTS)
Desc: Changes in average local terrestrial diversity for each grid cell caused by land-use, land-use intensity, and human population density, estimated by the PREDICTS model (Purvis et al., 2018). It reports number of species in each cell relative to a pristine baseline (percentage) and changes in species number (percentage) relative to 1900. Uses the LUH 2.0 projections for land-use and the PREDICTS database with 767 studies from over 32 000 sites on over 51 000 species from all taxa.

Plot Options
Country 2001 2020 sum

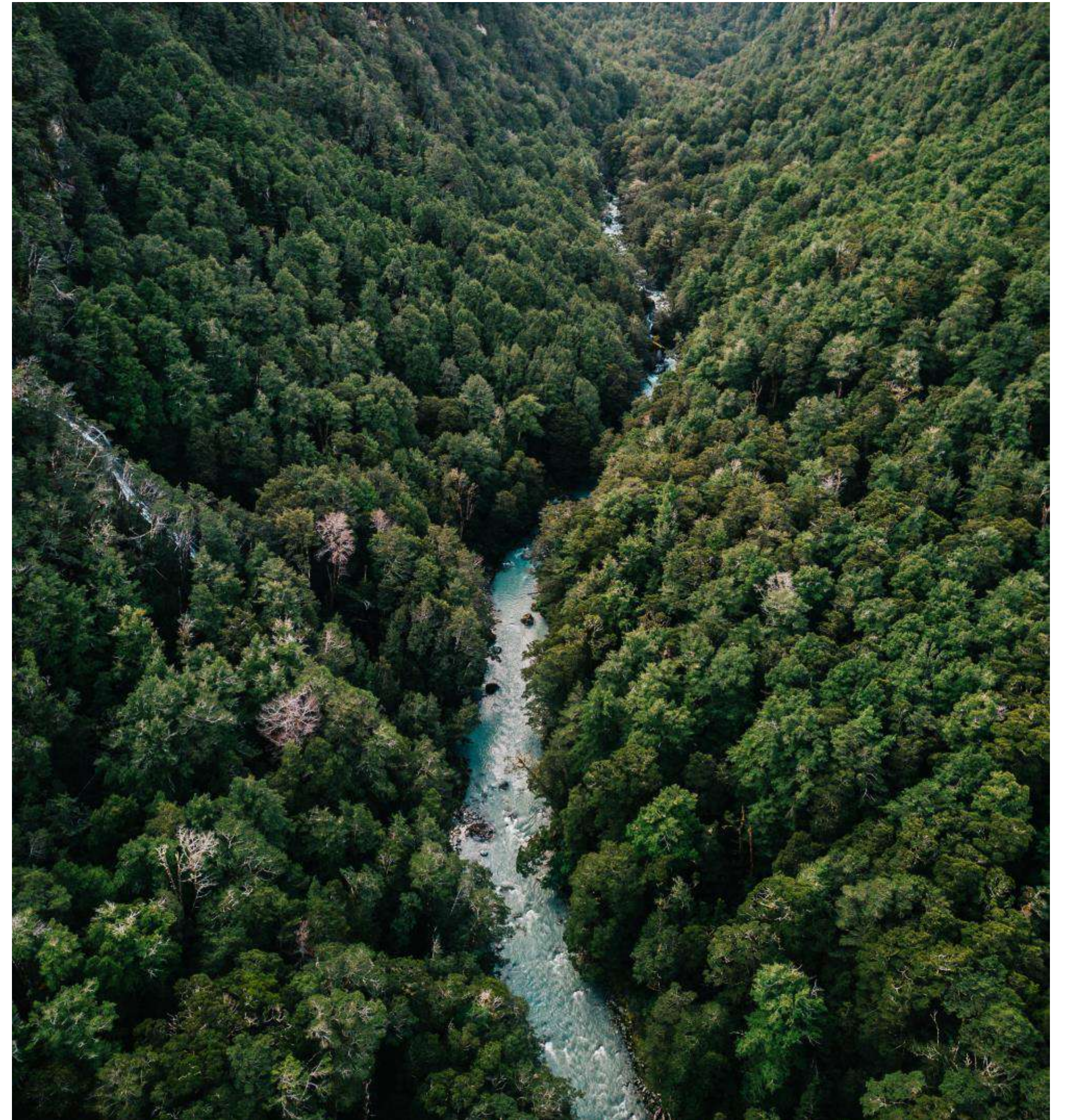
Calculate



GEO BON Core Activities

1. Developing the Essential Biodiversity Variables
- 2. Developing the Biodiversity Observation Networks**
3. Producing policy relevant outputs

Data, Information Needs and Challenges



Developing the Biodiversity Observation Networks

BONs: Contribute to the collection and analysis of harmonised biodiversity observations, the development of integrated and interoperable biodiversity monitoring programs, the development of data standards.

Thematic BONs
Marine BON (MBON)
Freshwater BON (FWBON)
Soil BON

MBON
Marine Biodiversity
Observation Network

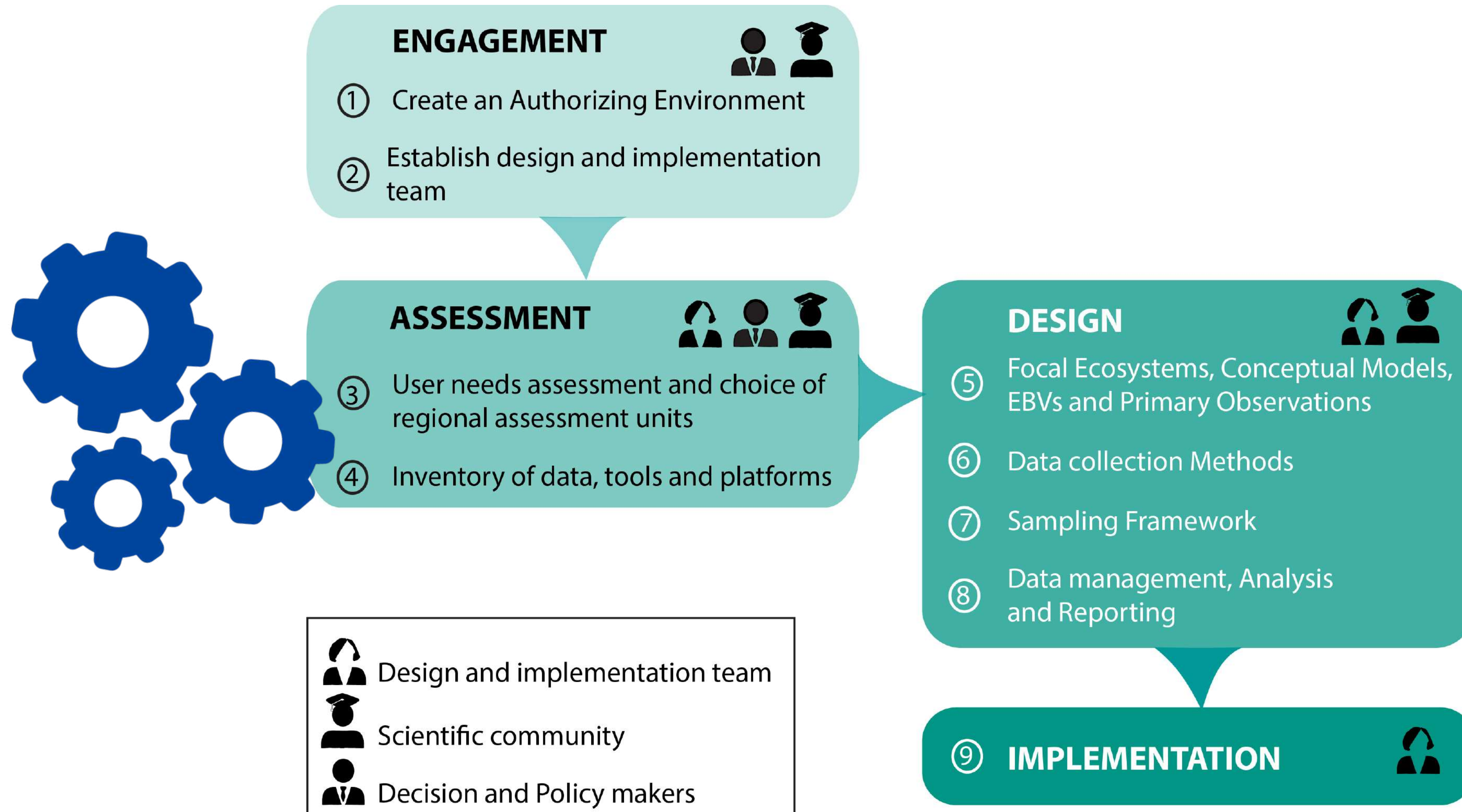
FWBON
Freshwater Biodiversity Observation Network



BON Endorsement
process

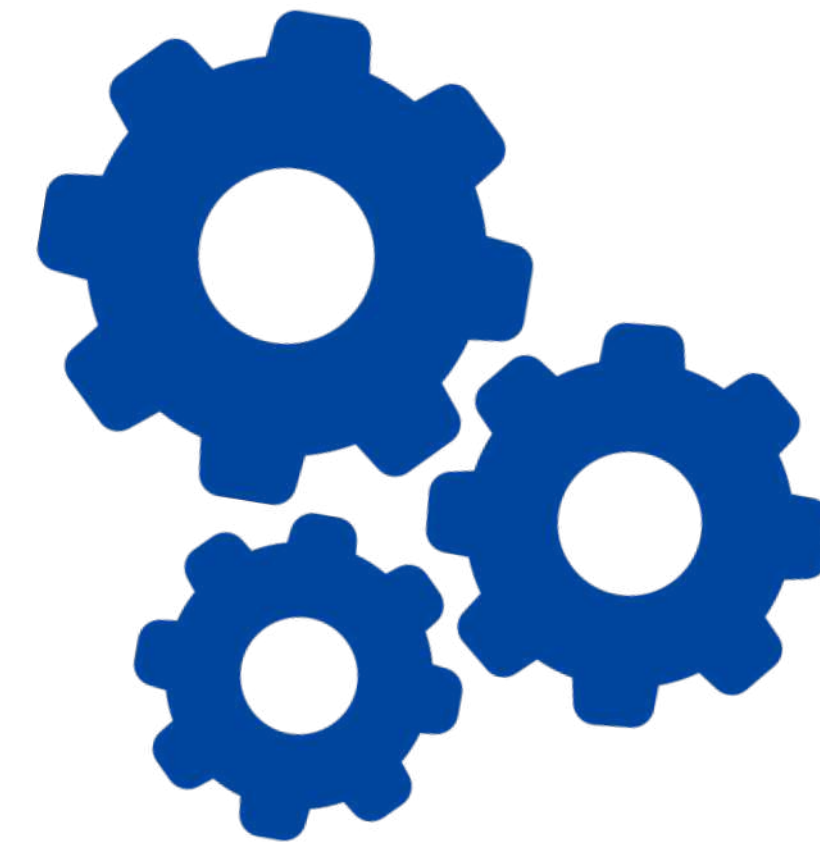


Developing the Biodiversity Observation Networks



Navarro et al., (2017) Current Opinion in Environmental Sustainability

Developing the Biodiversity Observation Networks



GEO BON

BON IN A BOX Latinoamerica Region

EN

BON IN A BOX

Improving Capacity for Biodiversity Conservation

BON in a Box (Biodiversity Observation Network in a Box) is a customizable and continually updated toolkit. It provides access to the latest biodiversity observation design, data collection protocols, and data management, analysis and reporting tools. It serves as a technology transfer and capacity building mechanism to ensure you have access to the best and most up-to-date tools and technologies for building a biodiversity observation system.

BON in a Box connects tools users and developers to promote ongoing tool improvements and the development of new tools. The goal is to **lower the threshold for the start-up or enhancement of a biodiversity observation networks** and support more effective conservation actions through the improved supply of quality biodiversity data. BON in a Box is a Group on Earth Observations – Biodiversity Observation Network initiative and the development of this Latin American regional version was led by Colombia's Alexander von Humboldt Institute.

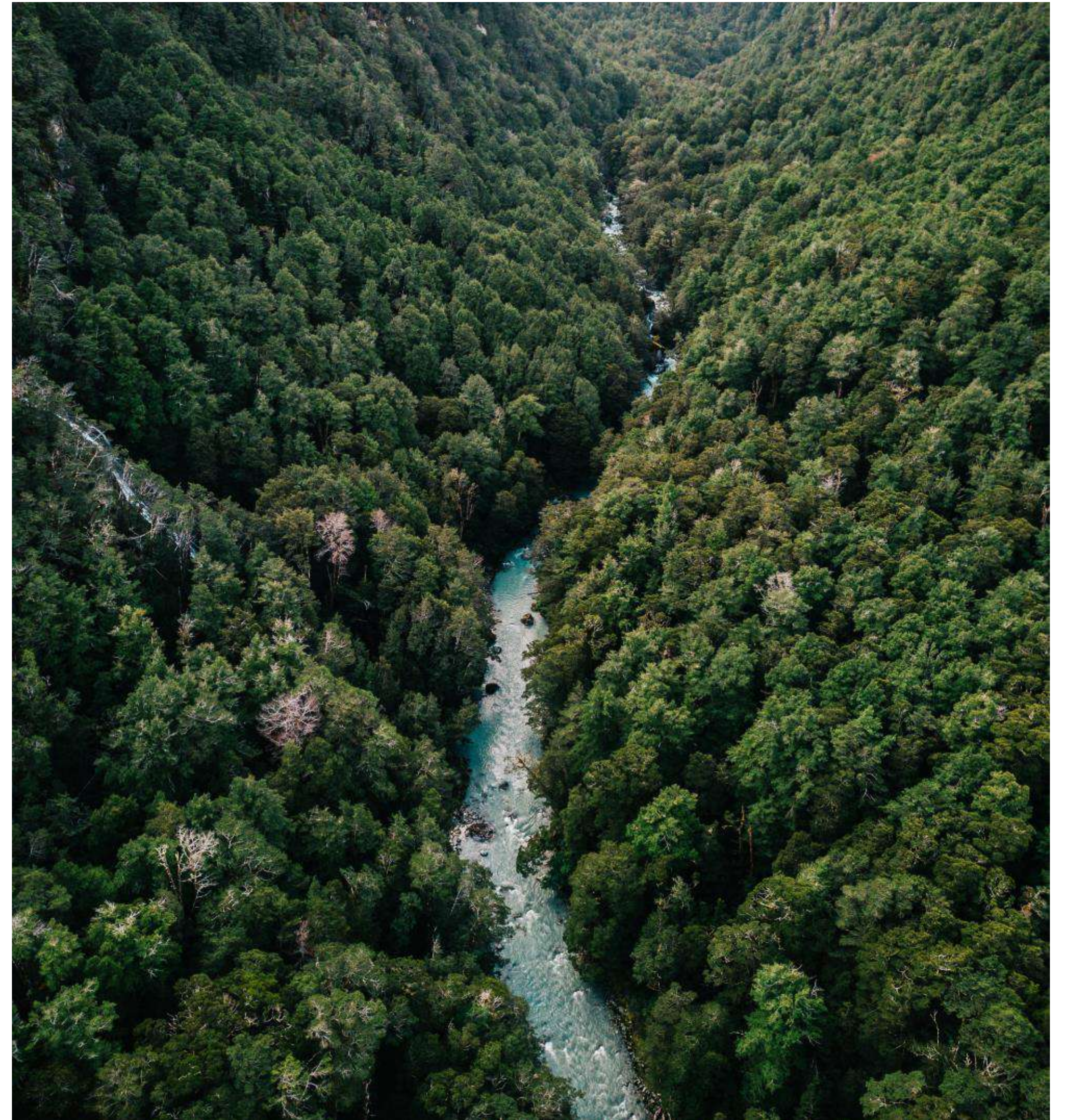
THE BOX TARGET REASON USAGE PARTNERS



GEO BON Core Activities

1. Developing the Essential Biodiversity Variables
2. Developing the Biodiversity Observation Networks
- 3. Producing policy relevant outputs**

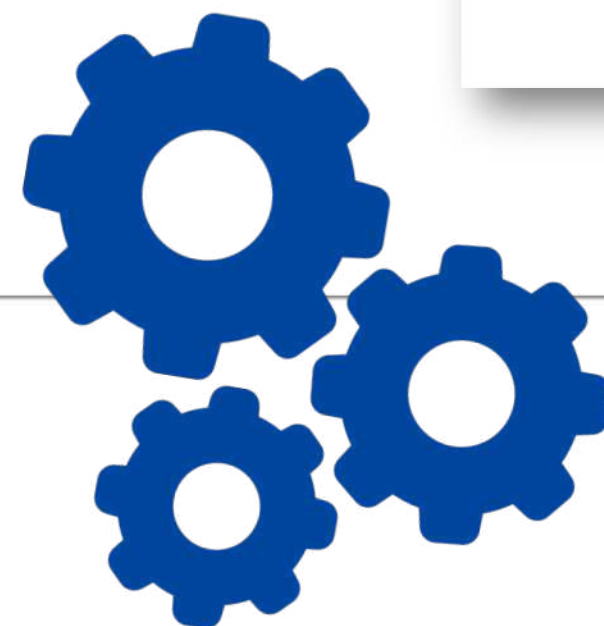
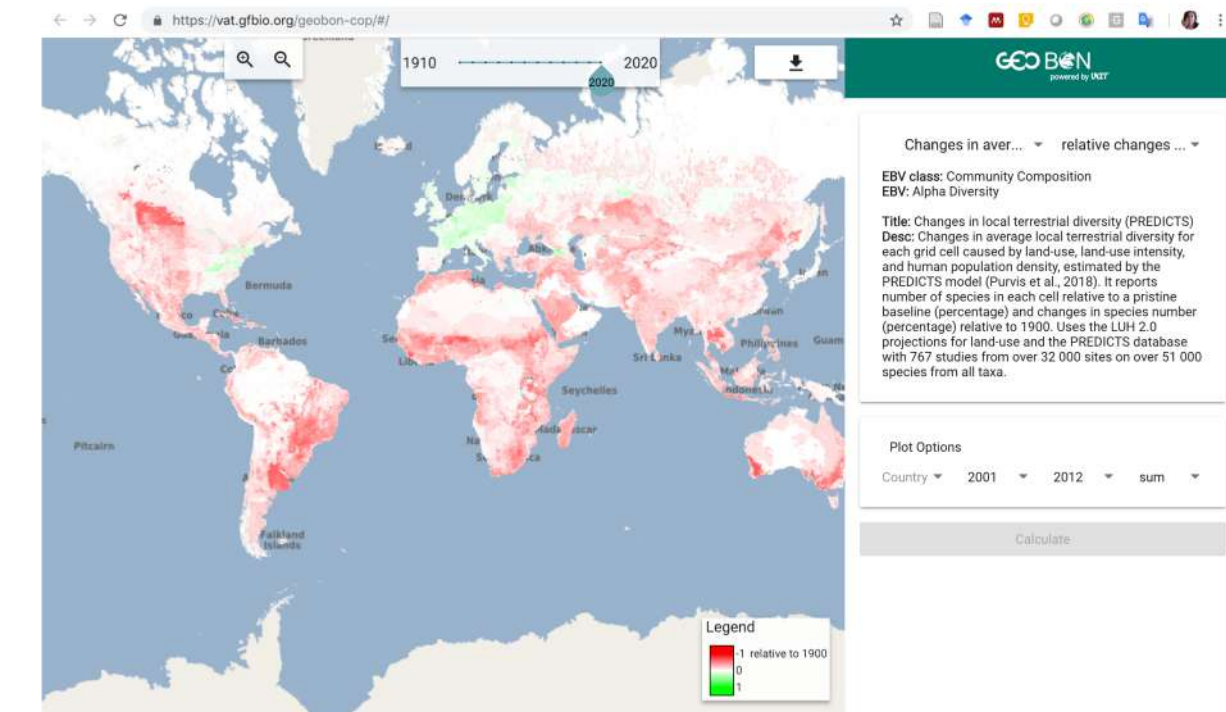
Data, Information Needs and Challenges



Producing policy relevant outputs

EBV based indicators: Integrating in situ and remote sensing observations for open access & real-time indicators

<p>SHI Species Habitat Indices</p> 	 	<p>Essential Biodiversity Variables: Species distributions Ecosystem extent and fragmentation</p>
<p>BHI Biodiversity Habitat Index</p> 		<p>Essential Biodiversity Variables: Ecosystem extent and fragmentation Taxonomic diversity</p>
<p>SPI Species Protection Index</p> 		<p>Essential Biodiversity Variables: Species distributions Ecosystem extent and fragmentation</p>
<p>PARC Protected Area Representativeness & Connectedness (PARC) Indices</p> 		<p>Essential Biodiversity Variables: Ecosystem extent and fragmentation Taxonomic diversity</p>
<p>GERI Global Ecosystem Restoration Index</p> 		<p>Essential Biodiversity Variables: Ecosystem extent Net primary productivity</p>
<p>SSII Species Status Information Index</p> 		<p>Essential Biodiversity Variables: Species distributions Taxonomic diversity</p>

Producing policy relevant outputs



Genetic Composition
Ecosystem Structure
Ecosystem Functions



Species Populations



Species Populations
Ecosystem Structure
Ecosystem Functions

Candidate EBV classes for the

SUSTAINABLE DEVELOPMENT GOALS



Ecosystem Structure



Species Traits
Ecosystem Structure
Ecosystem Functions



Species Populations
Ecosystem Structure

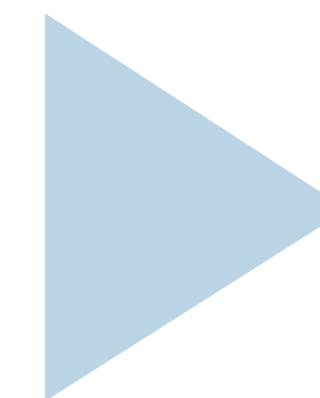


Species Populations
Ecosystem Structure
Ecosystem Functions



Target 14.2

Prototype product to integrate
EO, OBIS data, local surveys



GEO Data
Technology Workshop

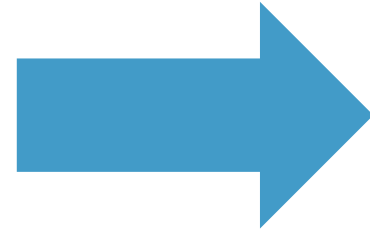
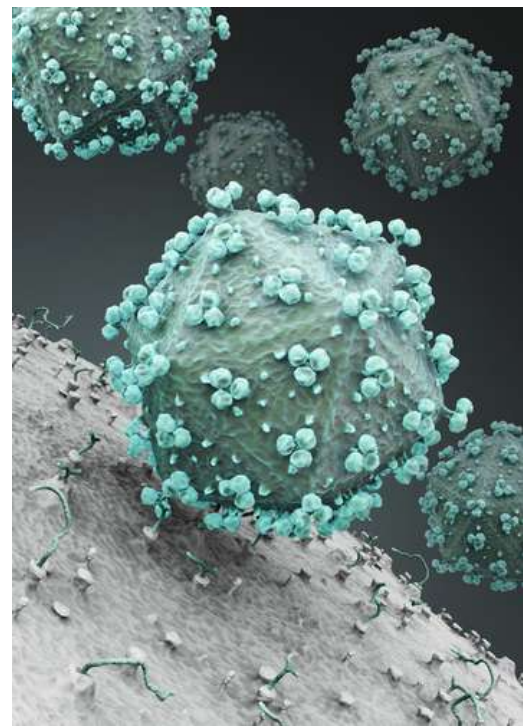


#GEOdatatech

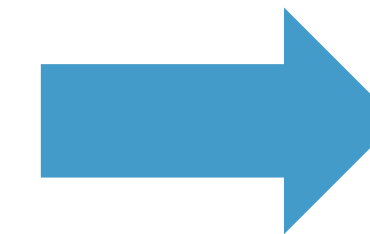
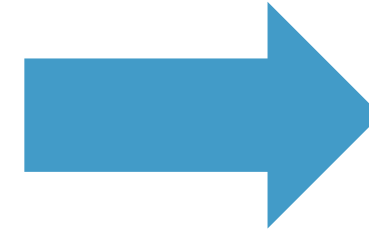
Producing policy relevant outputs: integrating human health and biodiversity monitoring



The example of the Nipah virus



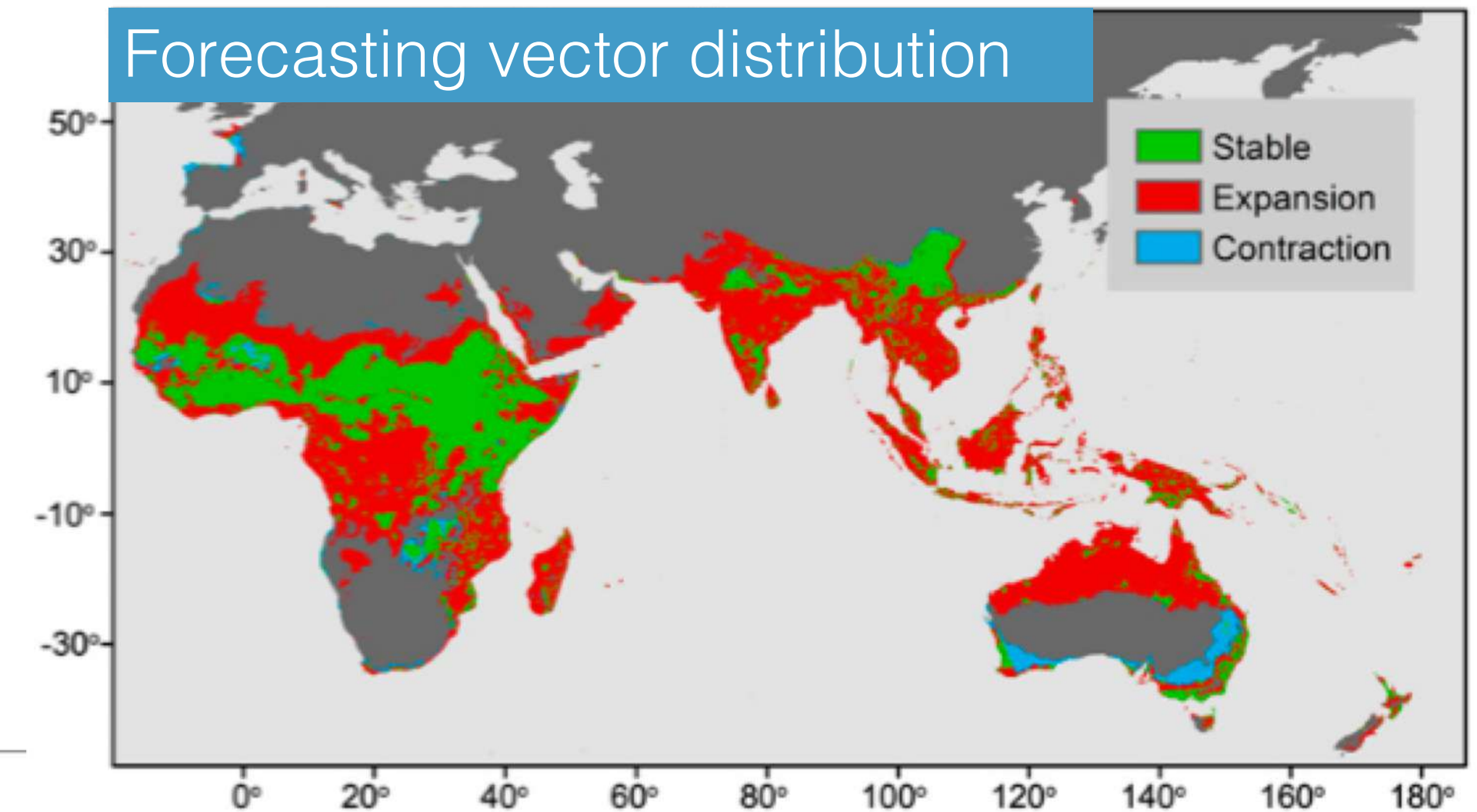
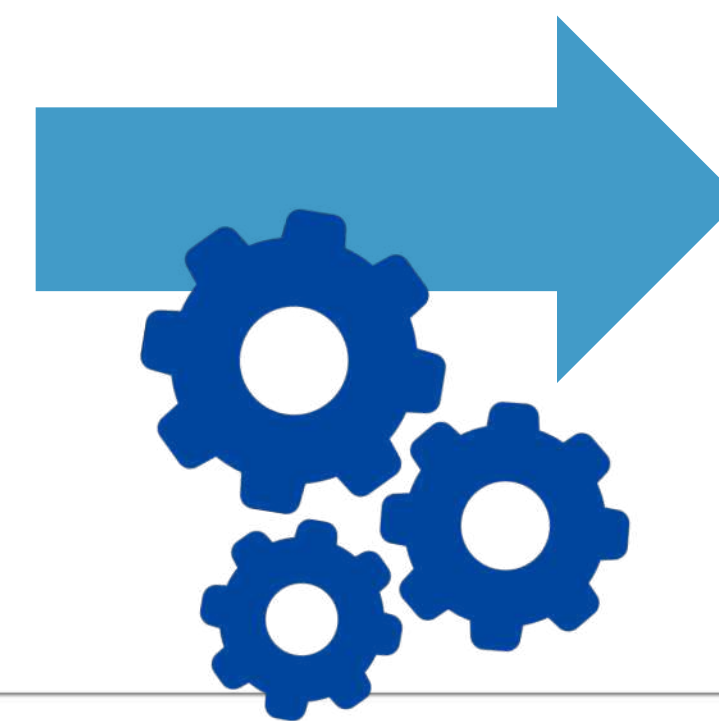
Pteropus poliocephalus source: EOL



 **Species Traits**
e.g. Phenology, Reproduction

 **Community Composition**
e.g. Species interactions

 **Ecosystem Structure**
e.g. Ecosystem extent, Fragmentation



Source: Daszak et al. 2013, PNAS

Thank you!

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Producing policy relevant outputs



THE BEIJING 2018 CALL ON BIODIVERSITY OBSERVATIONS FOR POST-2020 DECISION-MAKING

We, the Group on Earth Observation Biodiversity Observation Network (GEO BON), have gathered scientists and practitioners from over two dozen countries, on the occasion of our 10th anniversary, in Beijing, to discuss the future of biodiversity monitoring globally. We call on the Parties to the CBD to step up efforts on the collection, analysis and delivery of biodiversity observations.

Despite significant progress over the last decade in gathering biodiversity observations and on the development of indicators, significant gaps and barriers remain. At the time of the mid-term assessment of progress towards the Aichi biodiversity targets for 2020, uncertainties remained in the evaluation of most of the targets. Repeated, long-term biodiversity observations are crucial to detect changes in biodiversity and ecosystem services and for assessing current and future policy options through scenarios and models. Without a significant increase in global investment in biodiversity monitoring it is likely that existing observation gaps will continue to impair not only the assessment of policy goals but also their effective implementation.

To achieve a step change in action, we propose that the post-2020 targets explicitly include development of operational and sustainable national biodiversity observation networks. These networks would collect observations on multiple Essential Biodiversity Variables to inform the development, implementation and evaluation of national biodiversity policies. Such nationally encompassing monitoring systems would collect *in situ* and remote sensing data; aggregate and publish the data into public repositories using existing data standards; estimate or model Essential Biodiversity Variables; report on indicators relevant to national biodiversity strategy goals; and greatly facilitate policy implementation at a critical time for the world's biodiversity.

Beijing, 13 July 2018

