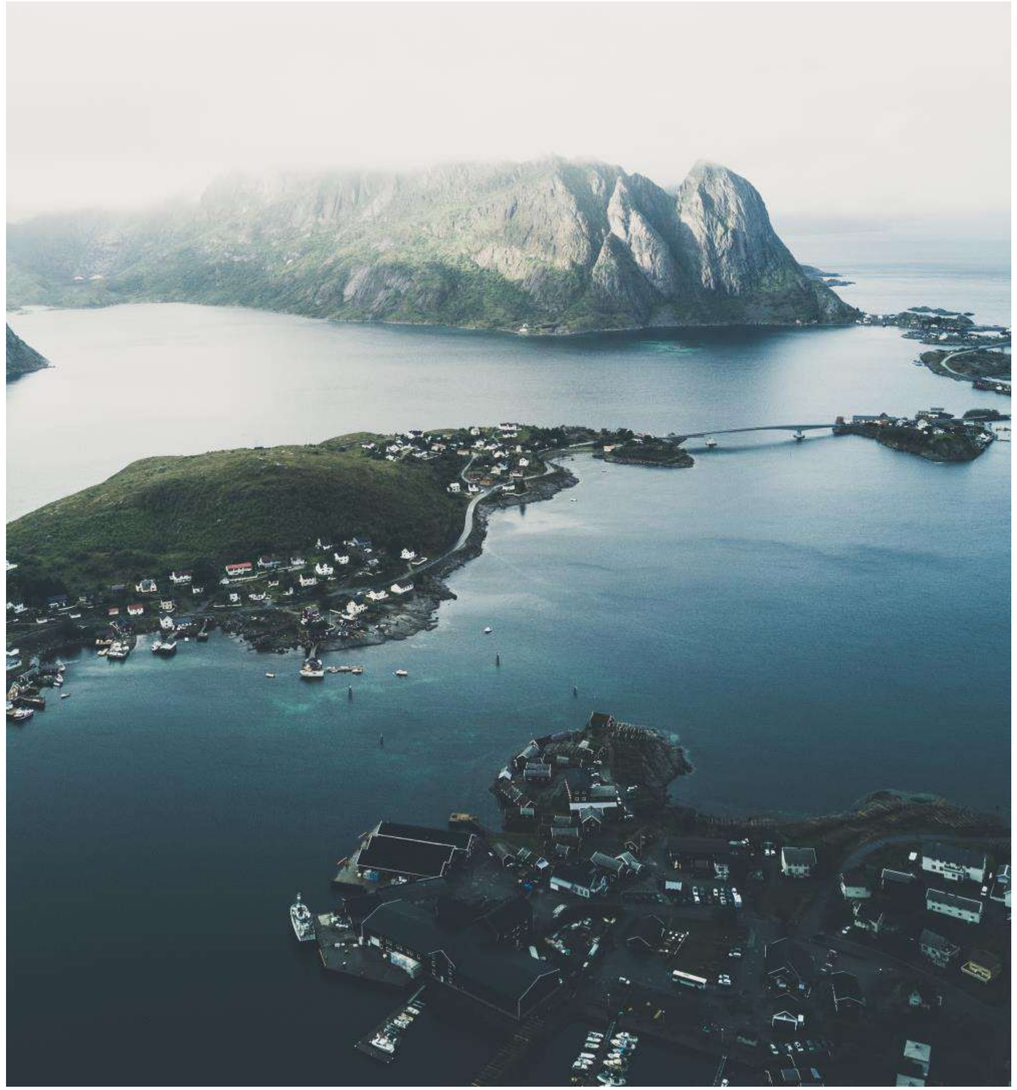
Monitoring biodiversity change



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
@GEOBON_org / laetitia.Navarro@idiv.de

The biodiversity crisis

Has the Earth's sixth mass extinction already arrived?

Anthony D. Barnosky[1,2,3], Nicholas Matzke[1], 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 Entomologisher 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

Intergovernmental Platform on Biodiversity & Ecosystem Services

ipbes
Science and Policy for People and Nature

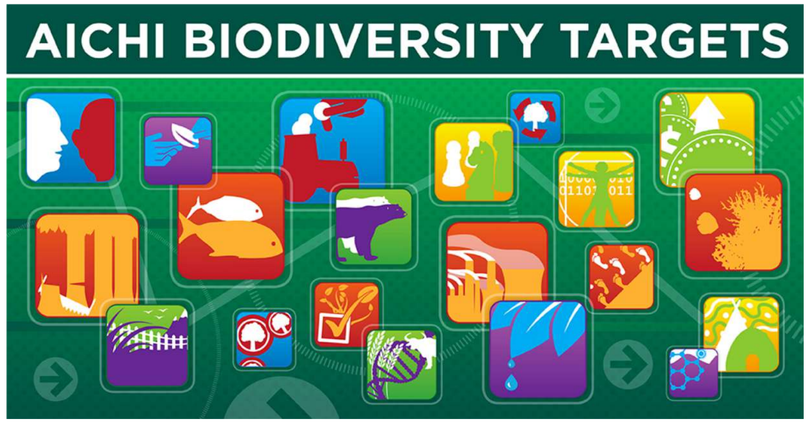
Ramsar

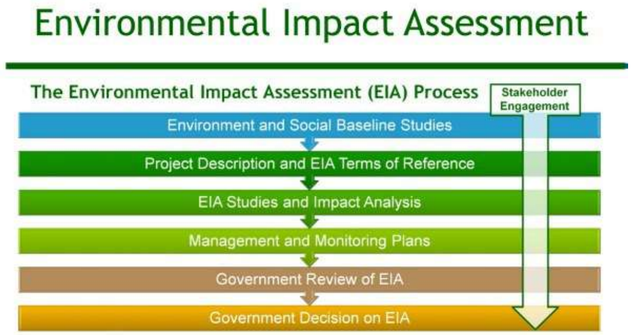
2011-2020
United Nations Decade on Biodiversity

Convention on Biological Diversity

UNCCD

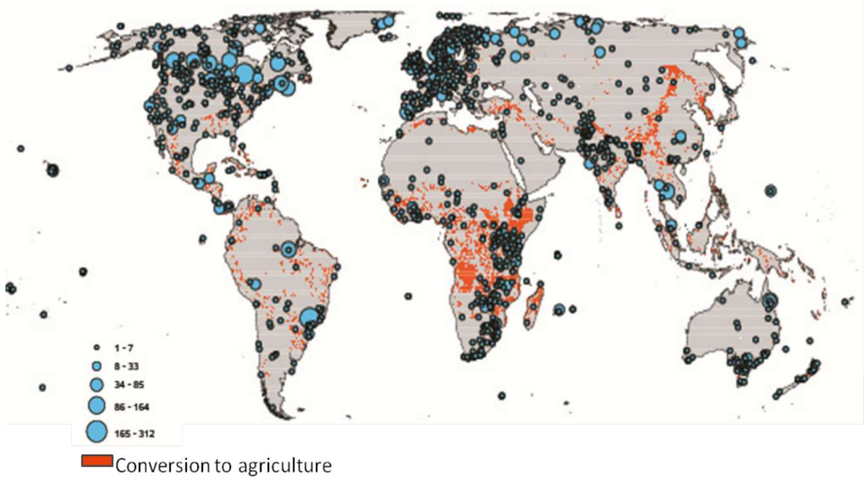
SUSTAINABLE DEVELOPMENT GOALS





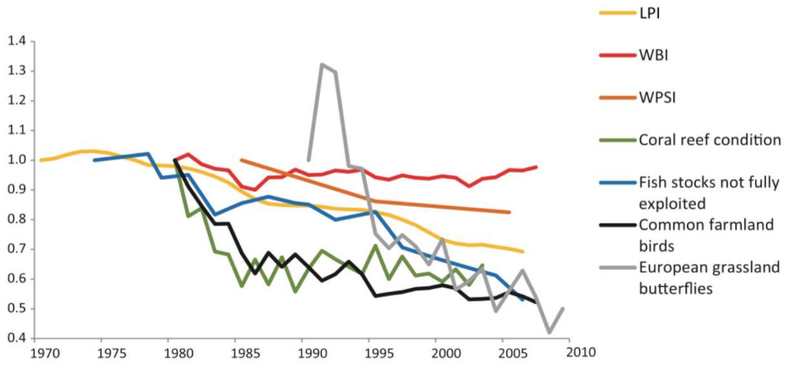
One challenge of biodiversity change: Knowledge gaps

Spatial gaps



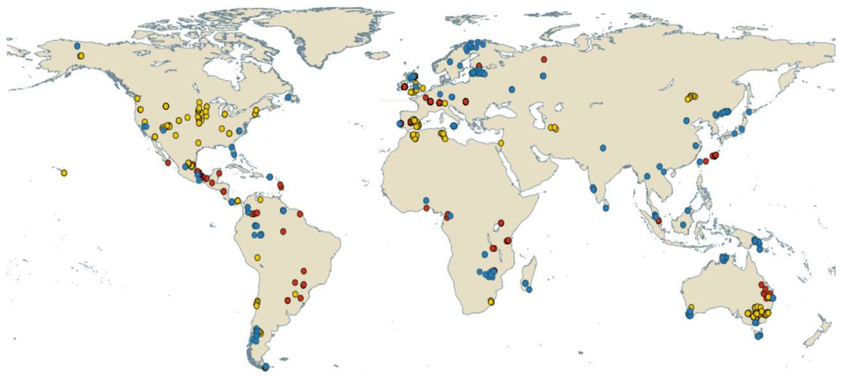
Living Planet Index Populations

Temporal gaps



Temporal trends in biodiversity indicators

Taxonomic gaps

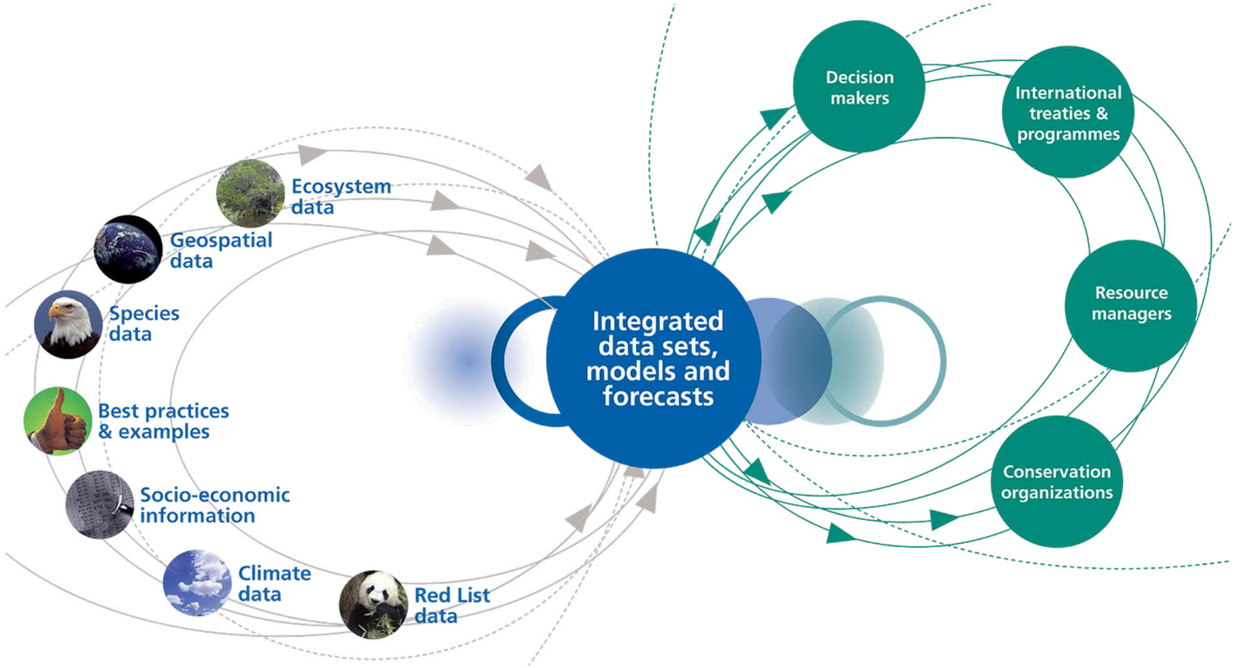


Distribution of sampling sites for soil bacterias, macrofauna and fungi

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.

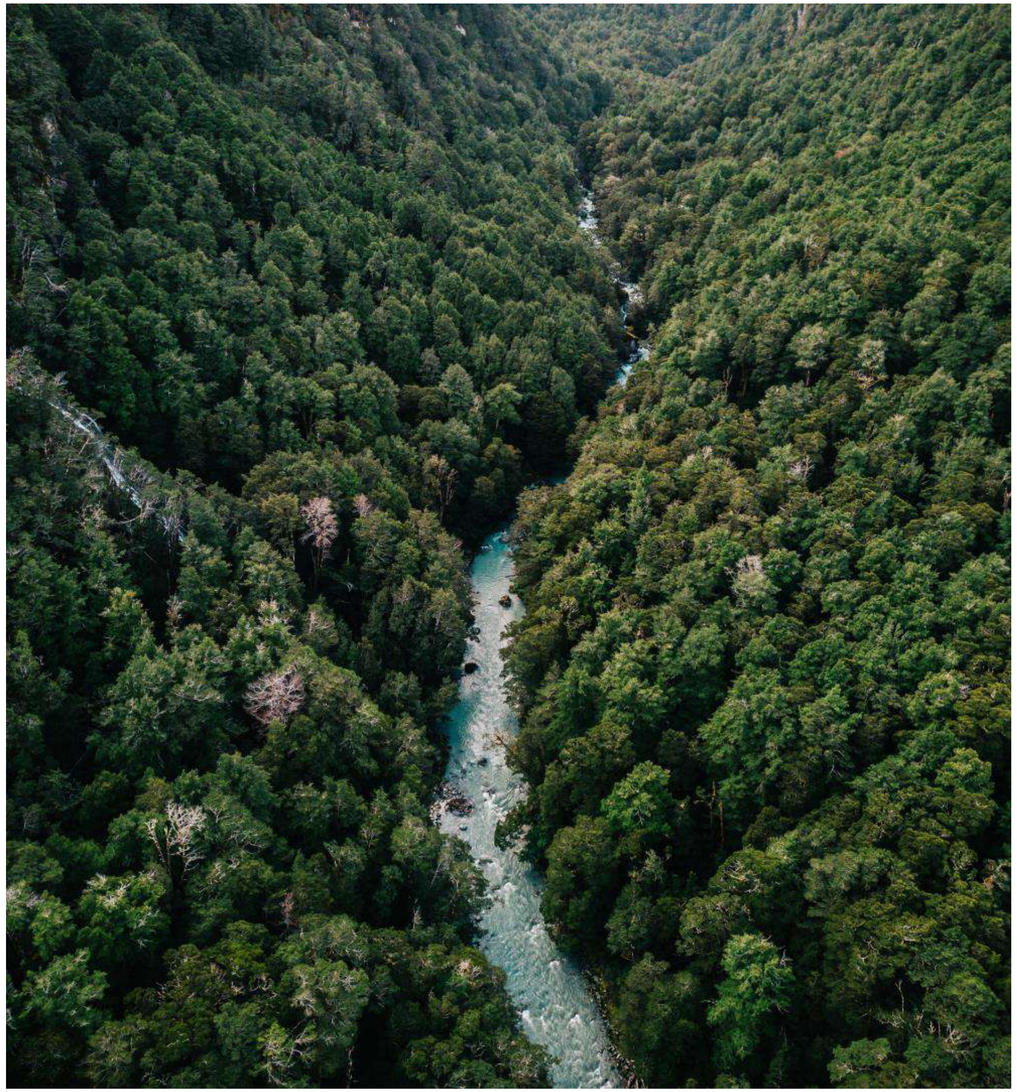
GEO BON in numbers

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

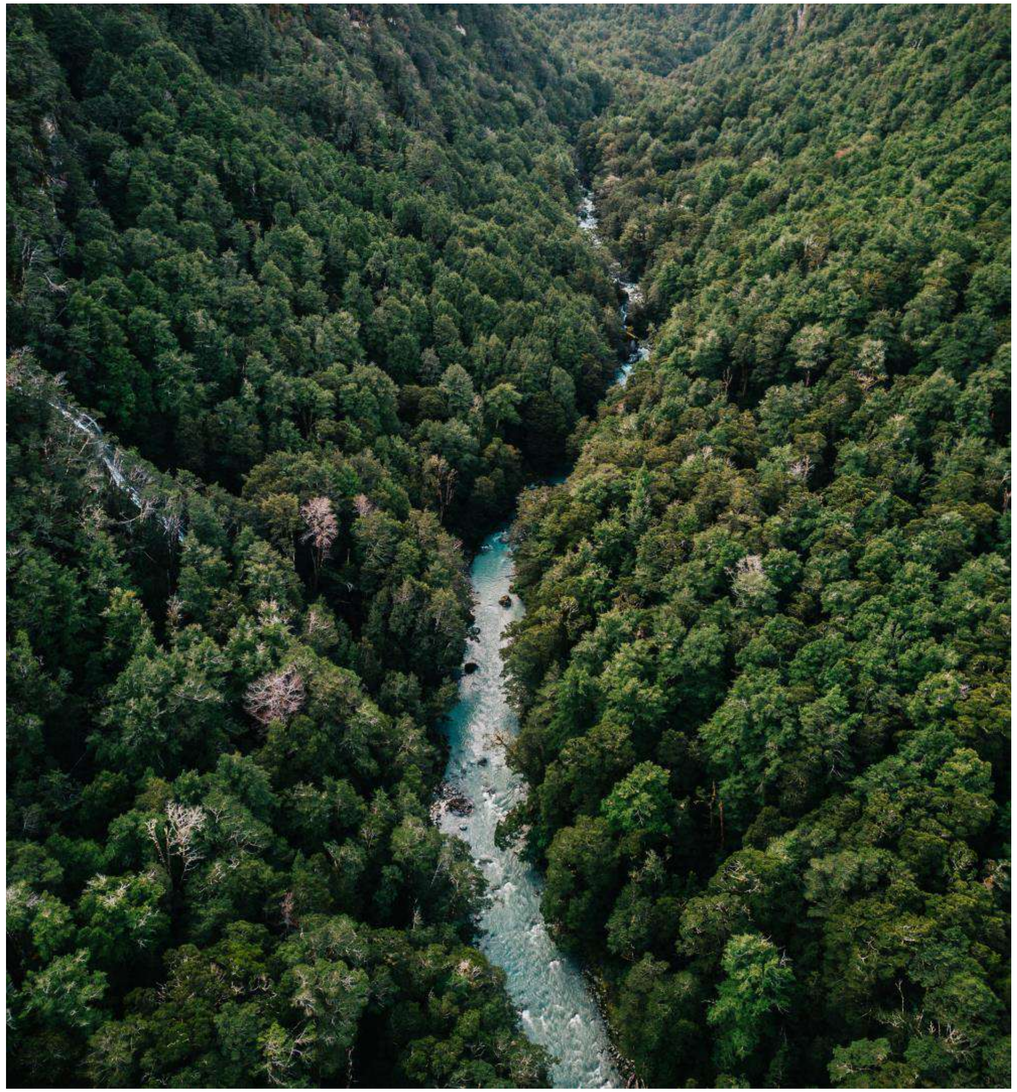
1. Developing the Essential Biodiversity Variables
2. Developing the Biodiversity Observation Networks
3. Producing policy relevant outputs



Data, Information Needs and Challenges

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 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

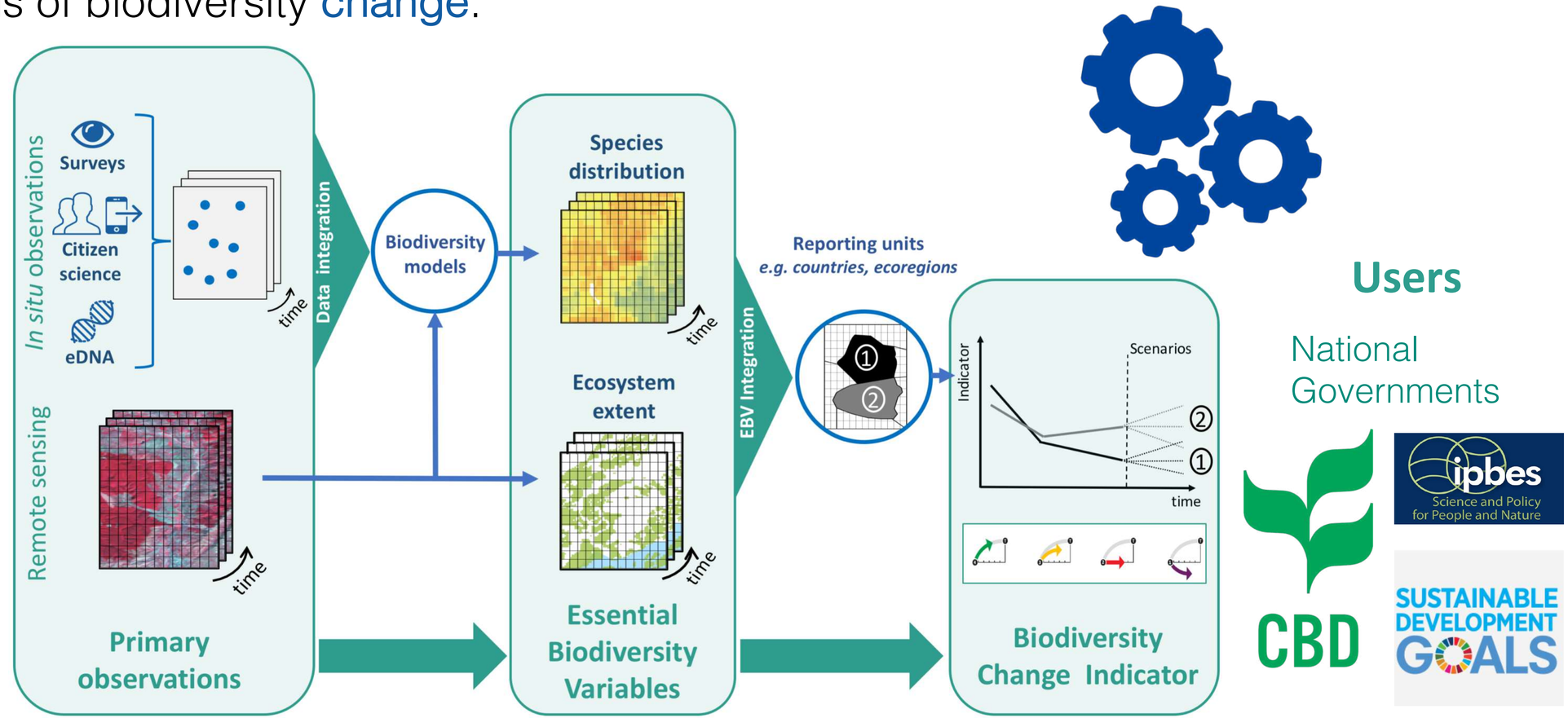
Community Composition
e.g. Species interactions

Ecosystem Structure
e.g. Ecosystem extent

Ecosystem Functions
e.g. Disturbance

Developing the Essential Biodiversity Variables

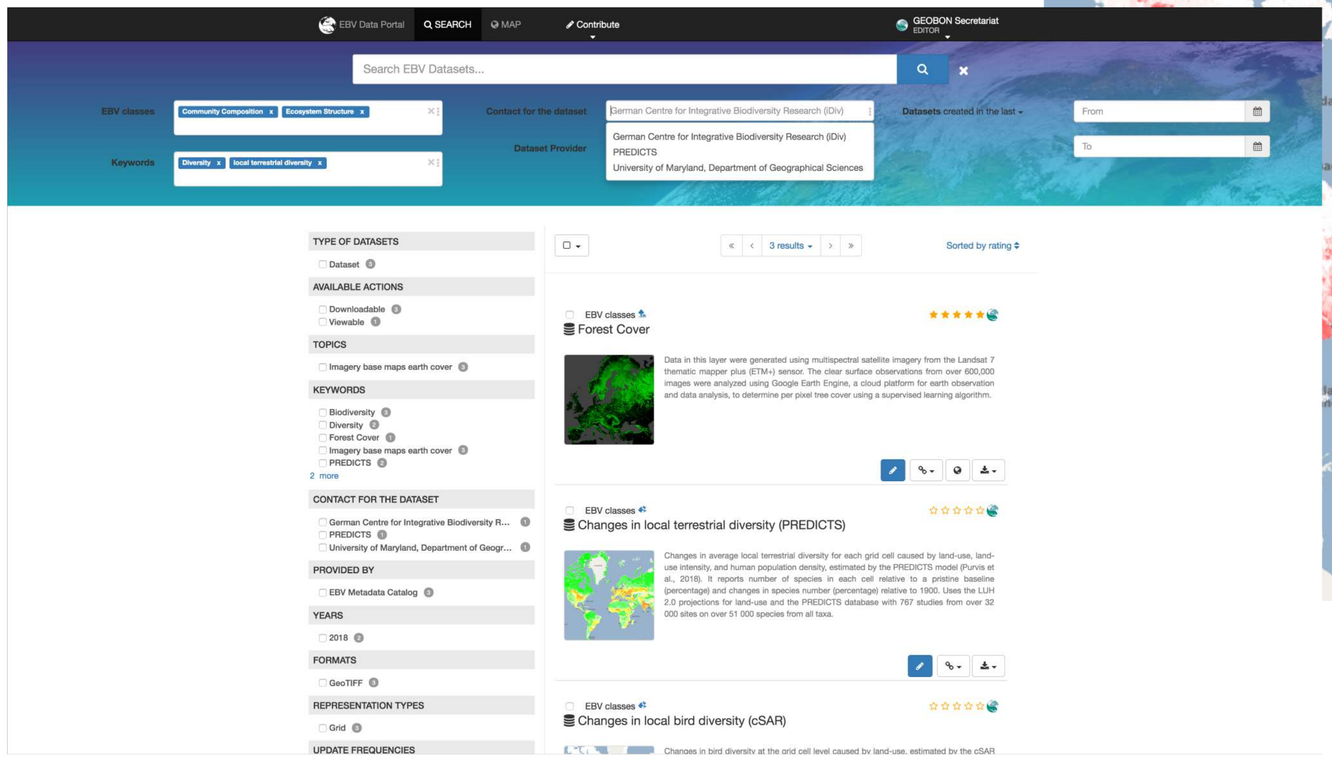
EBVs: Minimum set of measurements, complementary to one another, that can capture major dimensions of biodiversity change.

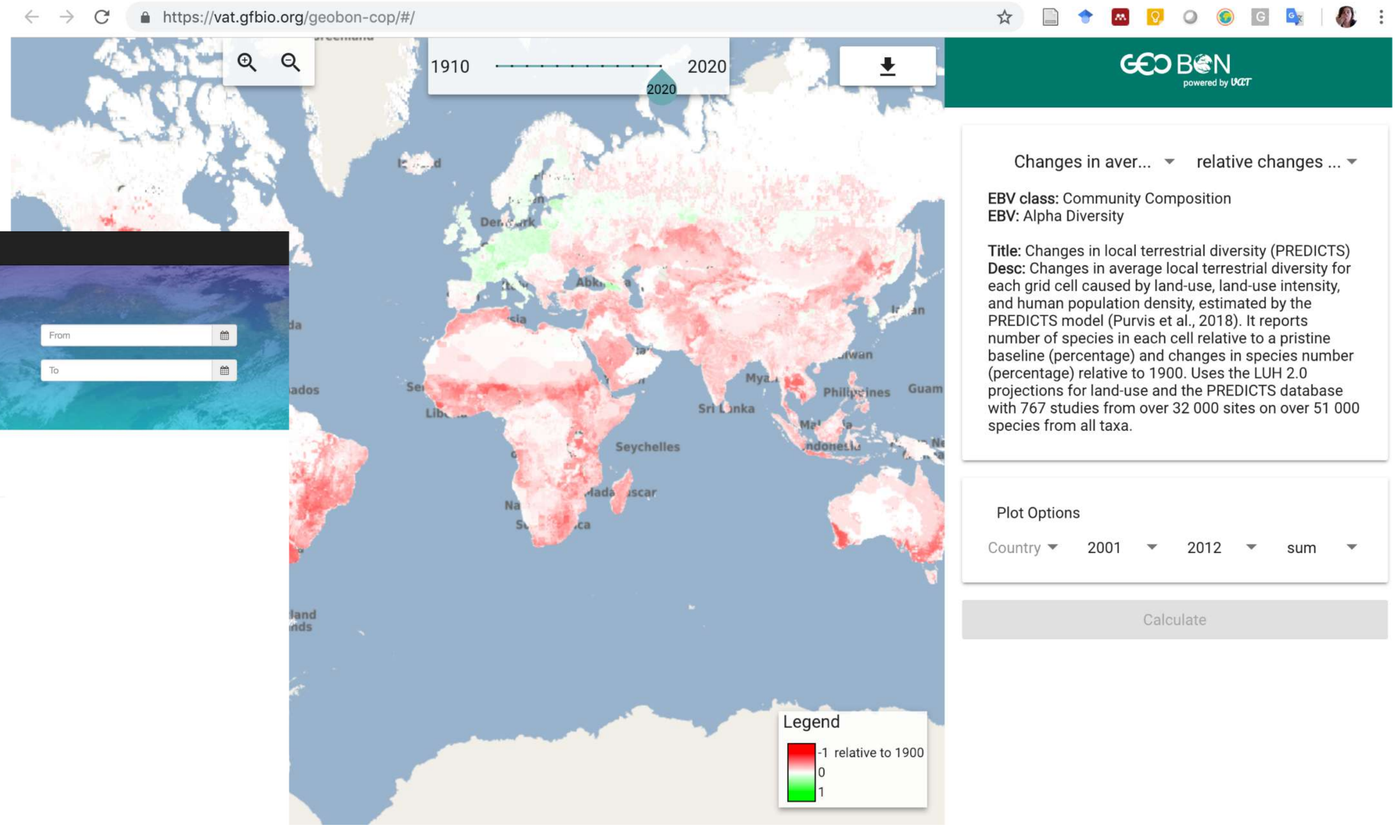


Navarro et al., (2017) Current Opinion in Environmental Sustainability

Developing the Essential Biodiversity Variables – EBV Data portal

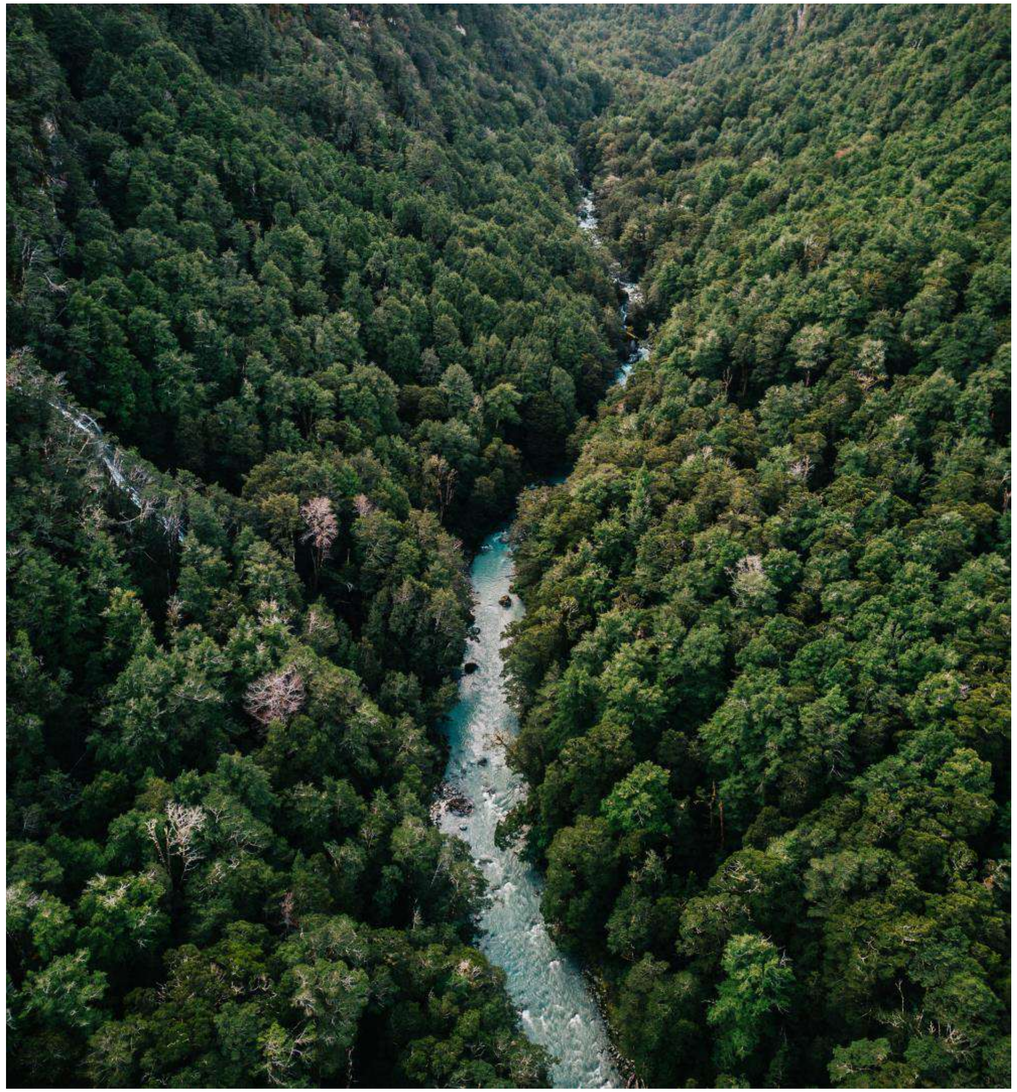
EBV catalogue and visualizer





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

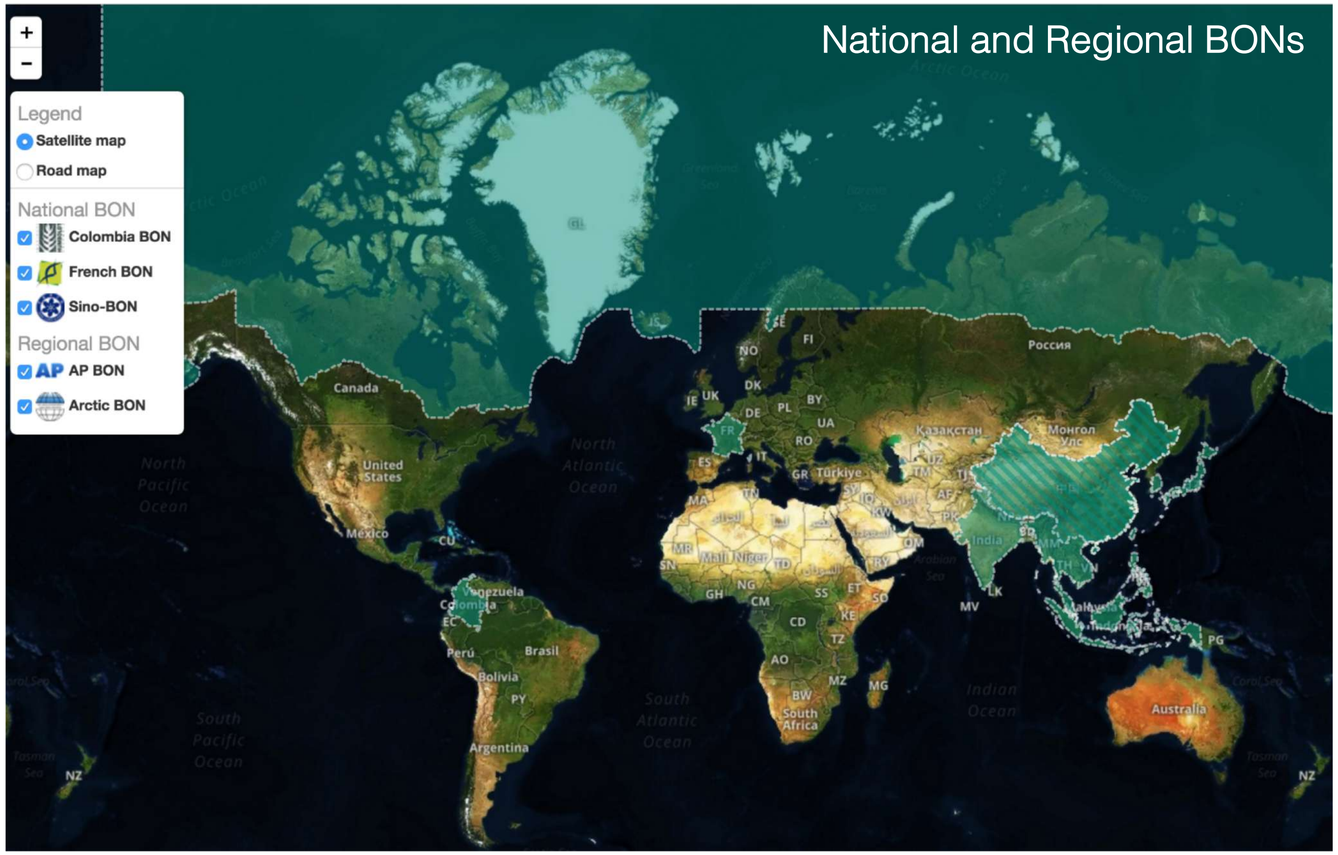
Developing the Biodiversity Observation Networks

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

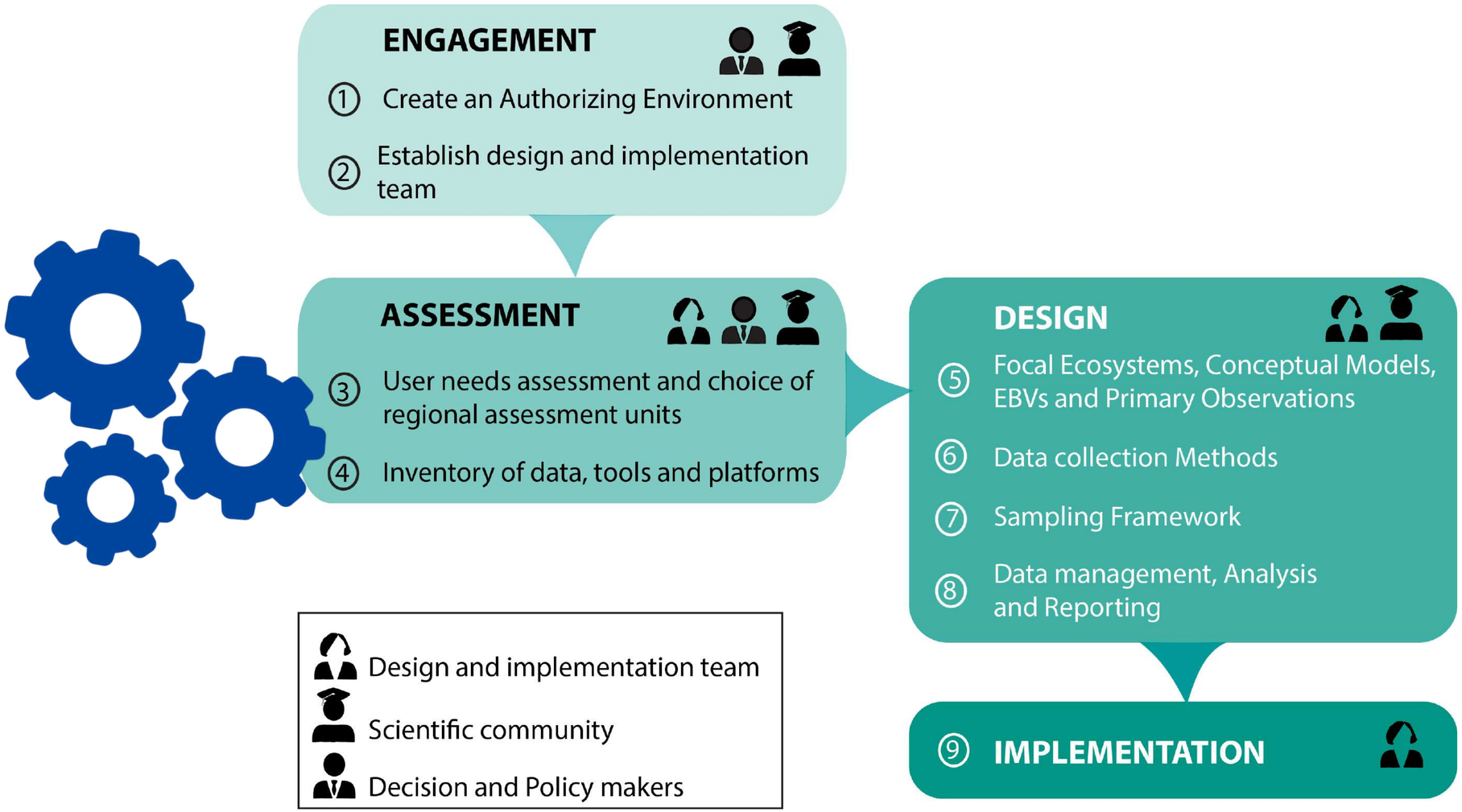
MBON
Marine Biodiversity Observation Network

FWBON
Freshwater Biodiversity Observation Network



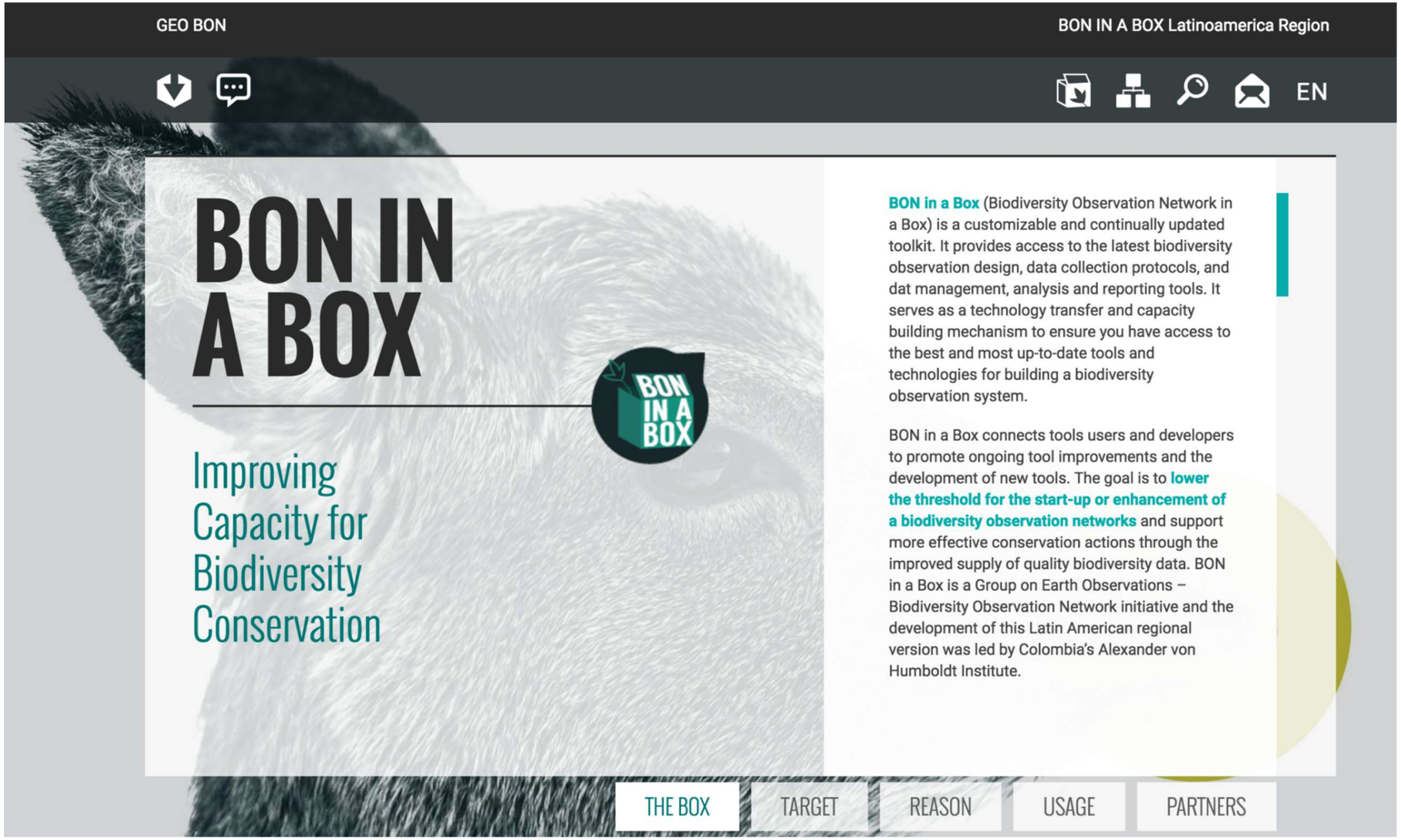
BON Endorsement process

Developing the Biodiversity Observation Networks



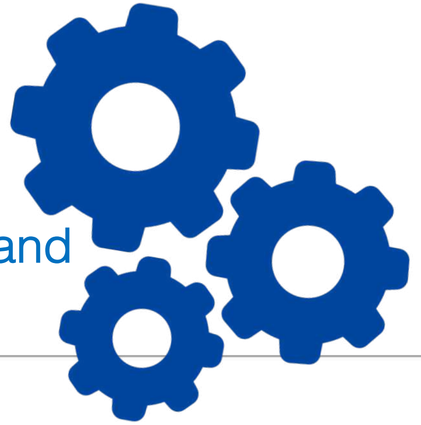
Navarro et al., (2017) Current Opinion in Environmental Sustainability

Developing the Biodiversity Observation Networks

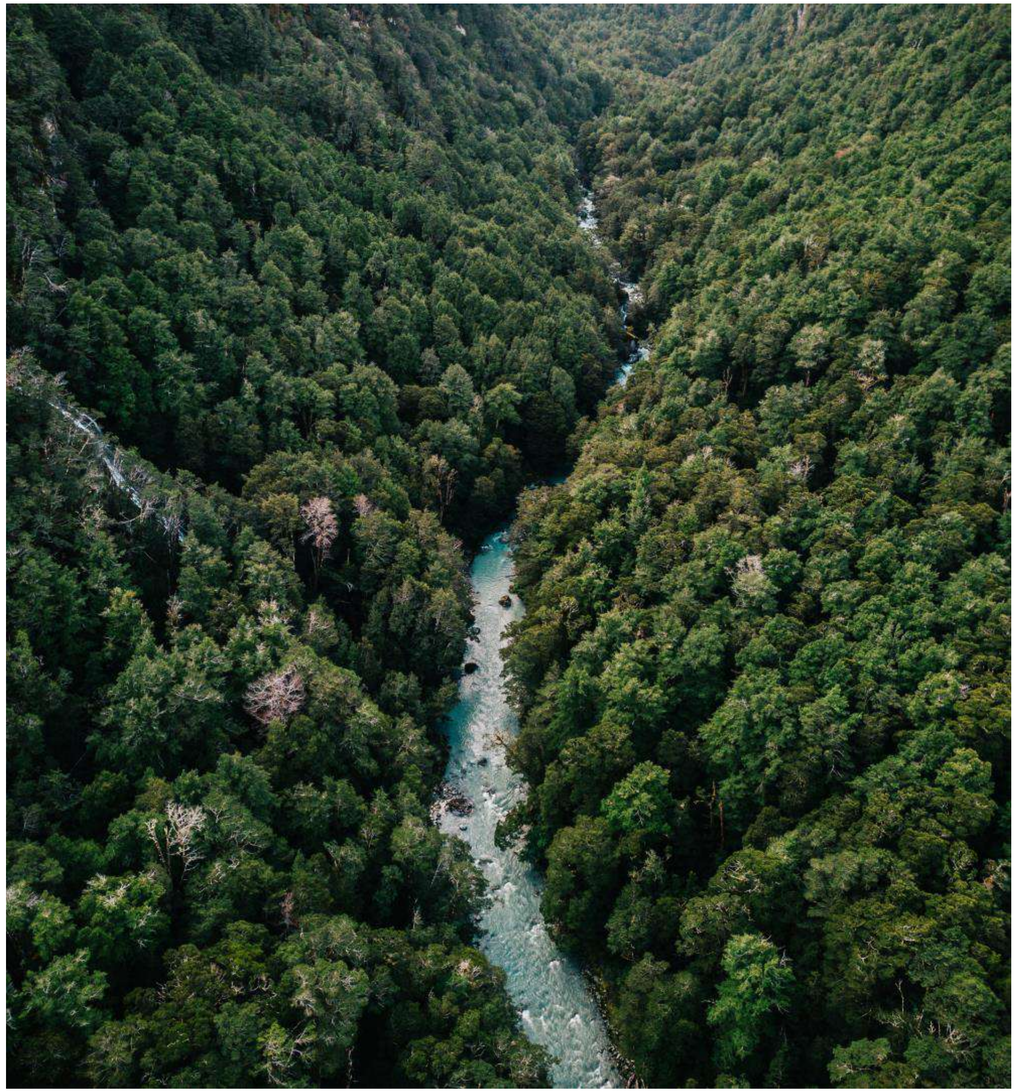


GEO BON Core Activities

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



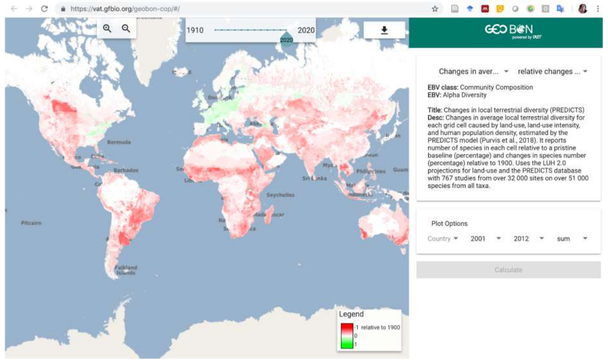
Data, Information Needs and Challenges



Producing policy relevant outputs

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

SHI Species Habitat Indices	MOL MAP OF LIFE	**Essential Biodiversity Variables:** Species distributions; Ecosystem extent and fragmentation
BHI Biodiversity Habitat Index	CSIRO	**Essential Biodiversity Variables:** Ecosystem extent and fragmentation; Taxonomic diversity
SPI Species Protection Index	MOL MAP OF LIFE	**Essential Biodiversity Variables:** Species distributions; Ecosystem extent and fragmentation
PARC Protected Area Representativeness & Connectedness (PARC) Indices	CSIRO	**Essential Biodiversity Variables:** Ecosystem extent and fragmentation; Taxonomic diversity
GERI Global Ecosystem Restoration Index	iDiv	**Essential Biodiversity Variables:** Ecosystem extent; Net primary productivity
SSII Species Status Information Index	MOL MAP OF LIFE	**Essential Biodiversity Variables:** Species distributions; Taxonomic diversity



CBD

ipbes Science and Policy for People and Nature

Producing policy relevant outputs

Candidate EBV classes for the SUSTAINABLE DEVELOPMENT GOALS

2 ZERO HUNGER
Genetic Composition
Ecosystem Structure
Ecosystem Functions

3 GOOD HEALTH AND WELL-BEING
Species Populations

6 CLEAN WATER AND SANITATION
Species Populations
Ecosystem Structure
Ecosystem Functions

11 SUSTAINABLE CITIES AND COMMUNITIES
Ecosystem Structure

14 LIFE BELOW WATER
Species Populations
Ecosystem Structure

13 CLIMATE ACTION
Species Traits
Ecosystem Structure
Ecosystem Functions

15 LIFE ON LAND
Species Populations
Ecosystem Structure
Ecosystem Functions

MBON
Marine Biodiversity Observation Network

OBIS
OCEAN BIOGEOGRAPHIC INFORMATION SYSTEM

Target 14.2

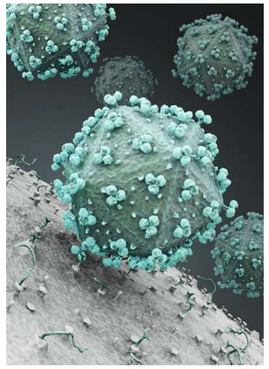
Prototype product to integrate EO, OBIS data, local surveys

14 LIFE BELOW WATER

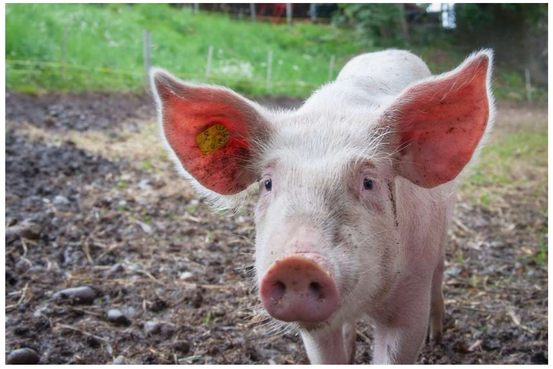
Producing policy relevant outputs: integrating human health and biodiversity monitoring

3 GOOD HEALTH AND WELL-BEING

The example of the Nipah virus



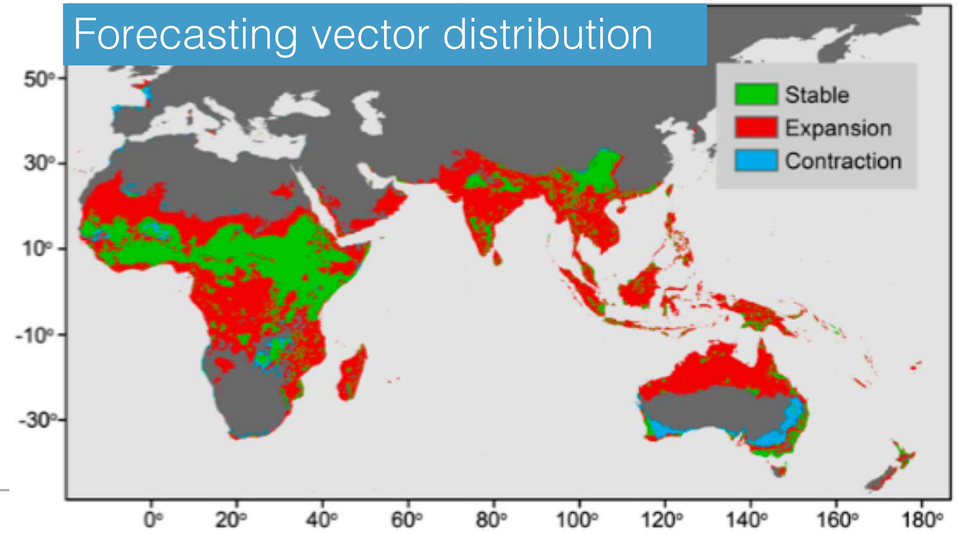
Pteropus poliocephalus source: EOL



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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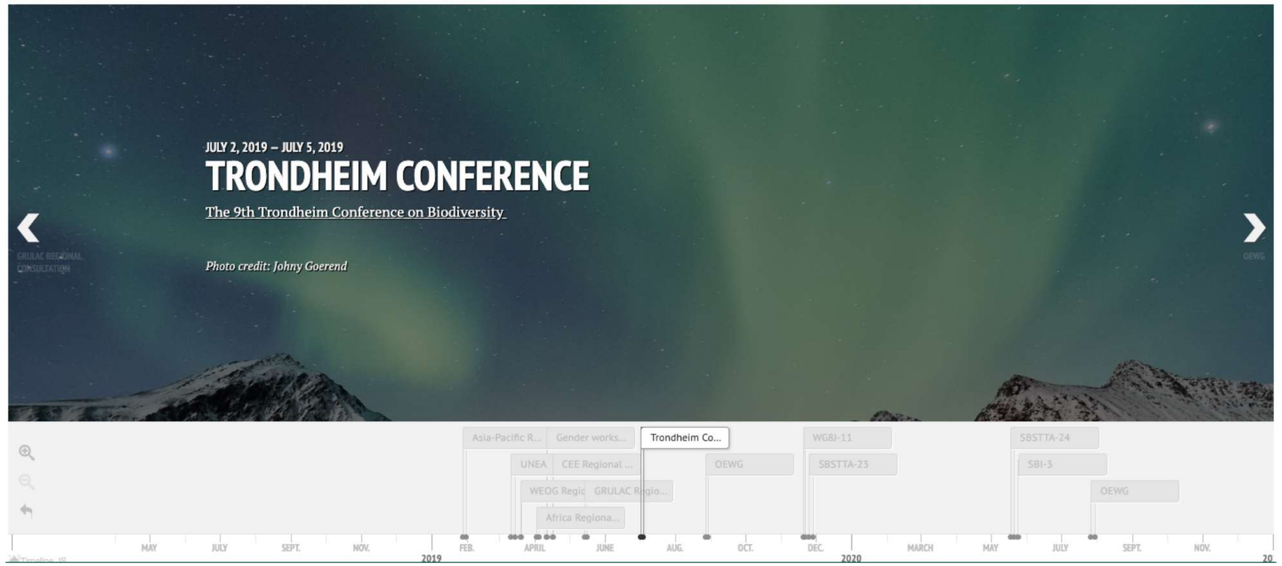
Producing policy relevant outputs

Convention on Biological Diversity

UN BIODIVERSITY CONFERENCE
Investing in biodiversity for people and planet
COP 14 - CP/MOP9 - NP/MOP3
Sharm El Sheikh, Egypt, 2018



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