Measuring and Addressing Global and Local Climate Change Impacts on Biodiversity through Earth Observations

GEO BON
Group on Earth Observations
Biodiversity Observation Network

Climate change is driver of biodiversity change

Climate change is a direct and indirect driver of biodiversity and ecosystem change. It can drive population extinction, rates of adaptation, and migration, and thus alter distribution of plants, animals and microbes. Climate change can act indirectly via the effects on other drivers, such as land-use change, pollution and invasive species. Climate change impacts can now be measured (and predicted) through Earth observations (EO), provided that EO are conducted in a **standardized** manner through **long-term monitoring.** GEO BON offers a standardized framework for linking essential climate and essential biodiversity variables to assess and predict impact of climate change on biodiversity and ecosystem processes.

Climate
- Temperature
- Precipitation
- Atmospheric conditions

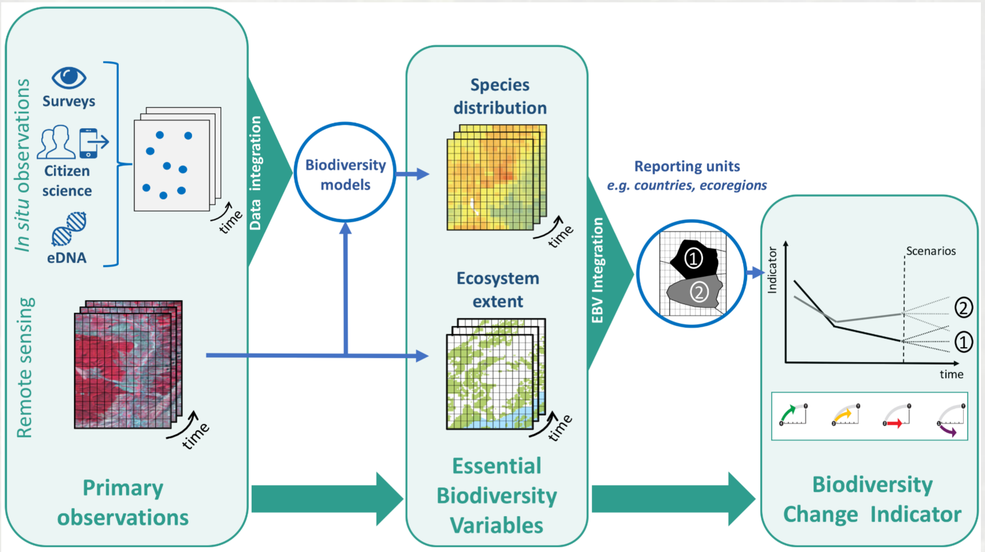
Environment
- Resources
- Gradients of energy
- Weather and extremes

Biodiversity
- Composition
- Phenology
- Migration
- Movement/colonization
- Interactions

Ecosystems
- Productivity
- Structure
- Fluxes
- Distribution

GEO BON workflow from EO to indicators

Figure from Navarro et al. 2017



Policy needs

National Governments

CBD

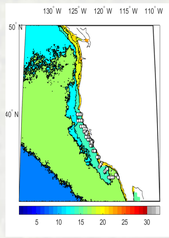
ipbes

SUSTAINABLE DEVELOPMENT GOALS

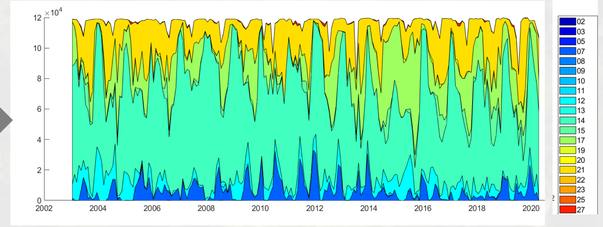
GEO BON is a global network of experts dedicated to understanding biodiversity change for decision-making. It uses biodiversity observations (remote sensing and *in situ*) collected in a standardized manner to calculate essential biodiversity variables which in turn are used to calculate various biodiversity indicators included in national reporting. Long-term monitoring frameworks allow the measurement of climate change impacts on biodiversity. GEO BON is working with partners (Parties and organizations) to provide tools and online platforms crucial for establishing monitoring networks (through Biodiversity Observations Networks – national, regional, thematic). For more information, visit https://geobon.org

Example: Impact of climate and events on pelagic seascape habitats

California coast



Seascape classes



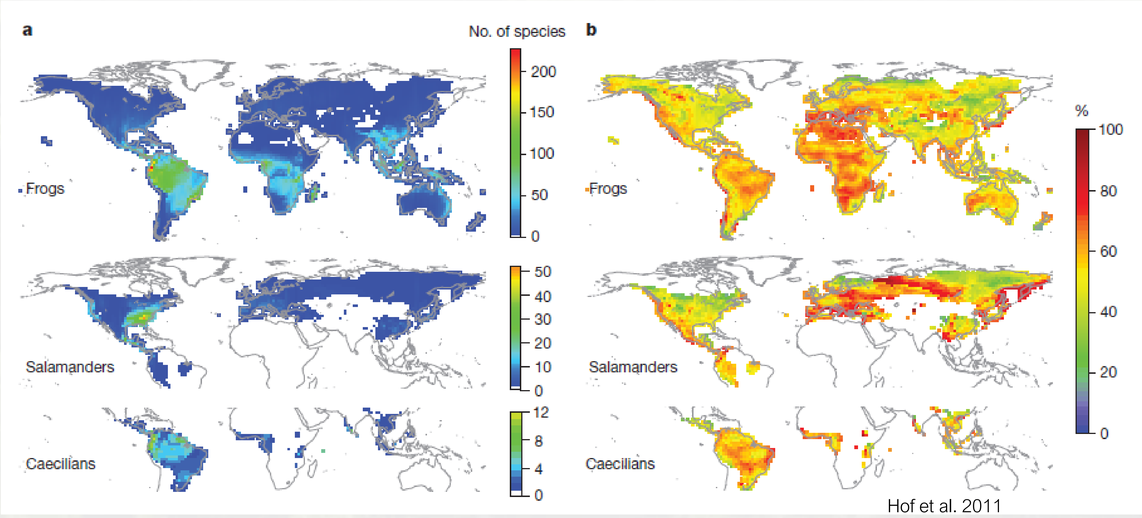
Time series for the spatial extent of seascapes (sub-seasonal and inter-annual variability). Late 2013 - Marine heat wave persisting through ENSO led to a decrease in seascape 14 (productive shelf seascape)

Heatwaves and El Niño-Southern Oscillation -> decrease in productive seascapes

Biodiversity: less krill, increased diversity (influx of warm water species). Also compression of forage habitat leading to larger predators prevalent in the nearshore, causing conflict/entanglement with shallow fixed gear fisheries. (Courtesy of M. Kavanaugh, MBON and NOAA researchers).

Example: Impact of climate on global amphibian diversity

Current species richness for frogs, salamanders, and caecilians and the intensity of climate as one factor threatening global amphibian diversity (projected for the year 2080).



Hof et al. 2011

a) Spatial variation of species richness (number of species per grid cell) of amphibians.

b) Intensity of threat from climate change (proportion of species projected to lose climatic suitability in a given area based on multiple climate models, emission scenarios and modelling algorithms).

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