

Biodiversity in the 21st Century at Gbg University

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Autumn 2025

1 Reading 1: Diaz et al 2019

1.1 Summary

- **telecoupling** – human actions increasingly act at a distance due to globalization
- increasing demand between supply and demand due to global trade
- the analysis pinpoints five crucial levers (priority interventions) and eight leverage points (for intervention)

1.2 Intro

- the human impact on life on Earth has increased since the 1970s
- both the benefits of economy and the cost of reducing nature are unequally distributed

1.3 Taking stock of the fabric of life

- over the past 50 years, the quality of nature to support life has declined on 14 of 18 categories identified by IPBES¹
- exceptions to the downward trend are: regulation of ocean acidification, energy, food and feed, materials and assistance
- more than 800 million people still face chronic food deprivation
- the biomass of world's vegetation has halved over human history
- forest area is only 68% of its preindustrial size

1.4 Direct and indirect drivers of change

- Direct drivers:
 - land/sea use change
 - direct exploitation
 - climate change
 - pollution
 - invasive alien species
 - others
- Indirect drivers:
 - demographic and sociocultural
 - economic and technological

- institutions and governance
- conflicts and epidemics
- examples of declines in nature:
 - natural ecosystems have declined by 47% on average, relative to their previous states
 - 25% of species are already threatened by extinction
 - biotic integrity – abundance of naturally present species
 - has declined by 23% on average in terrestrial communities
 - the global biomass of wild mammals has fallen by 82%
 - 72% of indicators developed by Indigenous Peoples and local communities have deteriorated

1.5 Progress towards internationally agreed goals

- 20 Aichi Targets in the Strategic Plan on Biodiversity 2011–2020
 - contains 54 elements
 - good progress has been made on 5
 - moderate progress towards 19
 - poor progress or movement away from target on 21
 - unknown progress on 17 elements

1.6 Levers and leverage points for transformative change

Levers:

- incentives and capacity building
- cross-sectional cooperation
- pre-emptive action
- decision-making in the context of resilience and uncertainty
- environmental law and implementation

Leverage points:

- embrace diverse vision of a good life
- reduce total consumption and waste
- unleash values and action
- reduce inequalities

¹Intergovernmental Platform on Biodiversity and Ecosystem Services

- practice justice and inclusion in conservation
- internalize externalities and telecouplings
- ensure environmentally friendly technology, innovation and investment
- promote education and knowledge generation and sharing

2 Lecture 1

2.1 Housekeeping

- Every Tuesday
- 18 - ca. 20h
- Live or recorded on Zoom
- All lectures will be recorded and available on Canvas
- Two in-person meetings
- Gothenburg Natural History Museum
- Gothenburg Botanical Garden
- Assignment: develop and submit an essay on a topic we cover in the course that is of particular personal interest. Open-ended and offers the opportunity for personal reflection, while also gaining experience in more scientific-styled writing.

2.2 Biodiversity bias

- 2 million – 1 trillion species on Earth
- ca. 1.7 million databased
- Knowledge derives from charismatic, macroscopic species.

2.3 Mechanisms of biodiversity formation

- speciation
- extinction
- migration

Adaptation = the process which enables organisms to adjust to their environment in order to ensure survival. This can lead to speciation.

Example: polar bears have extremely large feet to distribute weight better on snow.

2.4 Speciation

Types of speciation:

- allopatric – populations get geographically distanced which limits the gene flow
- peripatric – a small group gets isolated
- parapatric – populations are adjacent but not completely separated
- sympatric – species evolve from a single ancestral species while living in the same area

2.5 Extinction

The termination of any organism.

Species have a lifespan, on average 2 million years. After that, species either speciate or go extinct.

2.6 Dispersal

Dispersal = movement of individuals (through geological time, such as marsupials colonizing North America once South and North Americas got connected through geological time)

Since the industrial revolution, many species are progressively changing their distribution and dispersing further north.

2.7 Latitudinal species gradient

Closer to equator/tropics = more species (also more human languages!)

Does the diversity in species and language covary?

2.8 Species

How do we measure species for example in tropical jungle with countless species?

Quadrants: count within a small area then you can extrapolate

Species richness = the number of different species in an area

Numerical species richness = number of species per specific number of individuals

Species density = number of species per unit area

Species abundance = the relative abundance of species

Amazonia is known to be highly biodiverse, but a few species are very abundant and most species are incredibly rare. 1% of species make up for 50% of all trees.

2.9 Learning outcomes

- Biodiversity: number of differential biological variants found in a given place and time
- Speciation, extinction, and dispersal build biodiversity
- Biodiversity is not evenly distributed and can be measured in different ways

3 Reading 2: Forest et al 2018: Gymnosperms on the EDGE

3.1 Gymnosperms



- Comprising ginkgo, conifers, cycads, and gnetophytes
- 40% species at high risk of extinction
- For plants in general, this number is 20%