Causes and consequences of biodiversity change:

monitoring and knowledge gaps

Markus Fischer

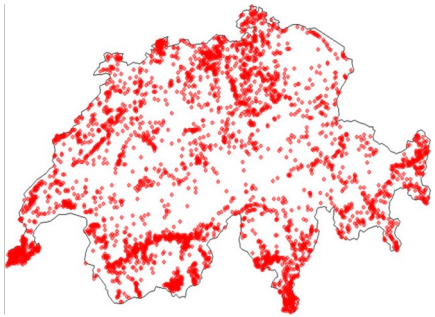
UNIVERSITÄT BERN

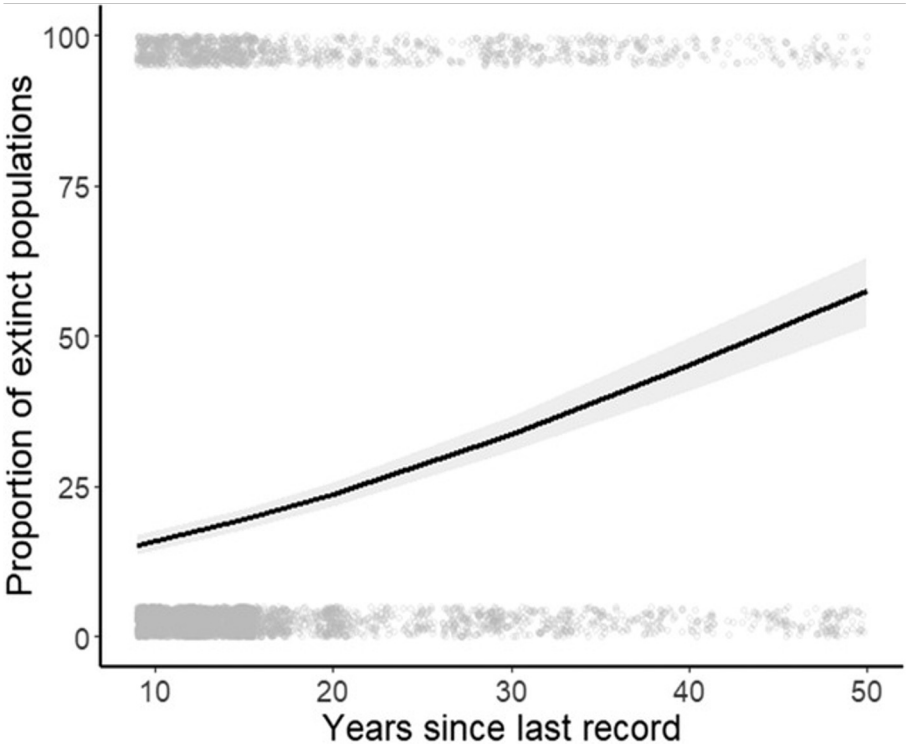
Science and Policy for People and Nature

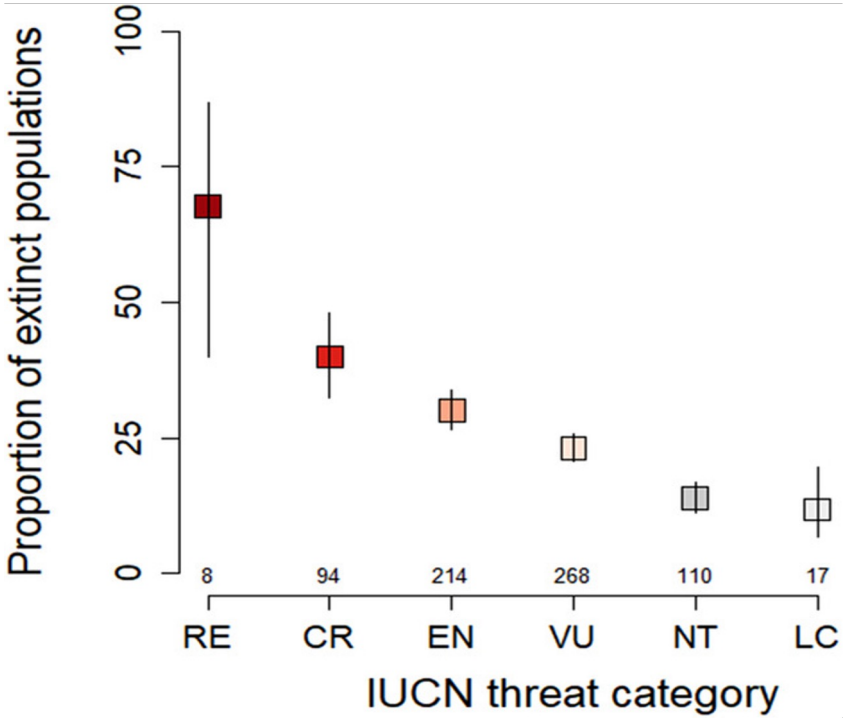
Nationwide revisitation reveals thousands of local extinctions across the ranges of 713 threatened and rare plant species

Conservation Letters. 2020;e12749.

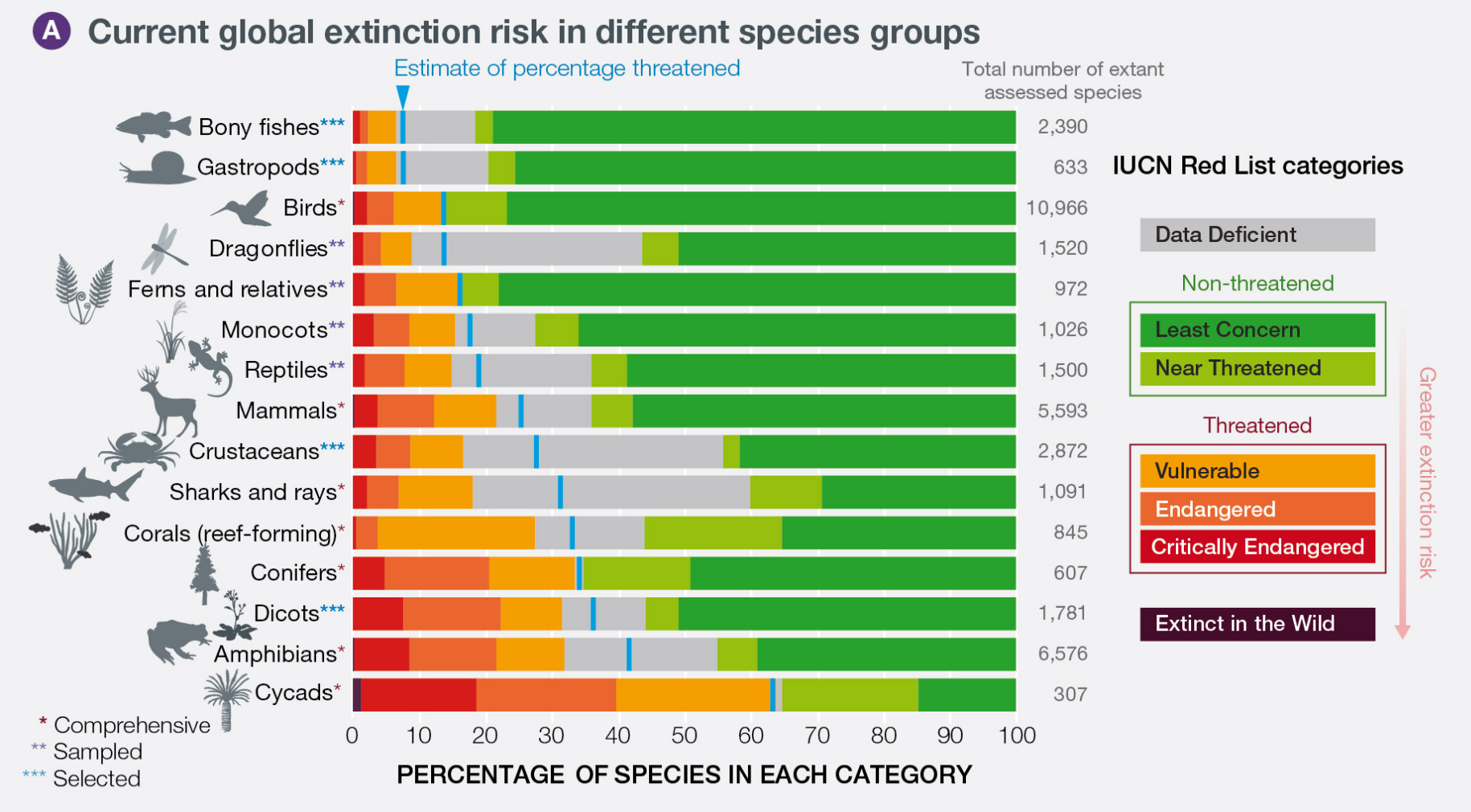
Anne Kempel[1,2] | **Christophe N. Bornand**[3] | **Andreas Gygax**[3] | **Philippe Juillerat**[4] | **Michael Jutzi**[3] | **Lionel Sager**[4] | **Beat Bäumler**[5] | **Stefan Eggenberg**[3] | **Markus Fischer**[1,2,6]







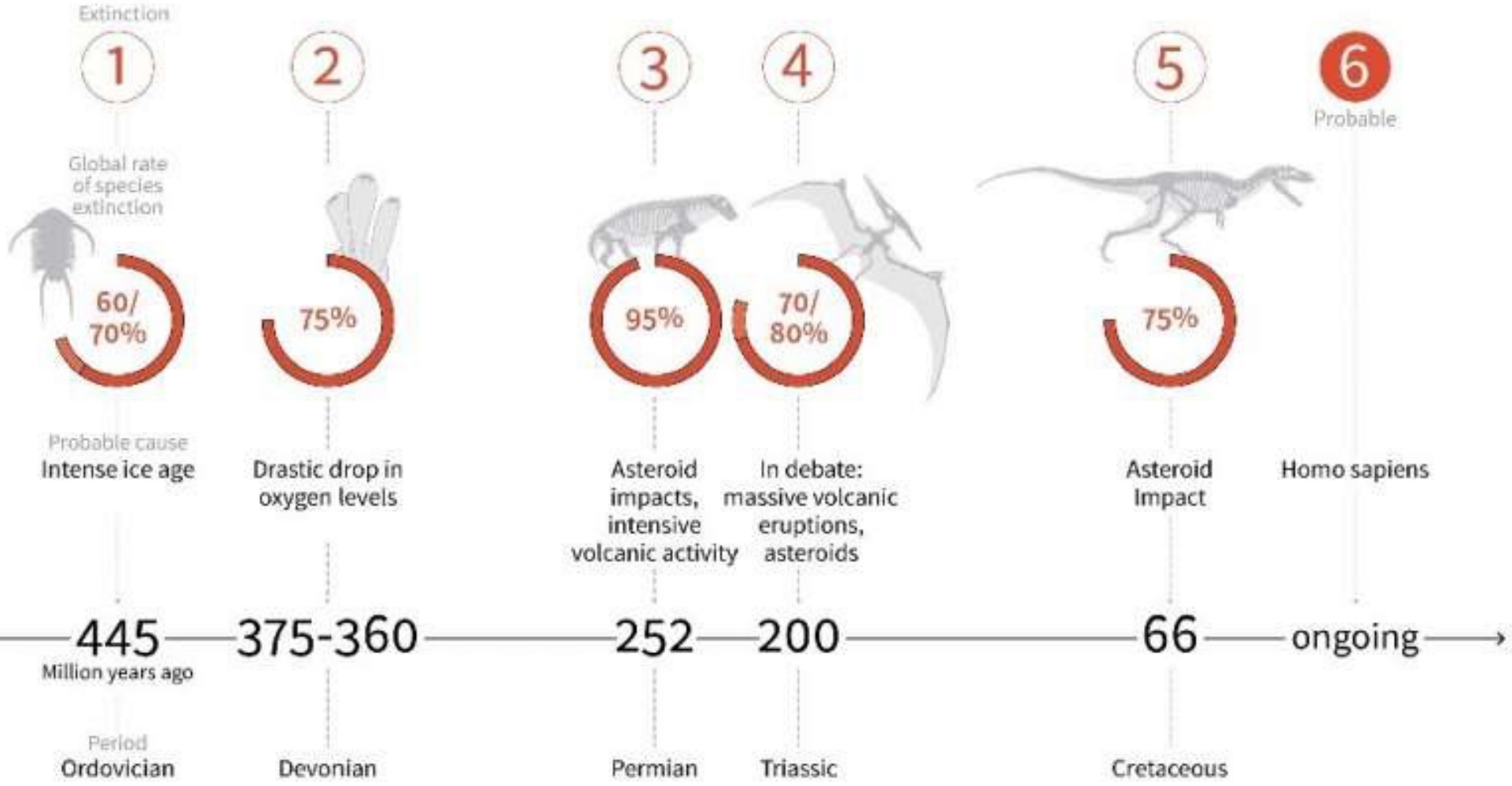
More species threatened than ever since humans evolved



(IPBES Global Assessment 2019)

Earth's "mass extinctions"

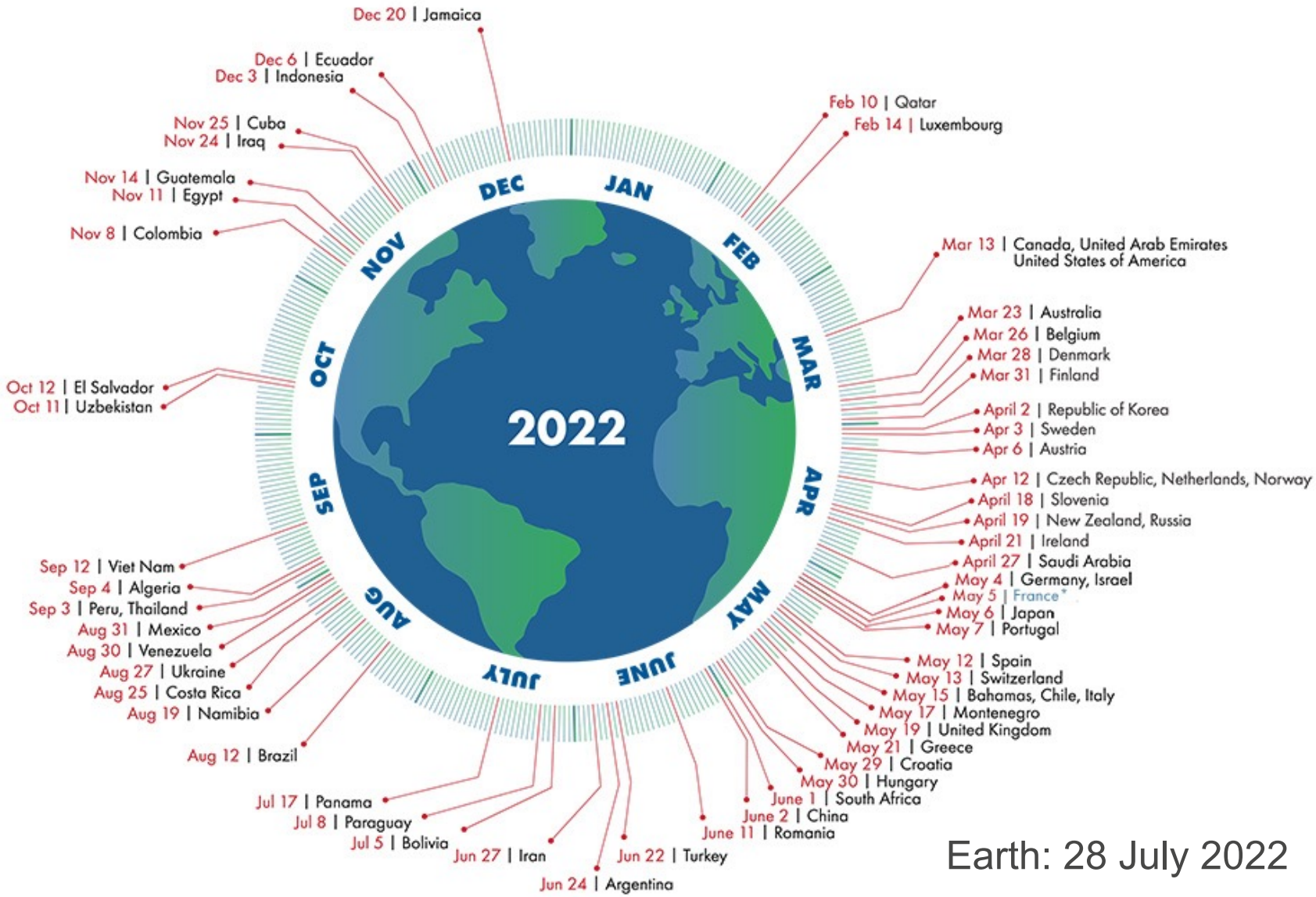
During the last 500 million years, Earth has experienced five periods when at least half the living creatures were wiped out



Sources: National Geographic, Encyclopedia Britannica, scientific studies

Country Overshoot Days 2022

When would Earth Overshoot Day land if the world's population lived like...



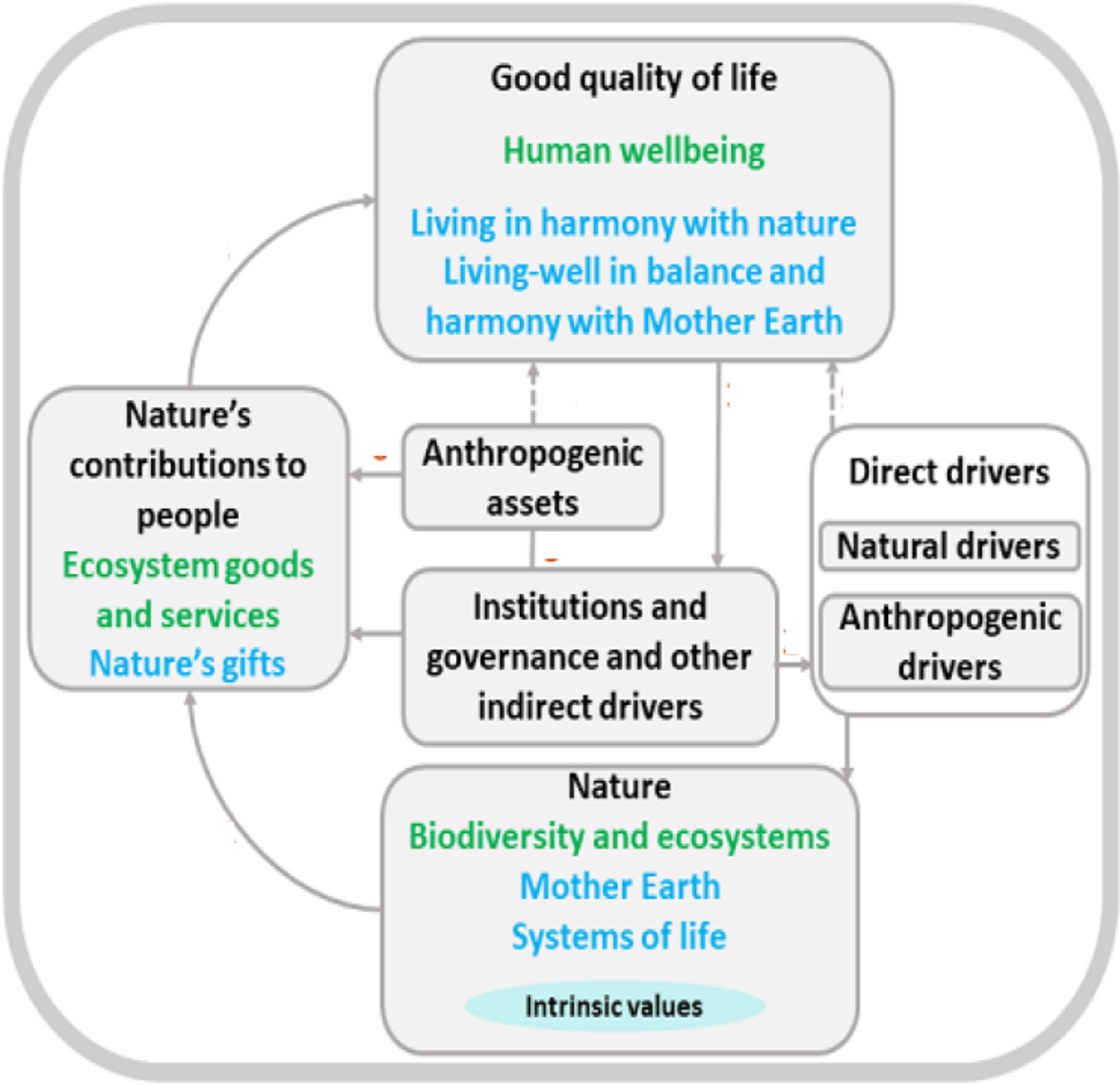
Earth: 28 July 2022

EARTH OVERSHOOT DAY

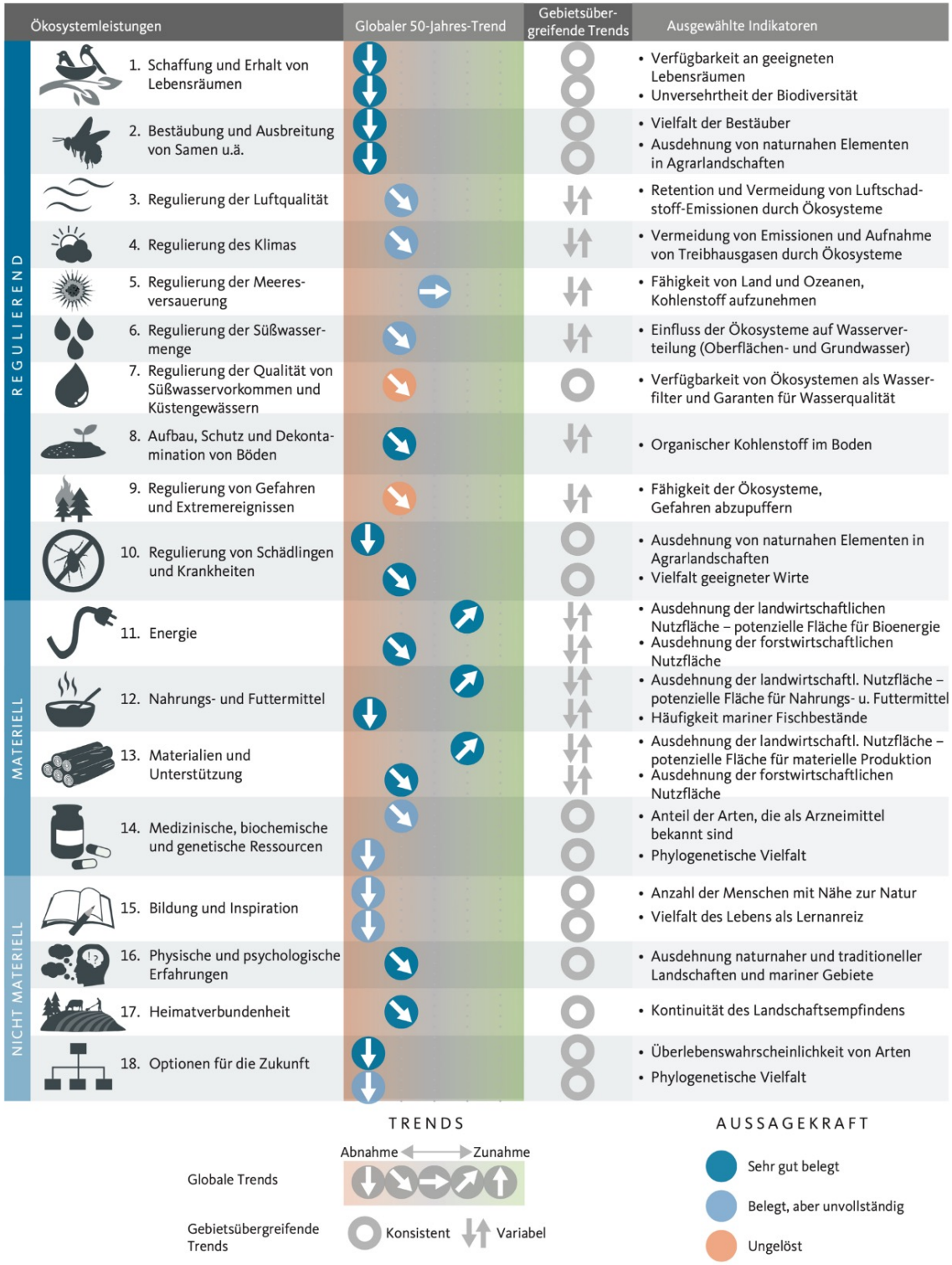
For a full list of countries, visit overshootday.org/country-overshoot-days.
*France Overshoot Day updated April 20, 2022 based on nowcasted data. See overshootday.org/france.

Source: National Footprint and Biocapacity Accounts, 2022 Edition
data.footprintnetwork.org

Global Footprint Network
Advancing the Science of Sustainability



IPBES conceptual framework (Diaz et al. 2015 Curr Opin Sust Dev)

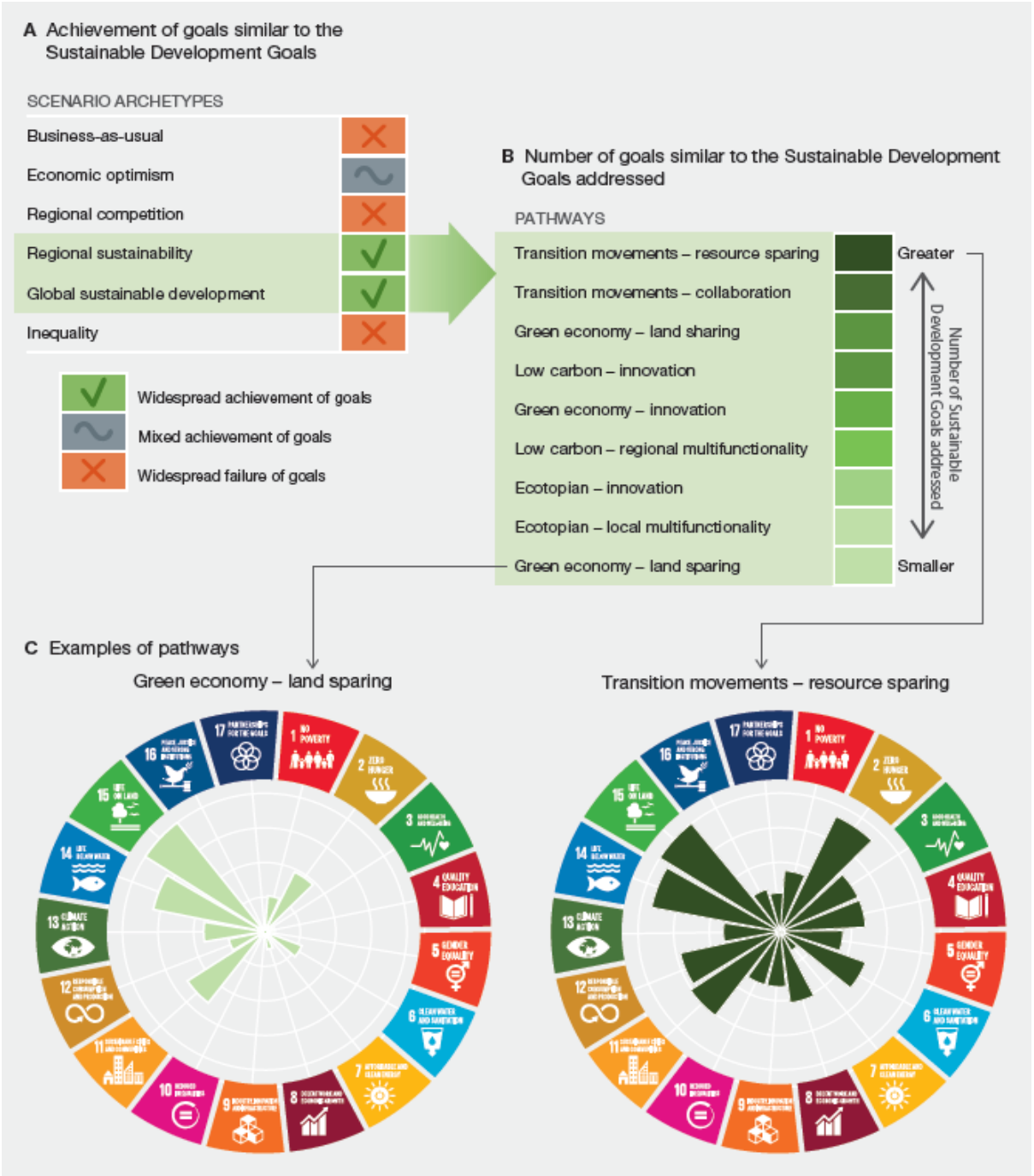


Land and sea use exploit material contributions of nature to people, at the expense of all others

(IPBES Global Assessment 2019)

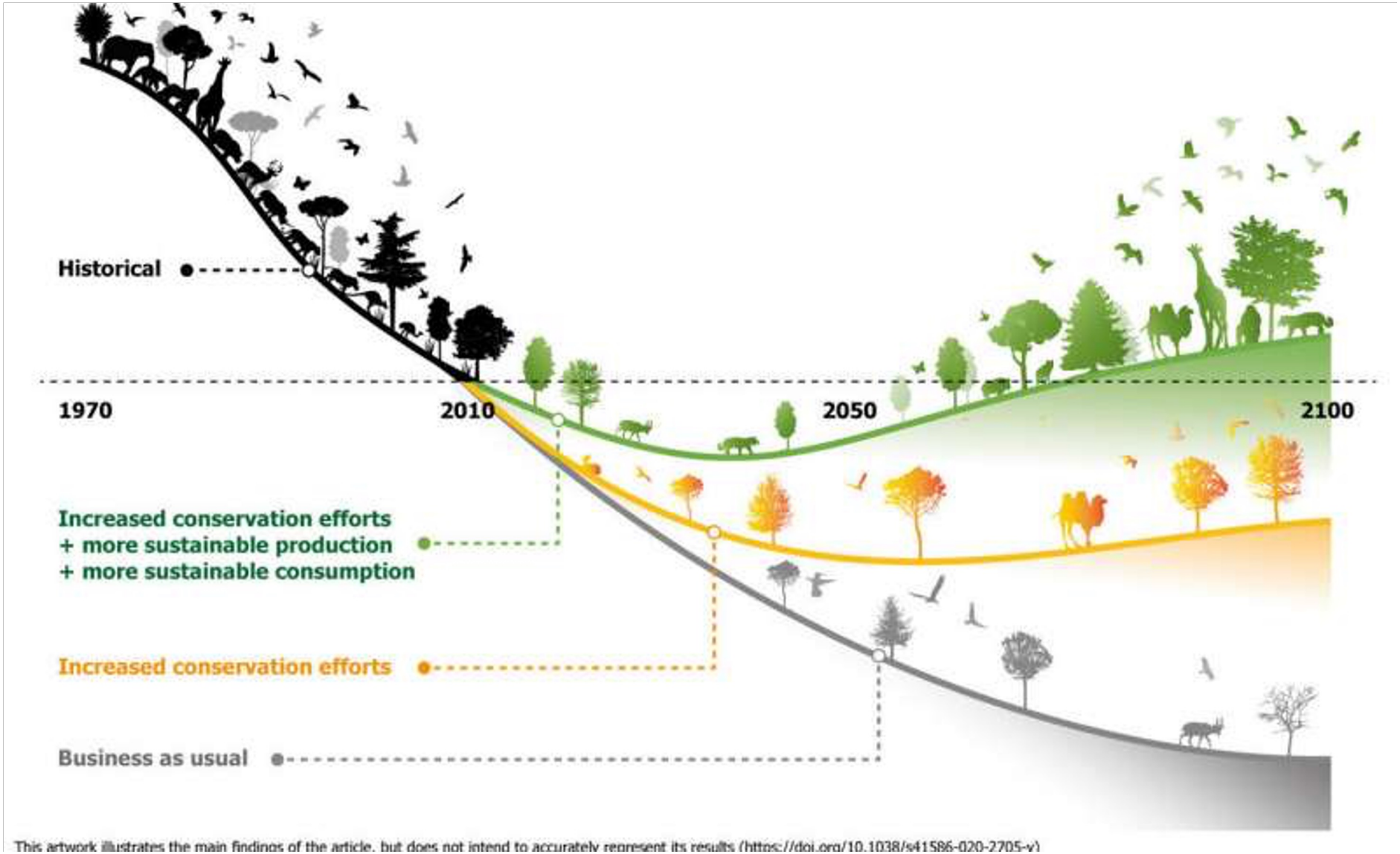
Scenarios and pathways toward and beyond 2030

The most effective pathways stress long-term societal transformation



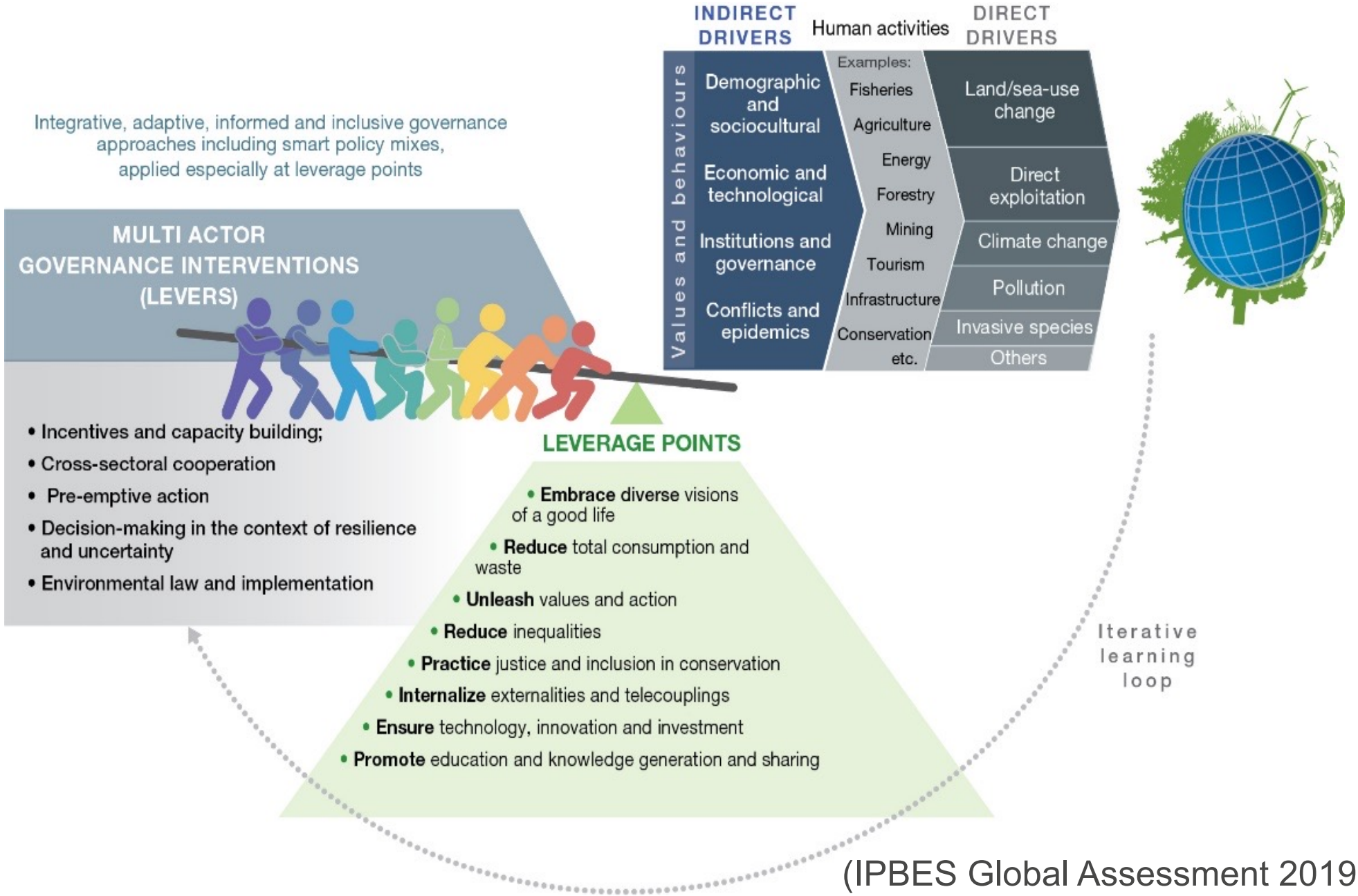
(IPBES - Europe and Central Asia Assessment 2018)

Reversing biodiversity loss requires conservation efforts, and much more



Leclerc et al. 2020 Nature

Transformative Change



(IPBES Global Assessment 2019)

EU BIODIVERSITY STRATEGY

Bringing nature back into our lives

Establish protected areas for at least:

30%
of land in Europe

30%
of sea in Europe

Restore degraded ecosystems at land and sea across the whole of Europe by:

Increasing organic farming and biodiversity-rich landscape features on agricultural land

Halting and reversing the decline of pollinators

Restoring at least 25 000 km of EU rivers to a free-flowing state

Reducing the use and risk of pesticides by 50% by 2030

Planting 3 billion trees by 2030

Unlock 20 billion EUR/year for biodiversity through various sources, including EU funds, national and private funding. Natural capital and biodiversity considerations will be integrated into business practices.

Put the EU in a **leading position in the world** in addressing the global biodiversity crisis.

Global Biodiversity Framework (draft)

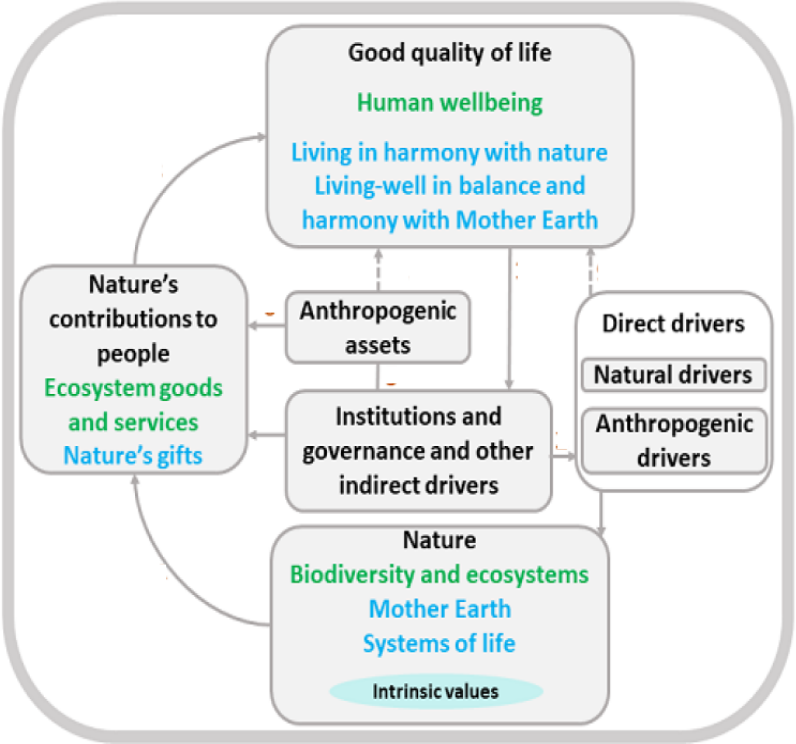
CBD OEWG on GBF 2021

Knowledge gaps

Gaps in our understanding of:

- nature
- nature's contributions to people
- the contribution of indigenous and local knowledge
- the status and trends of nature
- the drivers of biodiversity change

Large geographical variation in knowledge



Lack of integrated scenario and modelling studies

Gaps in the quantification and timing of pathways towards desired futures

Inadequate understanding of how

…to mainstream policy objectives across different sectors and scales

…to overcome trade-offs between various objectives

…to overcome obstacles

IPBES (2018, 2019, 2021)

Sparse and biased:
Vertebrate population trend data

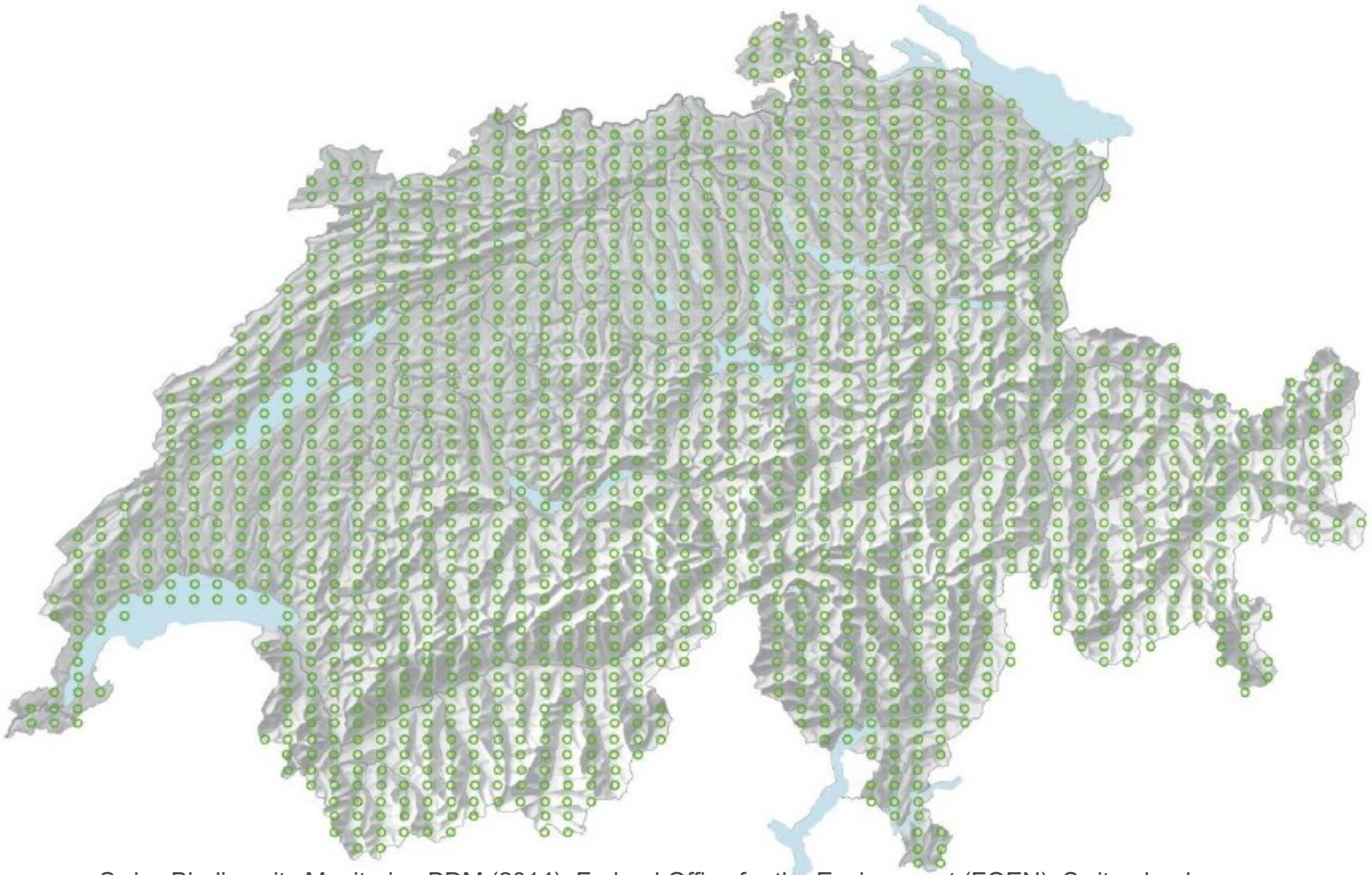
Collen et al. (Cons. Biol. 2009)

Research and monitoring

- Research and monitoring have complementary tasks
- Research needed on all knowledge gaps, and especially on mechanisms, indicators, successes, failures, and scenarios
- Biodiversity-related monitoring of indicators needed on the whole social-ecological system
- Both research and monitoring would largely benefit from integrated social-ecological study designs
- Research and monitoring are synergistic, but could be much more so

> Sampling grid for Z9 (vascular plants, mosses and molluscs)

The Z9 sampling grid for land-dwelling species comprises approximately 1600 terrestrial sampling areas.



Swiss Biodiversity Monitoring BDM (2014), Federal Office for the Environment (FOEN), Switzerland,
https://www.bafu.admin.ch/bafu/en/home/topics/biodiversity/publications-studies/publications/biodiversity-monitoring.html

Swiss biodiversity-related monitoring programmes

Biodiversity monitoring (BDM)

Impact monitoring of habitat protection (WBS)

Species and impact monitoring in forest reserves

Agricultural habitats (ALL-EMA)

Biodiversity monitoring of objects of the ministry of defence

National forest inventory (LFI)

National aquatic inventory

National soil inventory

Surface cover

Red lists

Breeding Bird Monitoring (MHB)

Hotspot 46 (2022) Surveillance de la biodiversité. Forum Biodiversité Suisse, SCNAT, Berne

Swiss biodiversity-related research

Excellent individual research on all aspects of the IPBES CF

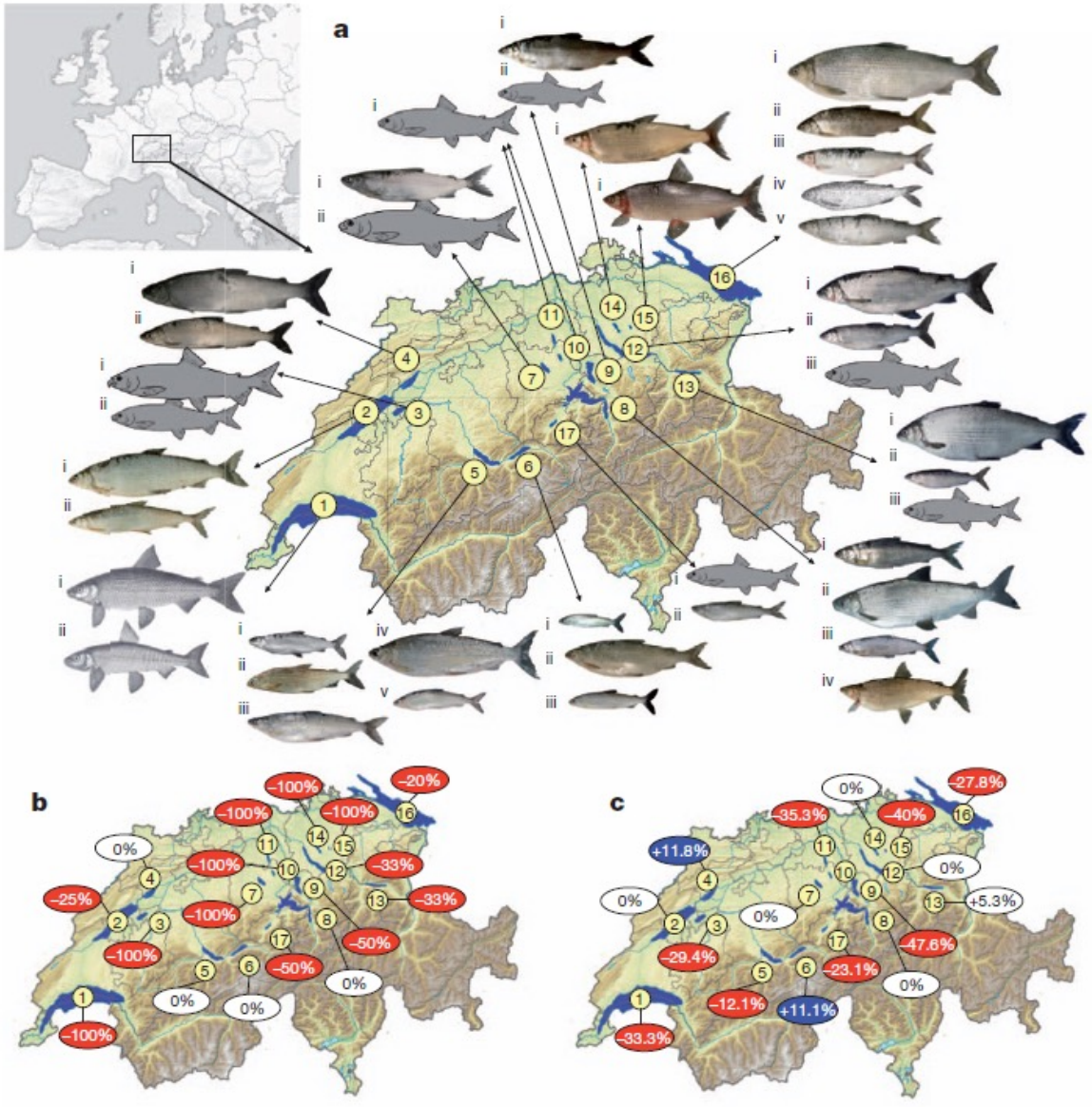
Excellent experimental research

Excellent research on BD-CC interaction

Excellent collaboration of research and monitoring communities

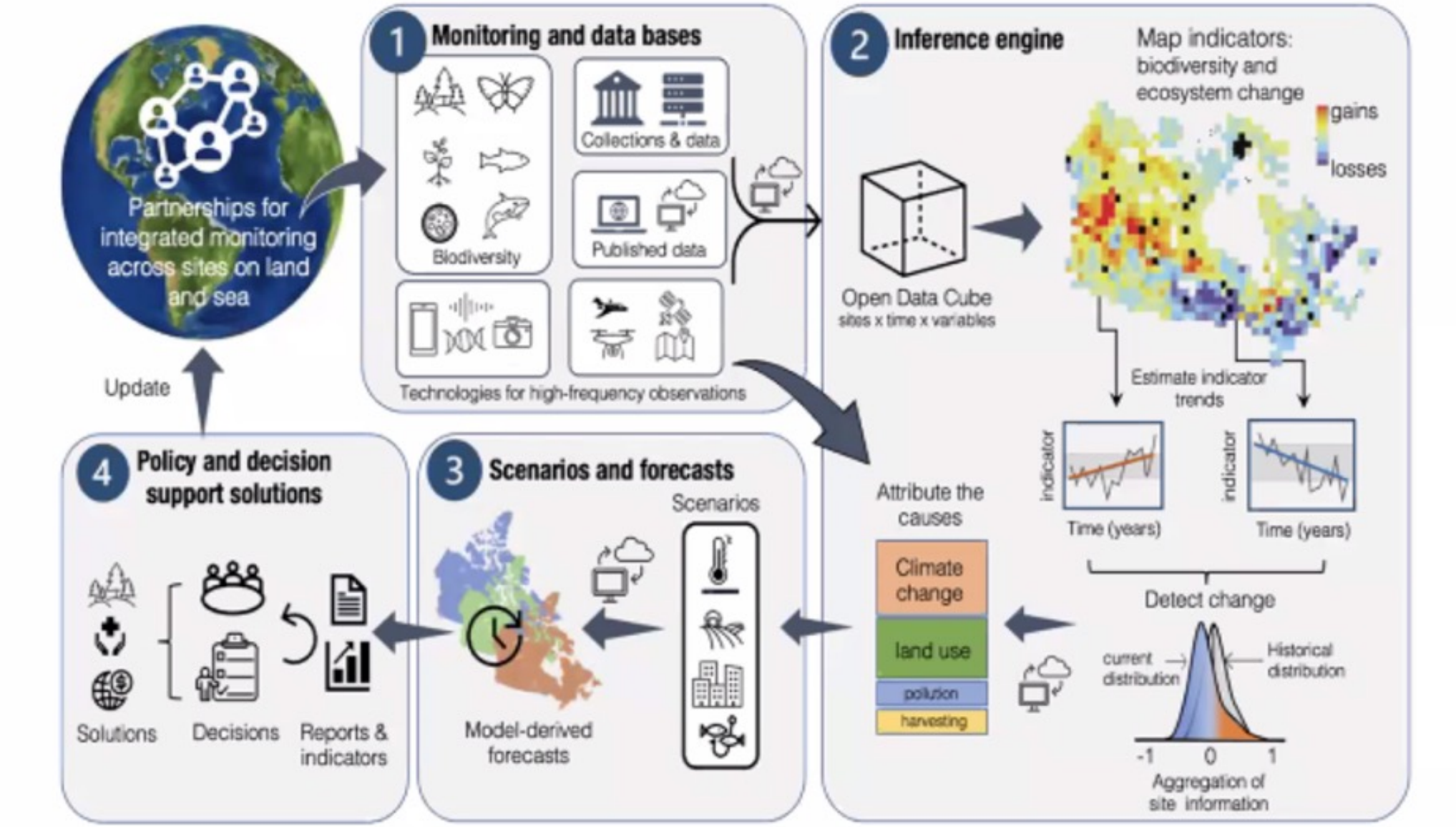
Biodiversity research still largely scattered

Numerous Swiss contributions to EU framework, horizon and Biodiversa programmes.



Vonlanthen et al. 2012 Nature

GEO-BON cycle of biodiversity monitoring and policy



Courtesy.A. Gonzalez, co-chair GEO-BON

Conclusions

- Biodiversity change can only be understood and tackled in a social-ecological context
- Lot of progress in our understanding of biodiversity change, its direct and indirect drivers and its consequences
- Need for transformative change and governance options also have become clearer
- However, most of this progress is based on insights provided by, and assessments across, individual projects
- Despite progress many knowledge gaps

Conclusions

- Research needed on the knowledge gaps, and especially on mechanisms, indicators, successes, failures, scenarios
- Current research programs typically too small, too short-lived, too narrow in scope, not sufficiently inter- or transdisciplinary, and not designed integratedly

- Biodiversity-related monitoring too narrowly focused on biodiversity change (of quite few indicators)
- Monitoring of the whole social-ecological system is needed
- Integrated monitoring designs are largely missing, very much compromising knowledge gain

- Research and monitoring are synergistic, but could be much more so
- EU and Swiss research and monitoring are synergistic, but could be much more so