

# Causes and consequences of biodiversity change: monitoring and knowledge gaps

*u*<sup>b</sup>

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<sup>b</sup>  
UNIVERSITÄT  
BERN

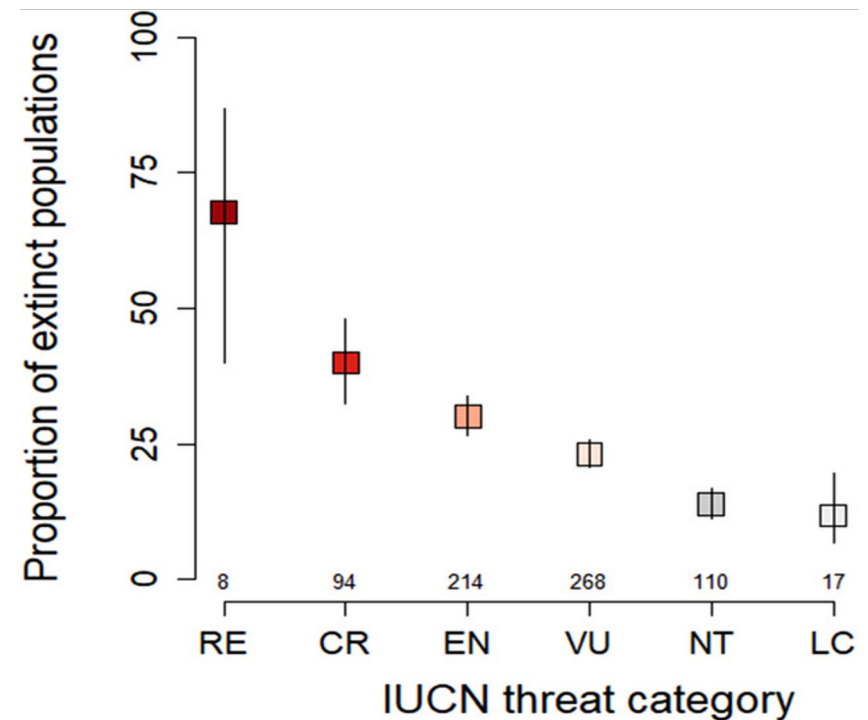
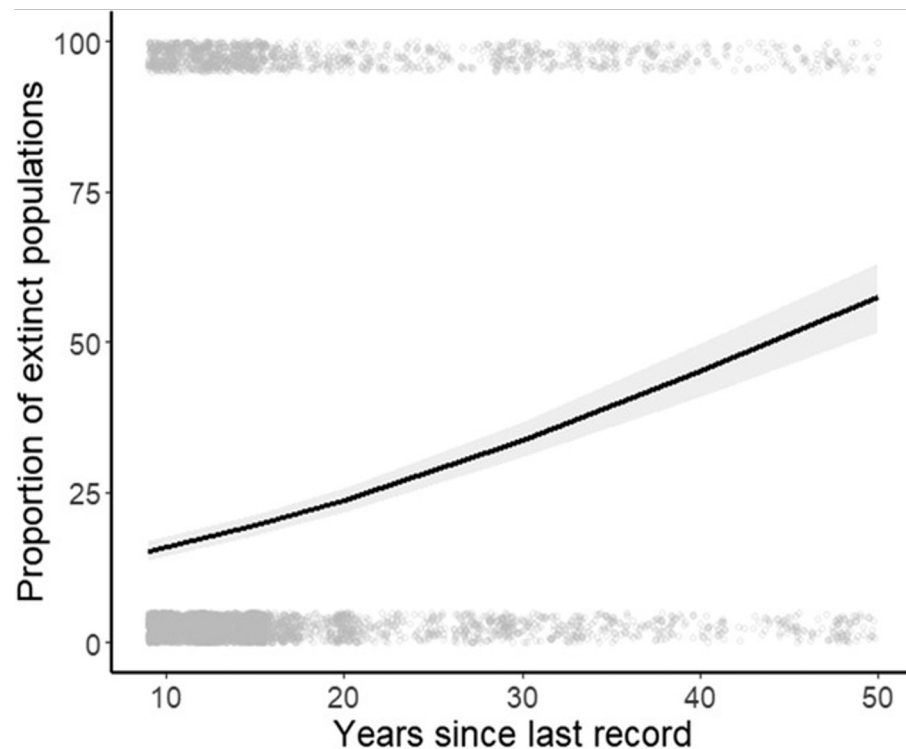
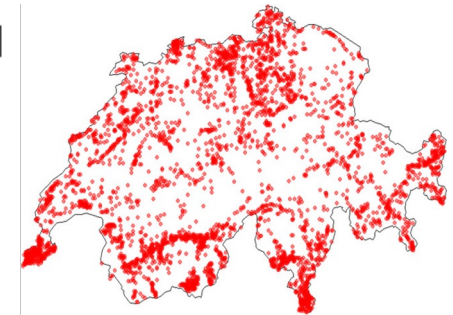
Markus Fischer

 **ipbes**  
Science and Policy  
for People and Nature

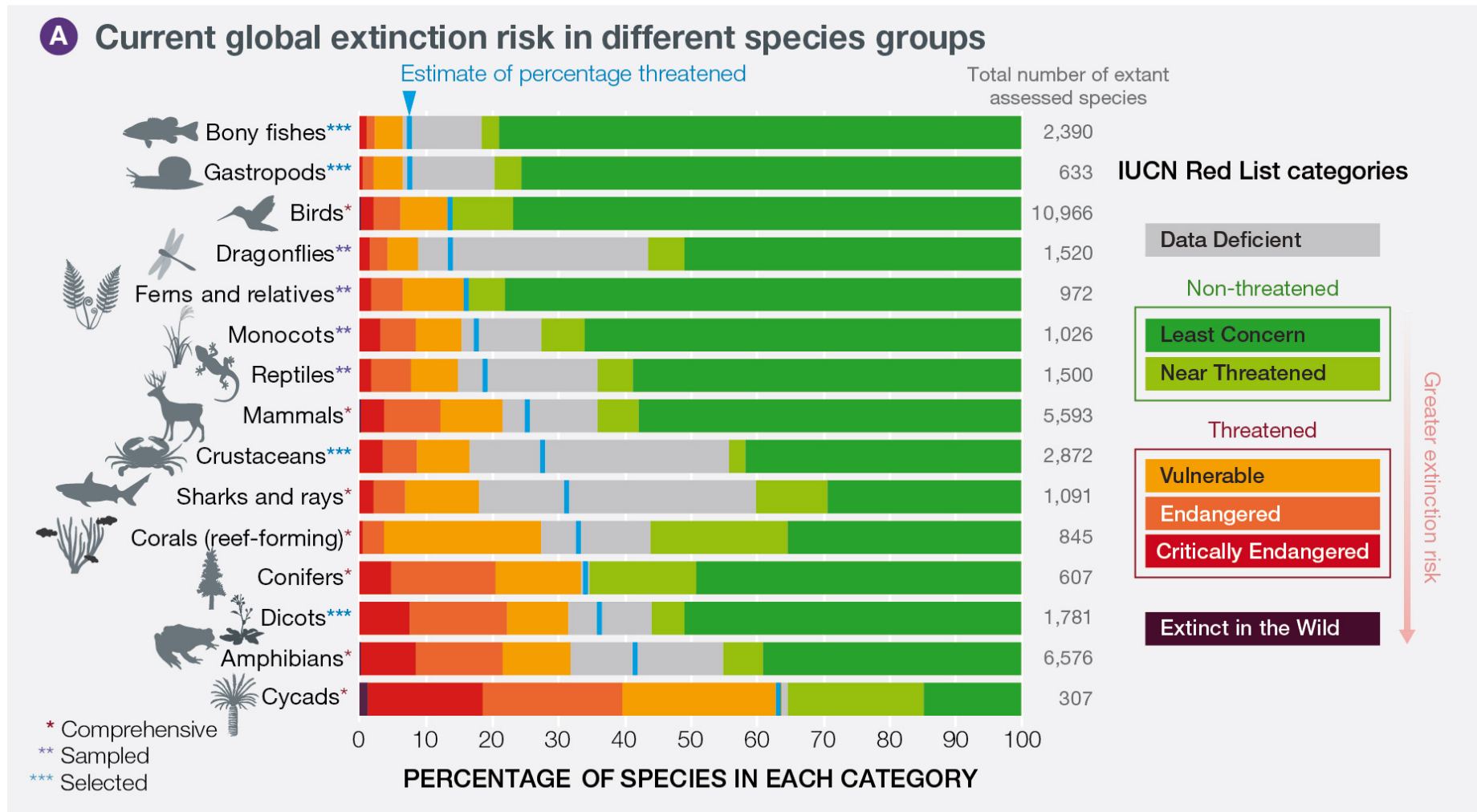
# Nationwide revisitation reveals thousands of local extinctions across the ranges of 713 threatened and rare plant species

*Conservation Letters*. 2020;e12749.

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



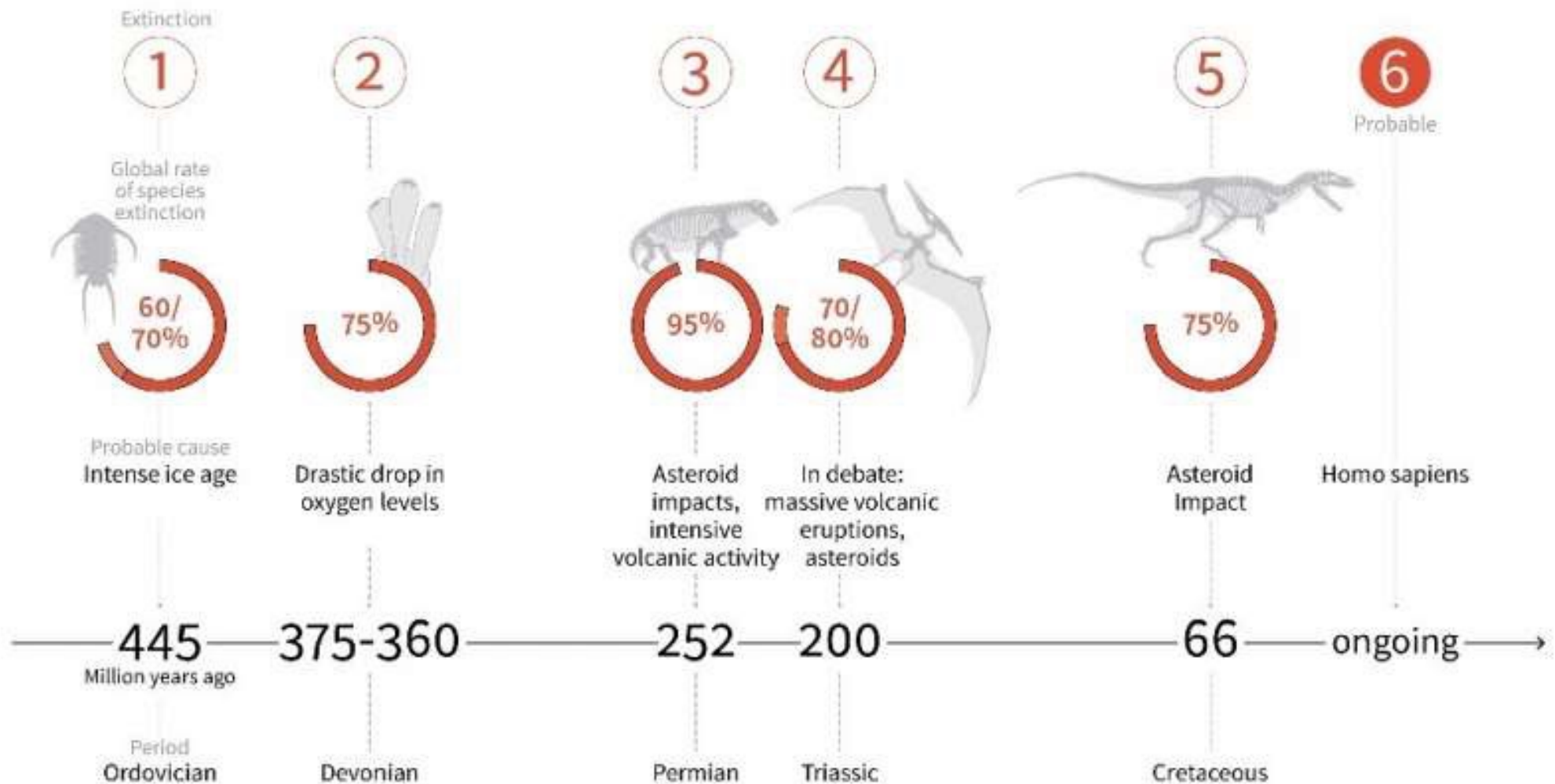
# More species threatened than ever since humans evolved



(IPBES Global Assessment 2019)

# Earth's "mass extinctions"

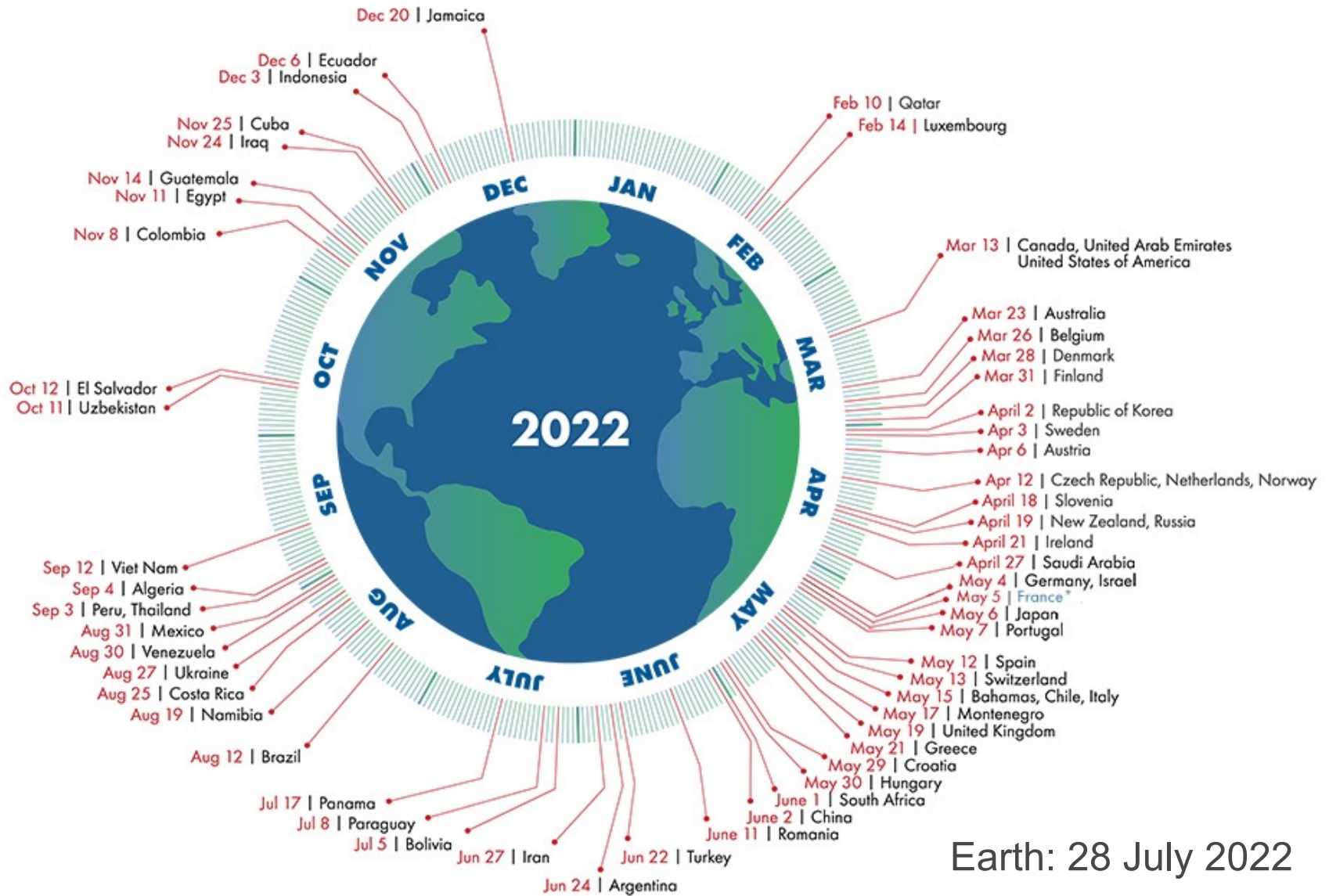
During the last 500 million years, Earth has experienced five periods when at least half the living creatures were wiped out



Sources: National Geographic, Encyclopedia Britannica, scientific studies

# Country Overshoot Days 2022

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

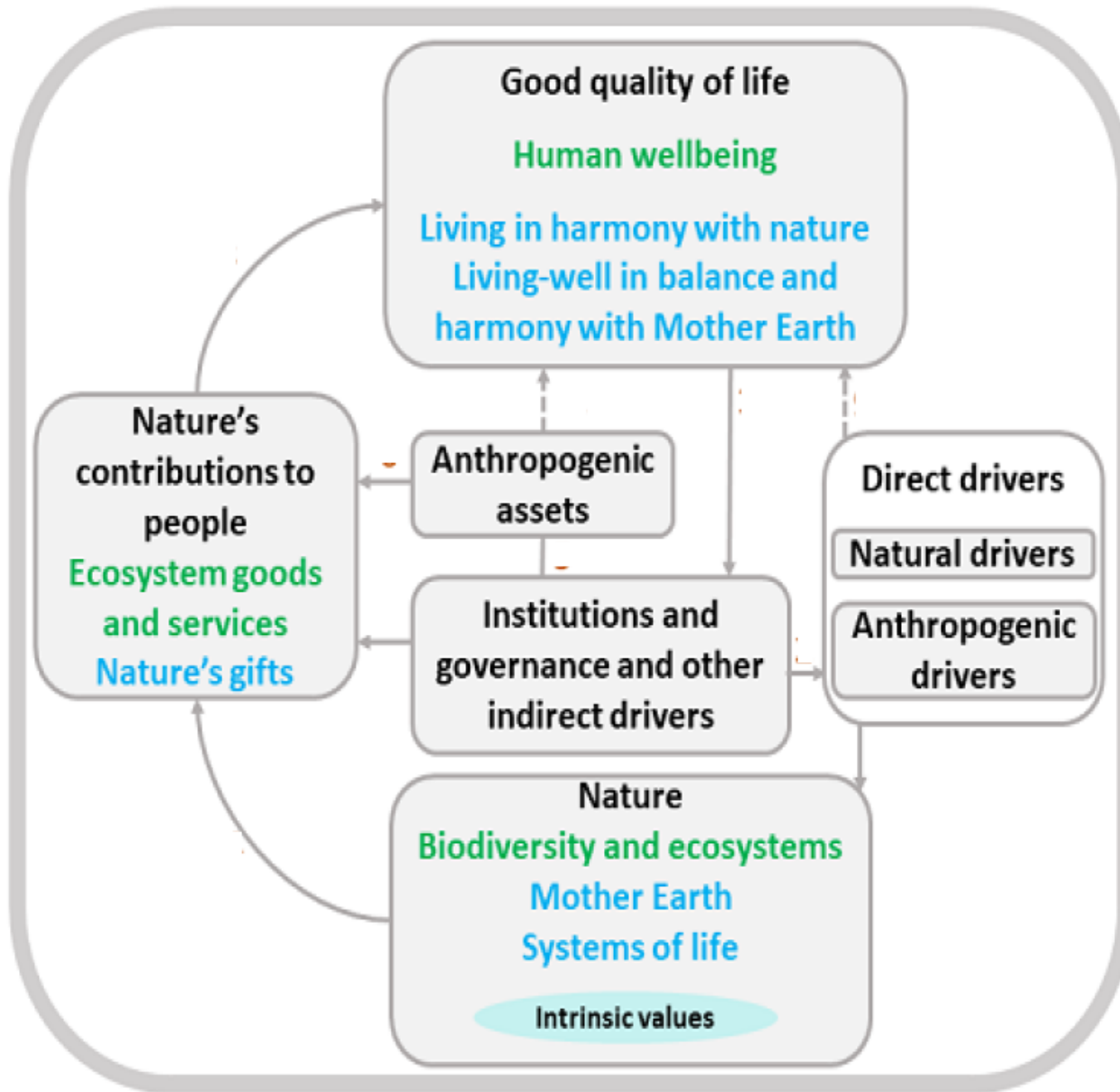


For a full list of countries, visit [overshootday.org/country-overshoot-days](https://overshootday.org/country-overshoot-days).

\* France Overshoot Day updated April 20, 2022 based on nowcasted data. See [overshootday.org/france](https://overshootday.org/france).

Source: National Footprint and Biocapacity Accounts, 2022 Edition  
[data.footprintnetwork.org](https://data.footprintnetwork.org)

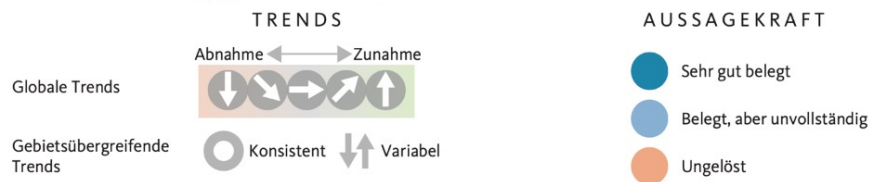




IPBES conceptual framework (Diaz et al. 2015 Curr Opin Sust Dev)

	Ökosystemleistungen	Globaler 50-Jahres-Trend	Gebietsübergreifende Trends	Ausgewählte Indikatoren
REGULIEREND	1. Schaffung und Erhalt von Lebensräumen	↓	○	• Verfügbarkeit an geeigneten Lebensräumen • Unversehrtheit der Biodiversität
	2. Bestäubung und Ausbreitung von Samen u.ä.	↓	○	• Vielfalt der Bestäuber • Ausdehnung von naturnahen Elementen in Agrarlandschaften
	3. Regulierung der Luftqualität	↘	↕	• Retention und Vermeidung von Luftschadstoff-Emissionen durch Ökosysteme
	4. Regulierung des Klimas	↘	↕	• Vermeidung von Emissionen und Aufnahme von Treibhausgasen durch Ökosysteme
	5. Regulierung der Meeresversauerung	→	↕	• Fähigkeit von Land und Ozeanen, Kohlenstoff aufzunehmen
	6. Regulierung der Süßwassermenge	↘	↕	• Einfluss der Ökosysteme auf Wasserverteilung (Oberflächen- und Grundwasser)
	7. Regulierung der Qualität von Süßwasservorkommen und Küstengewässern	↘	○	• Verfügbarkeit von Ökosystemen als Wasserfilter und Garanten für Wasserqualität
	8. Aufbau, Schutz und Dekontamination von Böden	↘	↕	• Organischer Kohlenstoff im Boden
	9. Regulierung von Gefahren und Extremereignissen	↘	↕	• Fähigkeit der Ökosysteme, Gefahren abzapuffern
	10. Regulierung von Schädlingen und Krankheiten	↓	○	• Ausdehnung von naturnahen Elementen in Agrarlandschaften • Vielfalt geeigneter Wirte
MATERIELL	11. Energie	↘ ↗	↕	• Ausdehnung der landwirtschaftlichen Nutzfläche – potenzielle Fläche für Bioenergie • Ausdehnung der forstwirtschaftlichen Nutzfläche
	12. Nahrungs- und Futtermittel	↘ ↗	↕	• Ausdehnung der landwirtschaftl. Nutzfläche – potenzielle Fläche für Nahrungs- u. Futtermittel • Häufigkeit mariner Fischbestände
	13. Materialien und Unterstützung	↘ ↗	↕	• Ausdehnung der landwirtschaftl. Nutzfläche – potenzielle Fläche für materielle Produktion • Ausdehnung der forstwirtschaftlichen Nutzfläche
	14. Medizinische, biochemische und genetische Ressourcen	↘	○	• Anteil der Arten, die als Arzneimittel bekannt sind • Phylogenetische Vielfalt
NICHT MATERIELL	15. Bildung und Inspiration	↓	○	• Anzahl der Menschen mit Nähe zur Natur • Vielfalt des Lebens als Lernanreiz
	16. Physische und psychologische Erfahrungen	↘	○	• Ausdehnung naturnaher und traditioneller Landschaften und mariner Gebiete
	17. Heimatverbundenheit	↘	○	• Kontinuität des Landschaftsempfindens
	18. Optionen für die Zukunft	↓	○	• Überlebenswahrscheinlichkeit von Arten • Phylogenetische Vielfalt

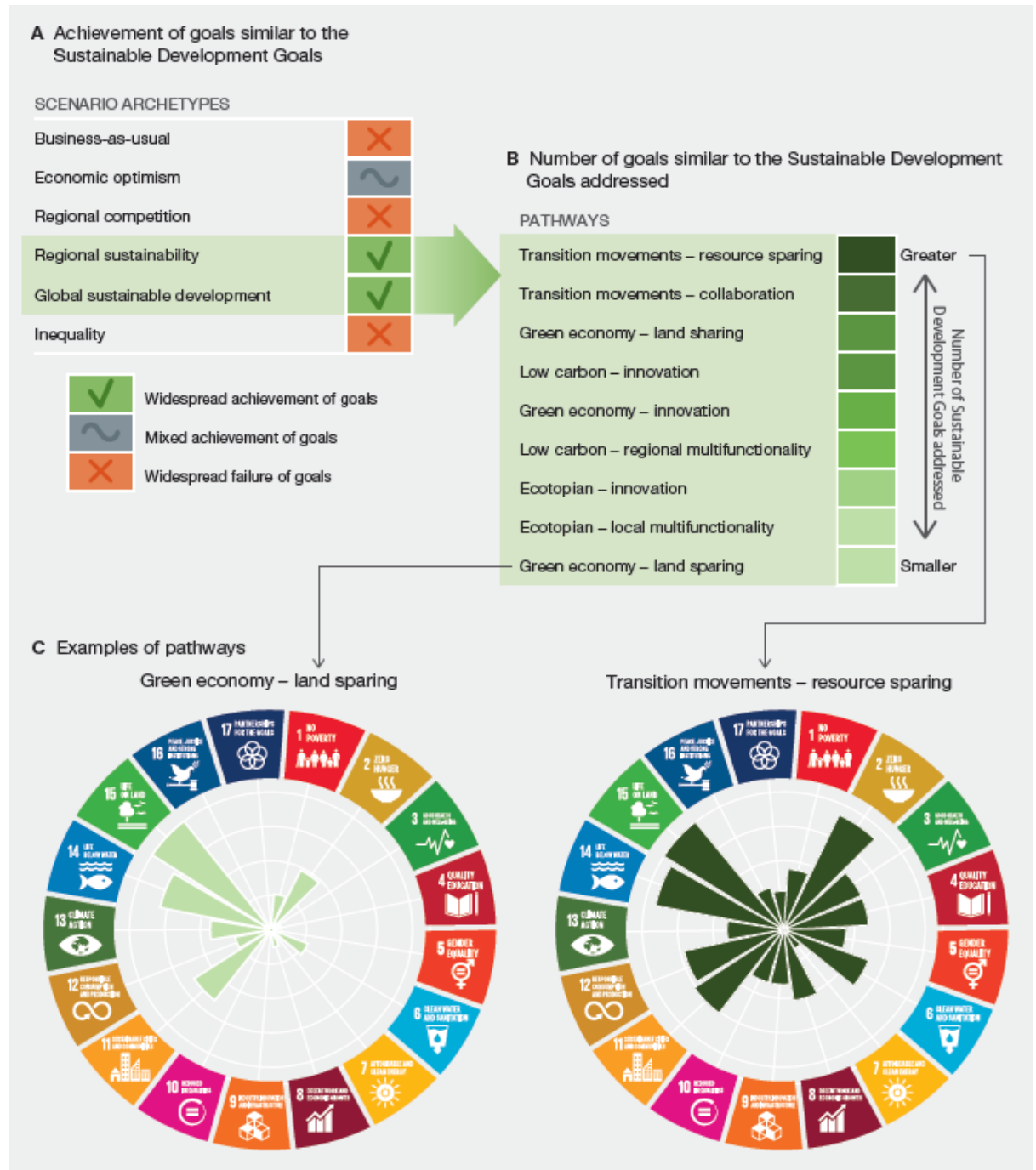
# Land and sea use exploit material contributions of nature to people, at the expense of all others



(IPBES Global Assessment 2019)

# Scenarios and pathways toward and beyond 2030

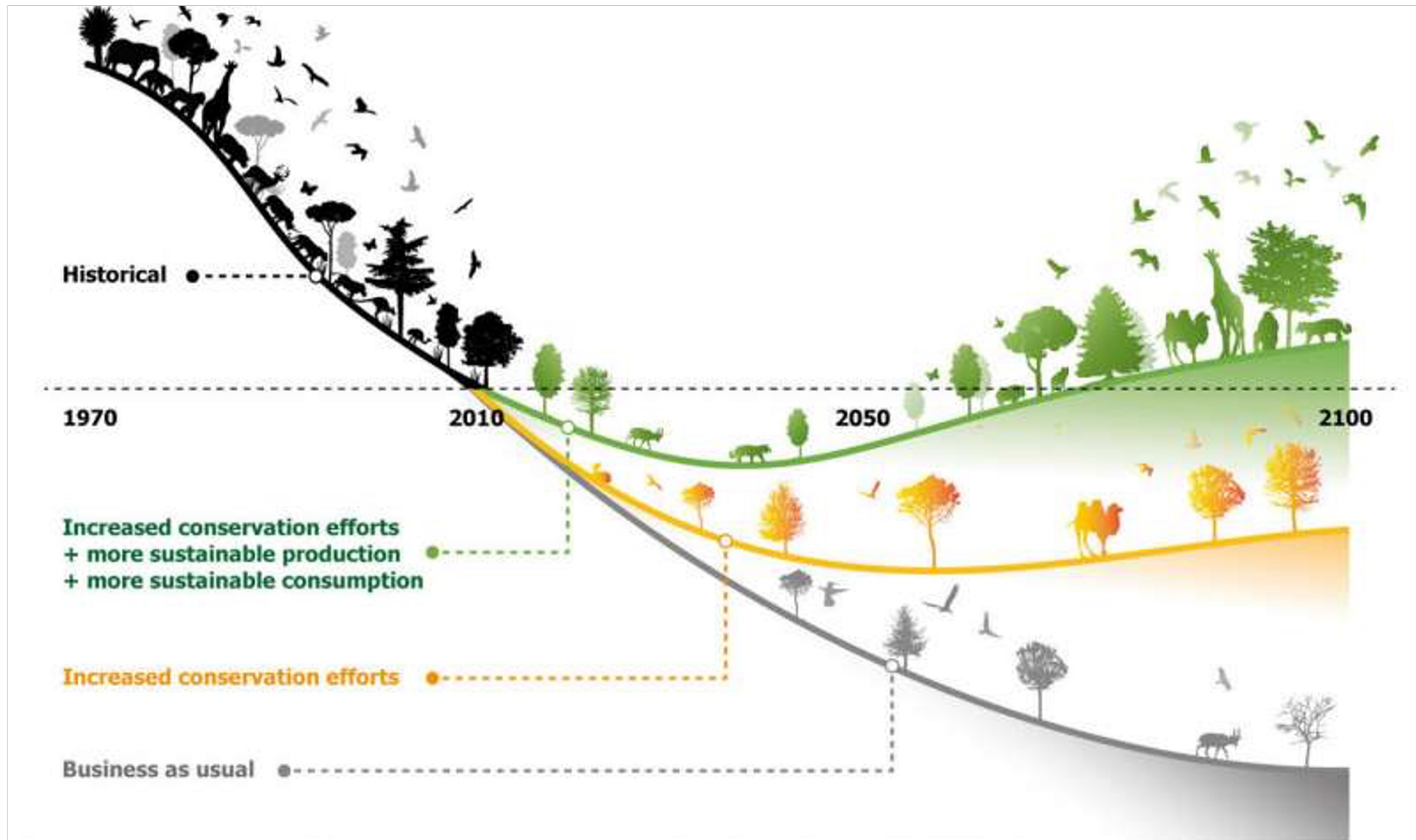
The most effective pathways stress long-term societal transformation



(IPBES - Europe and Central Asia Assessment 2018)

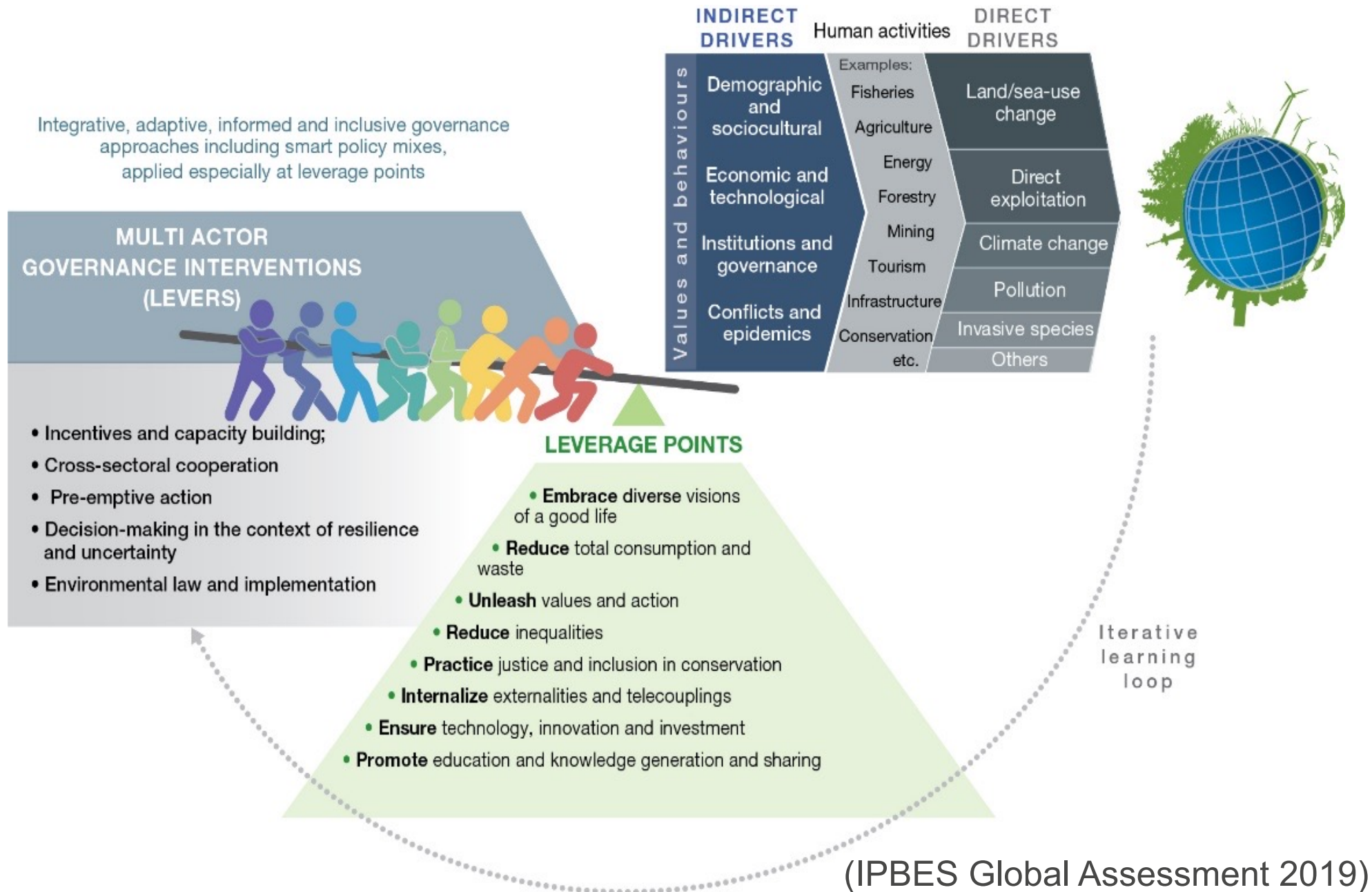


# Reversing biodiversity loss requires conservation efforts, and much more



This artwork illustrates the main findings of the article, but does not intend to accurately represent its results (<https://doi.org/10.1038/s41586-020-2705-v1>)

# Transformative Change



# 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)

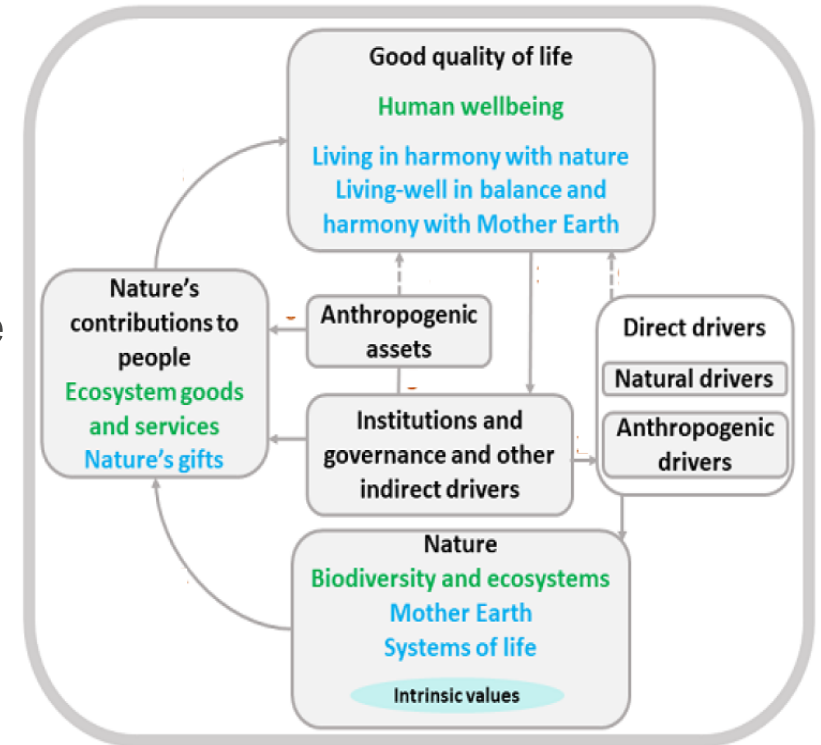


# Knowledge gaps

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

# **Sparse and biased:** Vertebrate population trend data



## Research and monitoring

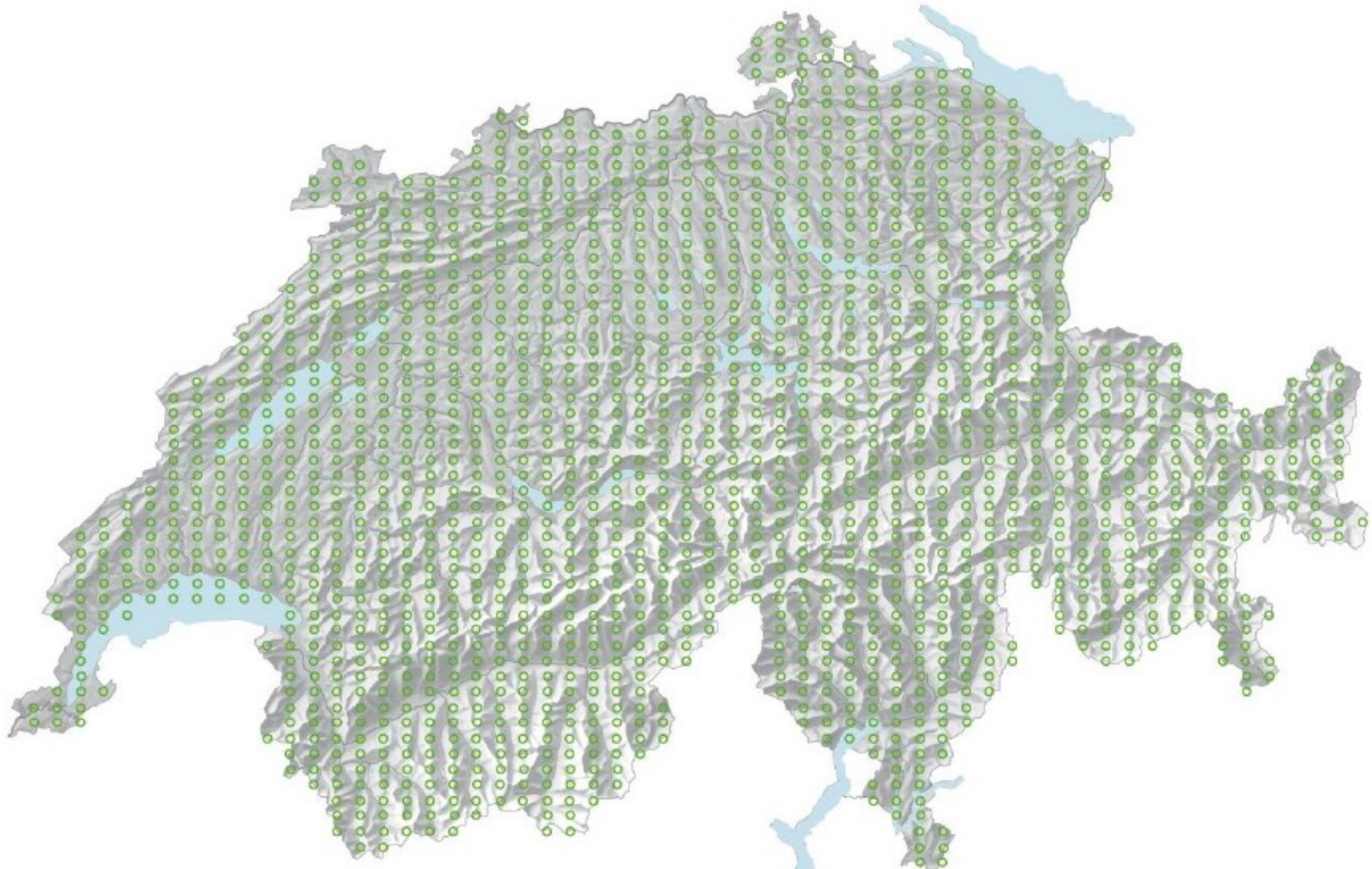
- Research and monitoring have complementary tasks
- Research needed on all knowledge gaps, and especially on mechanisms, indicators, successes, failures, and scenarios
- Biodiversity-related monitoring of indicators needed on the whole social-ecological system
- Both research and monitoring would largely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

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

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

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# Swiss biodiversity-related monitoring programmes



**Biodiversity monitoring (BDM)**

**Impact monitoring of habitat protection (WBS)**



**Species and impact monitoring in forest reserves**



**Biodiversity monitoring of objects of the ministry of defence**



**National aquatic inventory**



**Surface cover**



**Breeding Bird Monitoring (MHB)**



**Agricultural habitats (ALL-EMA)**



**National forest inventory (LFI)**



**National soil inventory**



**Red lists**

# Swiss biodiversity-related research

Excellent individual research on all aspects of the IPBES CF

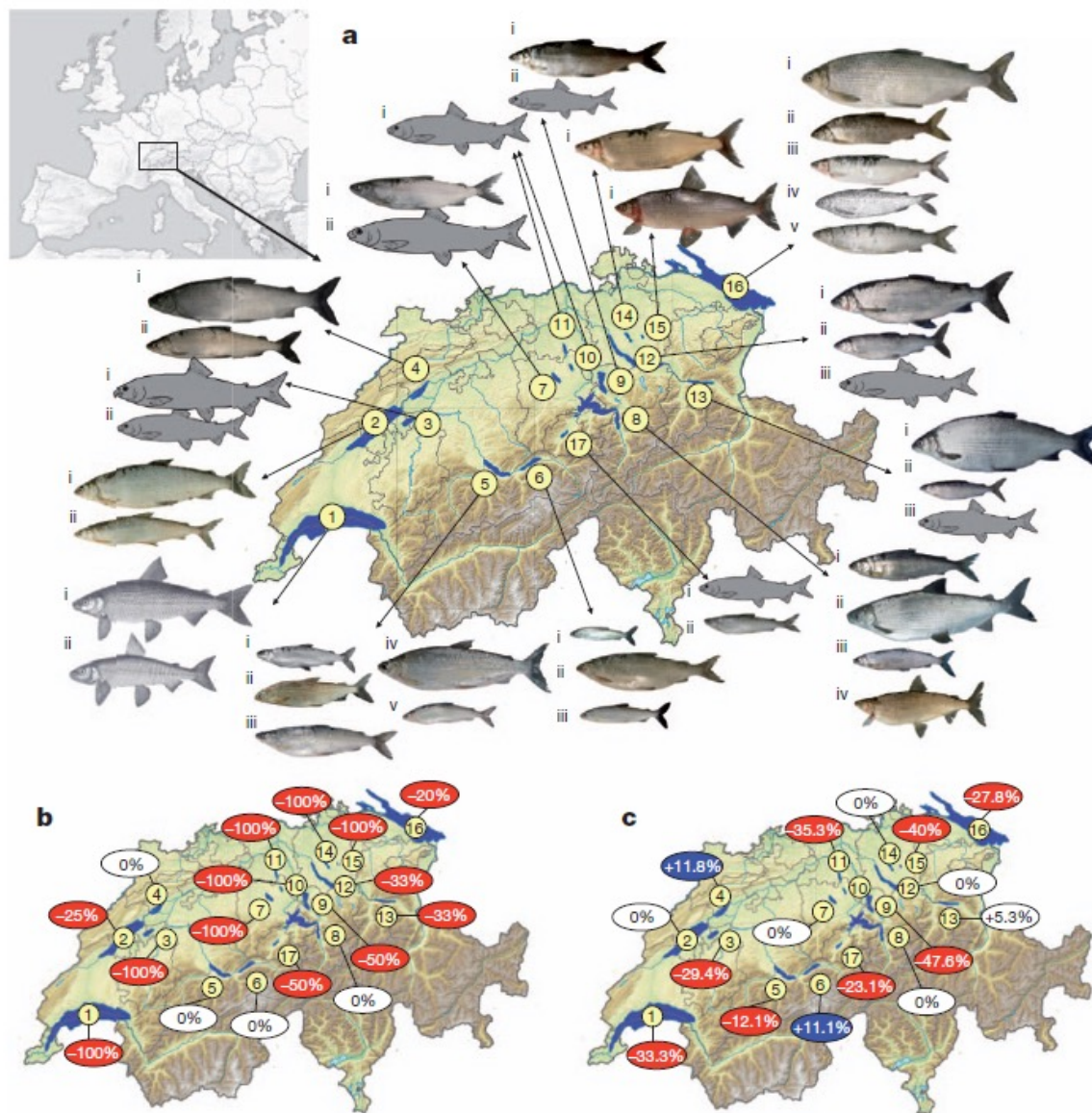
Excellent experimental research

Excellent research on BD-CC interaction

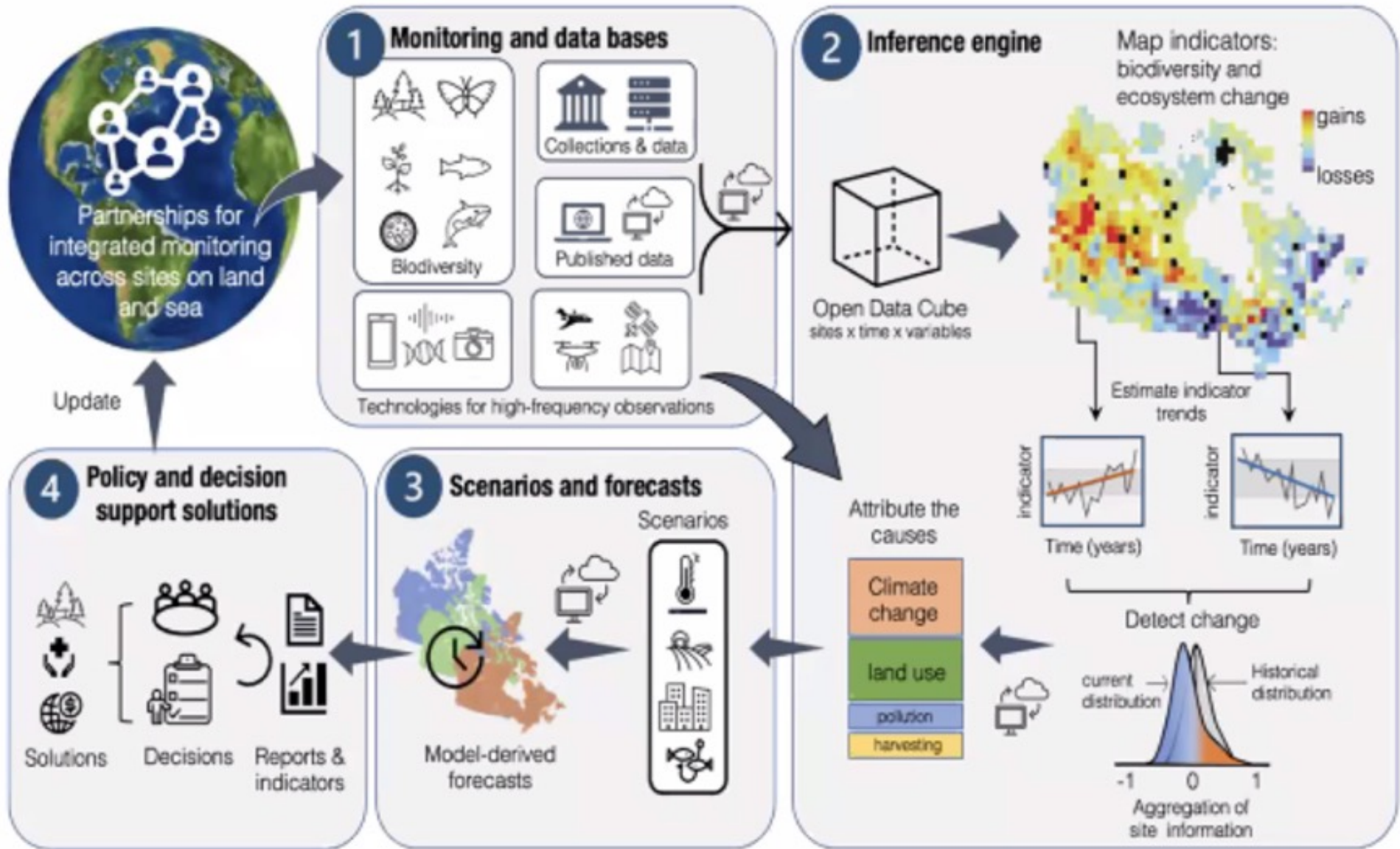
Excellent collaboration of research and monitoring communities

Biodiversity research still largely scattered

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



# GEO-BON cycle of biodiversity monitoring and policy



# 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