International Conference on Science and Technology for Sustainability 2021
Achieving Net Zero Emissions: The Roles of Academia
Day-2 "*Synergies and Trade-offs related to Climate Change* "

Why biodiversity matters?

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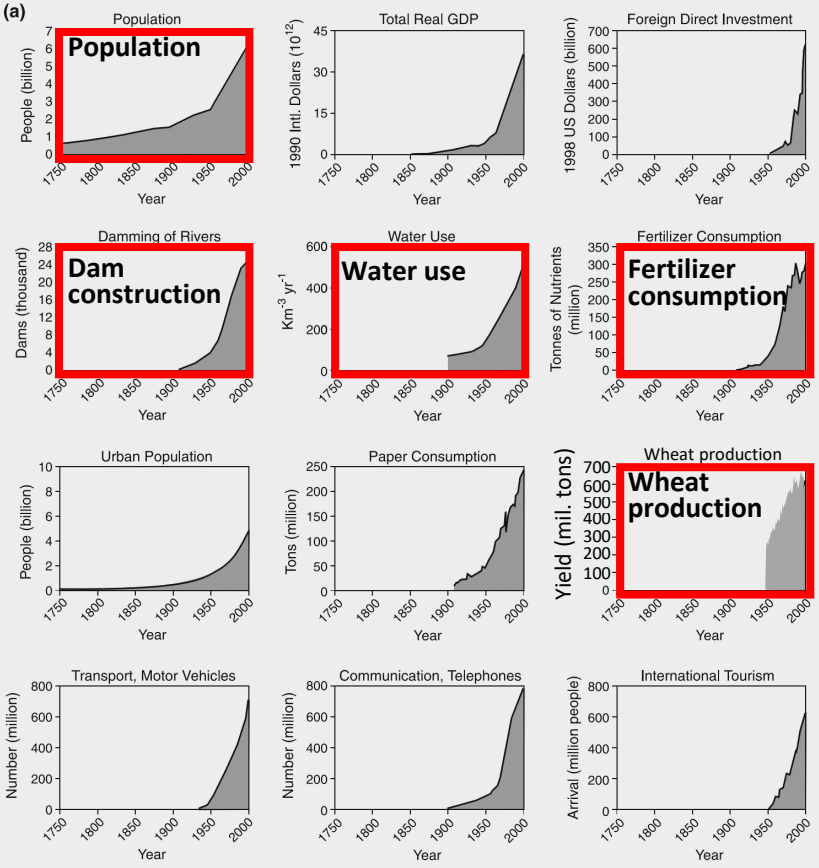
Ecosystem services to a city in the developed world (beneficiaries of ecosystem services)

Source: TEEB (2008). An Interim Report. European Communities.

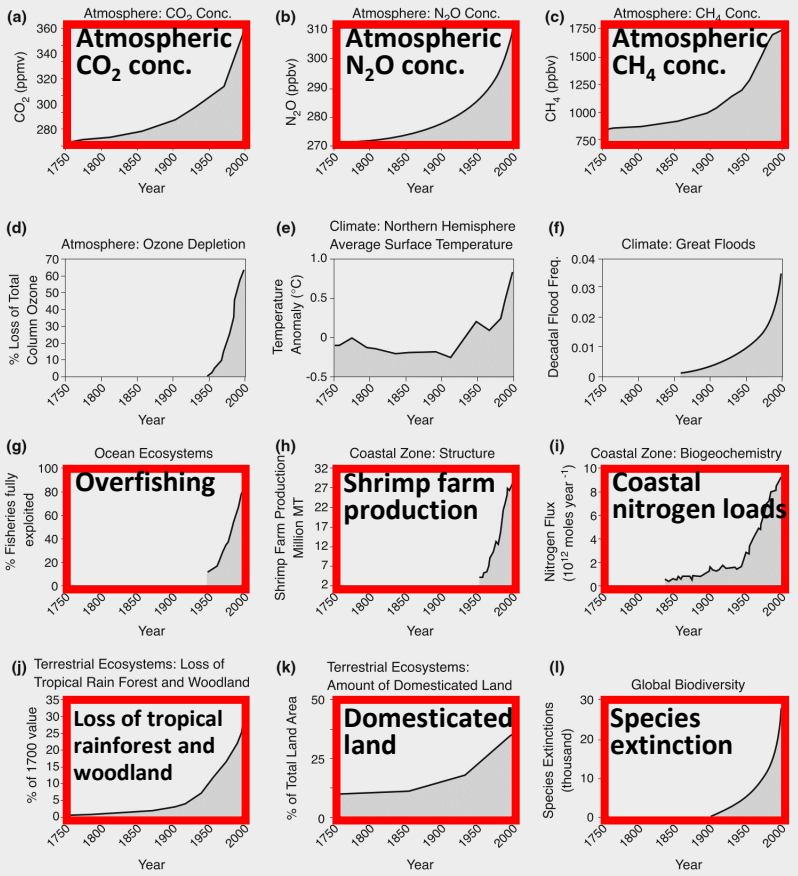
Expansion of human activity and environmental changes over the past 250 years

Human activities have greatly expanded along with modernization, which triggered environmental degradations.

Human activities



Environmental consequences



* The horizontal axis is the year in AD (1750-2000), and the vertical axis is the unit for each indicator (e.g. Population in "people", GDP in "dollars")

Source: Steffen et al. (2011). Wheat production is from FAOSTAT (online).

Over the past 50 years, our society has become materially wealthier But, we have lost many ecosystem services

Global trends in ecosystem serviccs in the past 50 years

Of the 27 indicators,

- Only 3 increased (land for food and feed, bioenergy, and other agricultural materials)
- Many of the other indicators declined (e.g., air & water quality, climate regulation, and habitat creation/maintenance)

Trend of ecosystem services

Global Trends

*The background color of the arrow differs depending on the level of certainty

Across regions Consistent Variable

Level of certainty

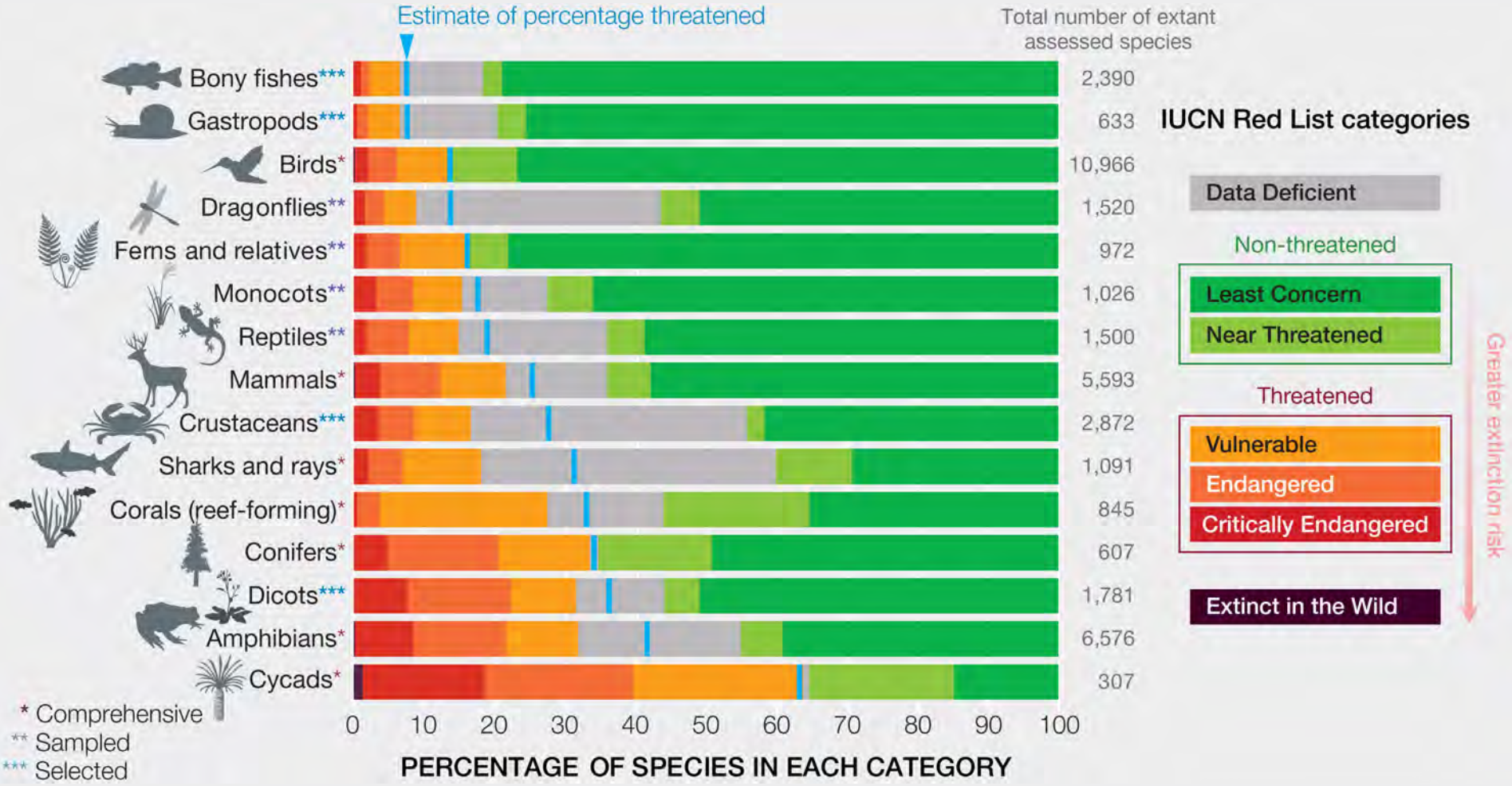
- Well established
- Established but incomplete
- Unresolved

Source: IPBES(2019)The Global Assessment Report on Biodiversity and Ecosystem Services: Summary for Policy Makers.

Human activity is threatening many species with extinction on an unprecedented scale across the globe.

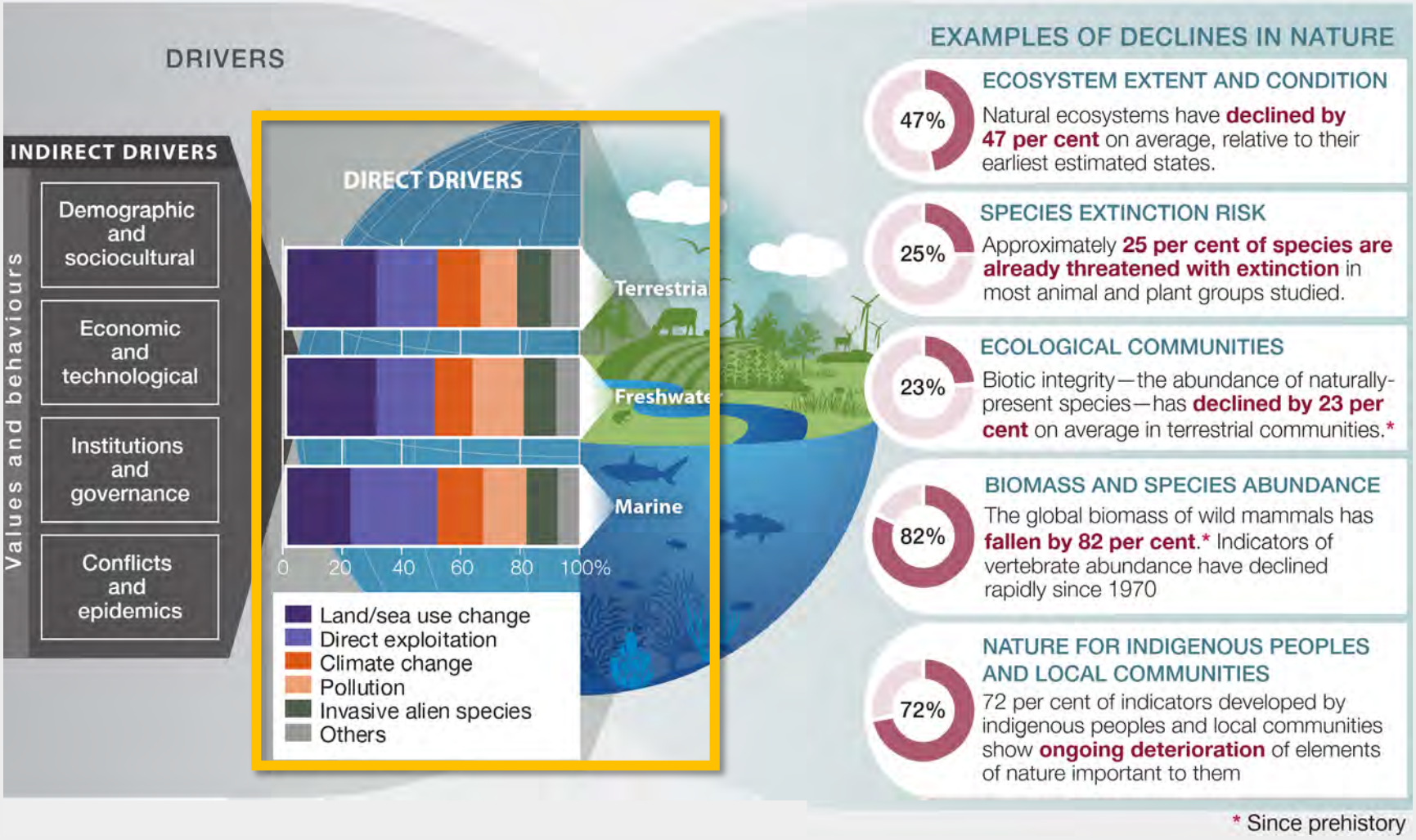
One million species are threatened with extinction.

Σ((% of threatened species group) x (Number of species per group)) = (Threatened species)



Source: IPBES（2019）The Global Assessment Report on Biodiversity and Ecosystem Services: Summary for Policy Makers.

Climate change is one of the major direct drivers of biodiversity decline

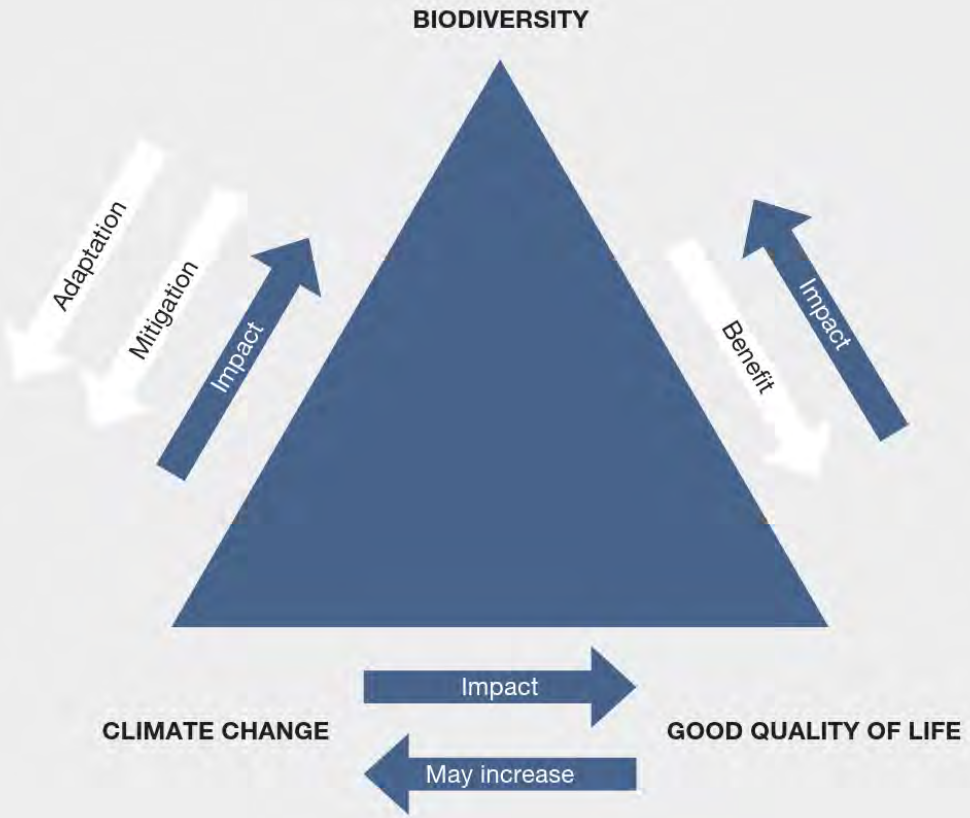


Terrestrial :Land use change > Direct exploitation > Climate change > Pollution > Invasive alien species
Freshwater :Land use change > Pollution > Direct extraction > Climate change > Invasive alien species
Marine :Direct exploitation > Sea use change > Pollution > Climate change > Invasive alien species

Source: IPBES（2019）The Global Assessment Report on Biodiversity and Ecosystem Services: Summary for Policy Makers.

Controlling climate change and protecting biodiversity are interdependent and essential for sustainable futures and good quality of life

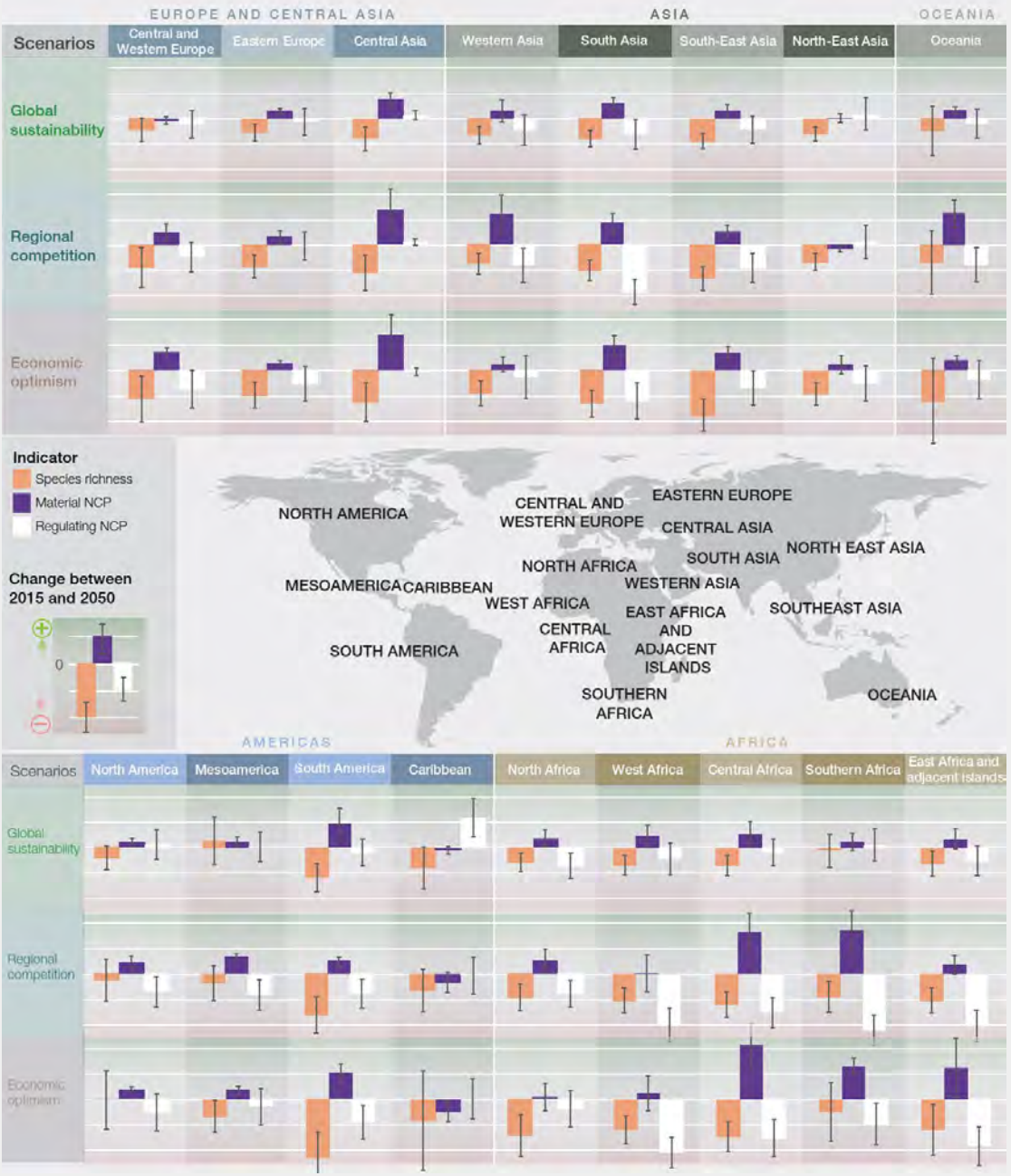
- If anthropogenic climate change continues, social-ecological systems will continue to be degraded
- Solving climate change requires consideration of biodiversity and vice-versa



Relationships between climate change, biodiversity, and good quality of life

Source: IPBES-IPCC (2021) Scientific Outcome of the IPBES-IPCC co-sponsored workshop on biodiversity and climate change

Meeting climate target will not halt the biodiversity decline.



Biodiversity
Species richness

Provisioning services
Food, feed, wood, bioenergy

Regulating services
Nitrogen retention, soil retention, crop pollination, crop pest control, carbon sequestration

- "**Global sustainability**" has the smallest impact on biodiversity and ecosystem services across the globe
- Impacts and their differences are large in the "**Regional competition**" and "**Economic optimism**."
- Provisioning serviecs are greatest in the "**Regional competition**" scenario and "**Economic optimism**," but at the expense of a decline in biodiversity and regulating services

Source: IPBES（2019）The Global Assessment Report on Biodiversity and Ecosystem Services: Summary for Policy Makers.

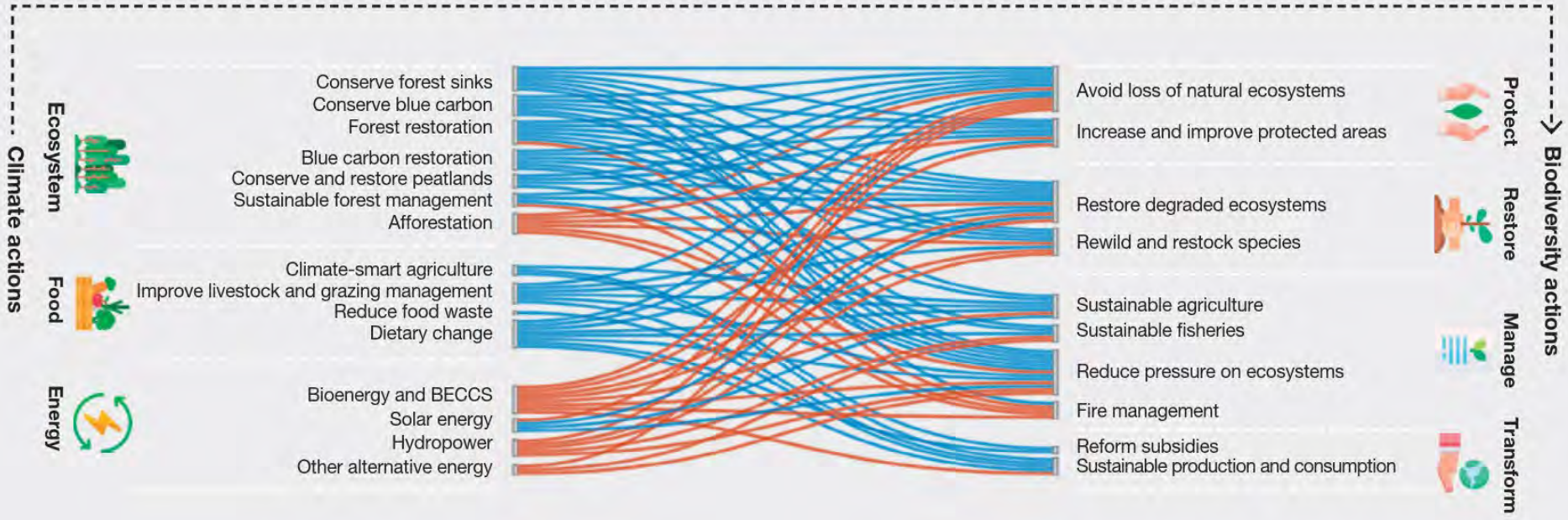
Measures that focus only on climate change mitigation and adaptation may have negative effects on biodiversity.

Climate measures that could have unexpected negative impacts include

- Large-scale monoculture of trees and bioenergy crops
- Planting trees in ecosystems that were not originally forests
- Reforestation with non-native tree species
- Wind power, hydroelectric power, mega-solar power plants
- Mining of resources for renewable energy technologies, etc.

Effects of actions to mitigate climate change on actions to mitigate biodiversity loss

（※ — : Synergy, — : Trade-off）

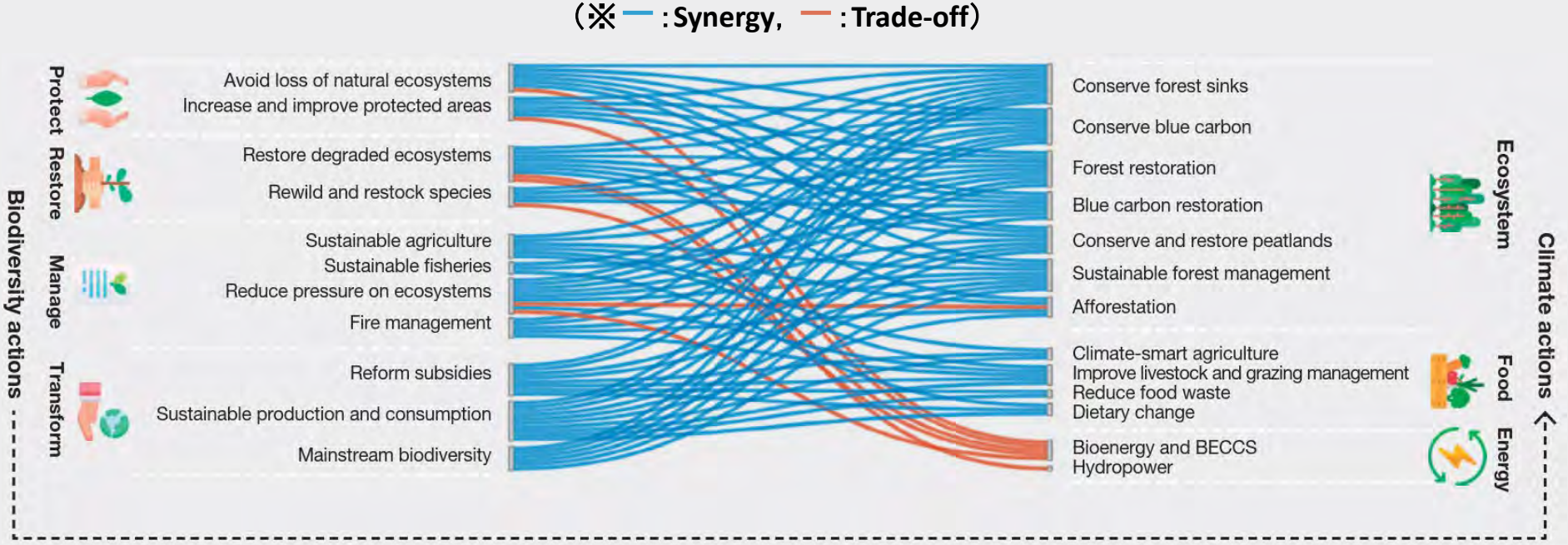


Source: IPBES-IPCC (2021) Scientific Outcome of the IPBES-IPCC co-sponsored workshop on biodiversity and climate change

Many biodiversity conservation measures are compatible with climate change measures.

- Protected areas, ecosystem management for conservation purposes (e.g., forest fire control, reintroduction of important species) often produce co-benefits
- Reduced per capita consumption, dietary changes, and sustainable use of natural resources will also contribute to addressing the biodiversity and climate crises

Effects of actions to mitigate climate change on actions to mitigate biodiversity loss



Source: IPBES-IPCC (2021) Scientific Outcome of the IPBES-IPCC co-sponsored workshop on biodiversity and climate change

Conservation, restoration, and sustainable management of ecosystems will produce co-benefits for climate mitigation/adaptation and biodiversity conservation.

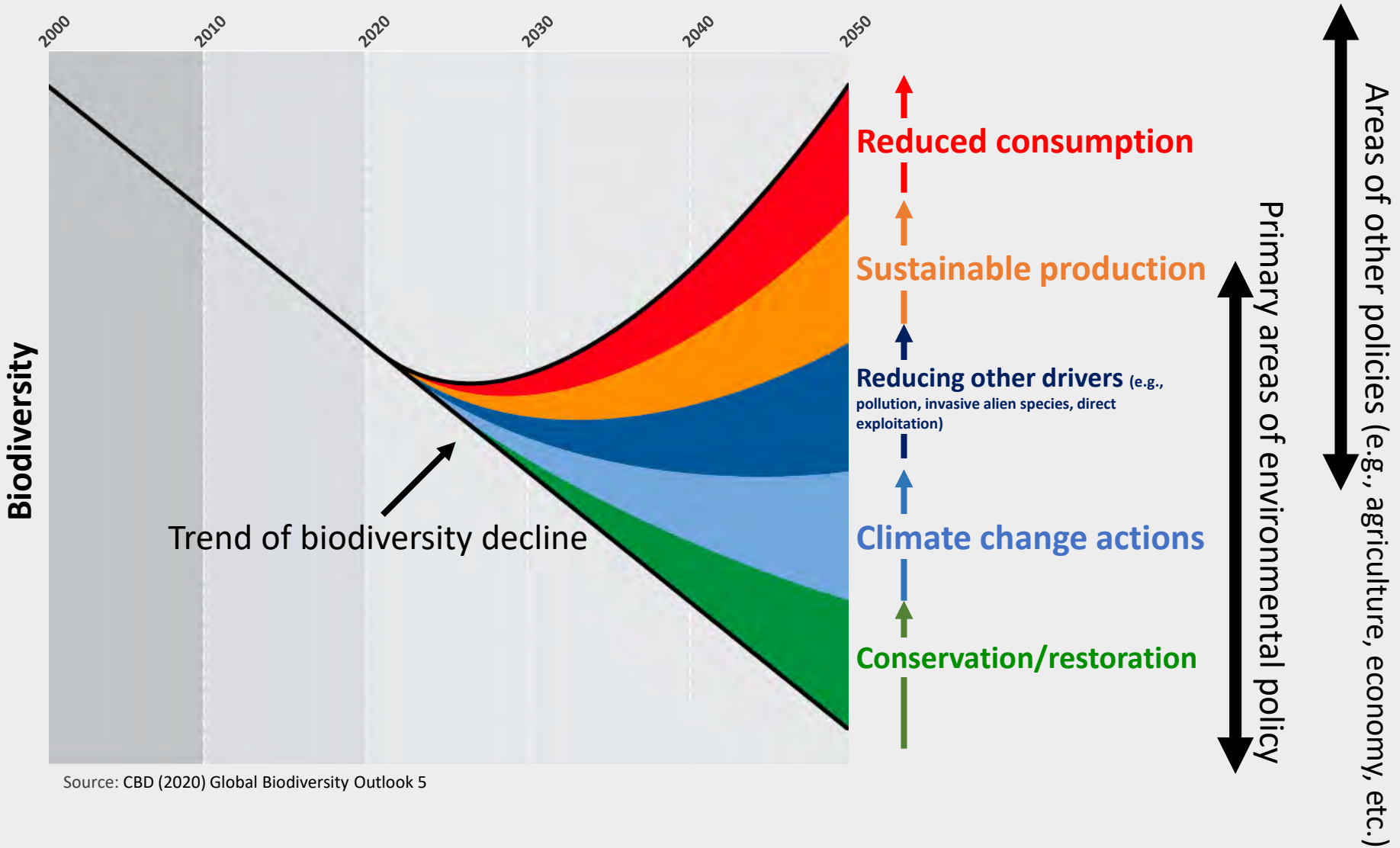
Nature-based solutions（NbS）will be one of the keys

"*actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits*" (IUCN)

- Avoidance of loss and degradation of terrestrial and marine ecosystems
- Building green infrastructure in cities
- Effective through long-term and planned implementation
- NbS will only be effective if there is an ambitious reduction in anthropogenic greenhouse gas emissions.

Source: IPBES-IPCC (2021) Scientific Outcome of the IPBES-IPCC co-sponsored workshop on biodiversity and climate change

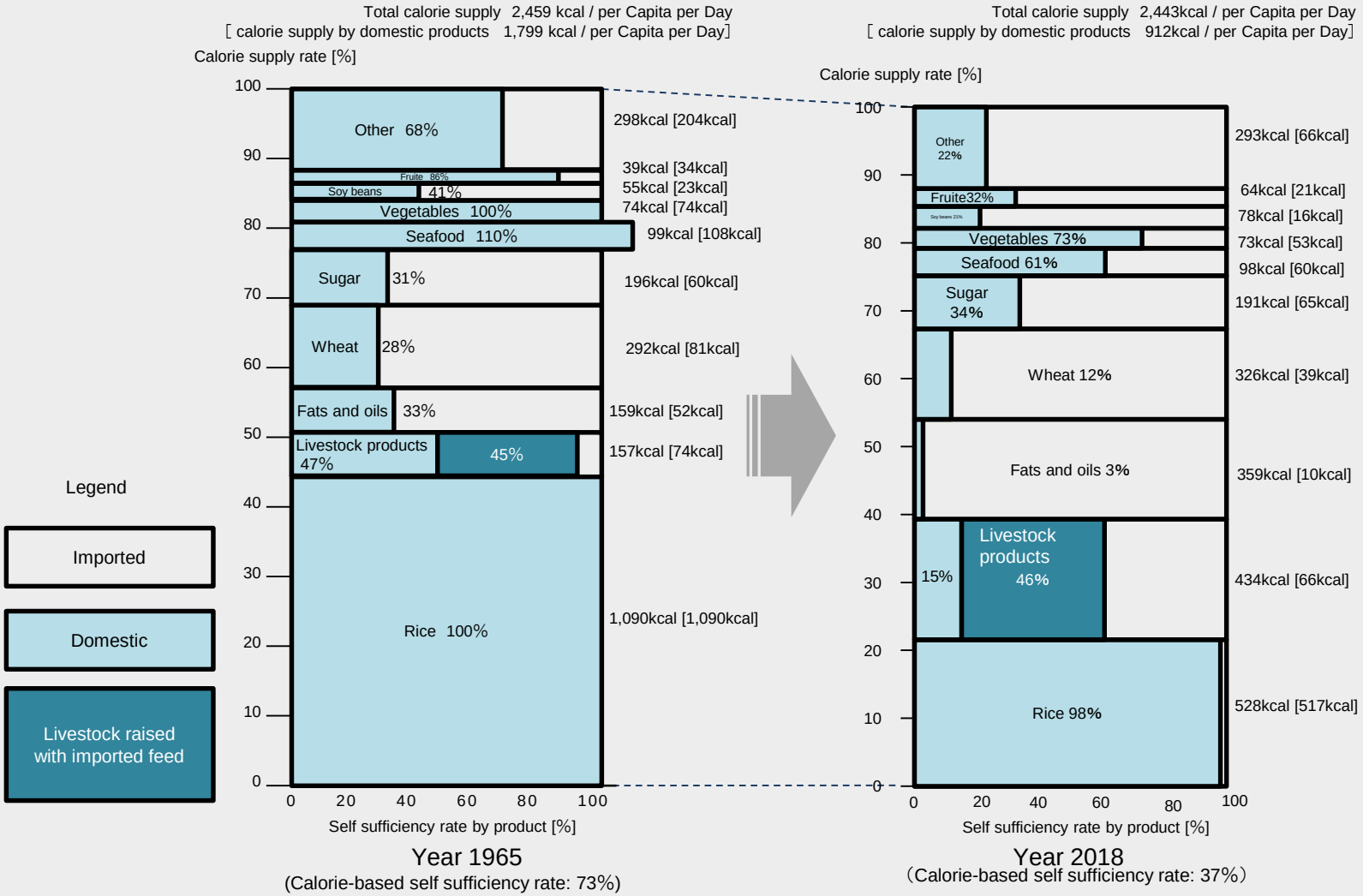
A portfolio of actions to reverse biodiversity decline



Source: CBD (2020) Global Biodiversity Outlook 5

Japan's food self-sufficiency rate (based on the calorific value of supply) is 37%.

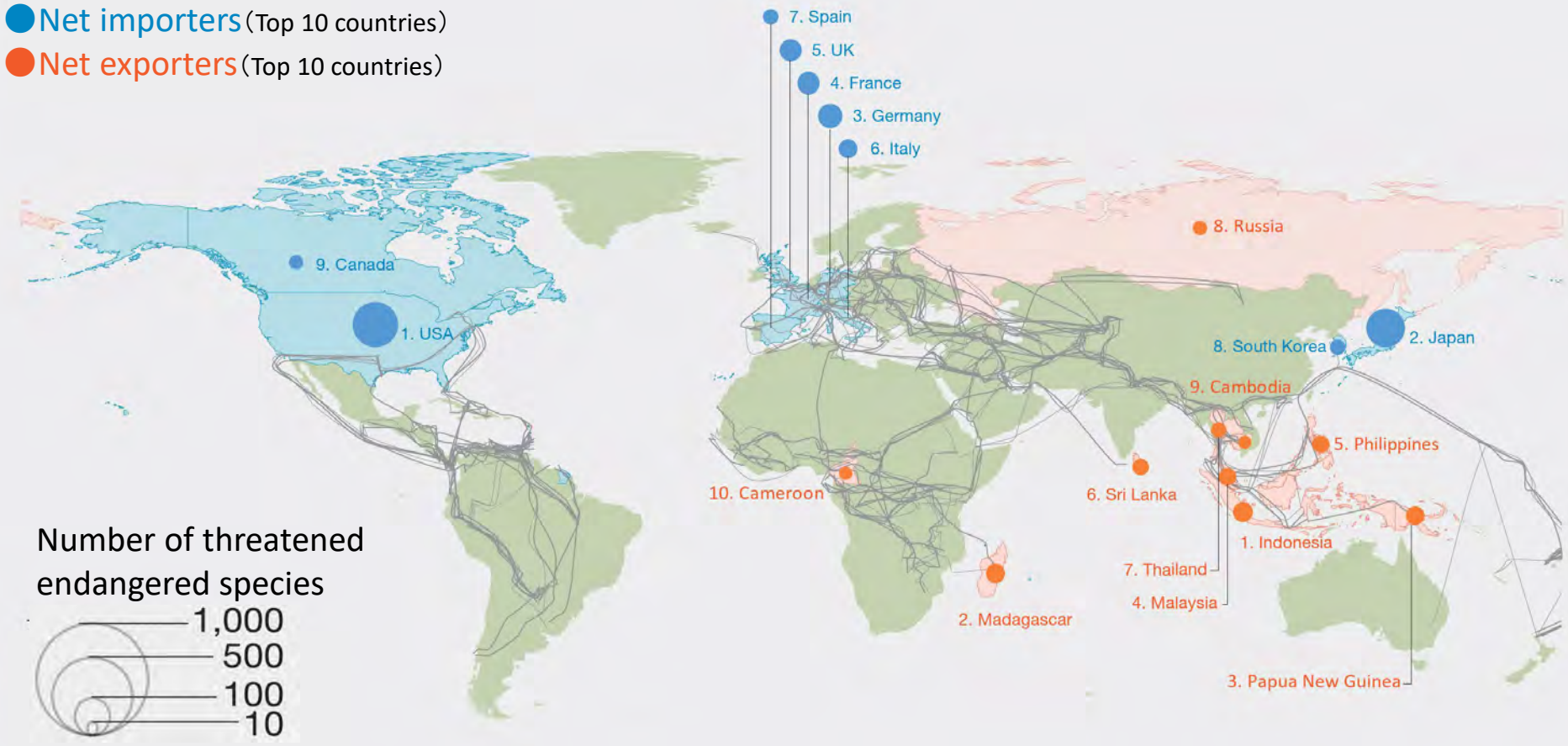
- Over the past 50 years, Japan's diet has become increasingly Westernized and its dependence on overseas sources of the food supply has increased.



Source: Food supply and demand table, Ministry of Agriculture, Forestry and Fisheries（2018）

Consumptions in developed countries have been causing a decline in biodiversity in other countries through trade.

Estimated impacts of international trades on endangered species
(based on data on 7,000 endangered species including the IUCN Red List)



IPBES (2019) The Global Assessment Report on Biodiversity and Ecosystem Services