Just and viable transformative change pathways and targets for biodiversity

REDUCING FOOTPRINTS — BUILDING RESILIENCE

IIASA 50

EST. 1972

D. Leclère[1], C. Wong[1], L. Nowak[2]
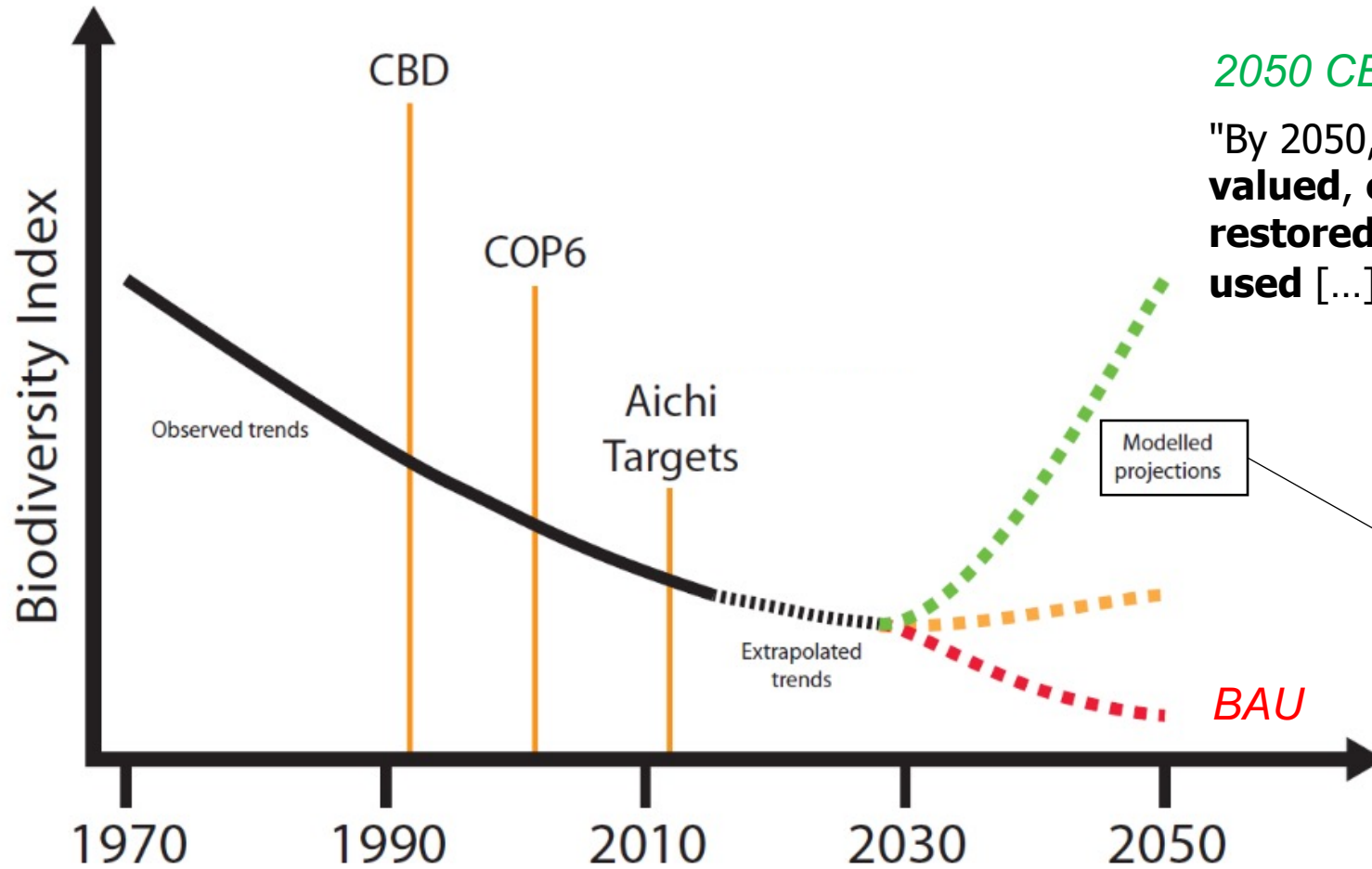
[1] IIASA Austria

[2] SGN, Germany

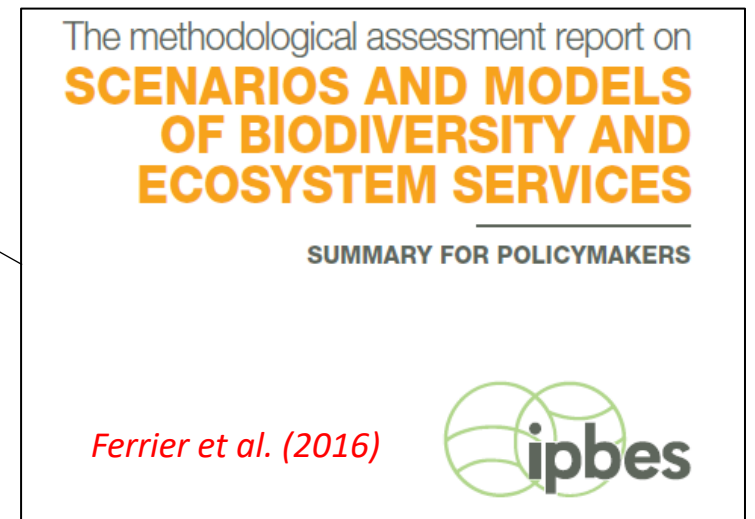Sep. 3rd 2024 | 87th LCA Discussion Form (Zurich, CH)

Biodiversity in LCA: how far have we come?

A recent example of biodiversity pathway application

Models and scenarios to support goal setting

2050 CBD vision

"By 2050, biodiversity is **valued**, **conserved**, **restored** and **wisely used** [...]"

The methodological assessment report on
SCENARIOS AND MODELS OF BIODIVERSITY AND ECOSYSTEM SERVICES

SUMMARY FOR POLICYMAKERS

Ferrier et al. (2016)

Mace et al. (Nat. Sus., 2018)
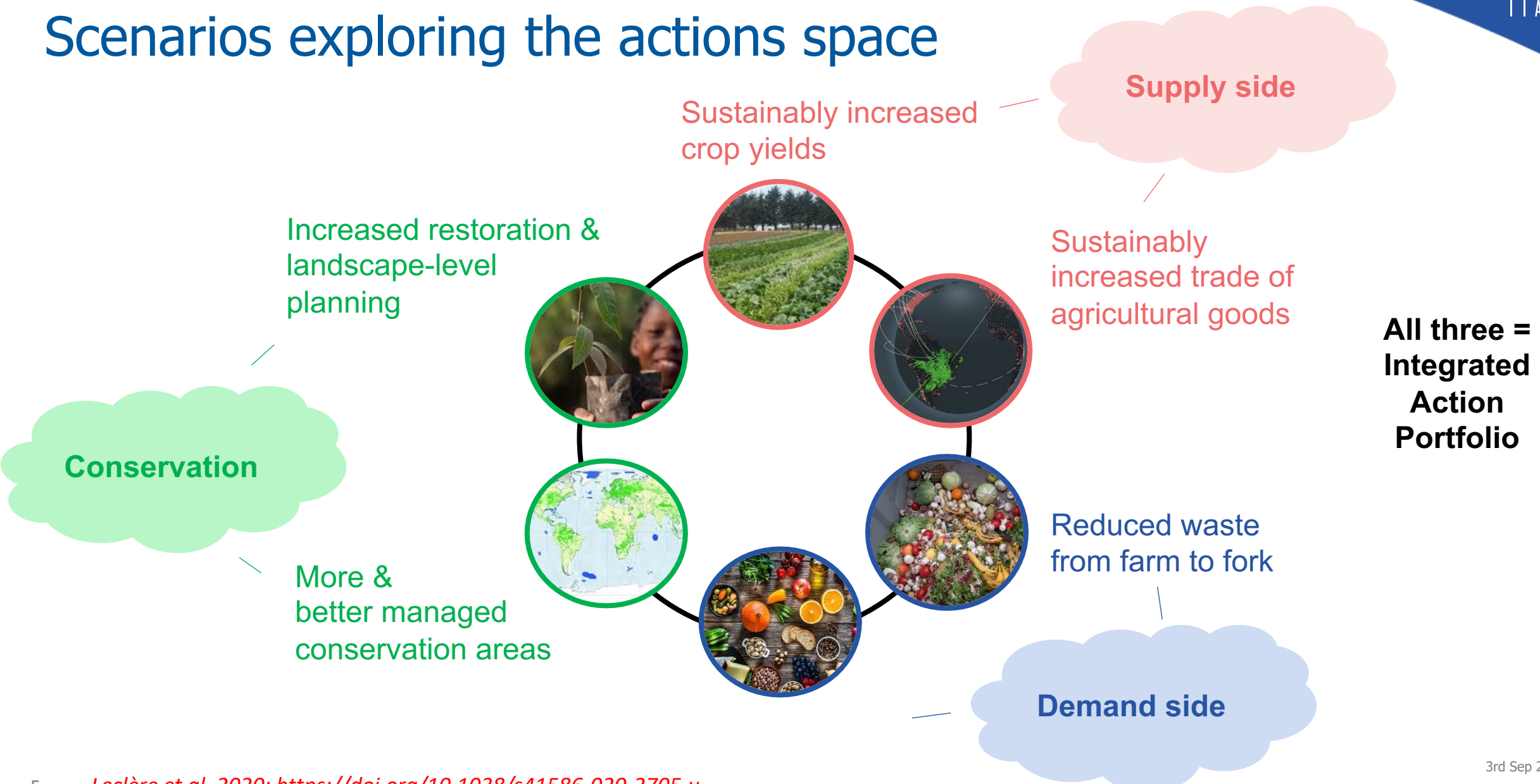
The bending the curve analysis

- Combining current data, models & scenarios from land-use & biodiversity modelling communities

- Fast track analysis on bending trends from habitat loss:

  Can we bend the curve of biodiversity loss without jeopardizing other SDGs?
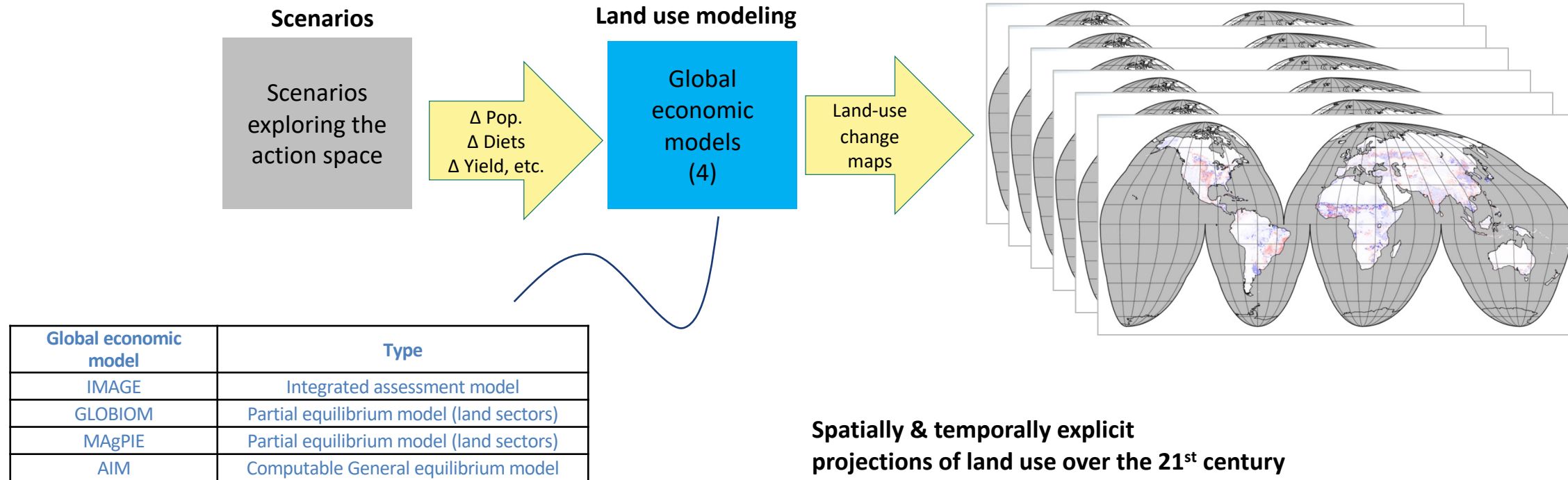
  If yes, what can we robustly say about how to get there?

  > New global scenarios exploring the action space

  > New multi-model assessment of these scenarios

 Leclère et al. 2020; https://doi.org/10.1038/s41586-020-2705-y

Scenarios exploring the actions space

Sustainably increased crop yields

Supply side

Increased restoration & landscape-level planning

Sustainably increased trade of agricultural goods

All three = Integrated Action Portfolio

Conservation

More & better managed conservation areas

Reduced waste from farm to fork

Demand side

Leclère et al. 2020; https://doi.org/10.1038/s41586-020-2705-y

3rd Sep 2024

D. Leclere, 87th LCA DF

Multi-model assessment

Scenarios

Scenarios exploring the action space

Δ Pop.
Δ Diets
Δ Yield, etc.

Land use modeling

Global economic models (4)

Land-use change maps

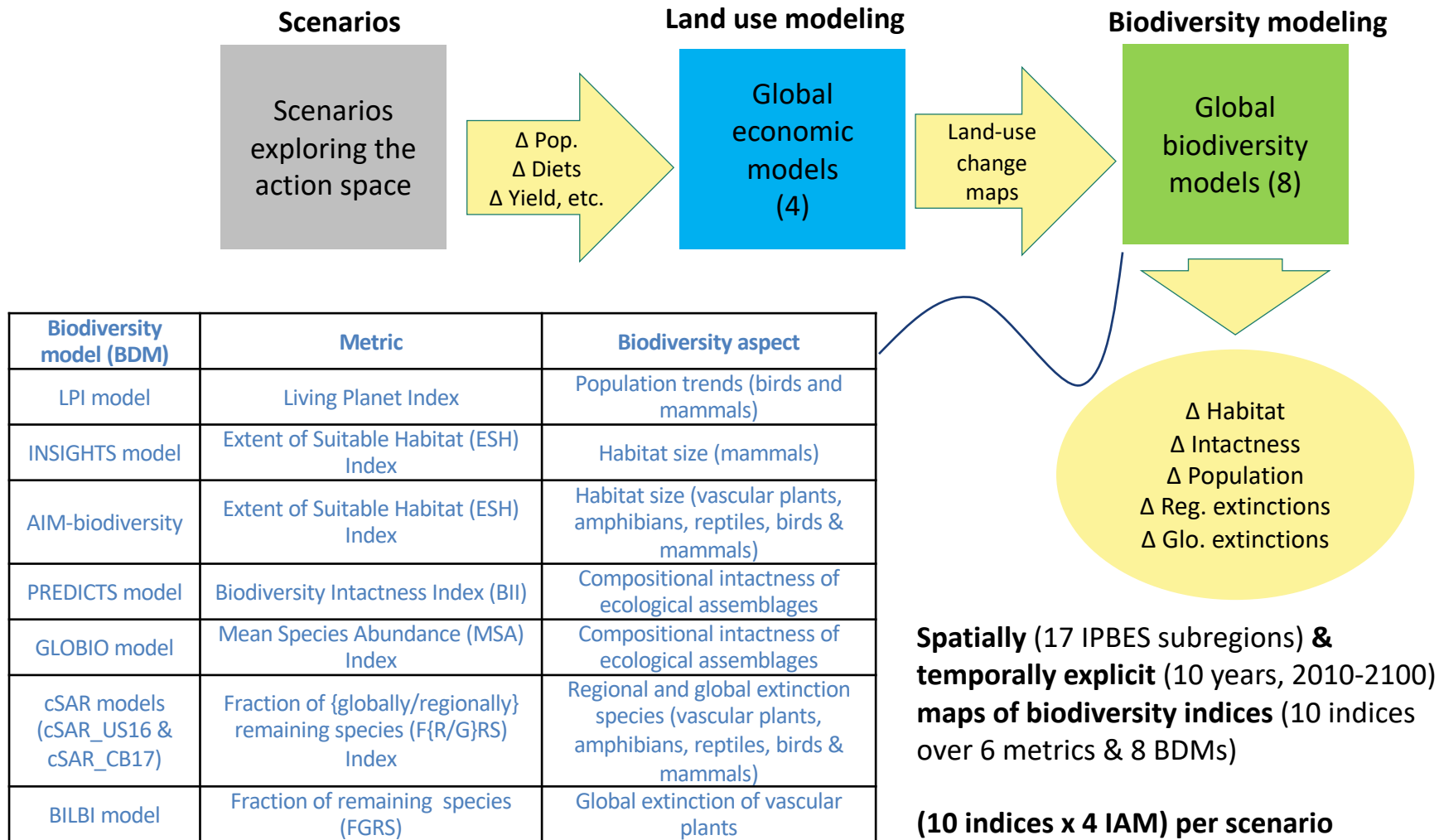| Global economic model	Type
IMAGE	Integrated assessment model
GLOBIOM	Partial equilibrium model (land sectors)
MAgPIE	Partial equilibrium model (land sectors)
AIM	Computable General equilibrium model

Spatially & temporally explicit projections of land use over the 21st century
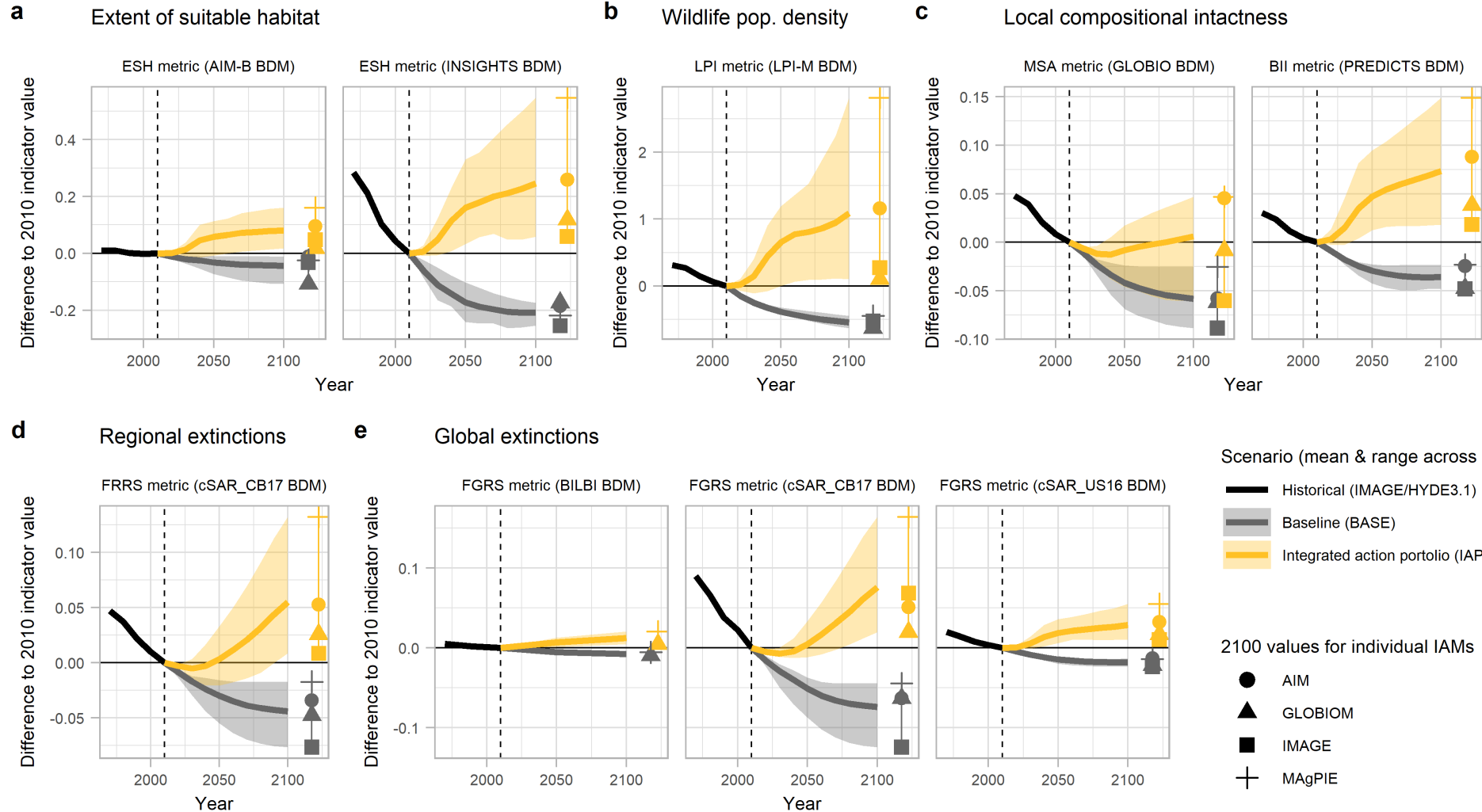
(12 LU classes x 4 econ models) per scenario
50 x 50 km resolution, 10-y time steps 2010-2100

NB: see presentation at 67th LCA DF

Multi-model assessment

Scenarios

Land use modeling

Biodiversity modeling

Scenarios exploring the action space

→ Δ Pop. Δ Diets Δ Yield, etc. →

Global economic models (4)

→ Land-use change maps →

Global biodiversity models (8)

Δ Habitat
Δ Intactness
Δ Population
Δ Reg. extinctions
Δ Glo. extinctions

Biodiversity model (BDM)	Metric	Biodiversity aspect
LPI model	Living Planet Index	Population trends (birds and mammals)
INSIGHTS model	Extent of Suitable Habitat (ESH) Index	Habitat size (mammals)
AIM-biodiversity	Extent of Suitable Habitat (ESH) Index	Habitat size (vascular plants, amphibians, reptiles, birds & mammals)
PREDICTS model	Biodiversity Intactness Index (BII)	Compositional intactness of ecological assemblages
GLOBIO model	Mean Species Abundance (MSA) Index	Compositional intactness of ecological assemblages
cSAR models (cSAR_US16 & cSAR_CB17)	Fraction of {globally/regionally} remaining species (F{R/G}RS) Index	Regional and global extinction species (vascular plants, amphibians, reptiles, birds & mammals)
BILBI model	Fraction of remaining species (FGRS)	Global extinction of vascular plants

Spatially (17 IPBES subregions) **& temporally explicit** (10 years, 2010-2100) **maps of biodiversity indices** (10 indices over 6 metrics & 8 BDMs)

(10 indices x 4 IAM) per scenario

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Yes, we can?

a Extent of suitable habitat — ESH metric (AIM-B BDM), ESH metric (INSIGHTS BDM)

b Wildlife pop. density — LPI metric (LPI-M BDM)

c Local compositional intactness — MSA metric (GLOBIO BDM), BII metric (PREDICTS BDM)

d Regional extinctions — FRRS metric (cSAR_CB17 BDM)

e Global extinctions — FGRS metric (BILBI BDM), FGRS metric (cSAR_CB17 BDM), FGRS metric (cSAR_US16 BDM)

Scenario (mean & range across IAMs):
Historical (IMAGE/HYDE3.1), Baseline (BASE), Integrated action portolio (IAP)

2100 values for individual IAMs:
AIM, GLOBIOM, IMAGE, MAgPIE

Trend reversal achieved by 2050 for 33 out of 34 IAM x BDI combinations

Leclère et al. (Nature, 2020)

How do we get there?

Increased conservation efforts are key ...

More and better managed PAs **AND** restoration **AND** landscape-level conservation planning:

- o Advances the date at which we reach peak biodiversity loss by several decades
- o Allows to set biodiversity on a recovery track

How do we get there?

Increased conservation efforts are key …

but are not enough!
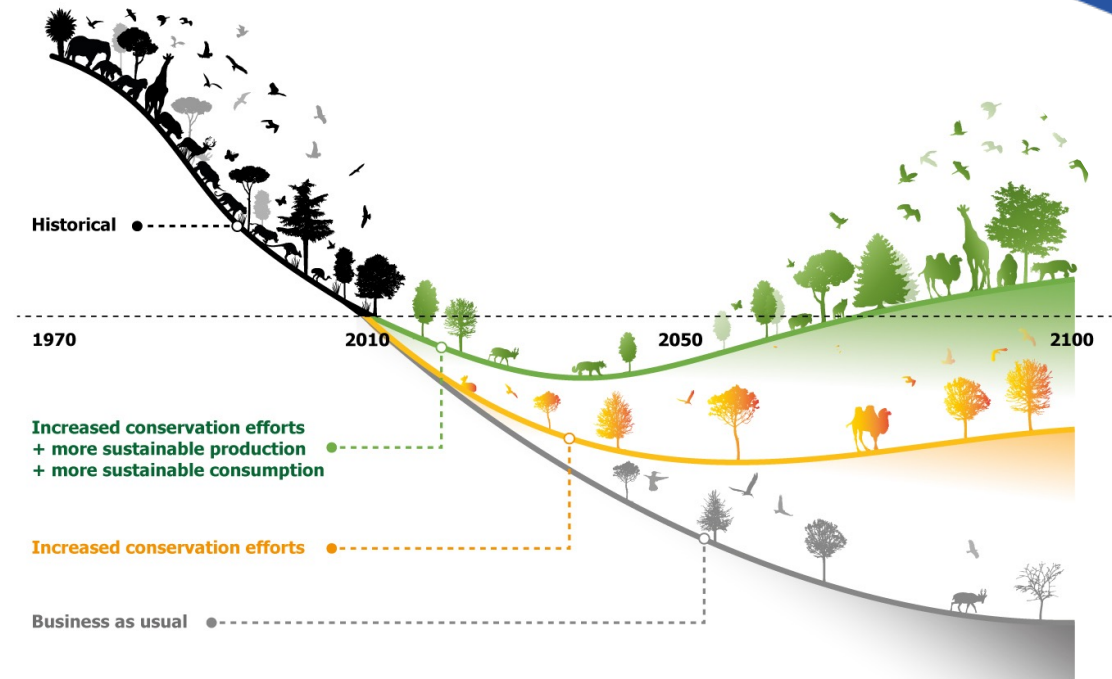
Only by **additionally** tackling the drivers of habitat loss (via **diet shift, reduced waste, sustainable increases in trade and crop yields**) will we robustly:

- Allow avoiding further habitat losses in the near-term
- Secure bending by 2050
- Keep food prices under control & generates large synergies with health, GHG emissions, water use, fertilizer application etc.

Some additional remarks

- Particularly impactful study
  - High media coverage, high citations, citations in main science-policy documents
  - A key reference in architecture design and target formulation of the KMGBF

- Includes collaboration between LCIA and IAM communities
  - e.g., cSAR-based biodiversity response to land use developed by LCIA community as one of the biodiversity models

- Some limitations that can benefit from further collaboration with LCIA community
  - Only land use impact on biodiversity
  - Limited accounting of land use management / intensity

Value-explicit scenarios and targets for just pathways

Supporting fair action for nature and people

A just transition for people, climate and nature ... that requires transformative change

IPBES-IPCC co-sponsored workshop (Pörtner et al 2021)
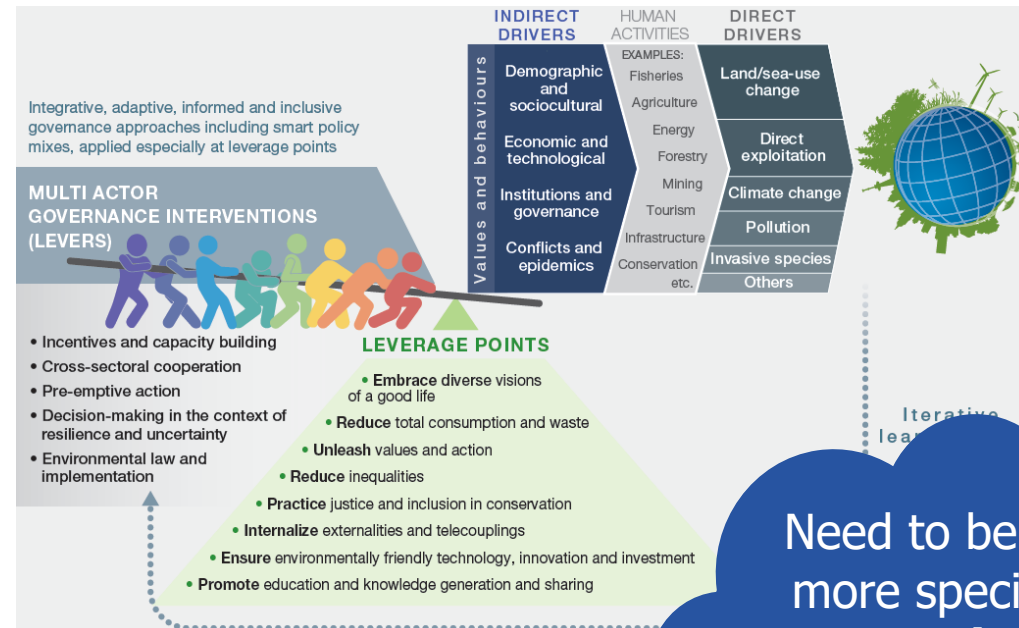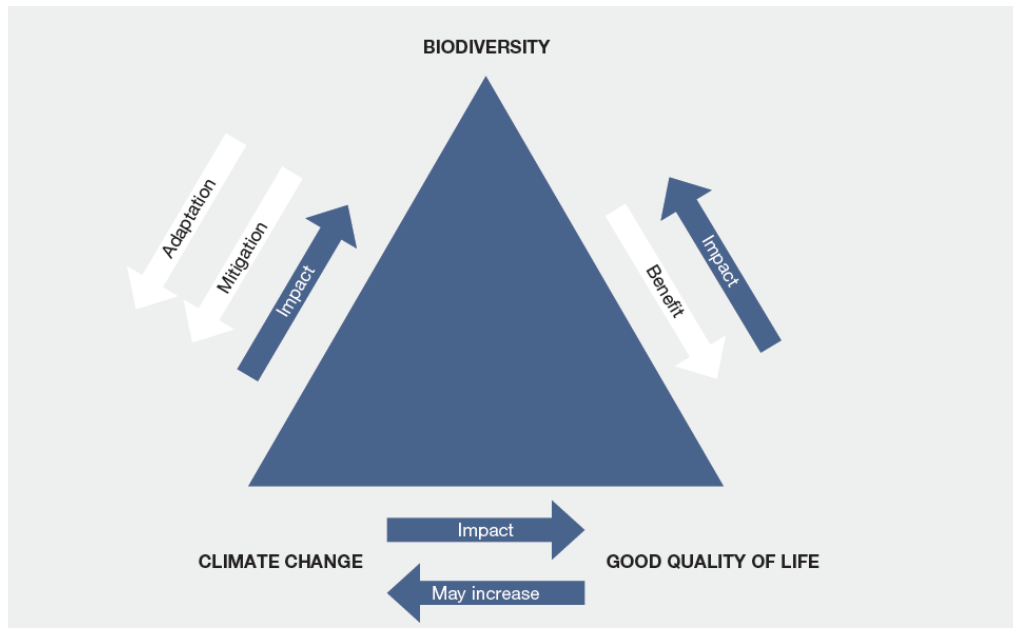
Need to be more far more specific about **values**, **interventions**, **synergies & trade-offs** and **fairness**

Environmental justice and value-explicit scenarios

- The perceived justice (across several dimensions) of goals and policies are key determinant of their acceptability and effectiveness

- Justice perceptions can be linked to values and worldviews, and translated into coherent goal and policy preferences

- Focusing scenario design on environmental justice principles enable the design of diverse, contrasted value-explicit scenarios, that support the identification of just and viable pathways
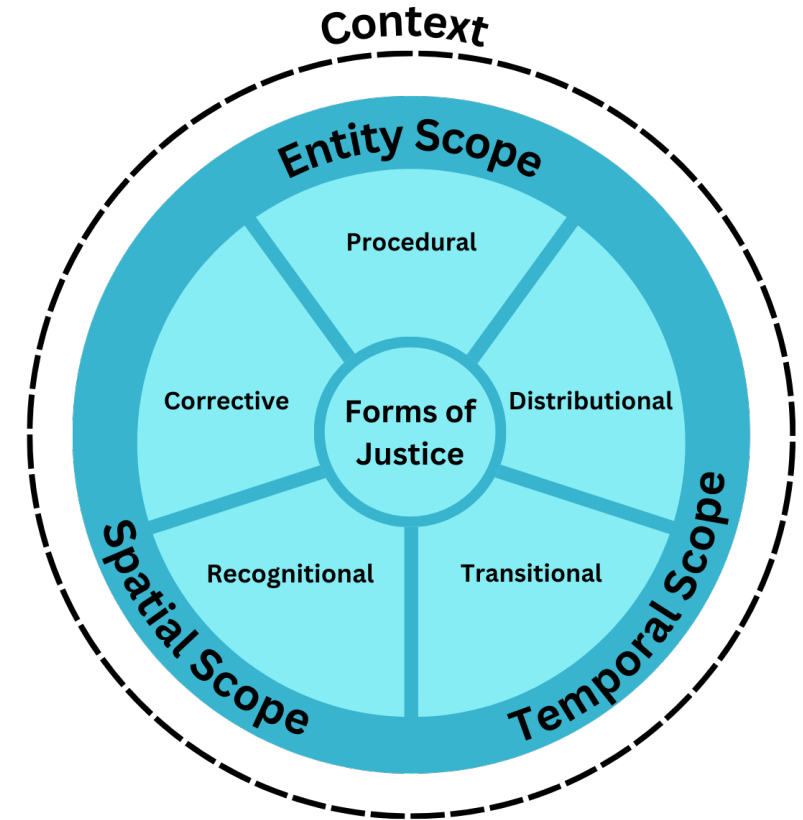
Hanger-Kopp et al., 2024 and Zimm et al., 2024

The RAINFOREST pathways

- Value-explicit scenarios about transformative change towards biodiversity and climate goals in the EU food and biomass nexus between climate action, production, trade, consumption, and human behavior

- Based on preferences for three forms of justice (distributive, procedural and recognitional)

- Linked to other value-explicit scenario frameworks (e.g., the Sustainable Development Pathways, and the Nature Futures)

- 1st draft of pathway narratives available here (feedback welcome)

Leclère et al, 2024

RAINFOREST Pathway Narratives

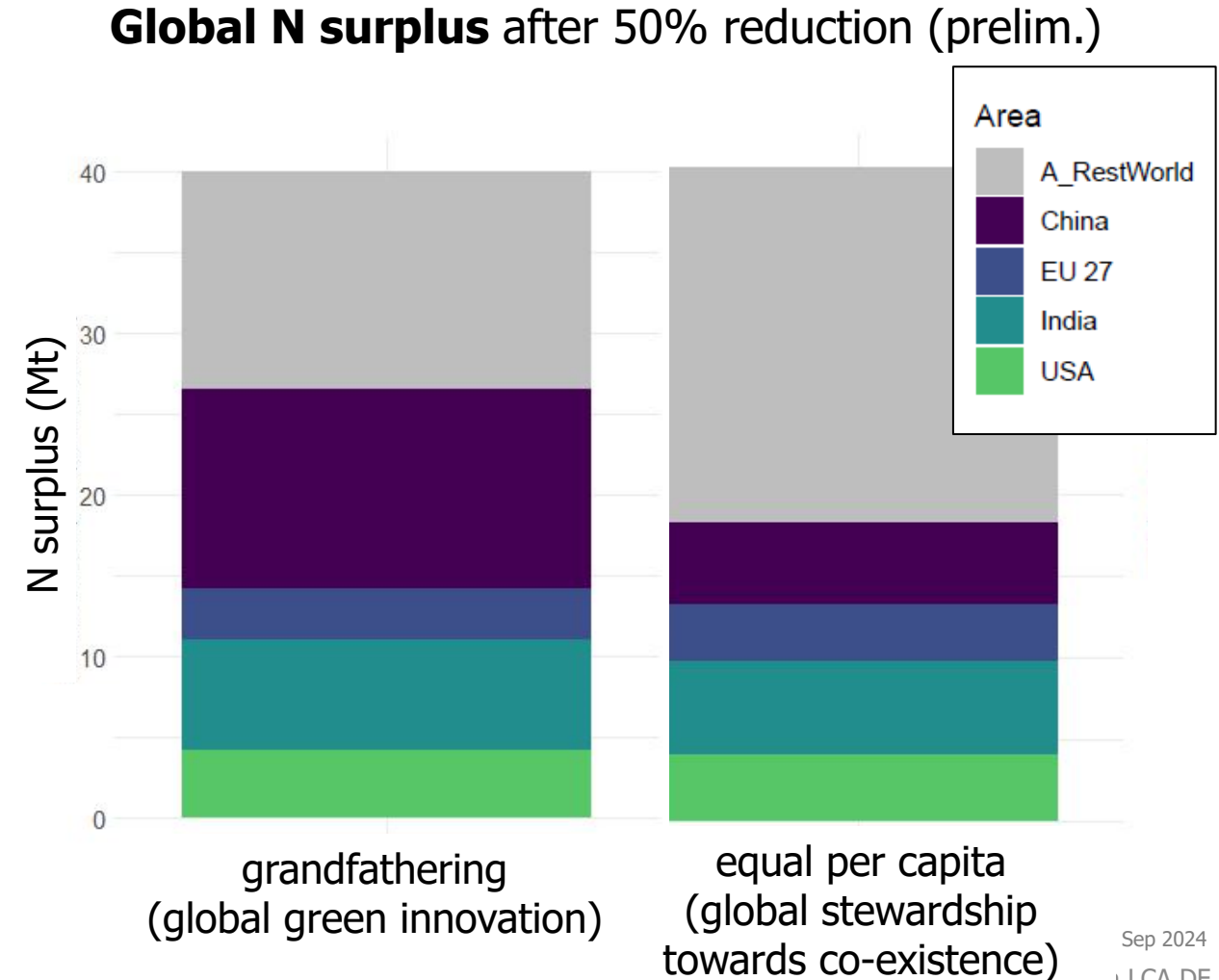Just and value-explicit transformational pathways

1. Global Green Innovation — Liberal point of view with individual freedom of choice at the core

2. Needs-based and Nature connected Local Stewardship — Communitarian point of view with equality at the core

3. Global stewardship towards co-existence — Managerial point of view with process at the core

|	Global green innovation	Needs-based and nature-connected local stewardship	Global stewardship towards co-existence
Distributive aspect of environmental justice	Preference for utilitarian approach, where those that can maximize environmental and social benefits most efficiently should be allocated the most resources. Cost-effectiveness, progressivity, capacity and grandfathering principles guide effort sharing.	Preference for egalitarian approach, where the outcome is based on need and parity (rather than on benefits derived) and universal measures are preferred to allow everyone equal access to NCPs. Need, capacity and subsistence principles guide effort sharing.	Preference for prioritarian approach, where the meeting of agreed goals such as poverty eradication are more important than efficiency or equality, and supra-national and multilateral bodies have a strong role in targets and implementation. Capacity and responsibility principles guide effort sharing.
Agriculture and forestry value chain segments / consumers	Consumers are incentivized by labelling and technology-led price reductions to switch to more sustainable preferences towards high value-added sustainable products (e.g., novel proteins, novel plant-based alternatives to animal products, engineered wood products and biomaterials), further regulatory frameworks demand consumers to reduce waste and increase material use rate.	Consumers take an active role by reducing their overall consumption and moving to a high share of plant-based, whole and organic foods and a strong reduction in overconsumption and waste, with an explicit choice to adhere to principles of sufficiency.	Consumers adjust their material consumption as required to meet production and restoration goals through a mix of financial incentives (including choice architecture and message framing), self- and societal-awareness and tighter regulations.

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# Scenario-specific cross-scale translation of action targets

Pathways
Value explicit
Environmental justice

⬇

Principles of
distributional justice

⬇

Effort sharing towards
biodiversity targets

Nowak et al. a, in prep.

Global N surplus after 50% reduction (prelim.)

N surplus (Mt)

Area
- A_RestWorld
- China
- EU 27
- India
- USA

grandfathering
(global green innovation)

equal per capita
(global stewardship
towards co-existence)

Sep 2024
LCA DF

Combining just pathways with models and targets

Nowak et al. b, in prep.

Combining just pathways with models and targets
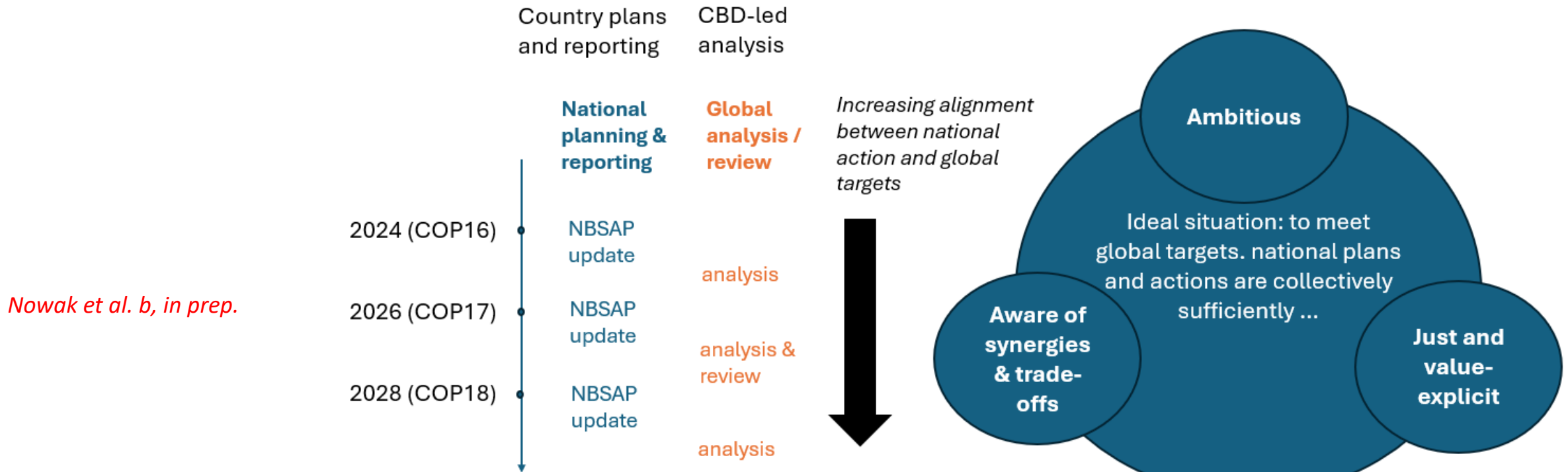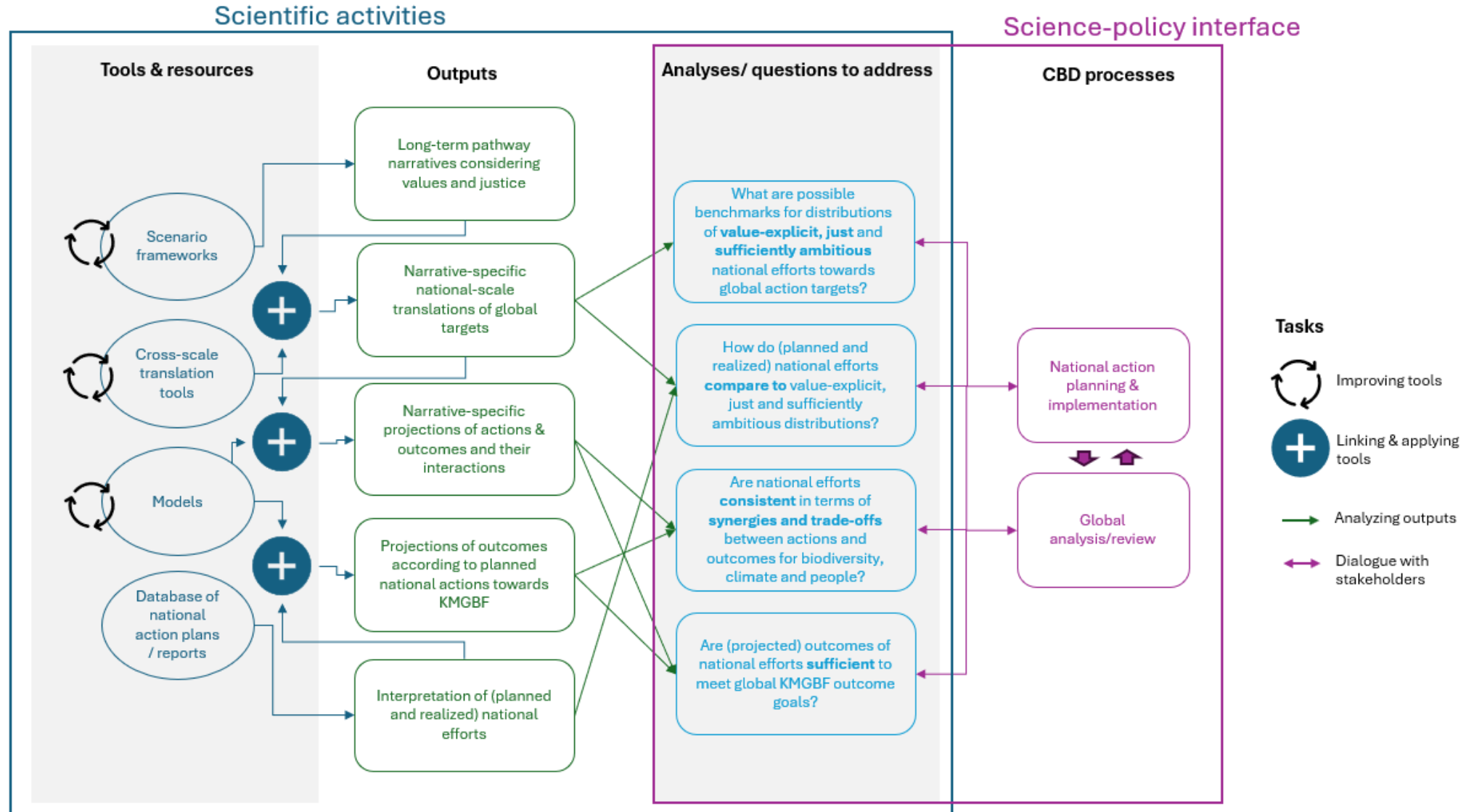
Nowak et al. b, in prep.

Key messages

- Models and scenario pathway research can be impactful

- Pathways research increasingly focusing on value-explicit scenarios & env. justice

- Fruitful collaboration between LCA and IAM communities, a lot more can be done

- Among future collaboration topics: articulating value-explicit scenarios, target downscaling and models to support KMGBF implementation