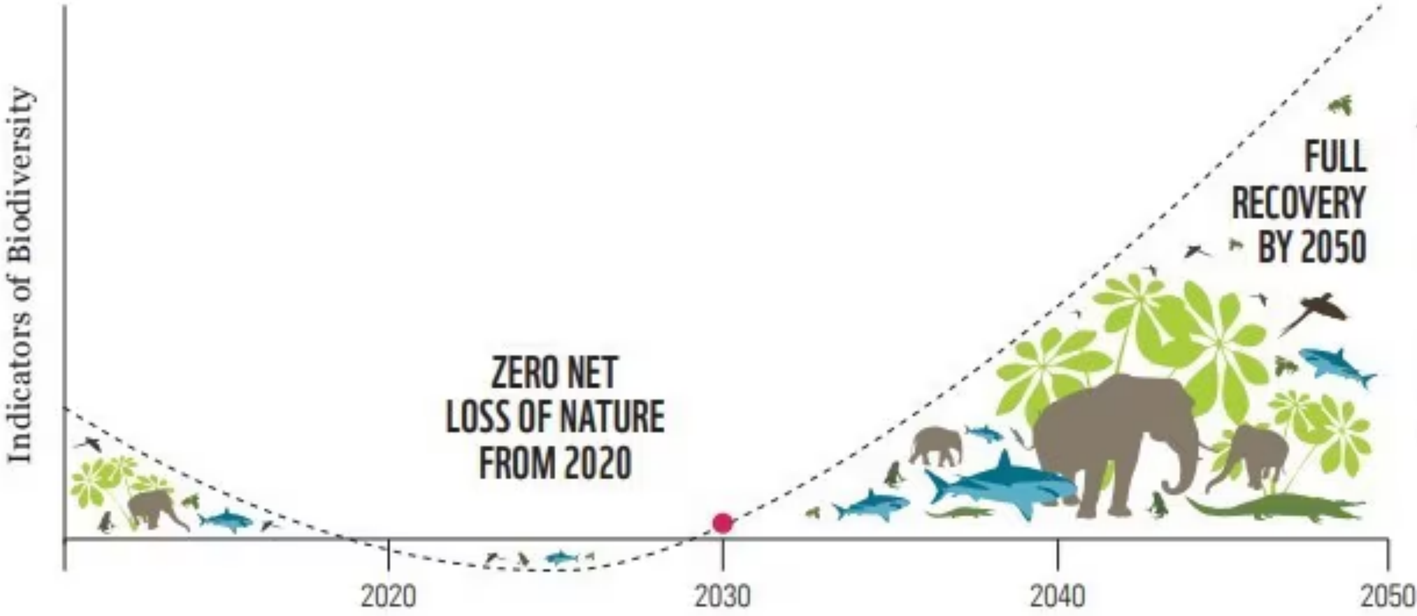
Forecasting biodiversity loss in the 21st Century

Glenn Moncrieff

The Nature Conservancy



"Dubious duo! (Explored)" by Sue Cro, CC BY-NC 2.0

Forecasting biodiversity loss in the 21st Century

Glenn Moncrieff

The Nature Conservancy

"Dubious duo! (Explored)" by Sue Cro, CC BY-NC 2.0

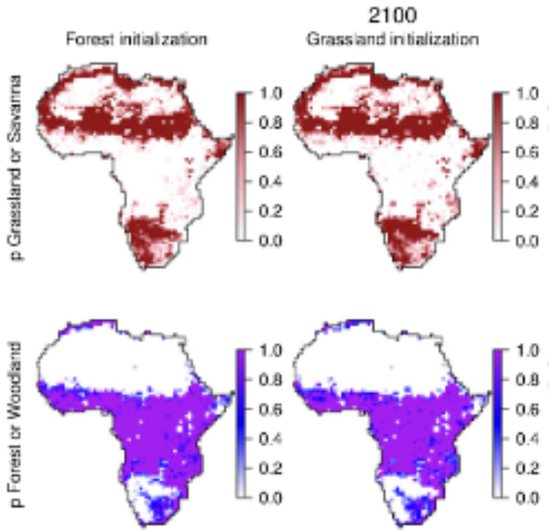
Research

New Phytologist

Increasing atmospheric CO_2 overrides the historical legacy of multiple stable biome states in Africa

Glenn R. Moncrieff[1], Simon Scheiter[2], William J. Bond[3] and Steven I. Higgins[4]

[1]Institute for Physical Geography, Goethe University Frankfurt am Main, Altenhöferallee 1, 60438 Frankfurt am Main, Germany; [2]Biodiversity and Climate Research Centre, Senckenberg Research Institute and Natural History Museum, Senckenberganlage 25, 60325 Frankfurt am Main, Germany; [3]Department of Biological Sciences, University of Cape Town, Private Bag, Rondebosch 7701, Cape Town, South Africa; [4]Department of Botany, University of Otago, PO Box 56, Dunedin 9054, New Zealand



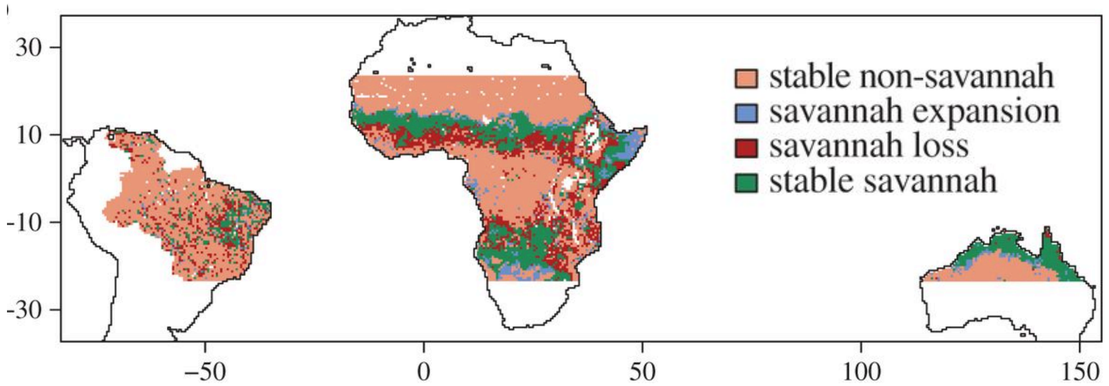
PHILOSOPHICAL TRANSACTIONS B

rstb.royalsocietypublishing.org

Research

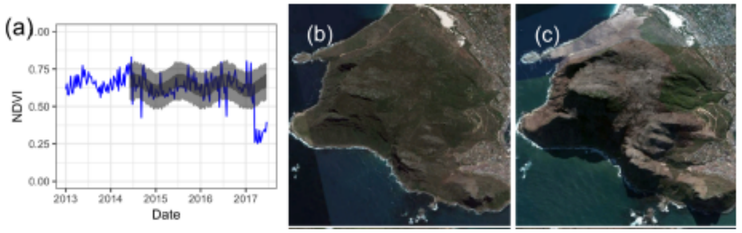
The future distribution of the savannah biome: model-based and biogeographic contingency

Glenn R. Moncrieff[1,2], Simon Scheiter[3], Liam Langan[3], Antonio Trabucco[4] and Steven I. Higgins[3,5]



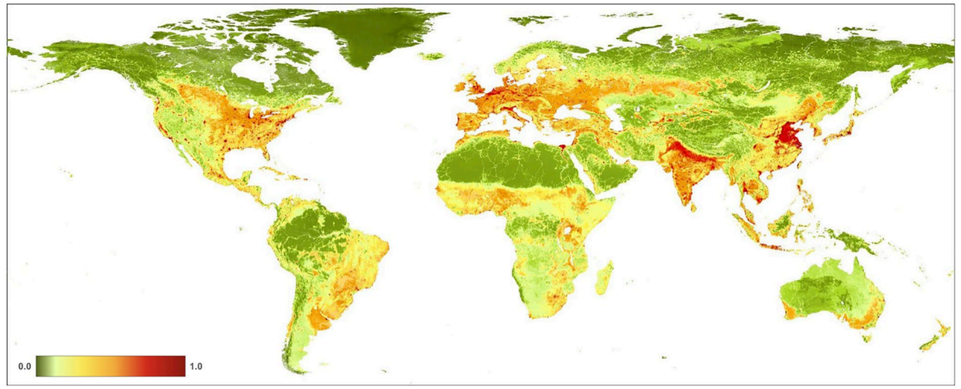
Near-real time forecasting and change detection for an open ecosystem with complex natural dynamics

Jasper A. Slingsby[a,b,*], Glenn R. Moncrieff[a,c], Adam M. Wilson[d]

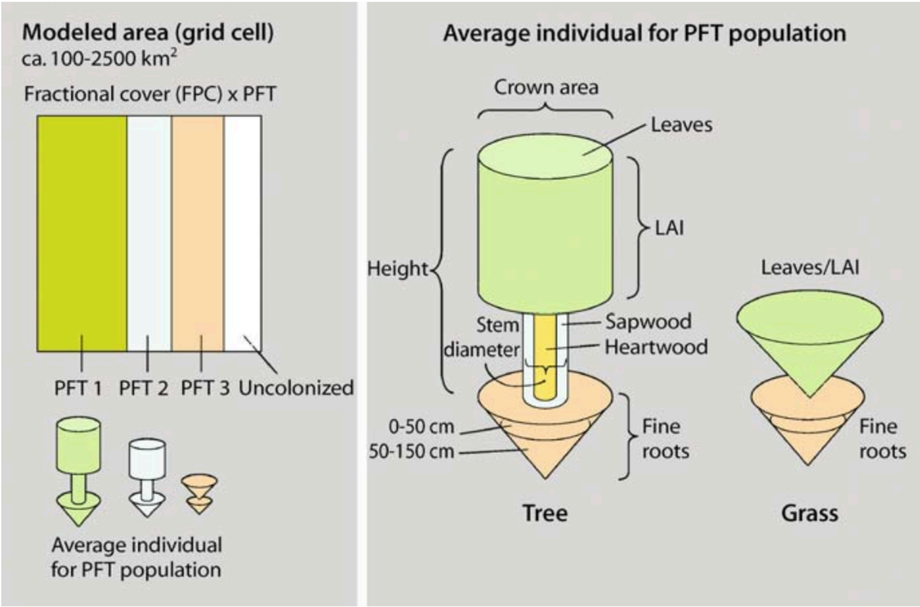


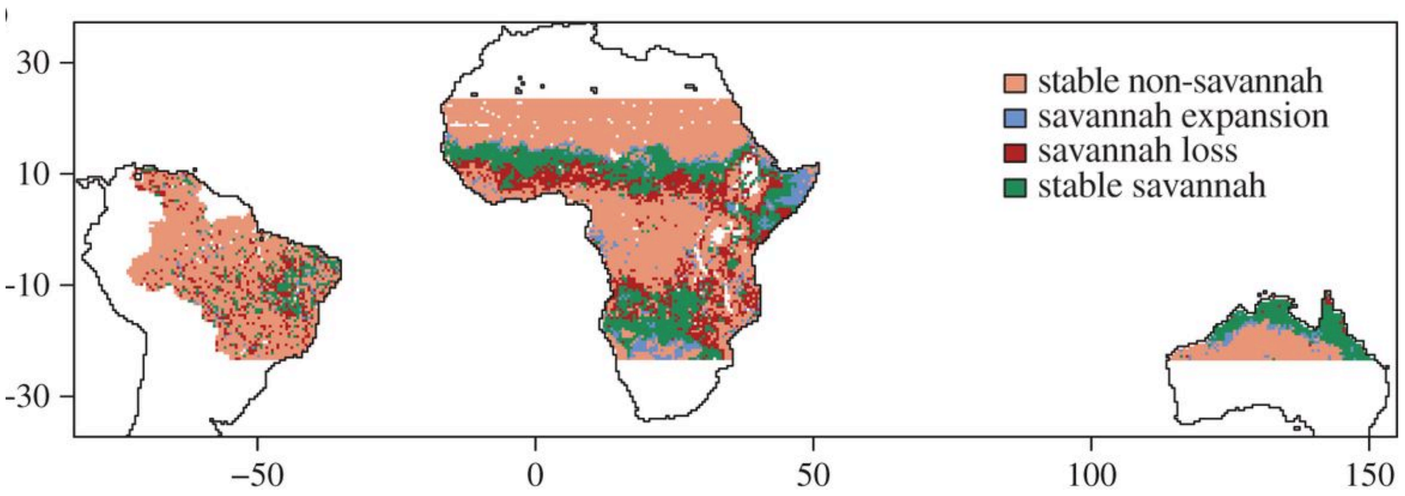
Global extent and change in human modification of terrestrial ecosystems from 1990 to 2022

David M. Theobald[1,2✉], James R. Oakleaf[3], Glenn Moncrieff[4], Maria Voigt[5], Joe Kiesecker[3] & Christina M. Kennedy[6]



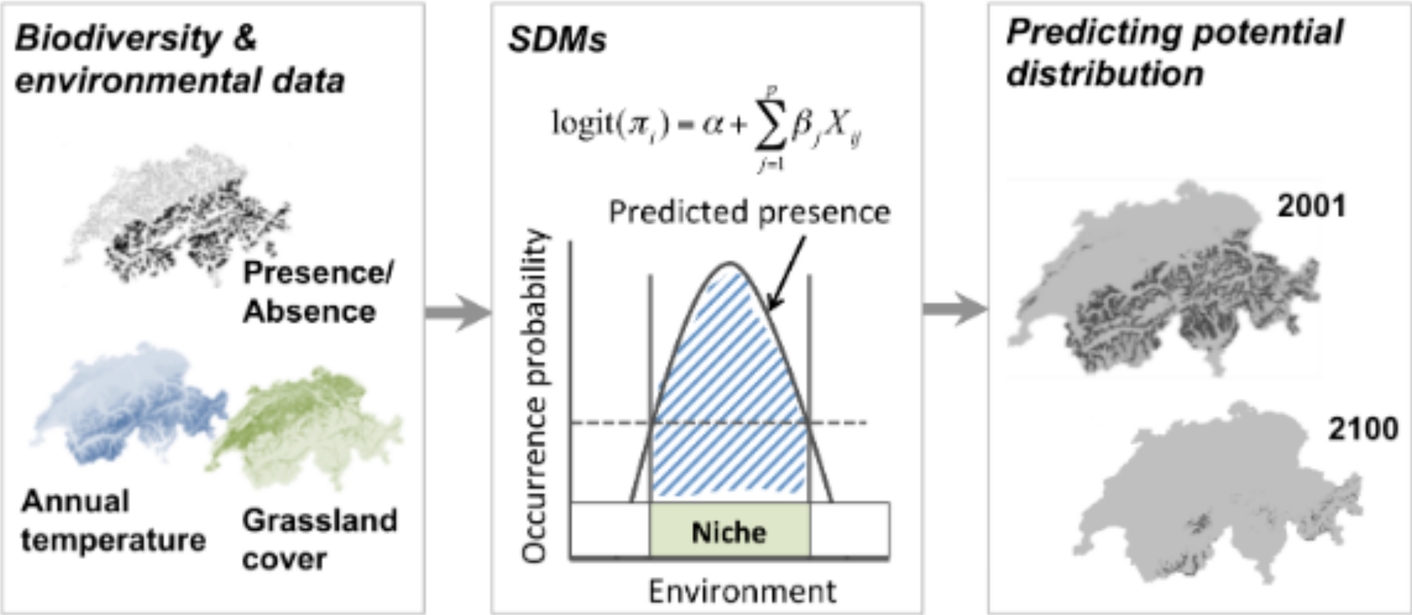
Approach 1: Dynamic Global Vegetation Models

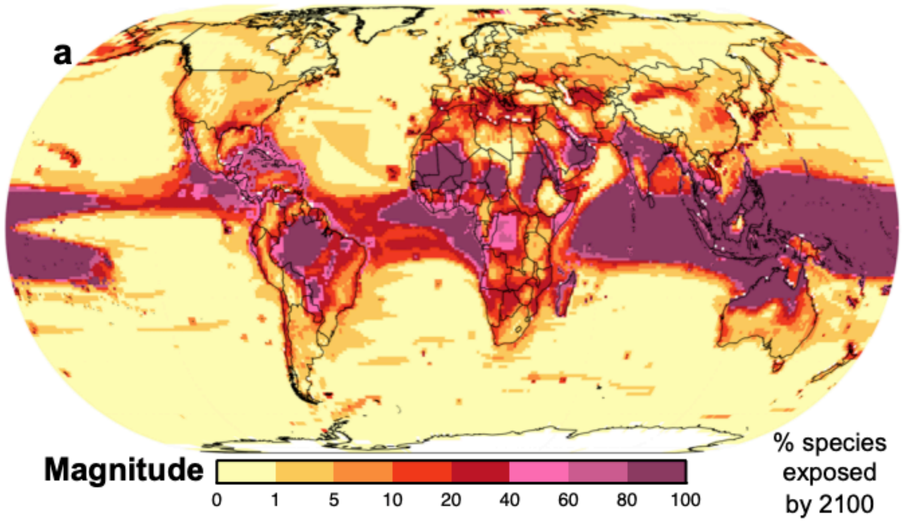




Moncrieff et al Phil trans B 2016

Approach 2: Niche/SDM/Correlative models

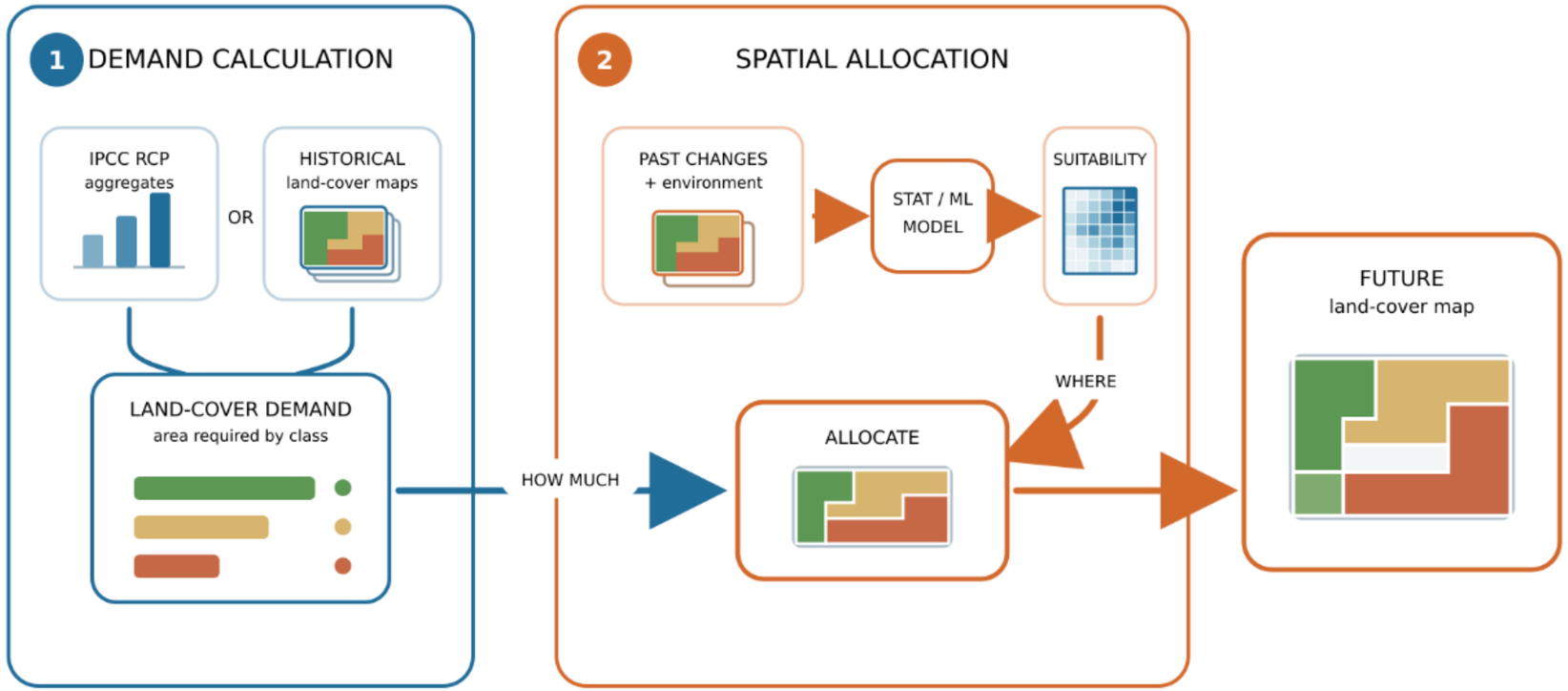


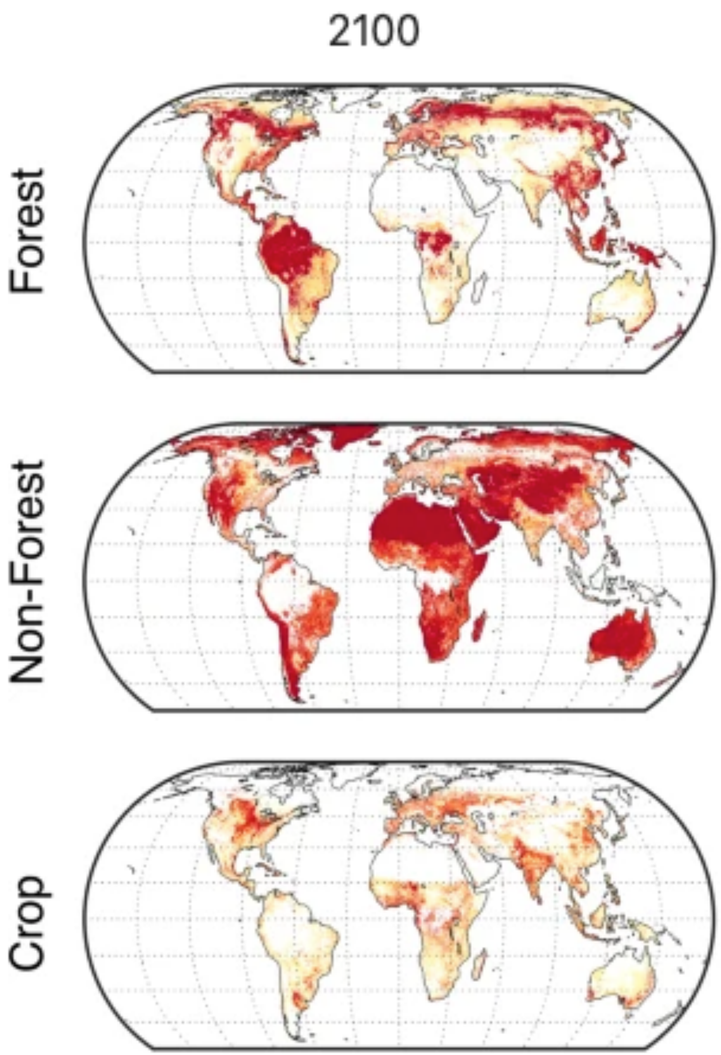


https://damariszurell.github.io/CLEWS-EDB/4_SDM_intro.html

Trisos et al Nature 2020

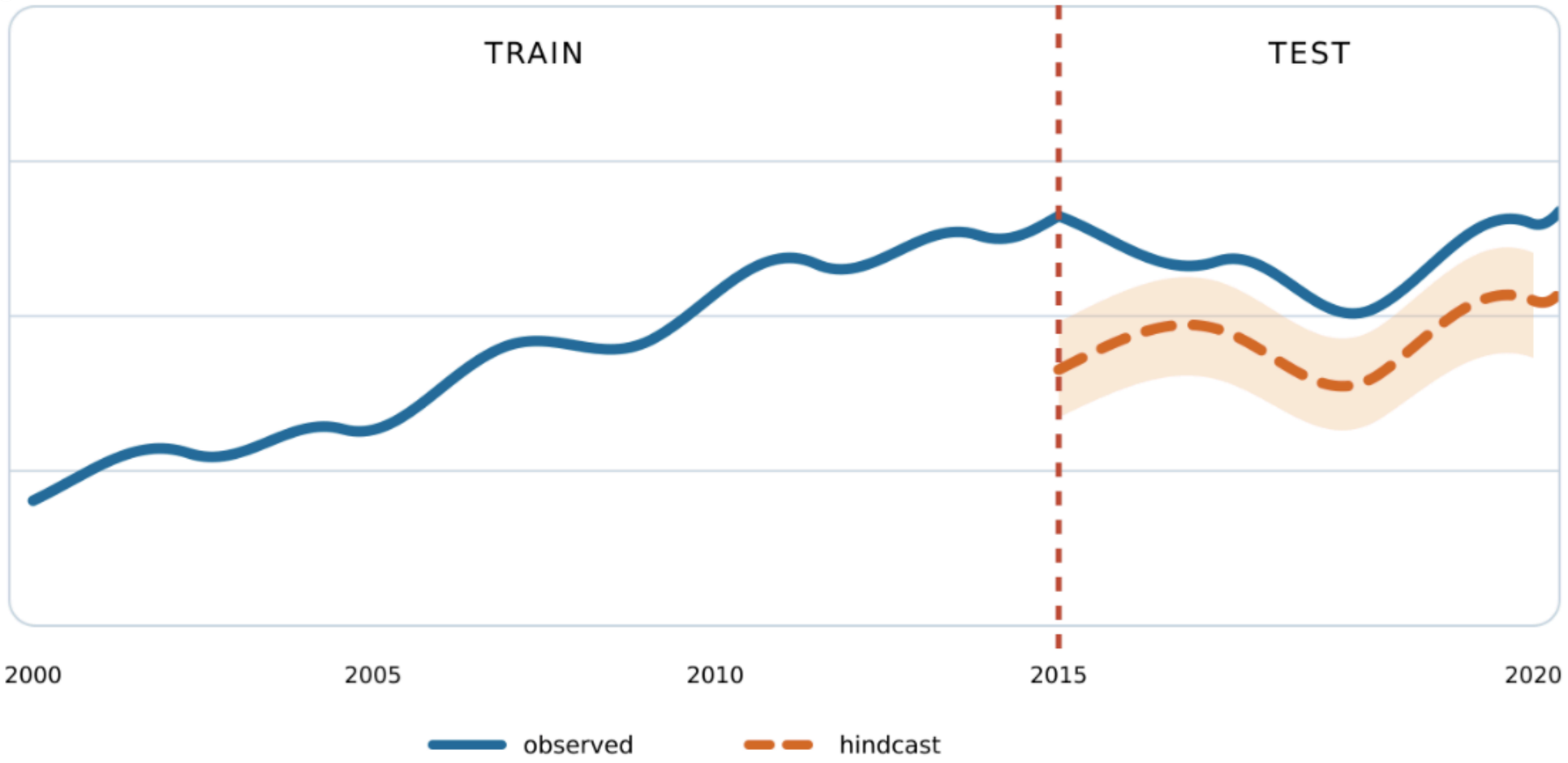
Approach 3: Land cover forecasting



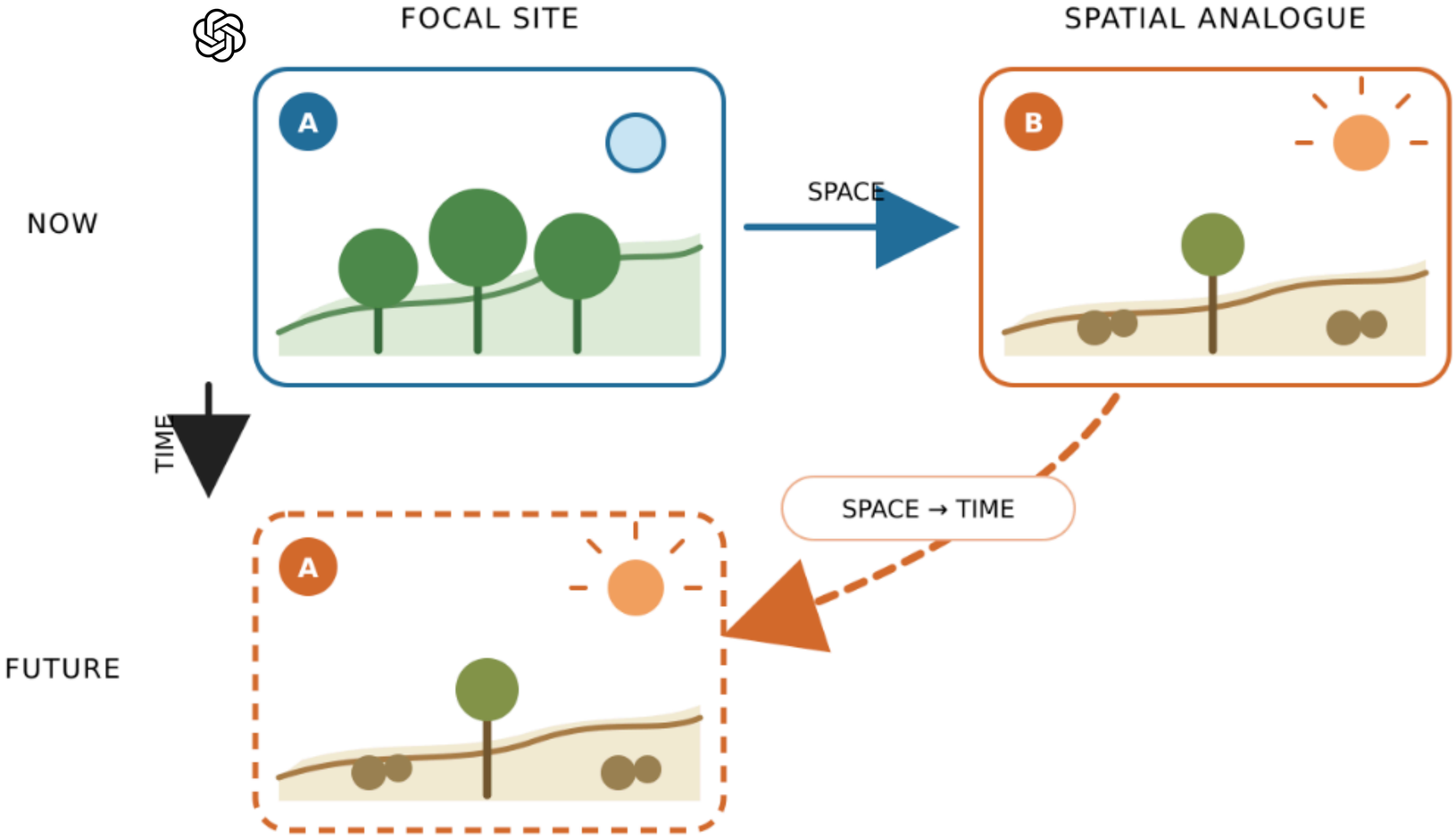


Chen et al 2020 Sci Data

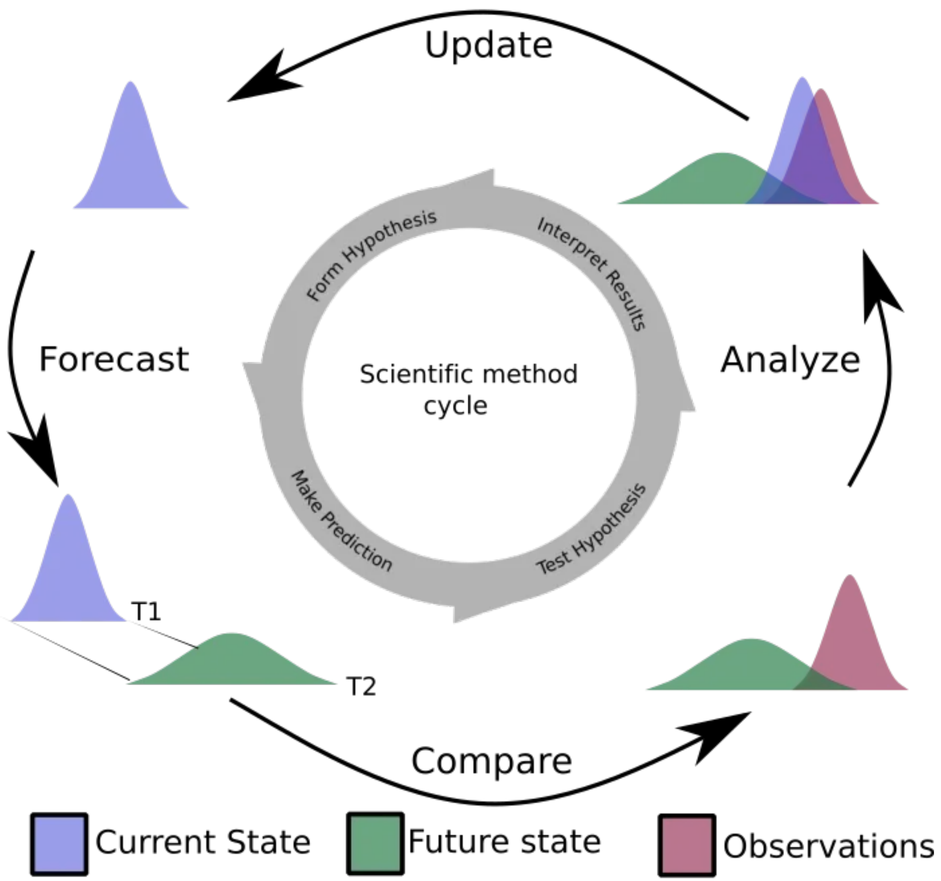
How do we fit and evaluate models



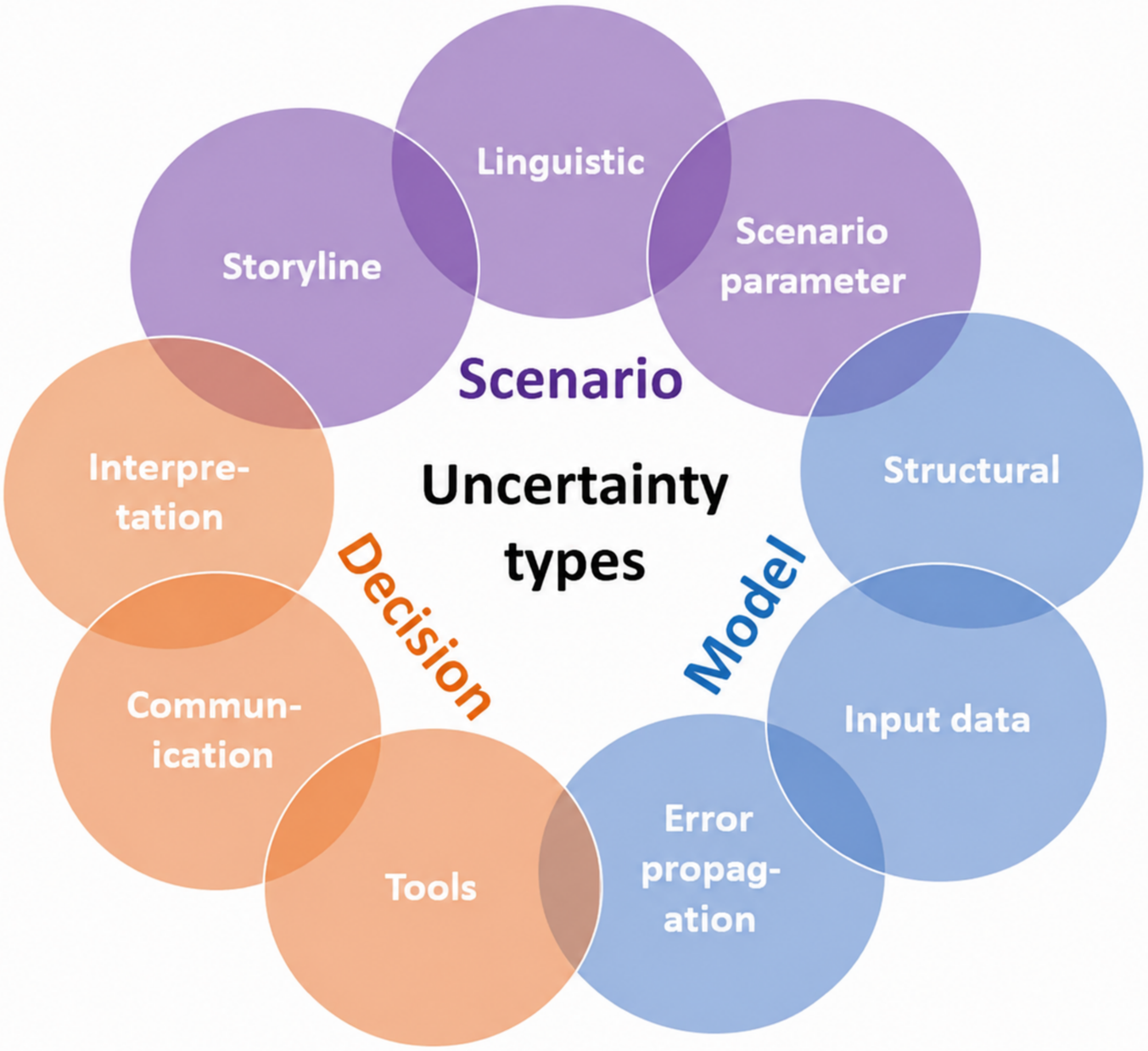
How do we fit and evaluate models



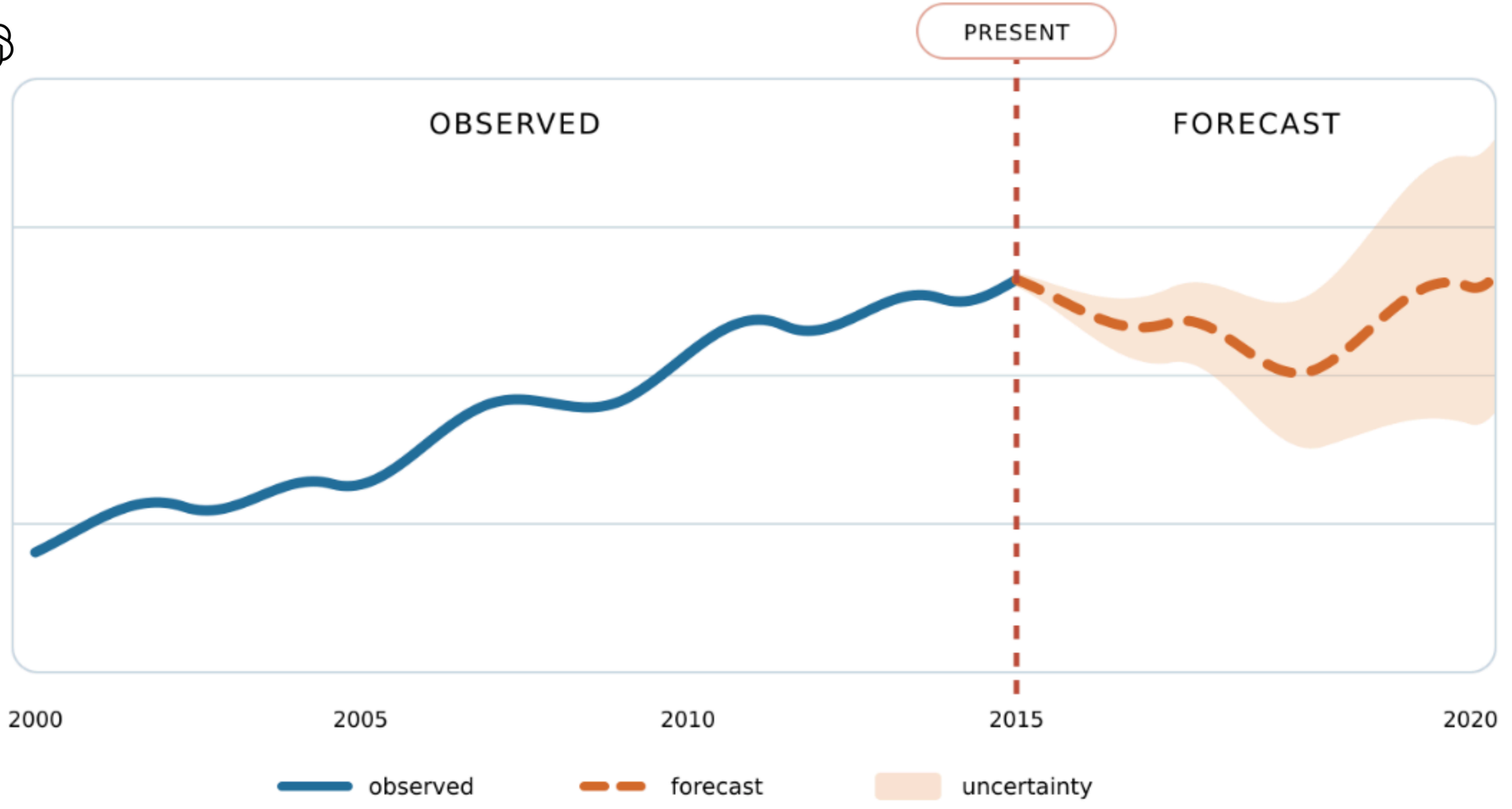
Near-term iterative vs medium - long range forecasting

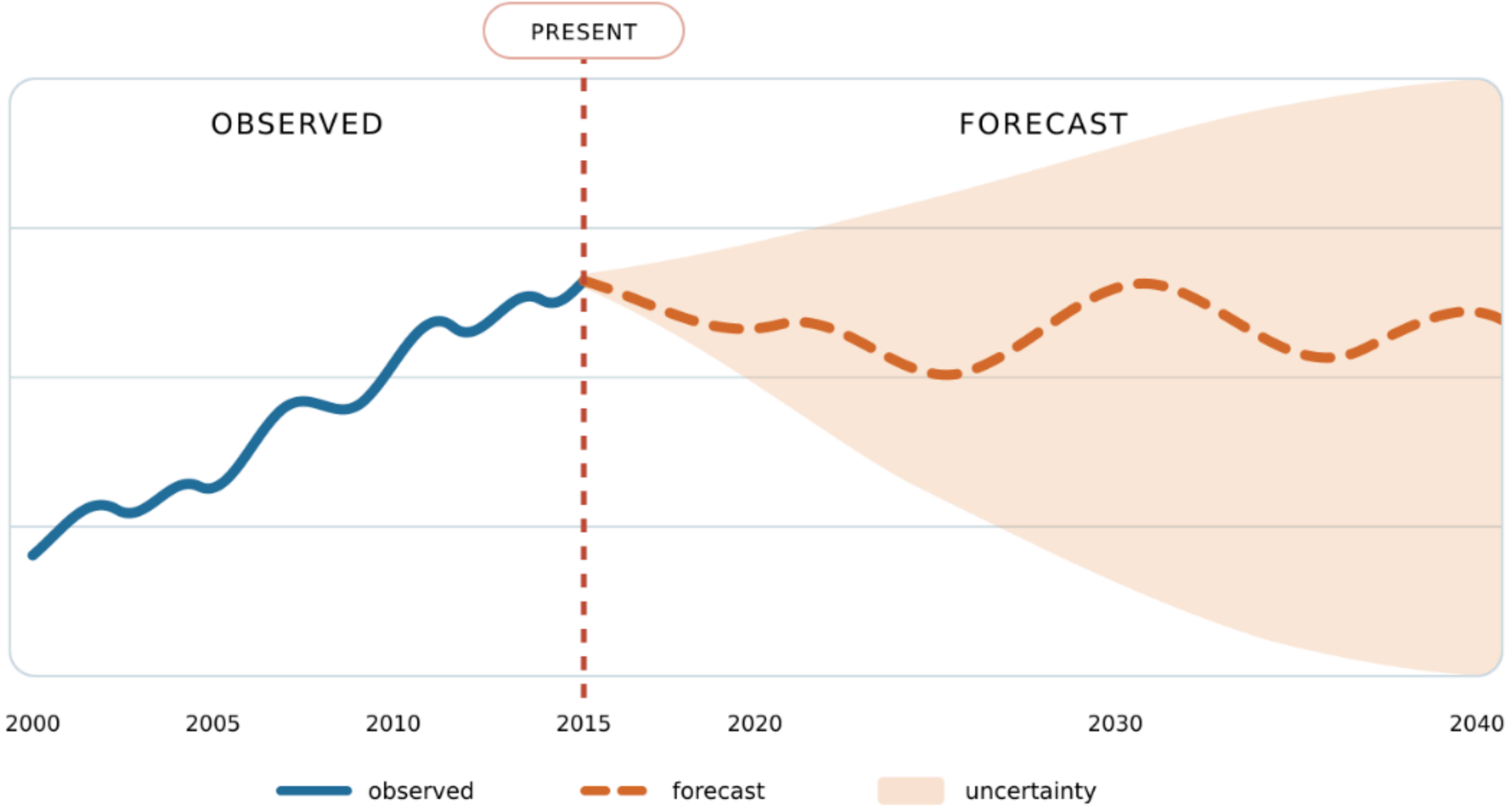


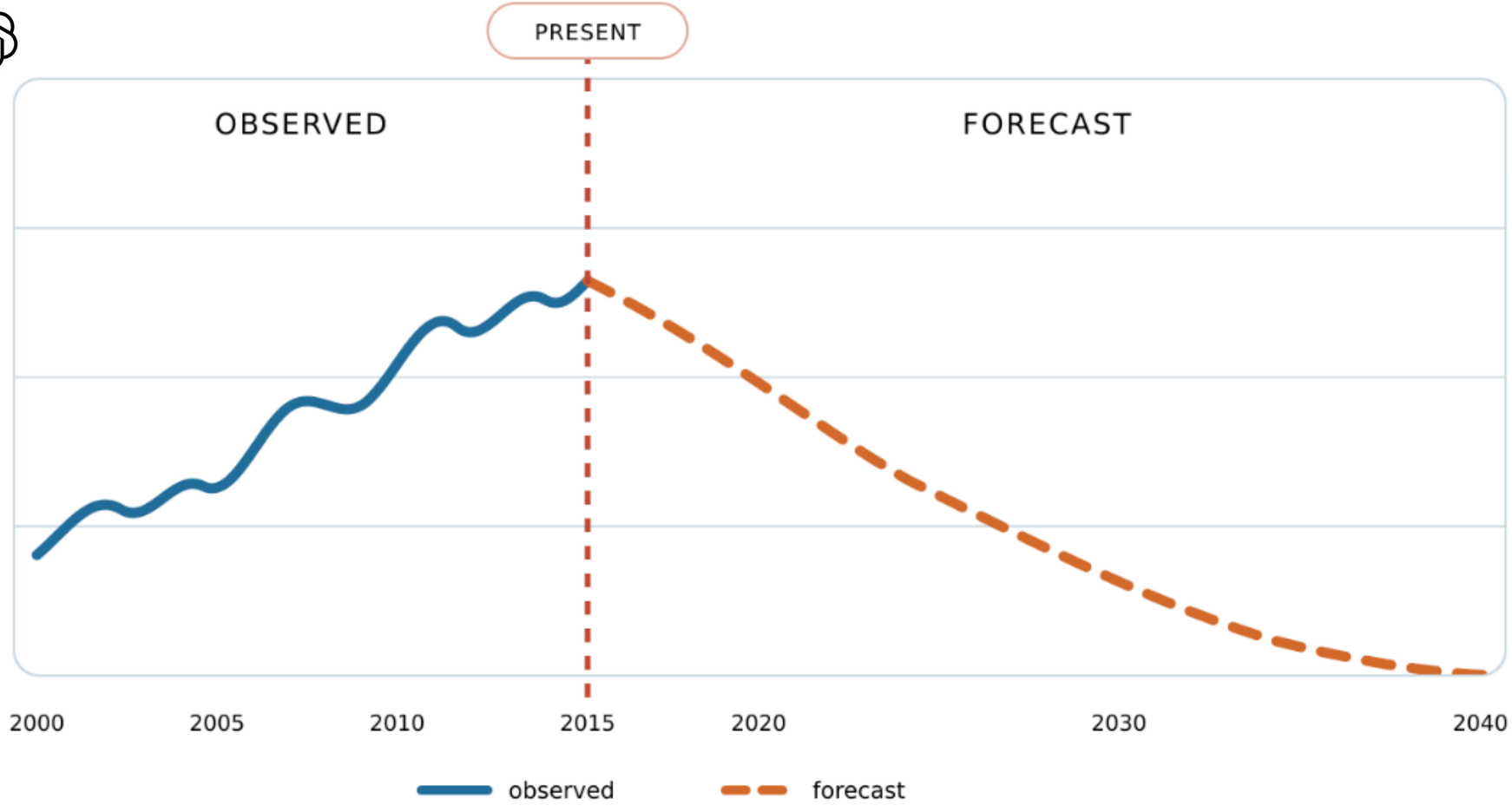
From lecture on data assimilation by Michael Dietze

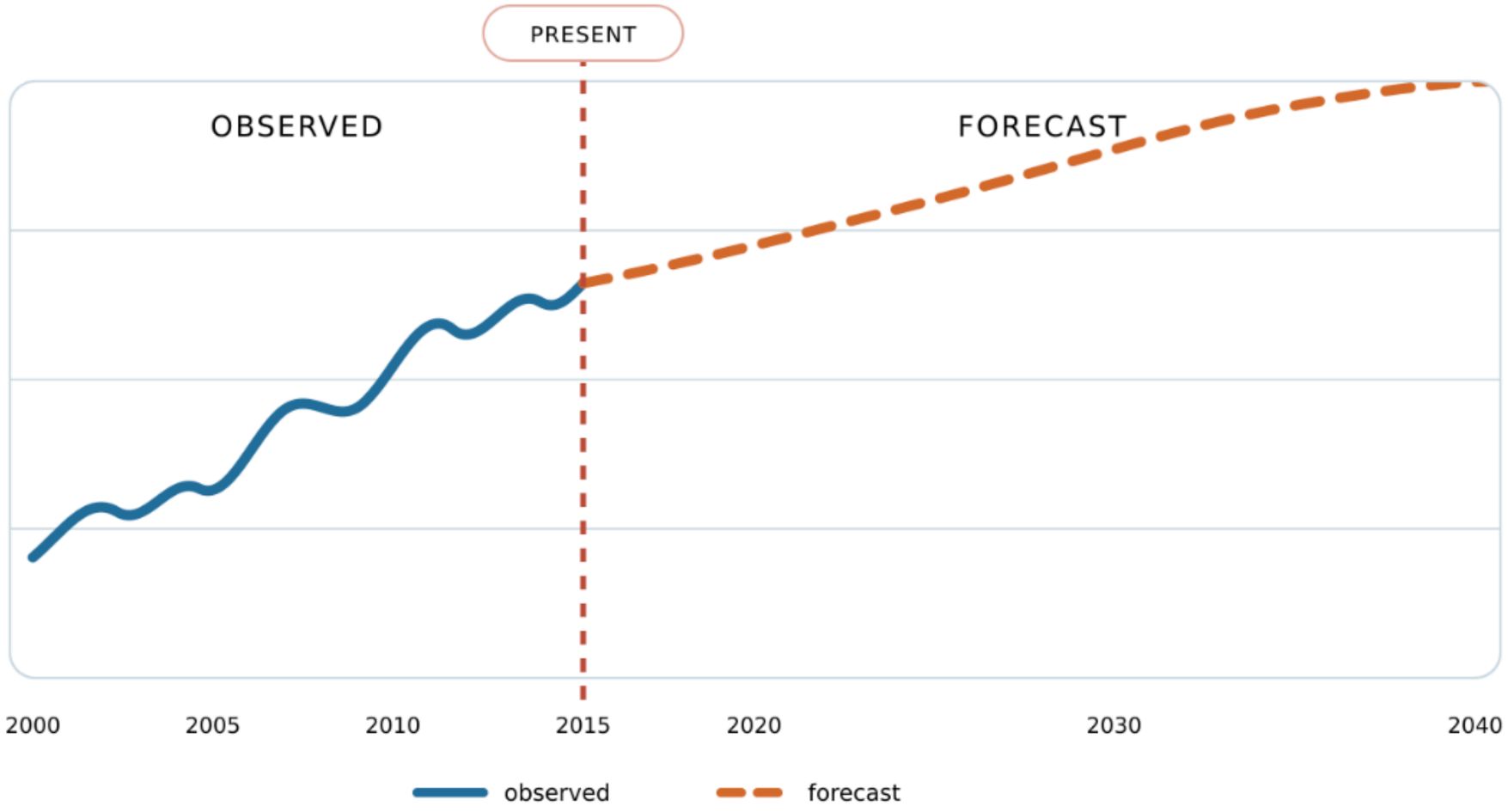


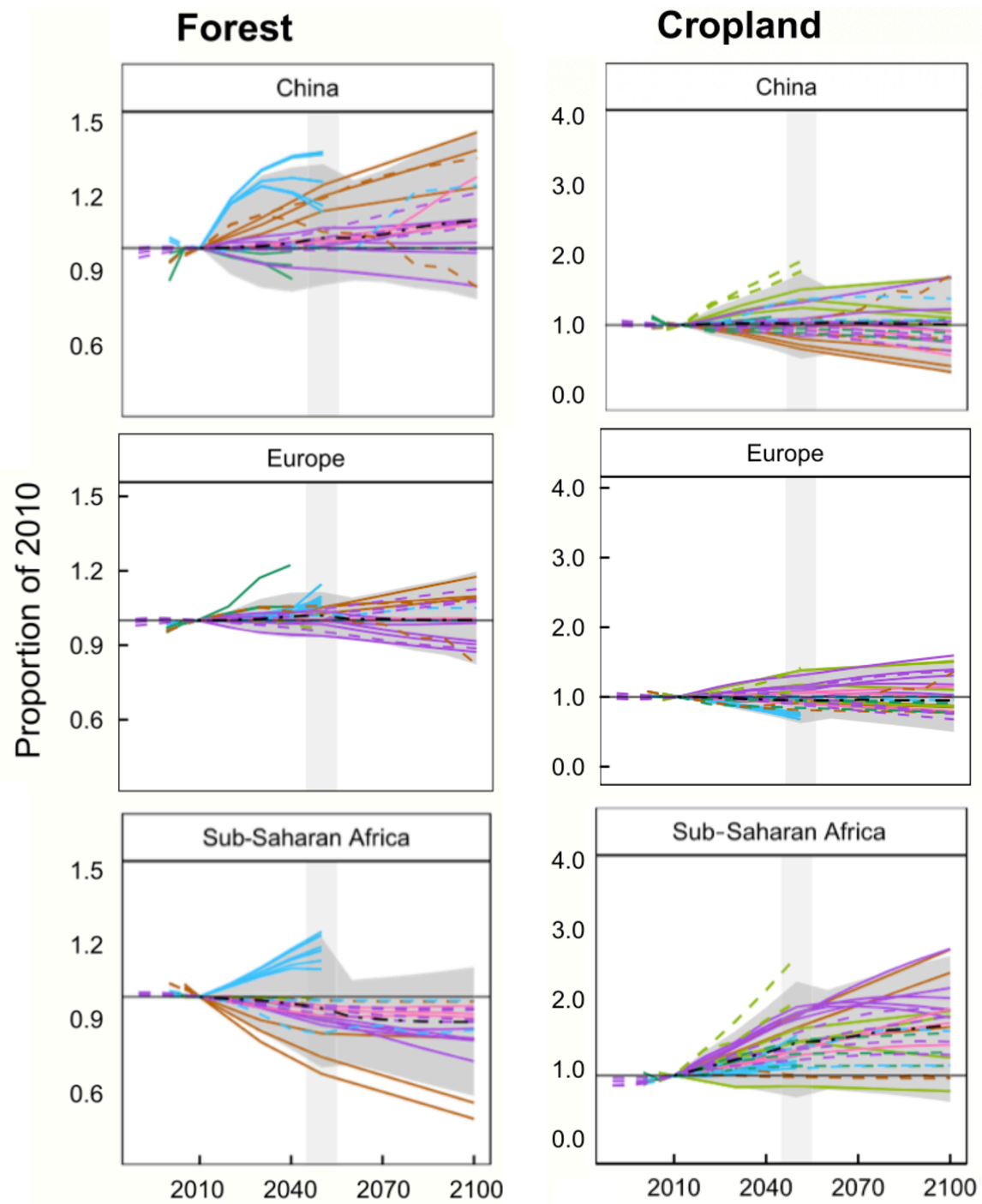
Rounsevell et al One Earth 2021


PRESENT
OBSERVED
FORECAST
2000
2005
2010
2015
2020
observed
forecast
uncertainty

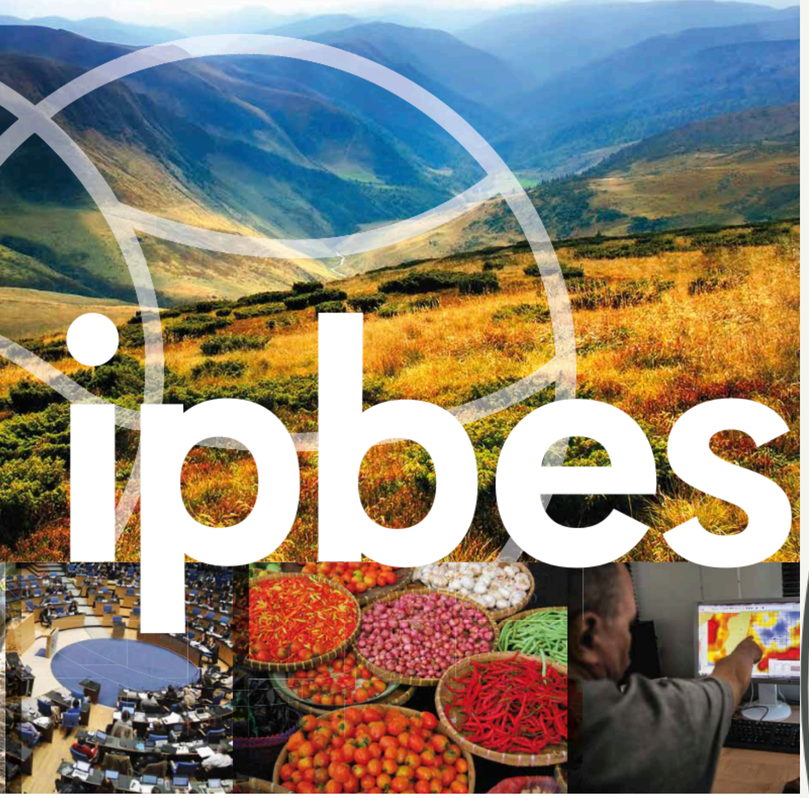

PRESENT
OBSERVED
FORECAST
2000
2005
2010
2015
2020
2030
2040
observed
forecast
uncertainty


PRESENT
OBSERVED
FORECAST
2000
2005
2010
2015
2020
2030
2040
observed
forecast


PRESENT
OBSERVED
FORECAST
2000
2005
2010
2015
2020
2030
2040
observed
forecast



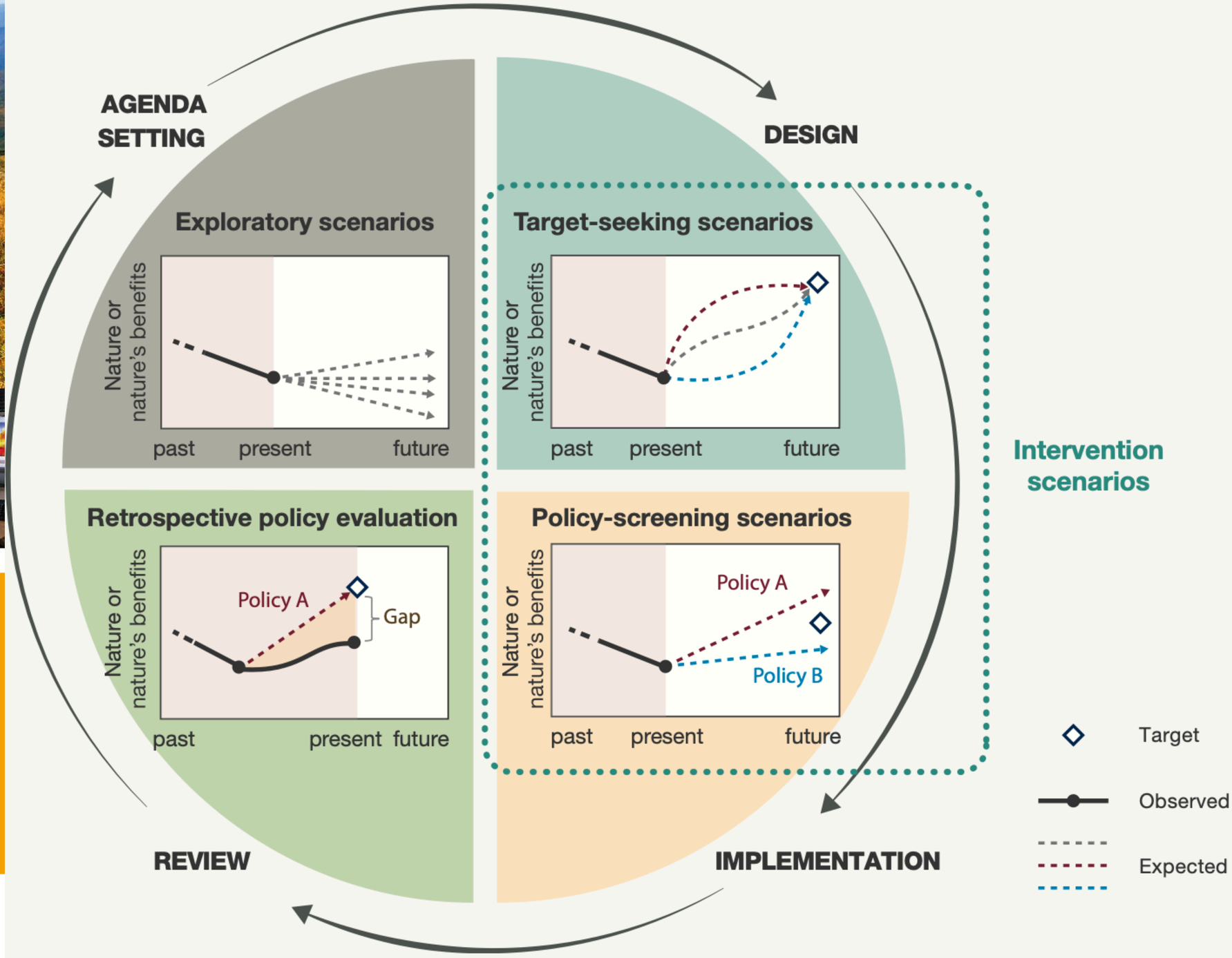
Prestele et al GCB 2016



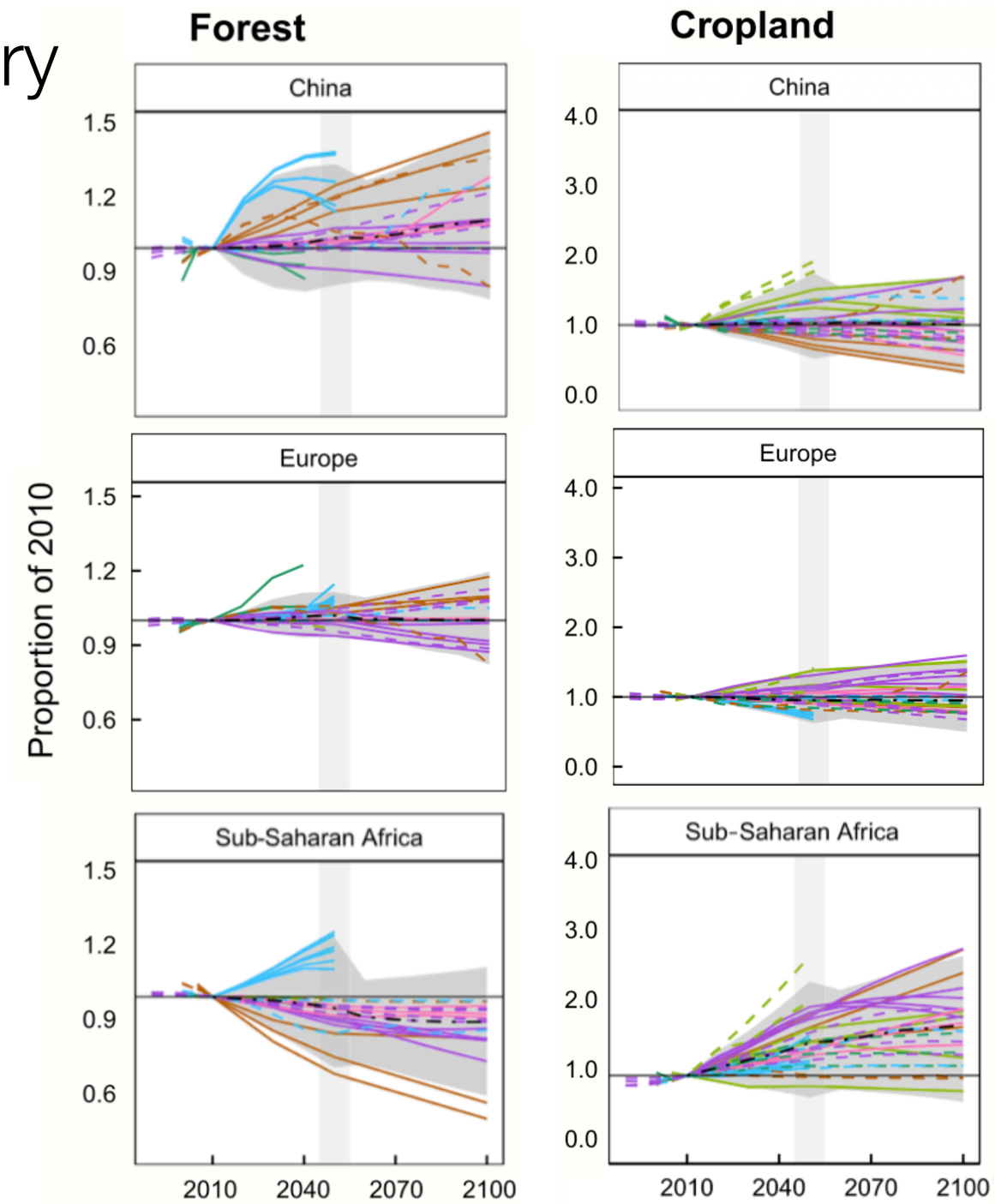
The methodological assessment report on

SCENARIOS AND MODELS OF BIODIVERSITY AND ECOSYSTEM SERVICES

ipbes

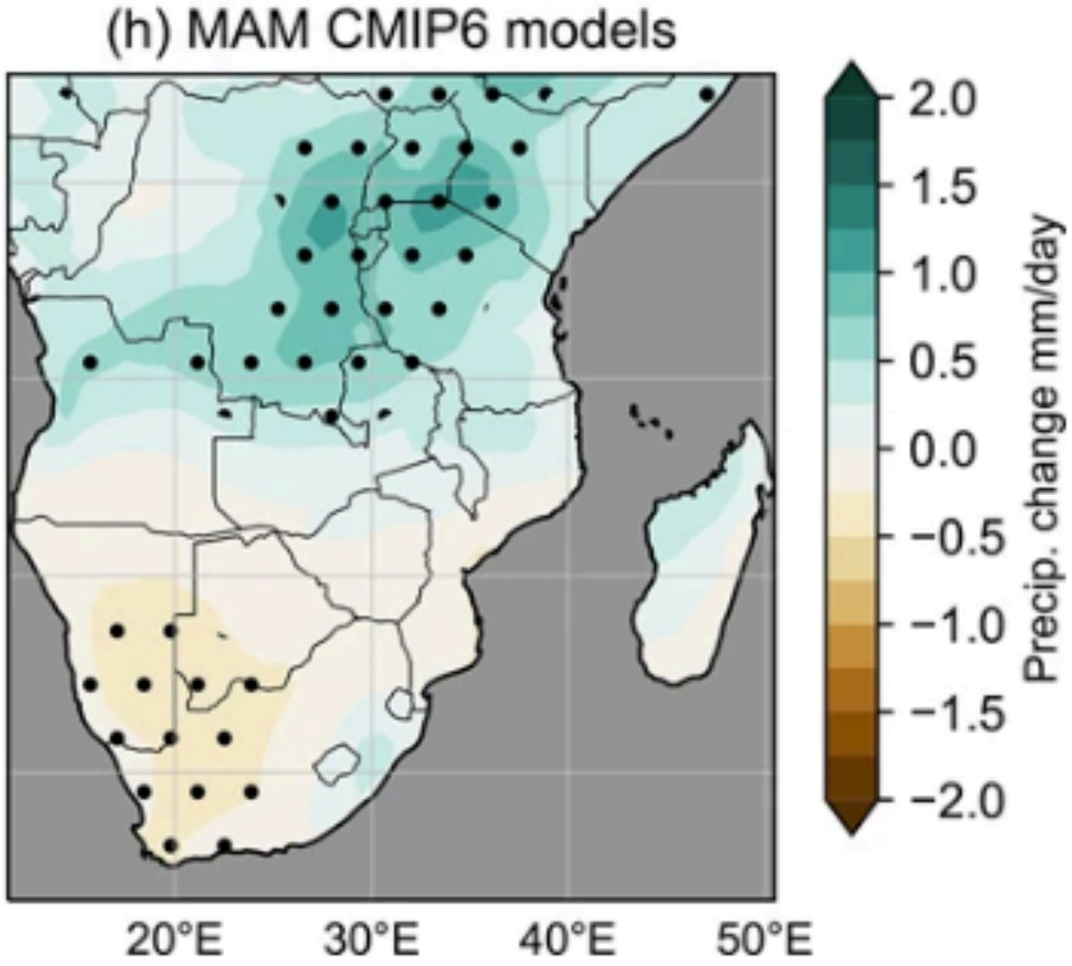


Exploratory



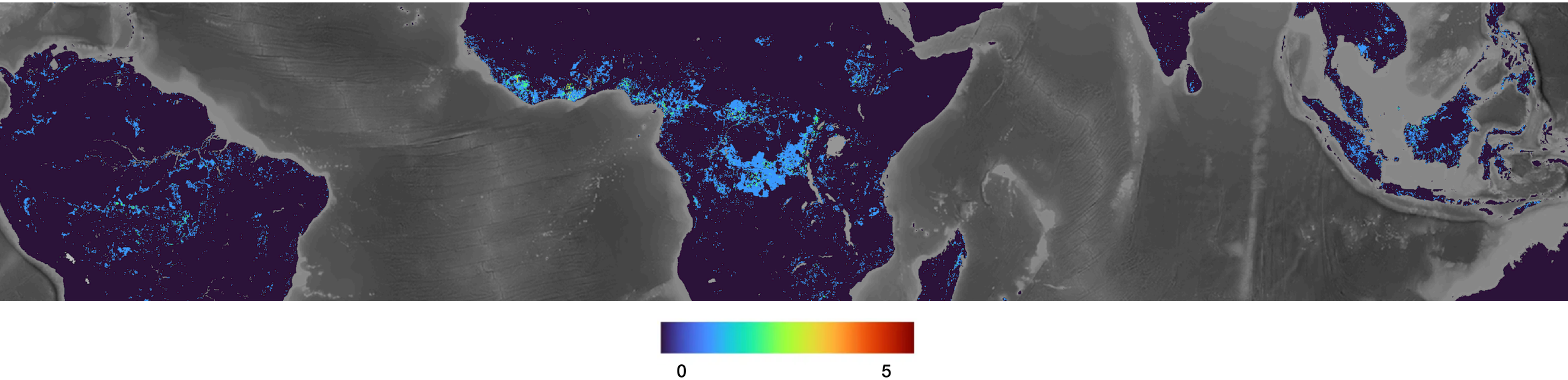
Prestele et al GCB 2016

Exploratory

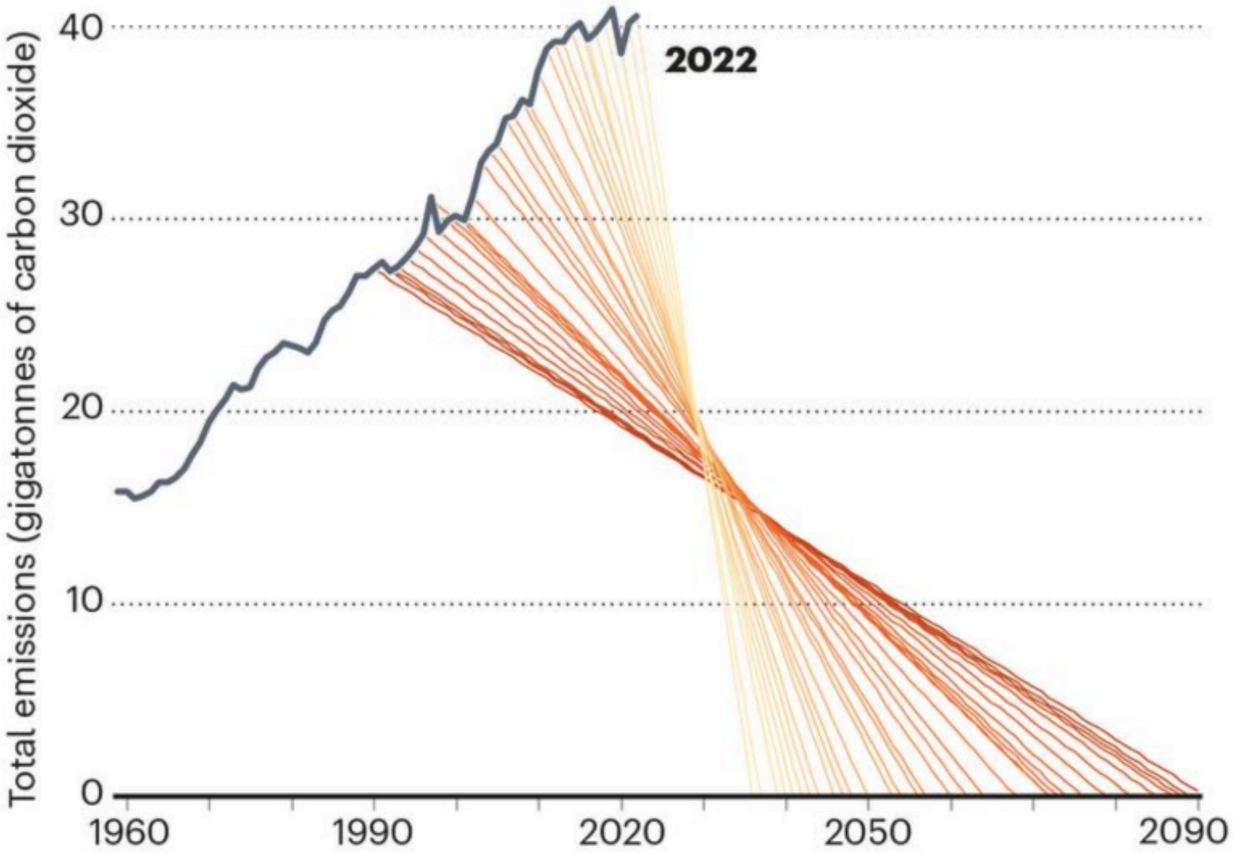


Kennedy-Asser Clim. Change. 2026

Exploratory

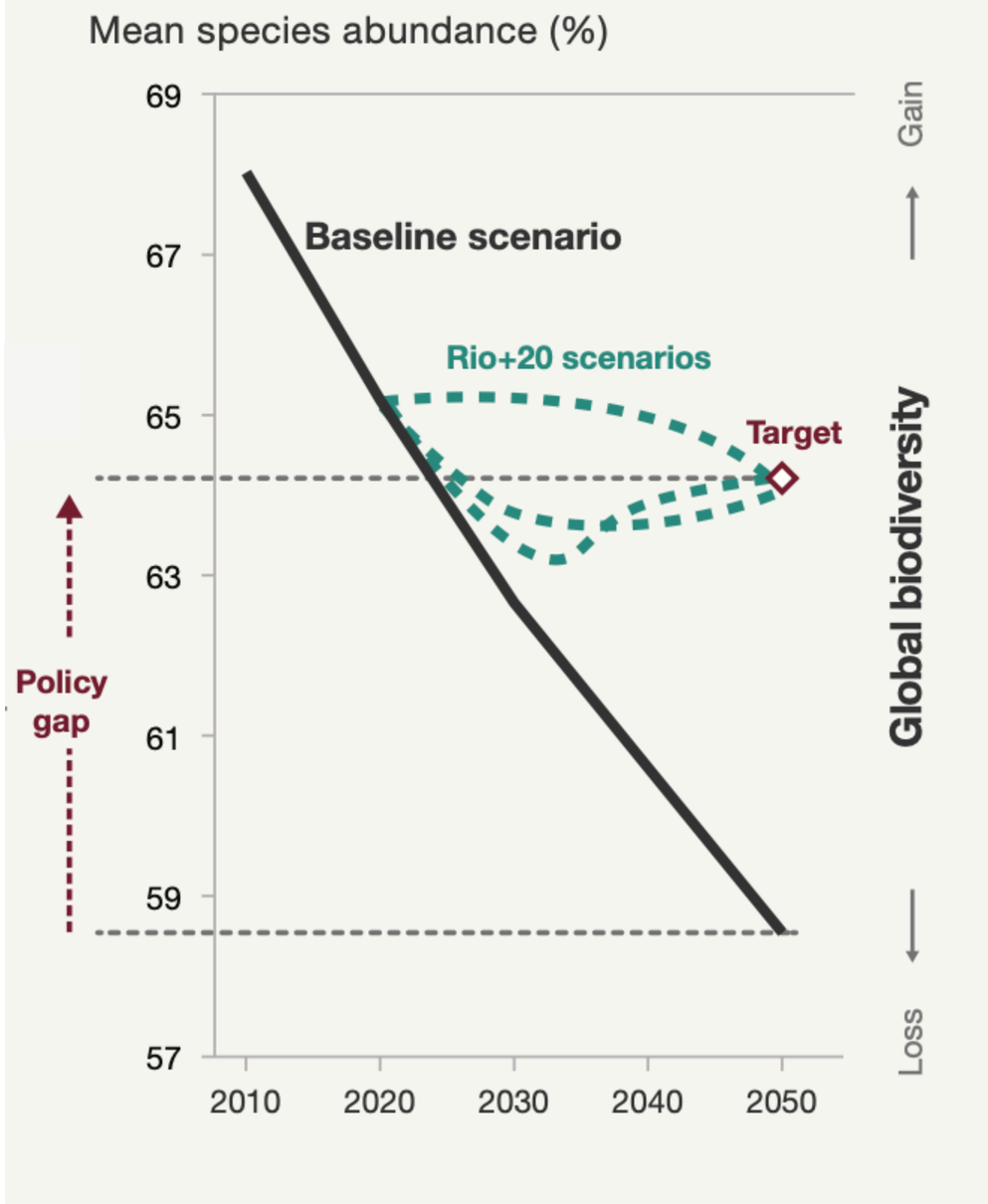


Target seeking

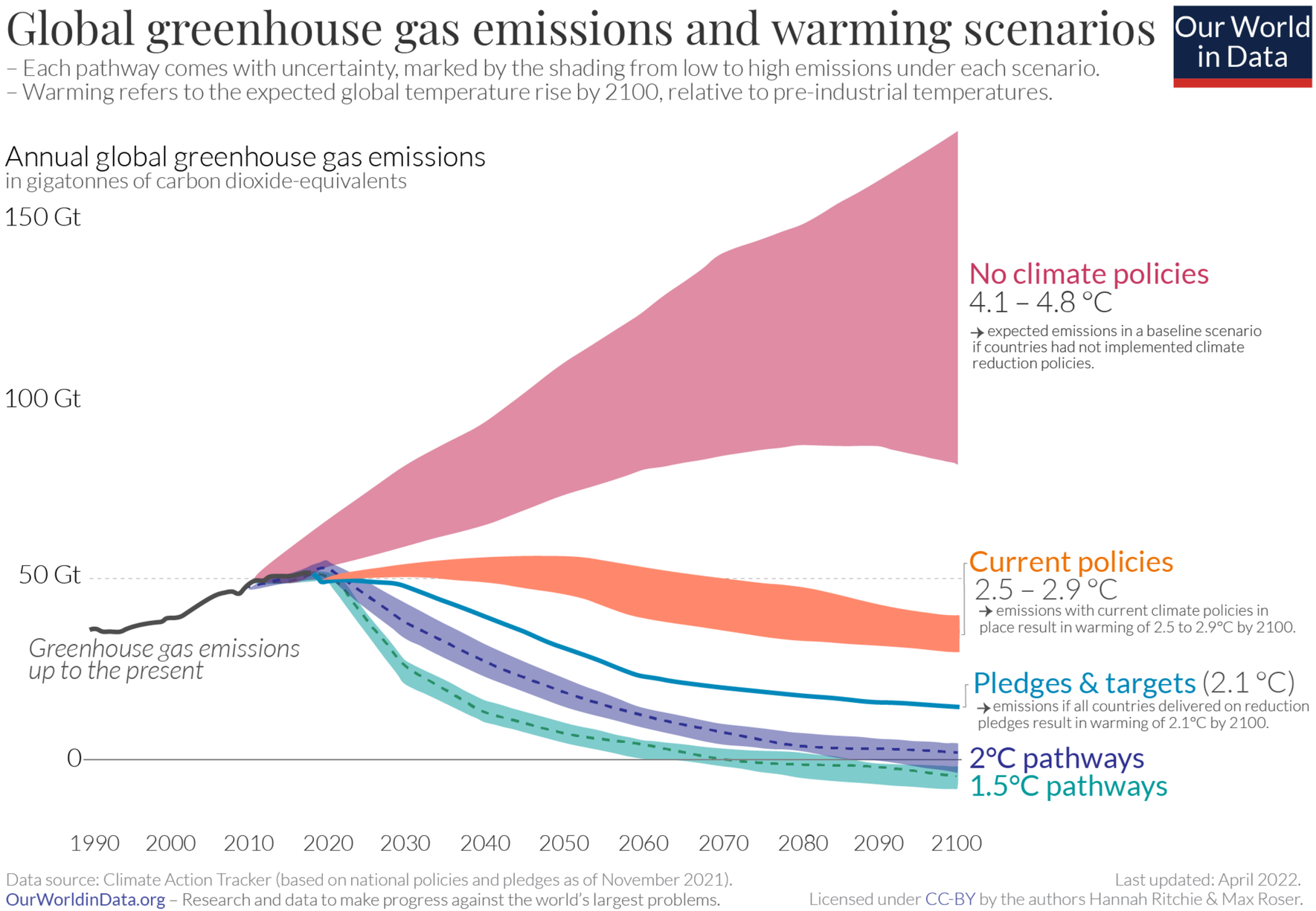


https://www.nature.com/immersive/d41586-023-03601-6/index.html

Target seeking

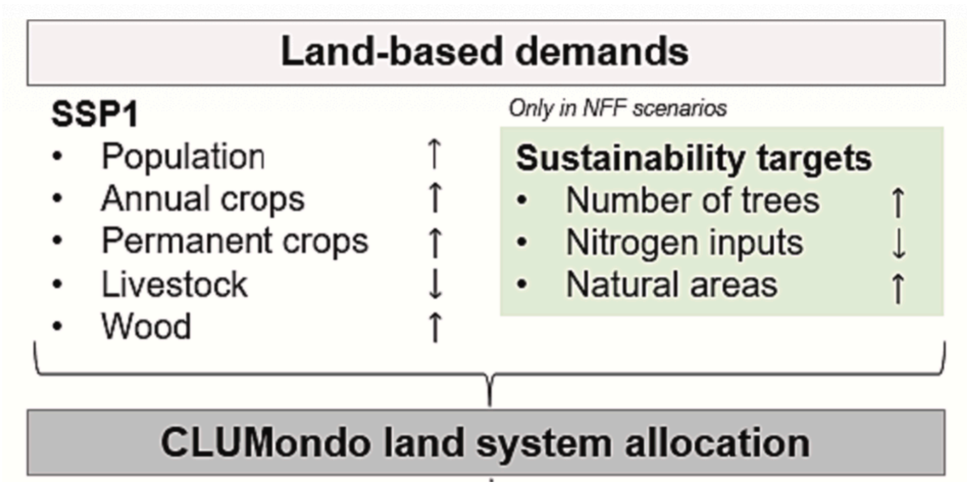


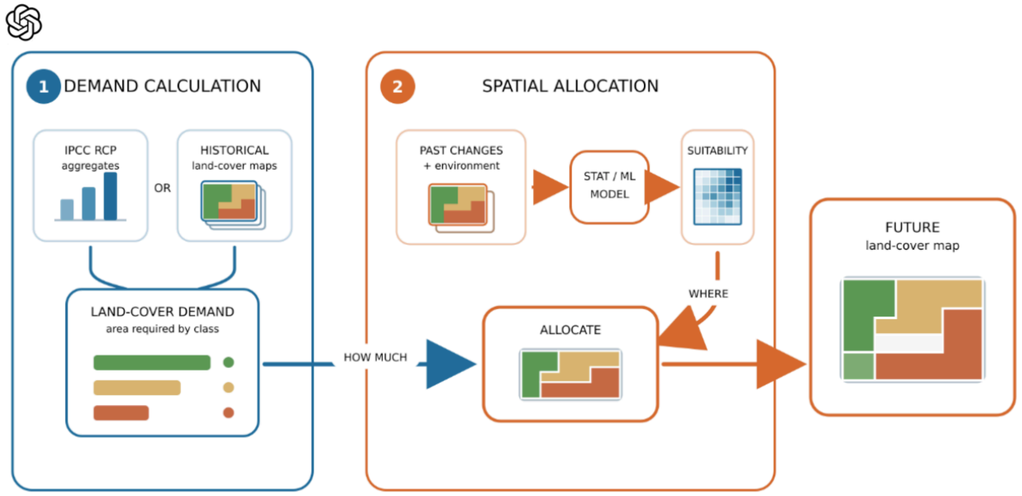
Policy screening



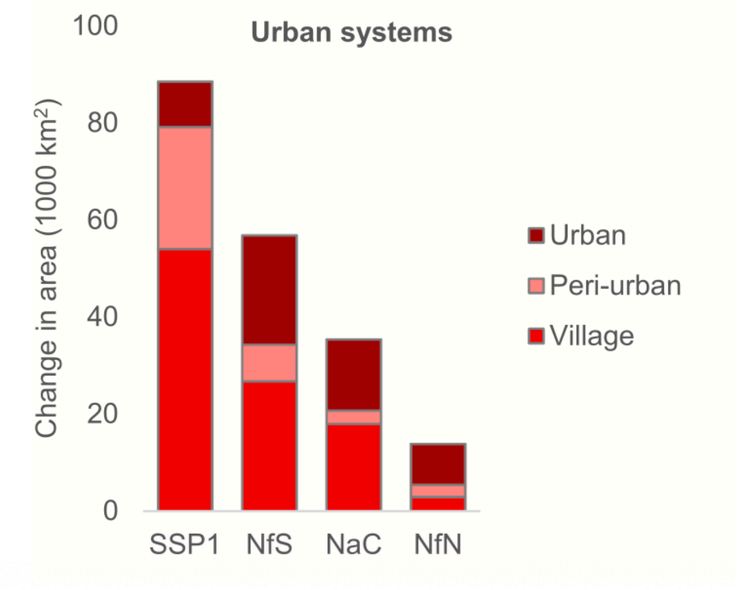
Policy screening

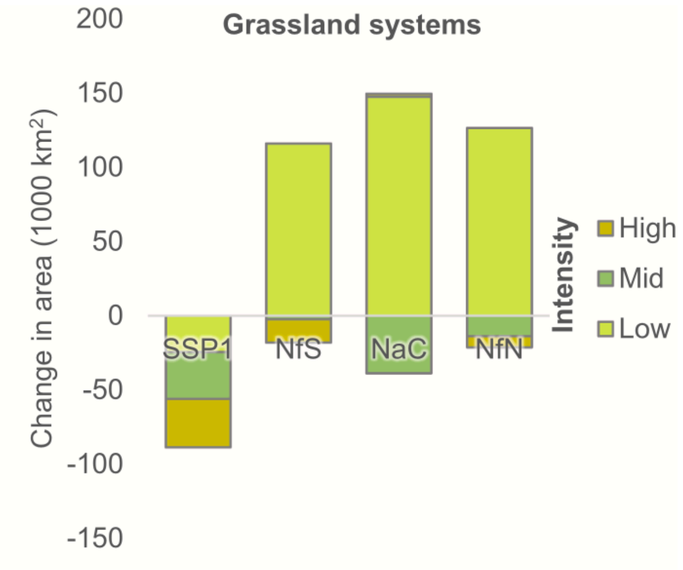
EU Green Deal target	Nature for Nature (NfN)	Nature as Culture (NaC)	Nature for Society (NfS)
Protect 30 % of land in Europe by 2030	The expansion of protected area focusses on priority areas for terrestrial vertebrates	The expansion of protected area focusses on culturally valued agricultural landscapes	The expansion of protected area focusses on priority areas for regulating NCPs (carbon accumulation)

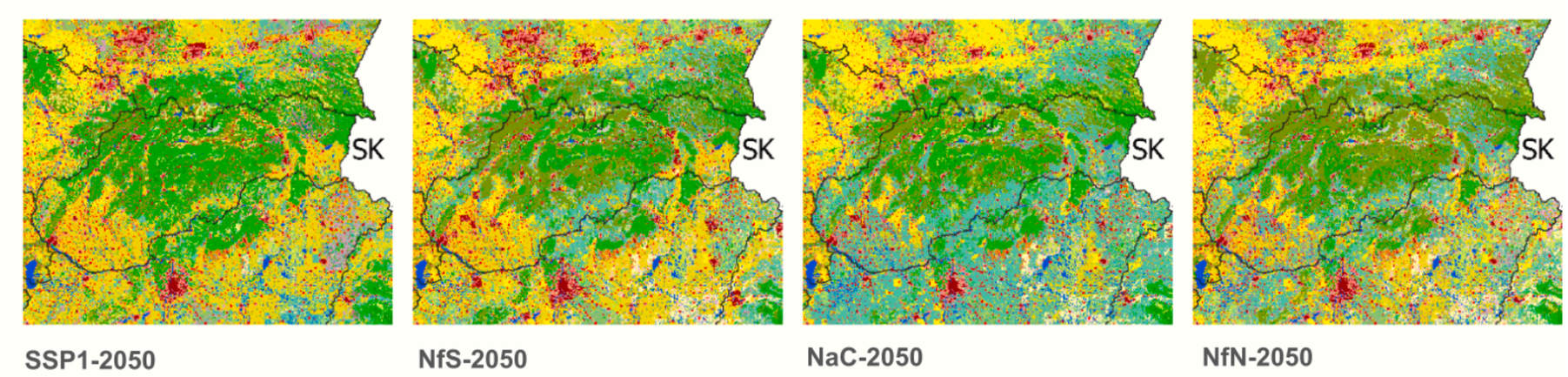




Policy screening







Kennedy-Asser Clim. Change. 2026

Underestimation and Suppression of Uncertainty

Model Selection Dominance

Ecological Oversimplification & Mechanistic Blind Spots

Scale Misalignment & Erasure of Local Context

Misleading Decision Support & False Certainty

Policy and business want biodiversity forecasts, they will use whatever is available

Biodiversity is complicated, that makes it hard to trust

The learning cycle is slow

Is a bad biodiversity forecast better than no forecast at all?

So are they useless? No! But decades behind CMIP