

Spatially explicit, simulatable, process-model based biosphere integrity metrics human colonization of the biosphere (M-COL) and risk of ecosystem destabilization (M-ECO)

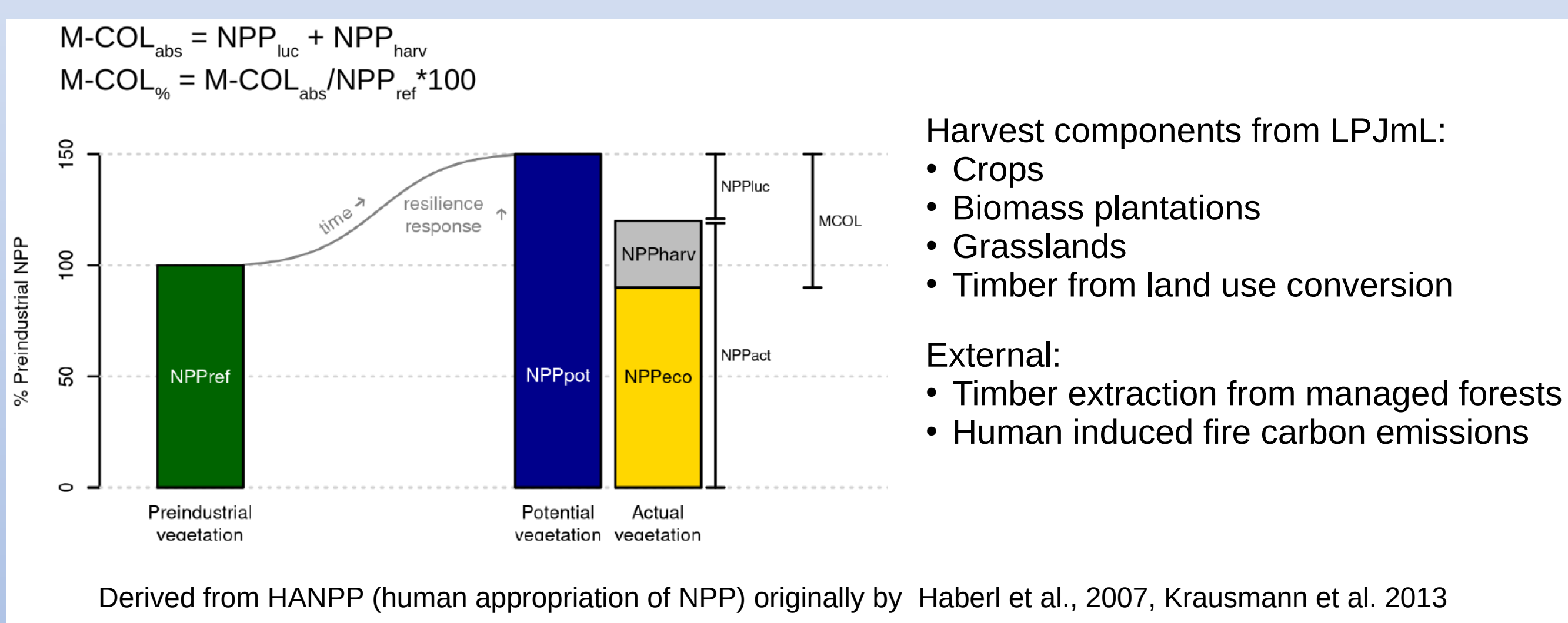
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METHODS

M-COL

Biosphere COLonization pressure

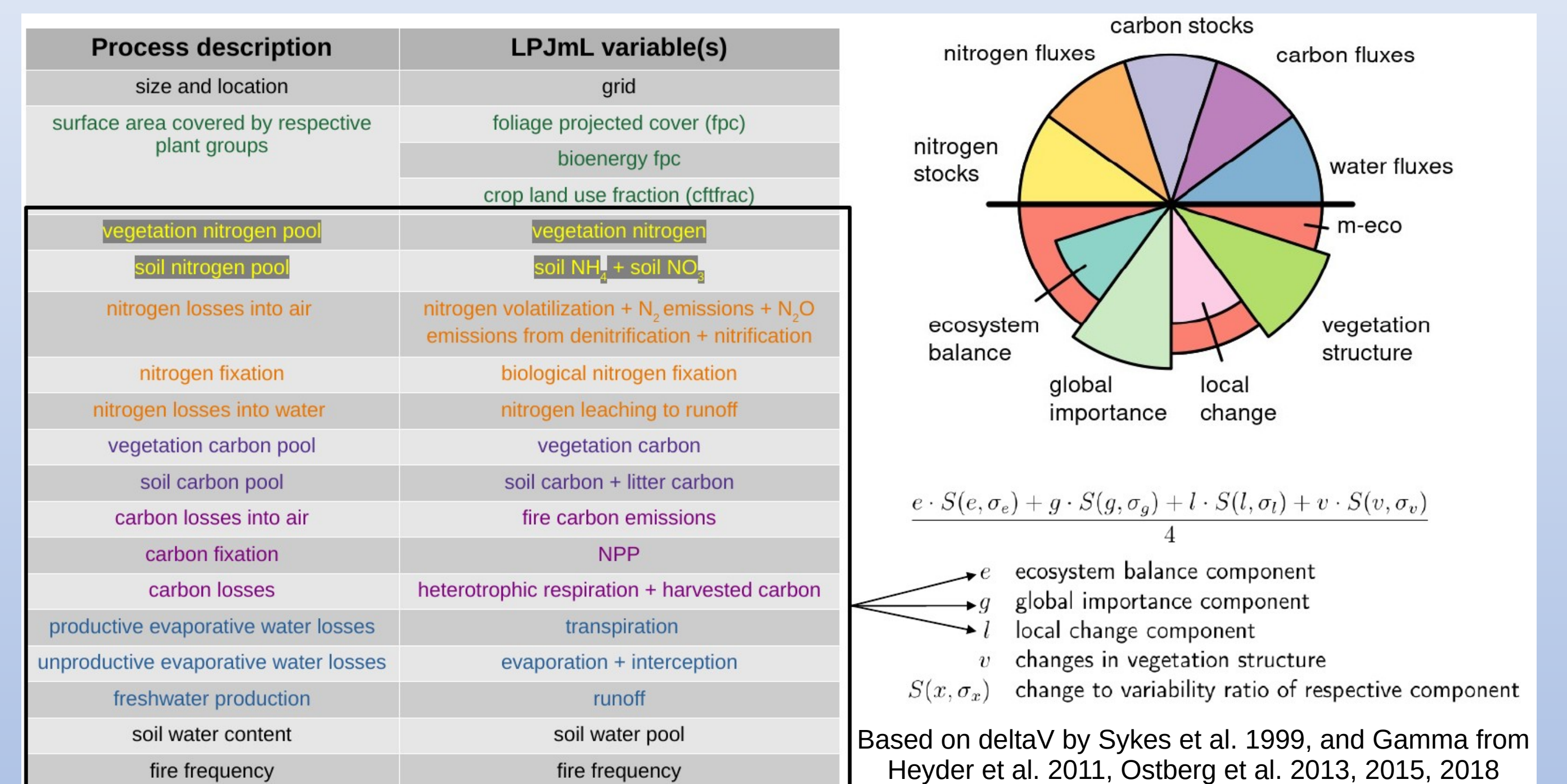
- Appropriation of net primary production (NPP) as the primary energy source for ecosystems
- 2 components:
 - harvest biomass extraction (NPP_{harv})
 - inhibited natural productivity (NPP_{luc})
- Early onset via agriculture and deforestation + acceleration during 20th century



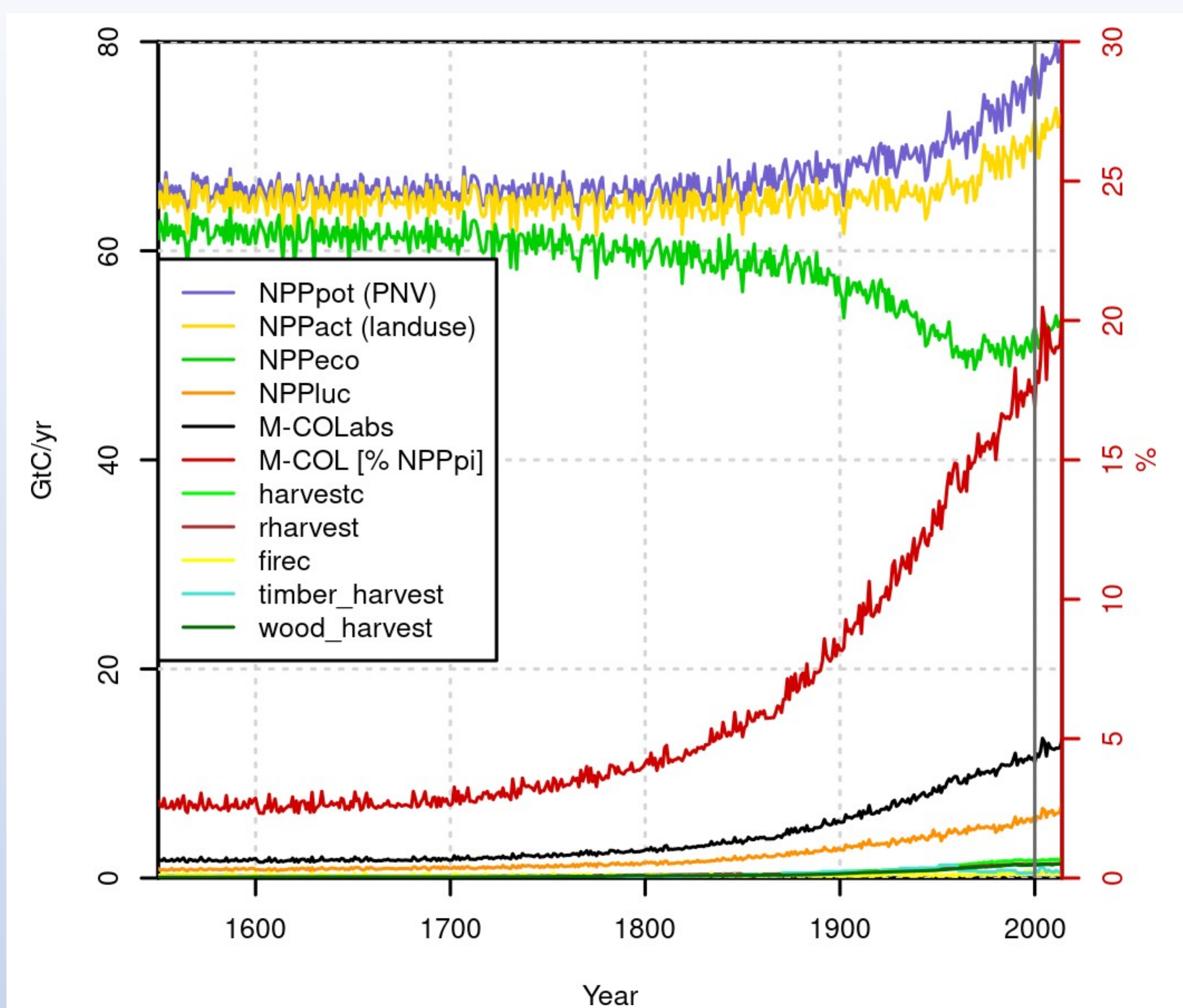
M-ECO

Risk of ECOSystem destabilization

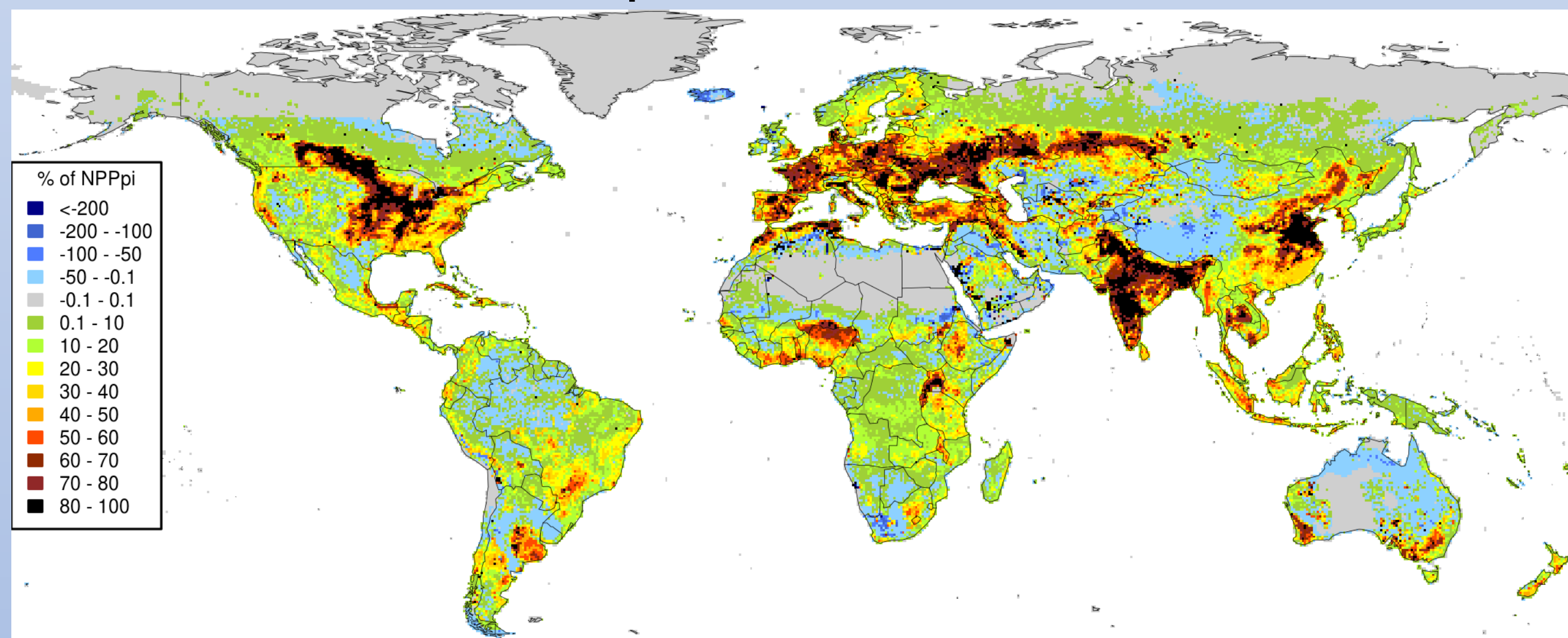
- Consequences of ecosystem pressure (land use, extraction + climate change)
- Shifts in biogeochemical conditions as a proxy for the systemic risk of biosphere destabilization
- Dissimilarity of an ecosystem state from a reference condition measured by vegetation structure change, local change, global importance, ecosystem balance – aggregated as a multidimensional proxy



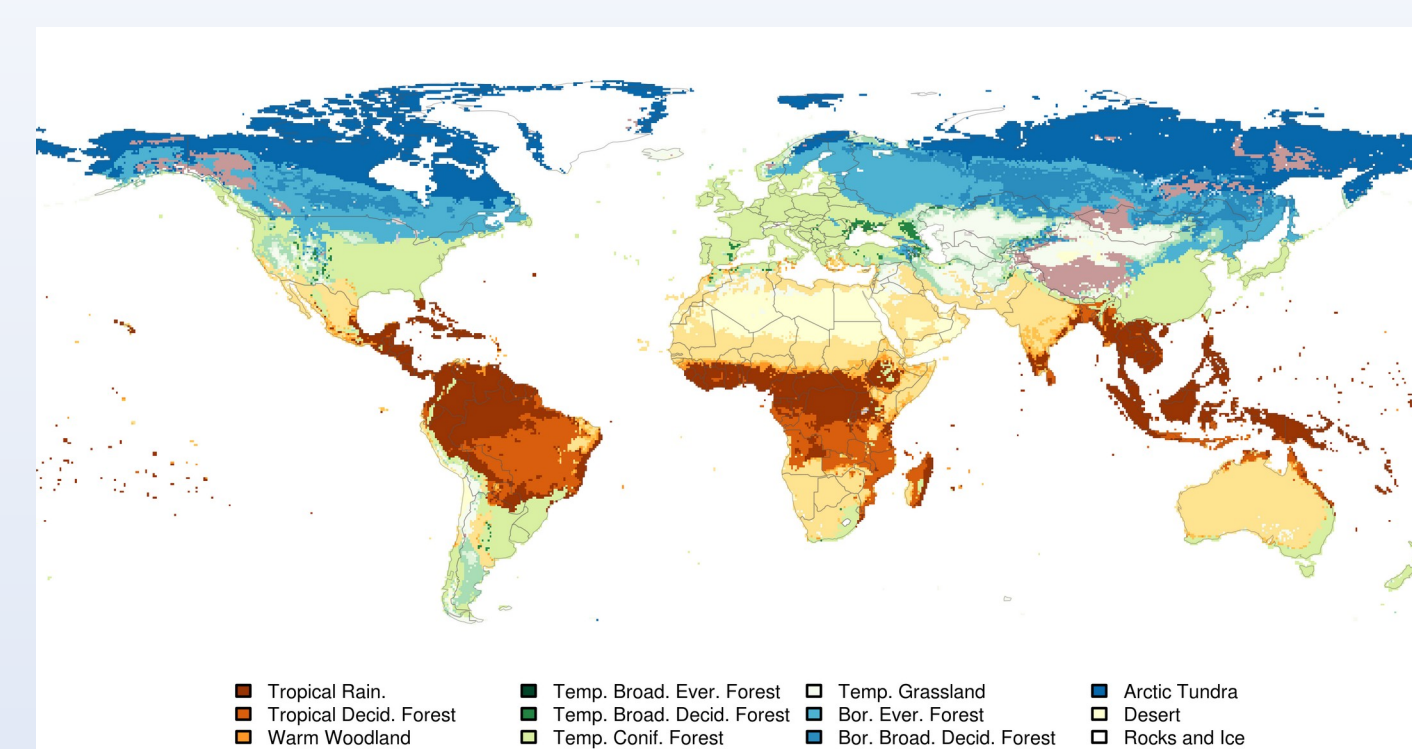
RESULTS



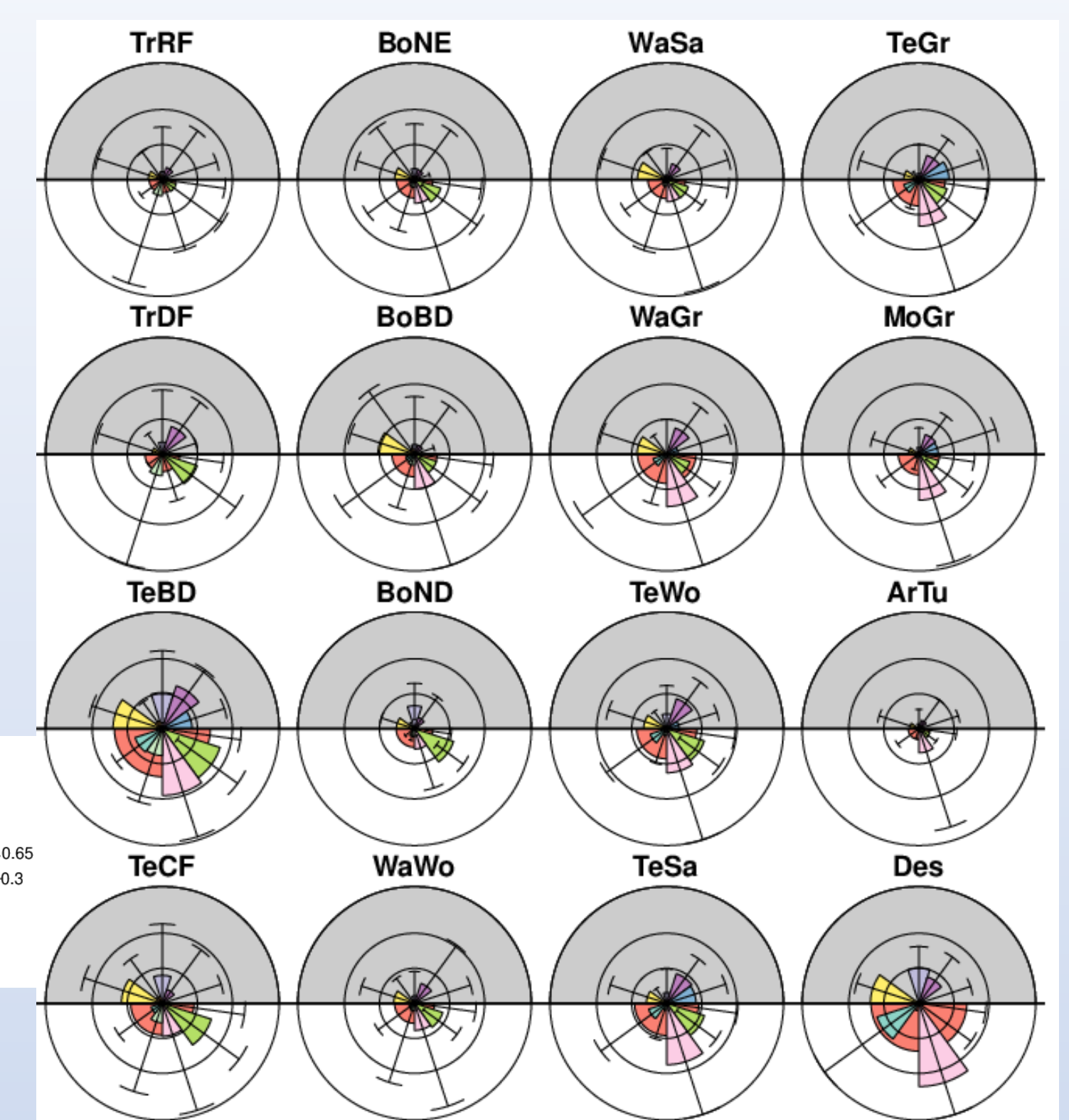
M-COL in % of preindustrial reference NPP



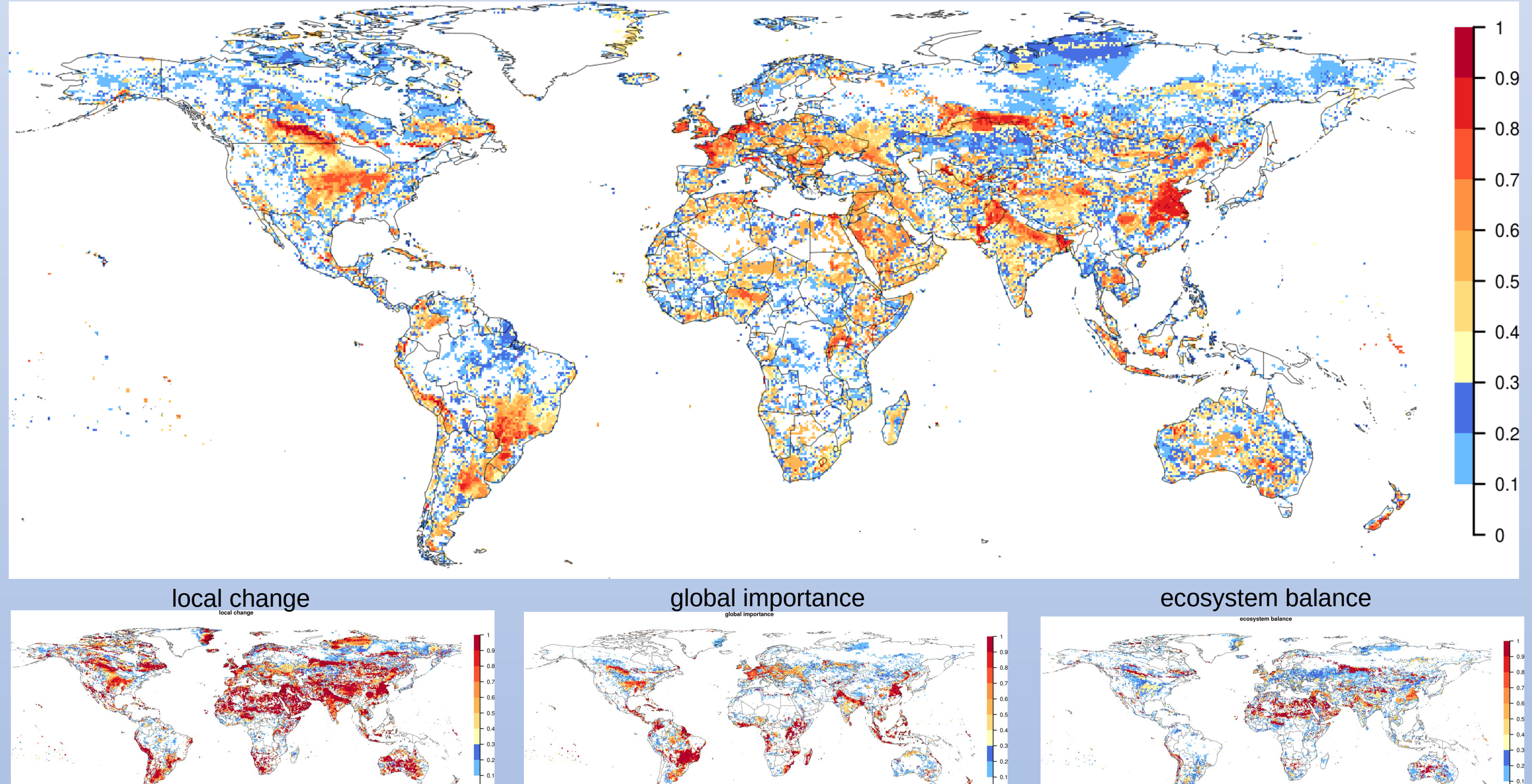
Biome classification



M-ECO aggregated per Biome



M-ECO total



- M-COL indicates large areas with extraction of >25% of preindustrial NPP
- Strong increase since 1900
- To be suggested as new control variable for Planetary boundary of biosphere integrity
- Open source R package available soon

- M-ECO highlights regions with strong biogeochemical change
- Useful to map regions with a risk for biosphere degradation → land use scenario development and scenario analyses
- Flexible use (compare any states)
- Currently tailored to LPJmL, but could also be included in MIPs
- What are requirements to apply it to your model?