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A global approach to assess land use impacts on biodiversity in LCA

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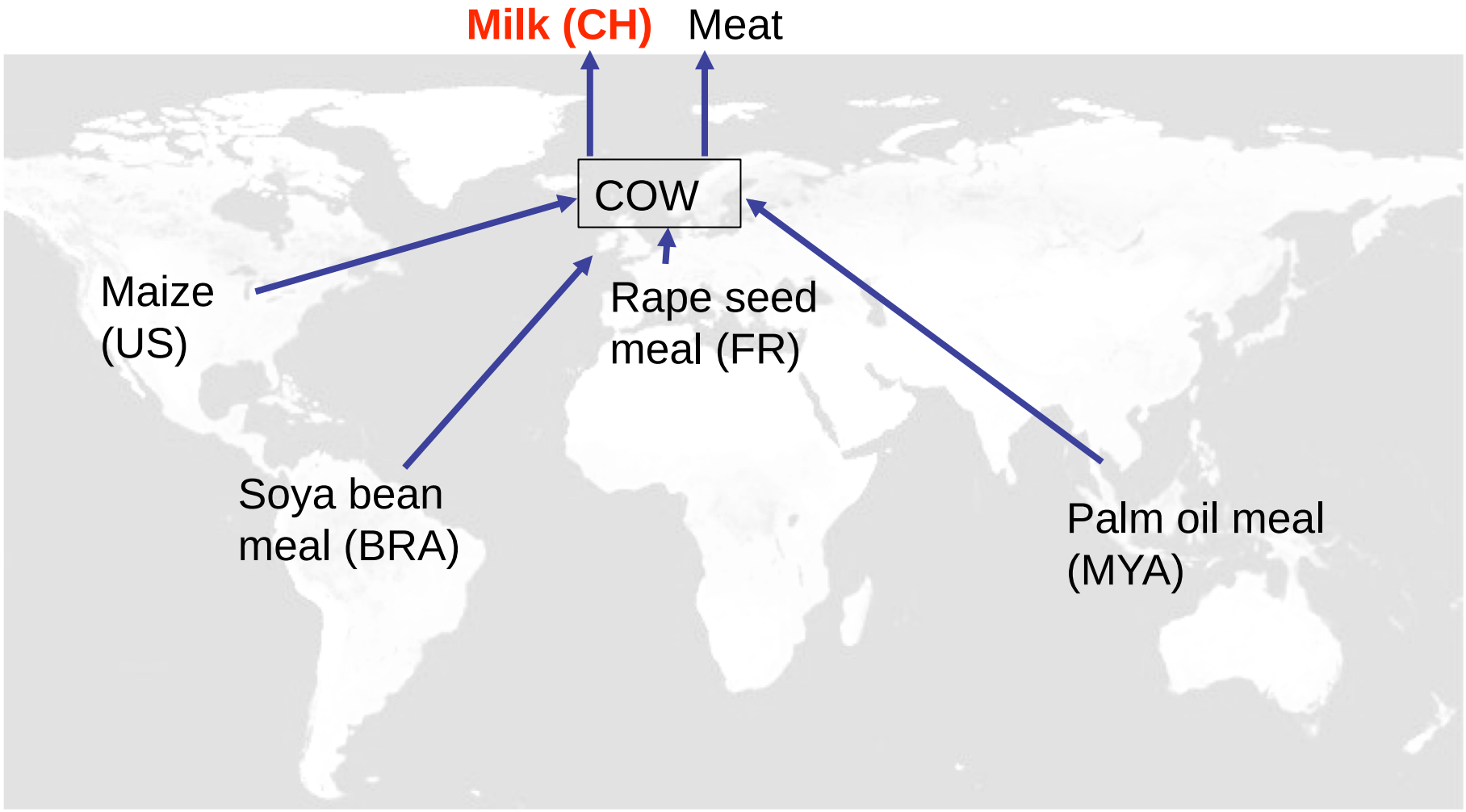
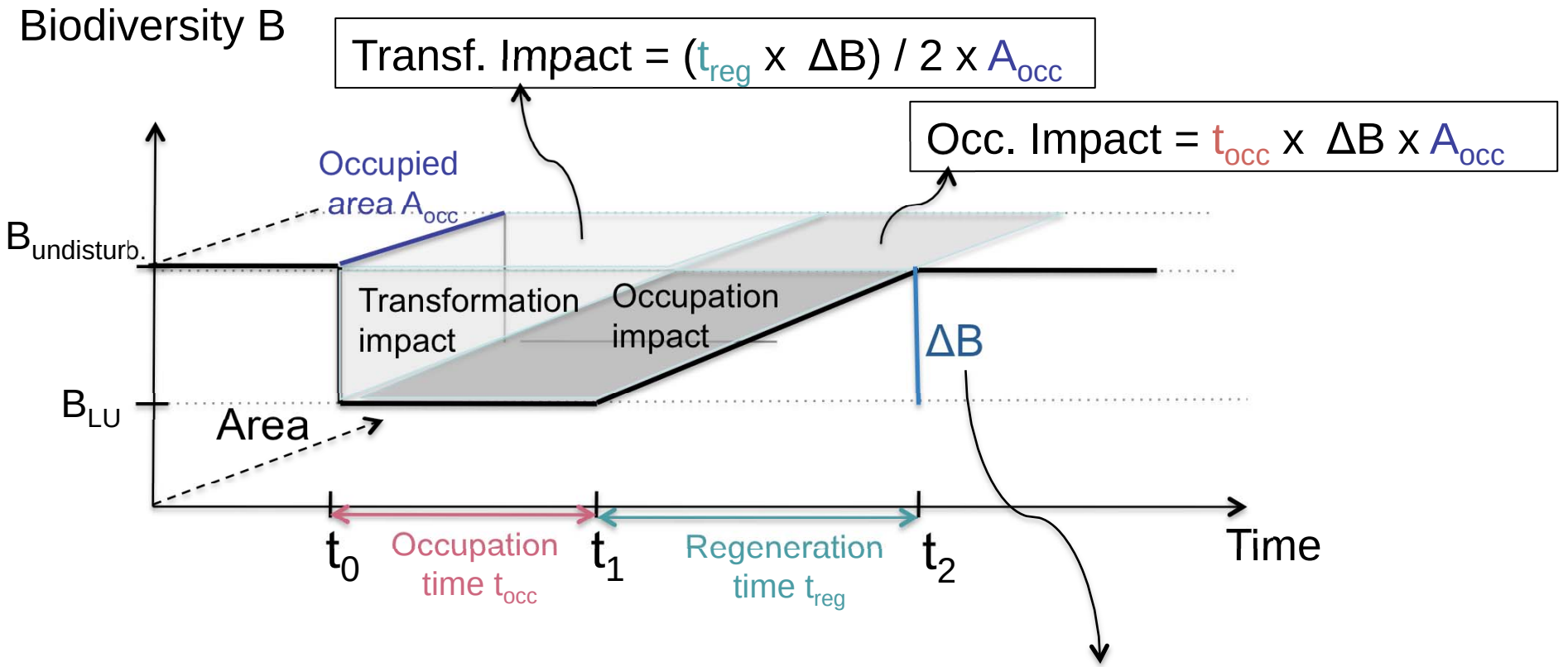
Why do we need a global method?



Impact calculation

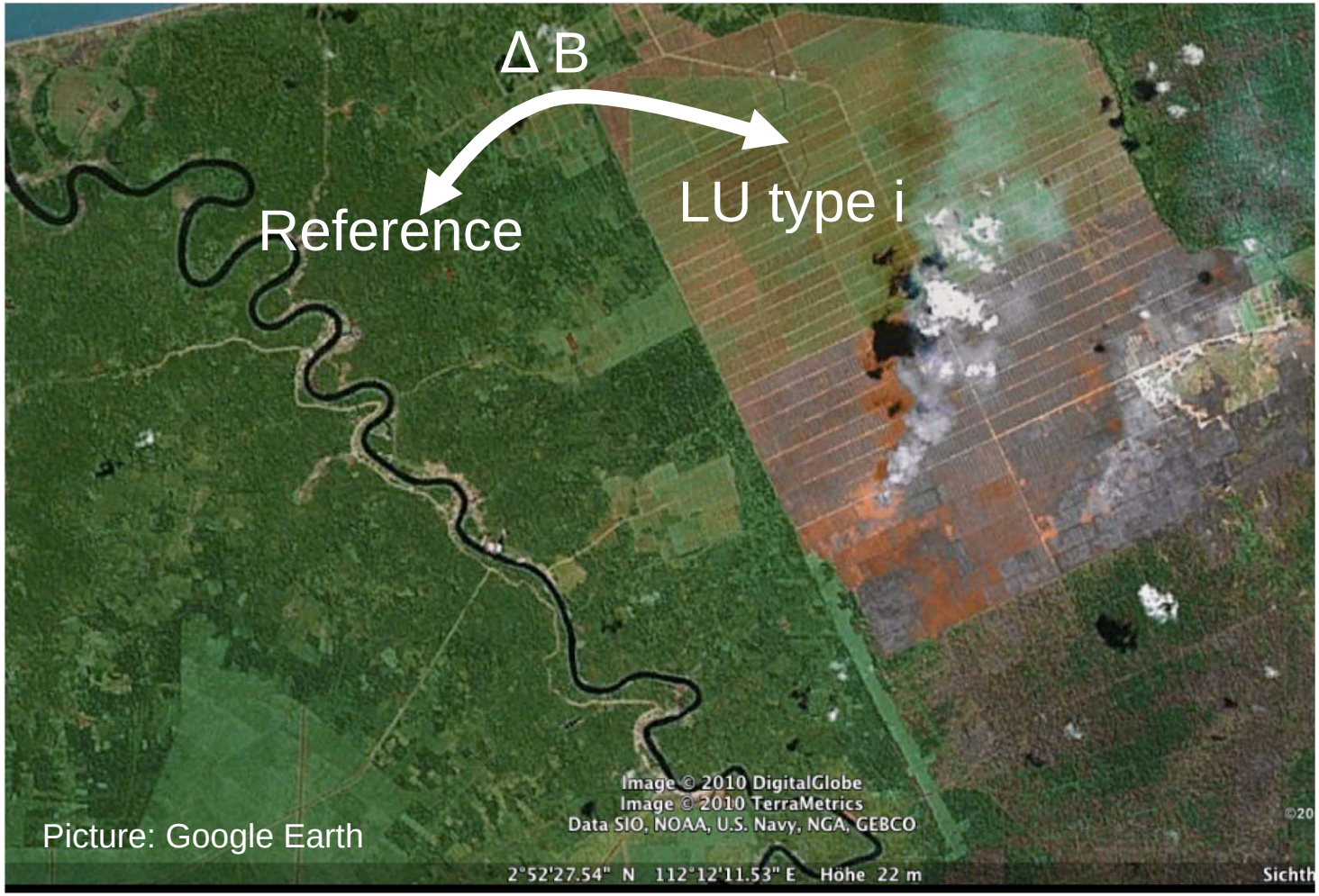


Varies between:
- land use type
- world regions
- taxonomic groups

adapted from Mila i Canals et al., 2007

Biodiversity impact: Meta-analysis

Based on GLOBIO3 (Alkemade et al., 2009)



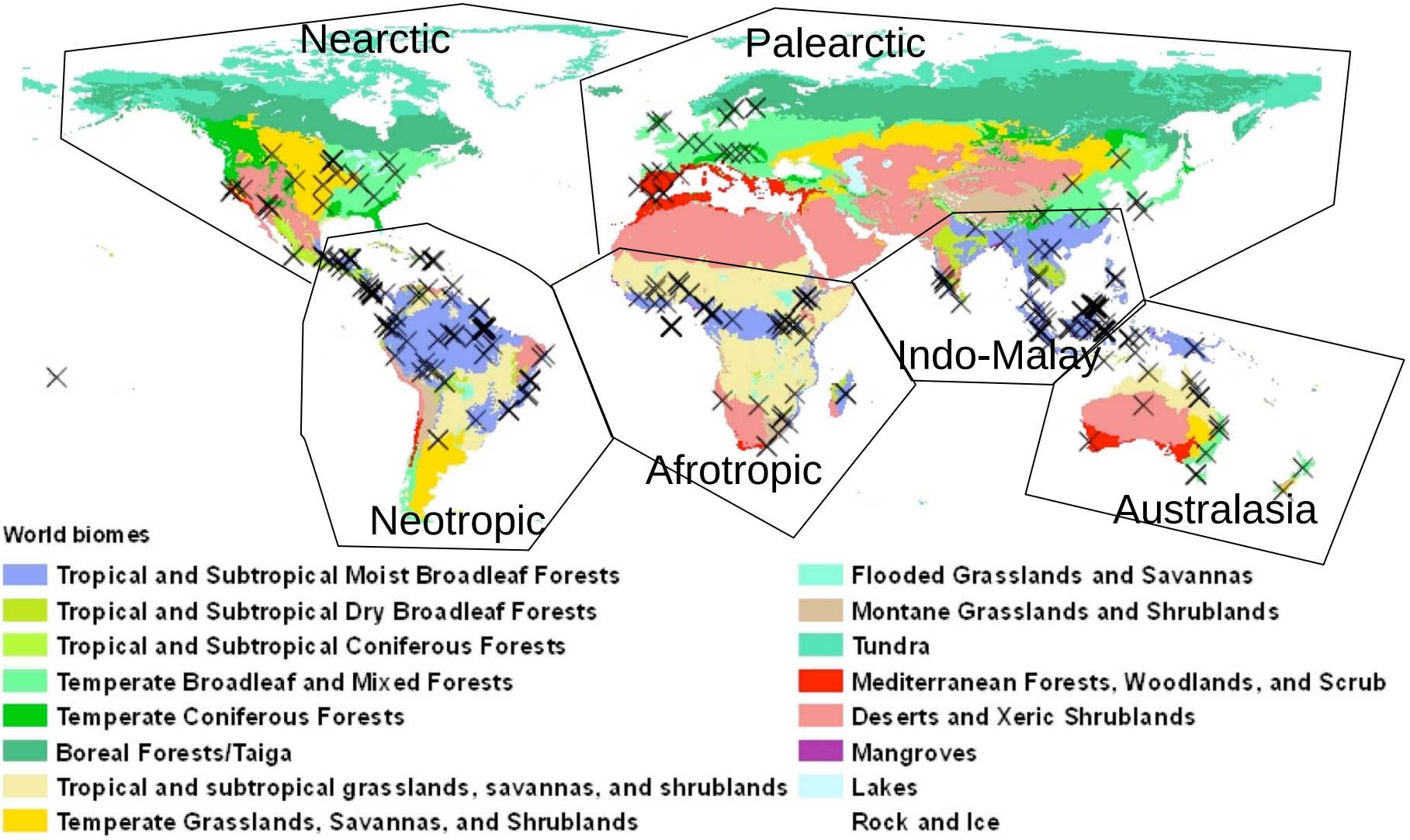
Includes various

- taxa
- world regions
- LU types
- species abundance & richness

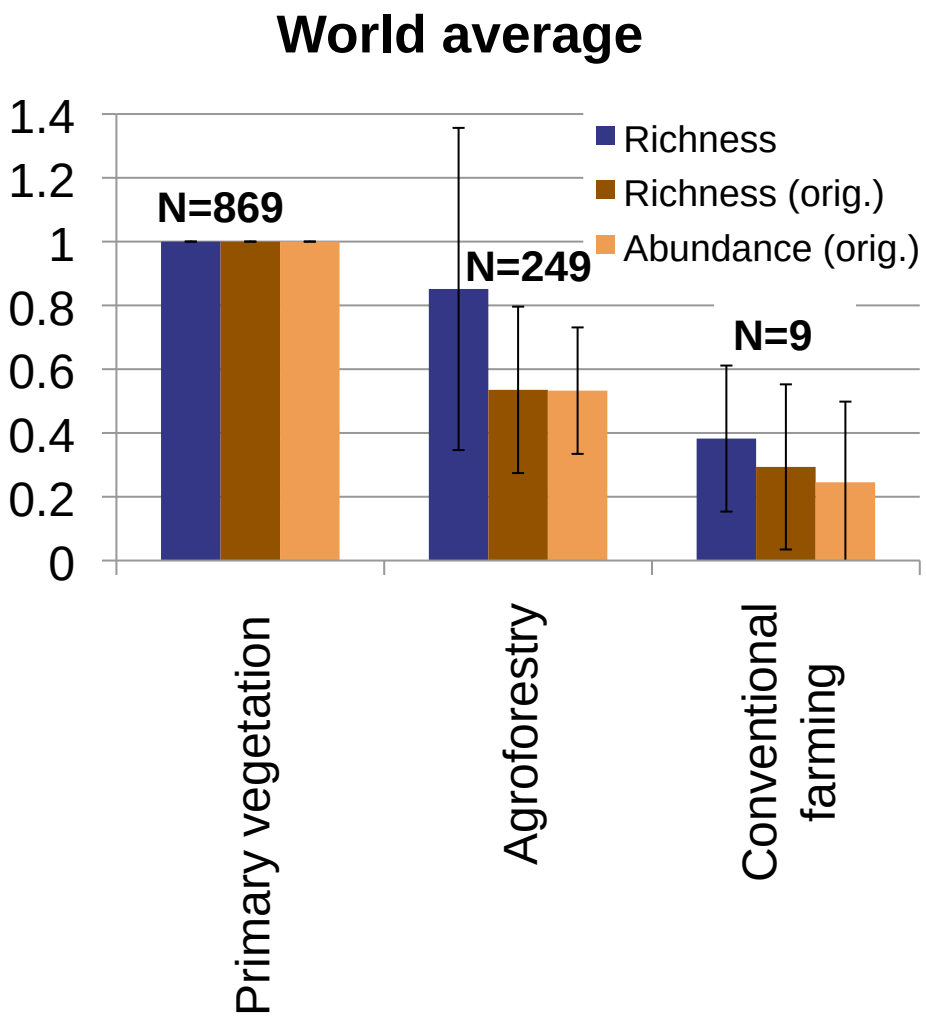
GLOBIO3 indicators: example

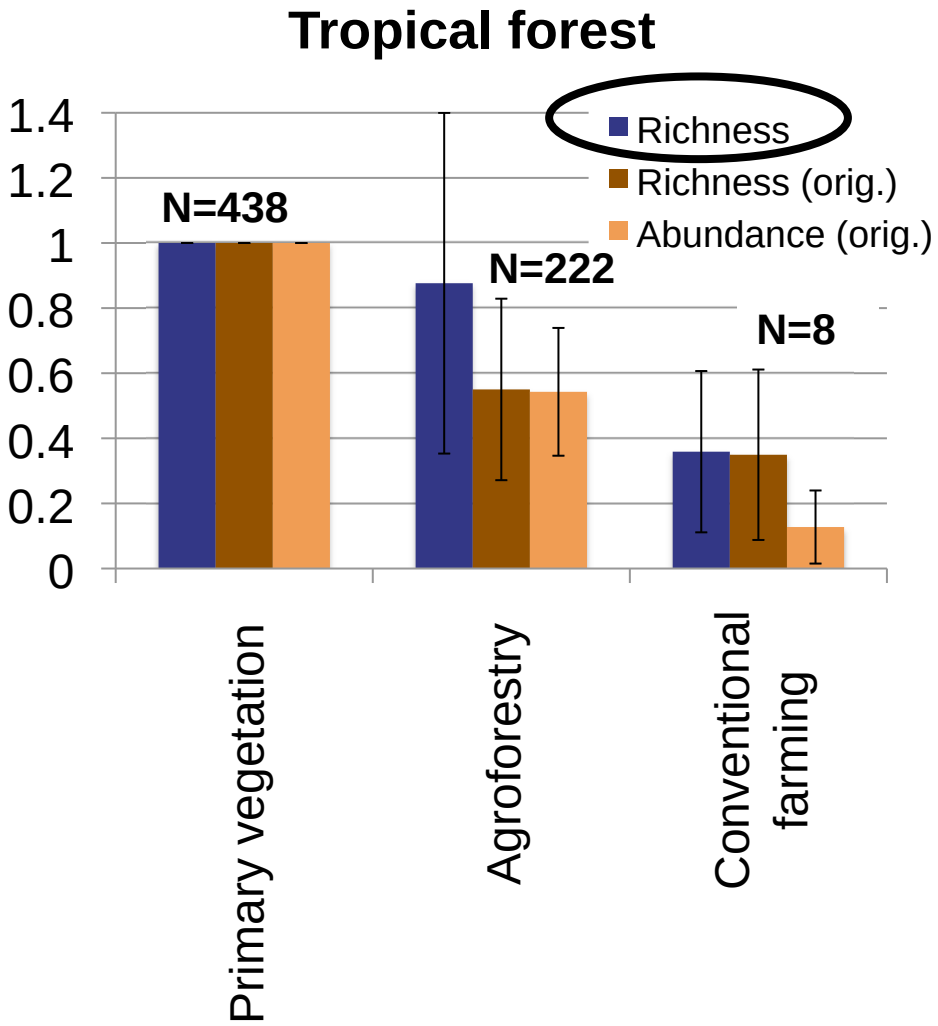
	Reference	LU type i	Relative difference
Abundance species A	5	0	0
Abundance species B	4	2	2/4
Abundance species C	3	1	1/3
Abundance species D	0	10	-
Species richness	3	3	**=1**
Species richness of original species	3	2	**=0.67**
Mean species abundance of original species	4	1	**= 0.27**

Geographical distribution of data (GLOBIO3)



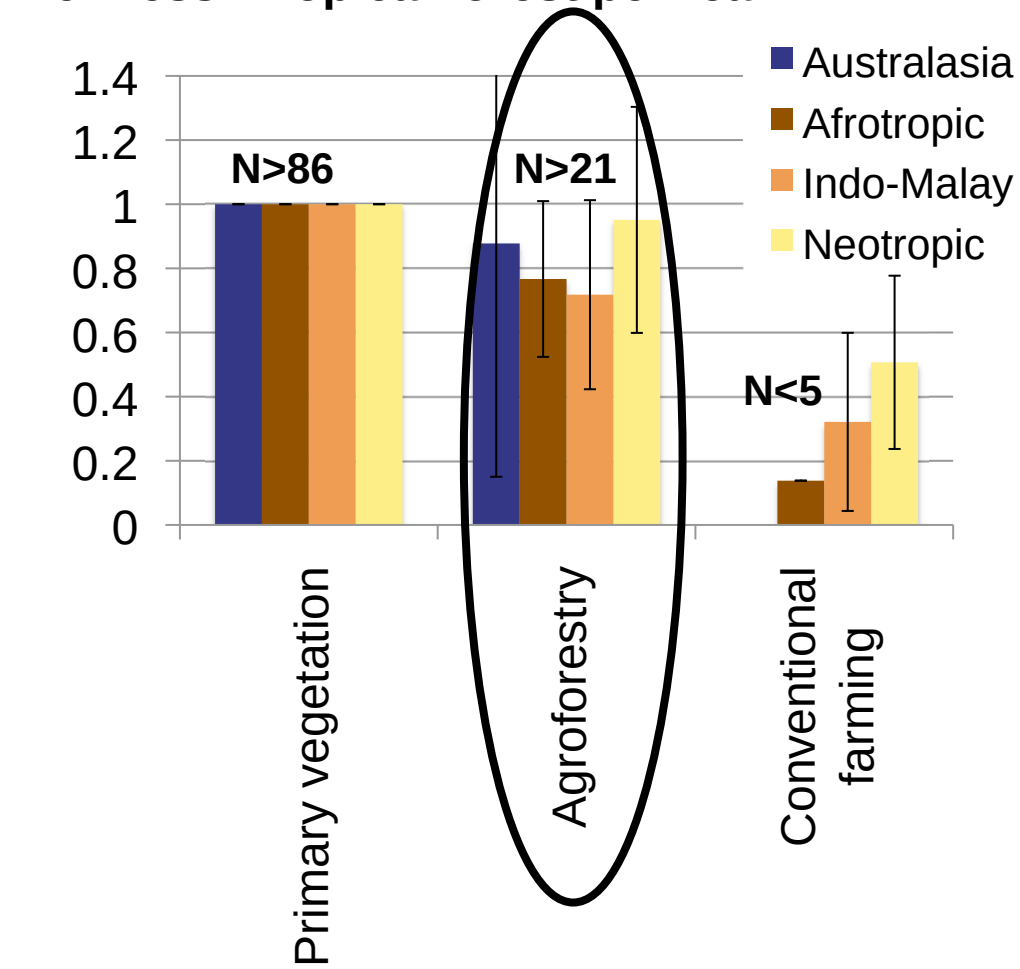
Results (prelim.): all indicators



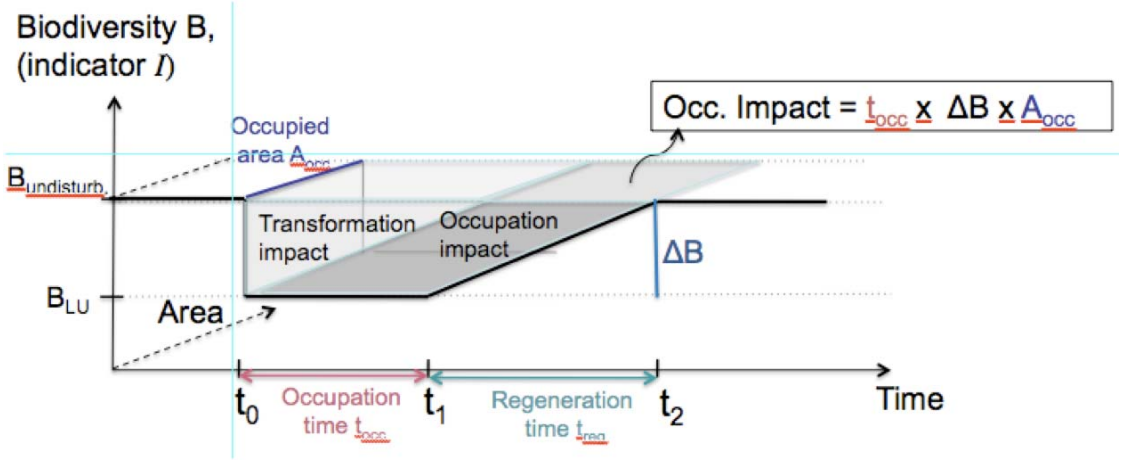


Resuls (prelim.): Richness per realm

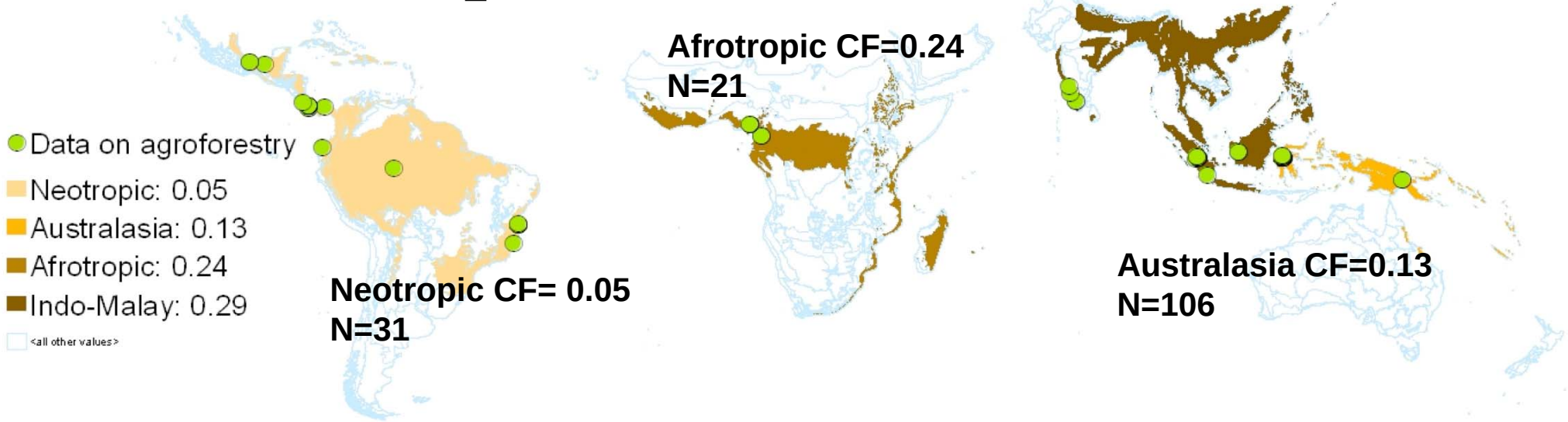
Richness: Tropical forest per realm



Results (prelim.): Occupation Tropical agroforestry



$$CF_{Occ.\ AF} = \underbrace{(B_{reference} - B_{AF})}_{=1}$$



Neotropic CF= 0.05
N=31

Afrotropic CF=0.24
N=21

Indo-Malay CF= 0.29
N=70

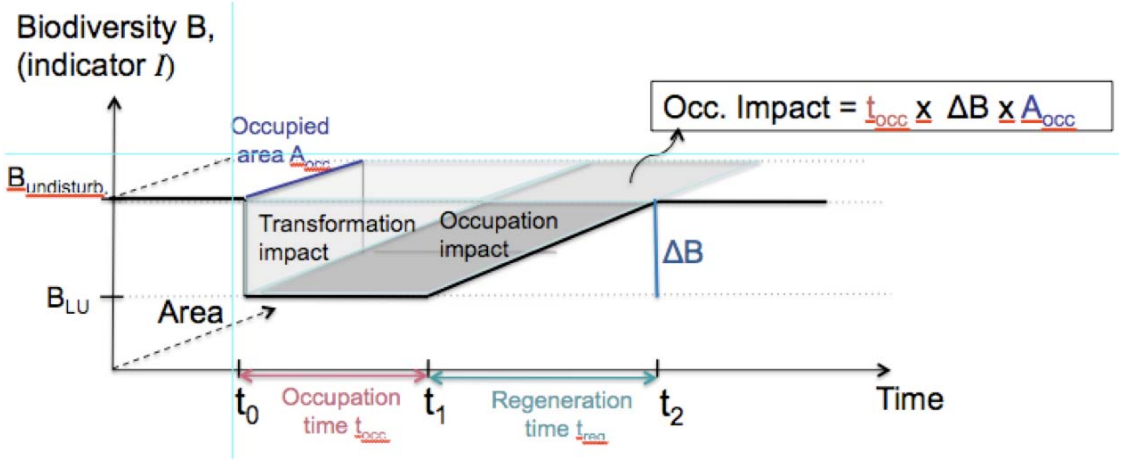
Australasia CF=0.13
N=106

Further regionalization:
Regional weighing factor per ecoregion =

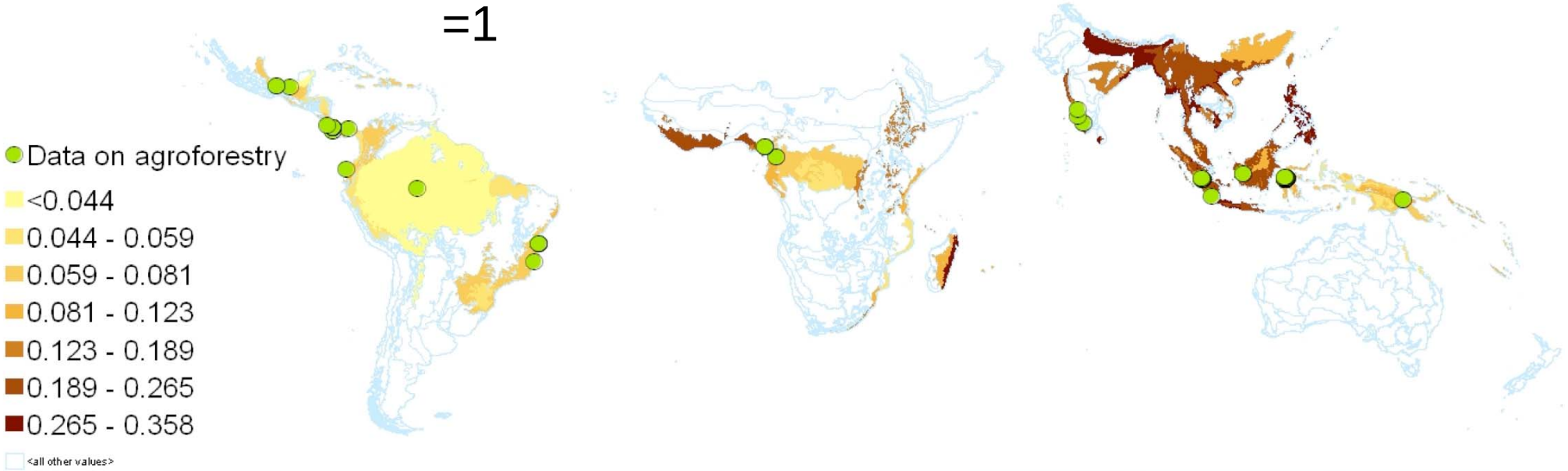
Adapted from Weidema & Lindeijer, (2001)

- Vulnerabiltiy Index (0 -1)
  - Higher impacts in highly disturbed regions
  - Data: share of “undisturbed” land (GLC 2000)
- Irreplaceability index (0 -1)
  - Higher impacts in regions with high degree of endemism
  - Data: near endemic birds and mammals (WWF)
- Richness Index (0 -1)
  - Higher impacts in regions with high species richness
  - Data: birds, mammals (WWF), plants (Kier et al., 2005)

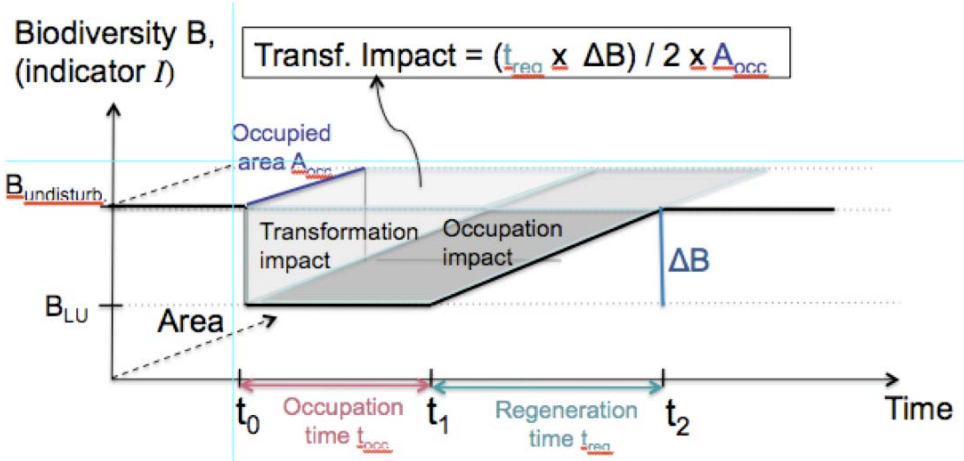
Results (prelim.): Occupation Tropical agroforestry



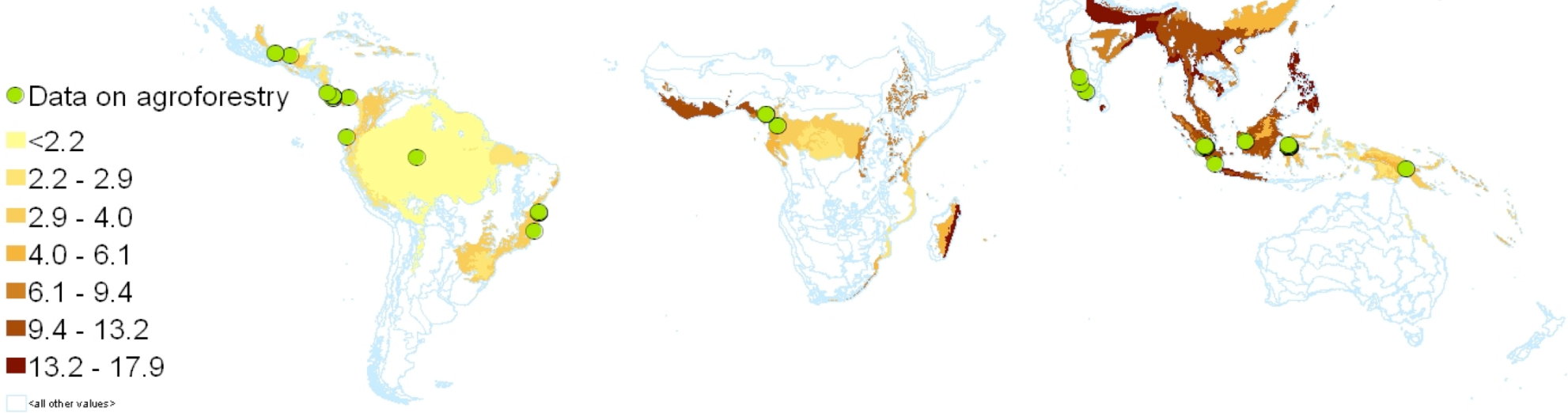
$$CF_{Occ.\ AF} = \underbrace{(B_{reference} - B_{AF})}_{=1} * \{\text{regional weighing factor}\}$$



Results (prelim.): Transformation Tropical agroforestry



$$CF_{Transf.\ AF} = \underbrace{(B_{ref.} - B_{AF})}_{=1} * \{reg.\ WF\} * \underbrace{t_{reg}}_{\approx 100\ years\ (tropical\ forest)} / 2$$



Uncertainties

- Inventory:
  - which commodity, where does it come from?
  - quantification of land transformation (and occupation)
- Impact assessment:
  - Meta-analysis: which studies are captured, choice of indicator and reference, uncertainties of original studies, …
  - Weighing scheme: WWF data, choice of weighing factors, …

➜ Next steps: Compare alternative approaches

Conclusion

- Global approaches needed for global value chains (but: trade-off between accuracy)
- Knowledge & data available: synthesis and interpretation
- Fill data gaps (e.g. conventional agriculture in tropics, boreal forests)

Thank you...

- Thomas Koellner (University of Bayreuth)
- Stefanie Hellweg (ETH Zurich)
- Roland Scholz (ETH Zurich)
- Rob Alkemade (PBL, Netherlands)