



PBL Netherlands Environmental
Assessment Agency

Including biodiversity in national accounts:

Using the Extent of Suitable Habitat

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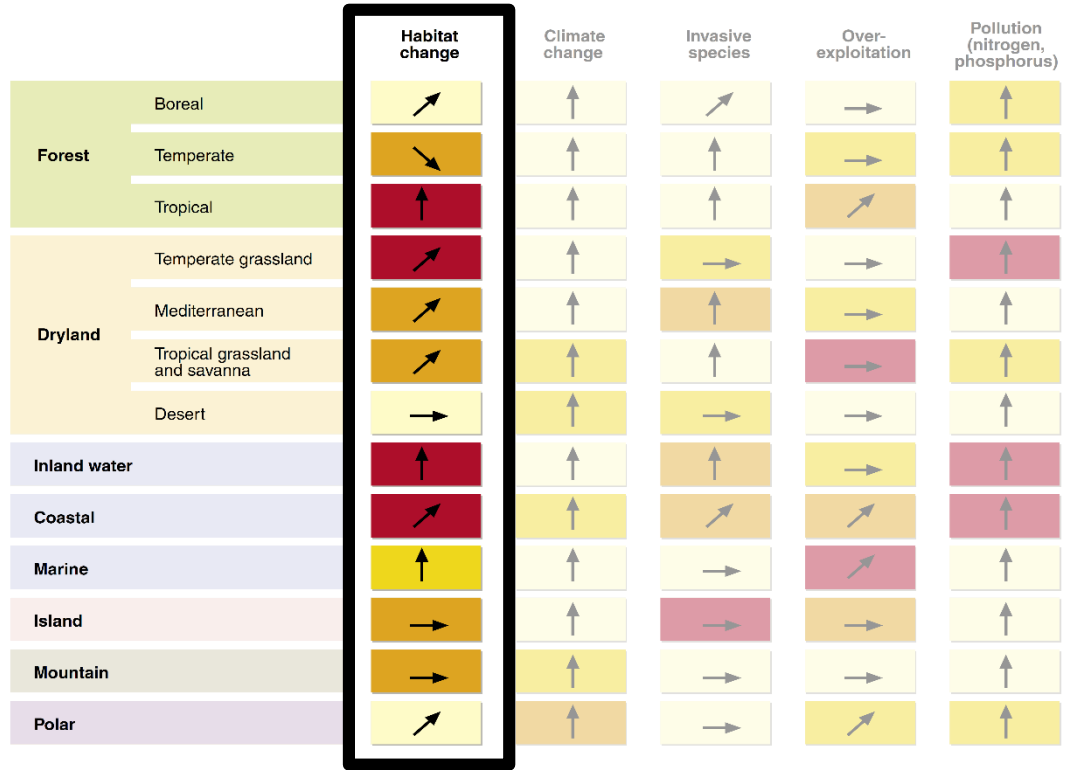
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Background

- WAVES project
 - Environmental accounting next to economic accounting:
System of Environmental Economic Accounts – Experimental
Ecosystem Accounting (UN – UN statistics)
 - Changes in ecosystem condition
 - MSA -> Species Habitat Indices (SHI)
 - › Species-specific indicator

Introduction



- Important to:
 - Quantify impact of habitat change on biodiversity

Driver's impact on biodiversity over the last century

Low
Moderate
High
Very high

Driver's current trends

Decreasing impact
Continuing impact
Increasing impact
Very rapid increase of the impact

Source: Millennium Ecosystem Assessment



Introduction

- Information needed on:
 - Degradation of biodiversity due to habitat change
 - Changes in natural capital
- Until now, few studies have investigated species' habitat change on a global scale
 - Limited taxonomic coverage

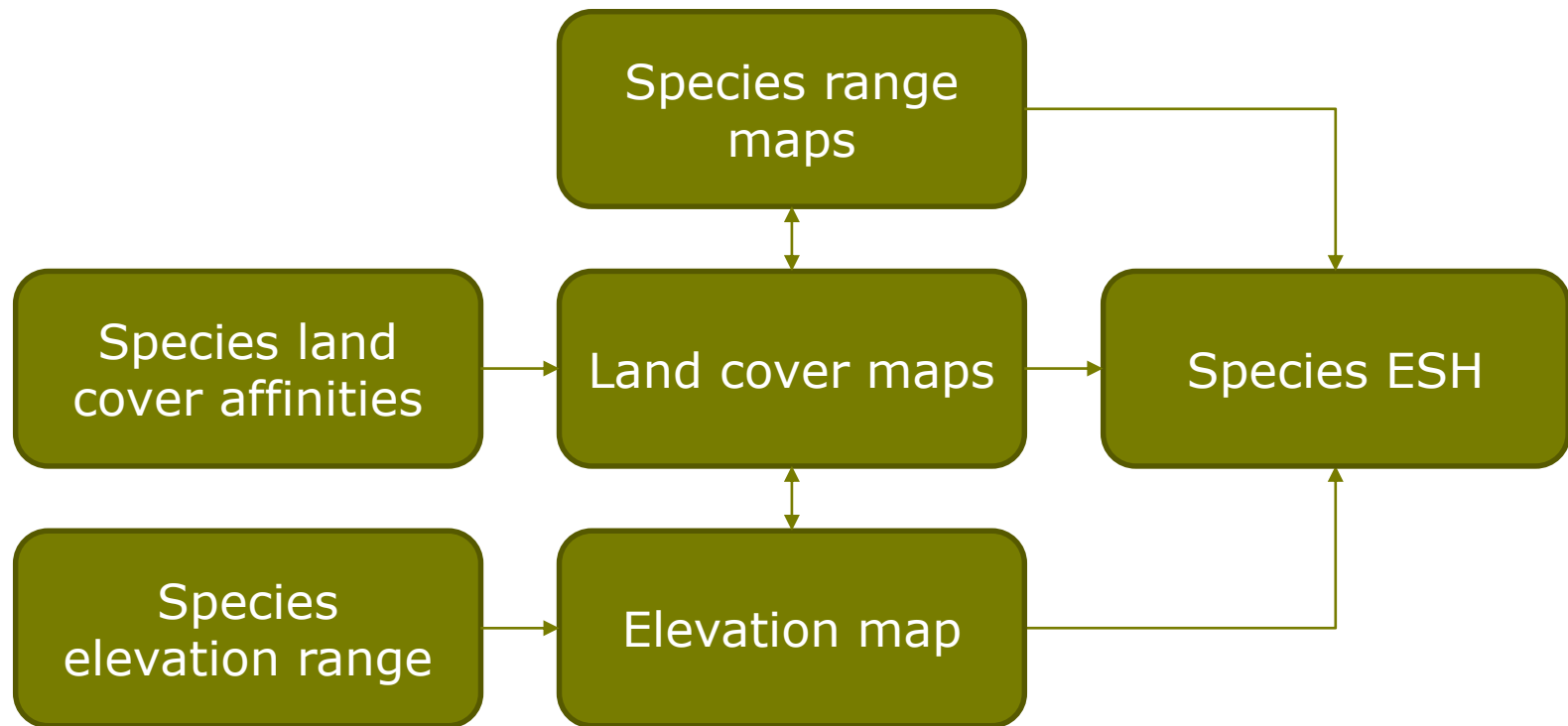


Goal

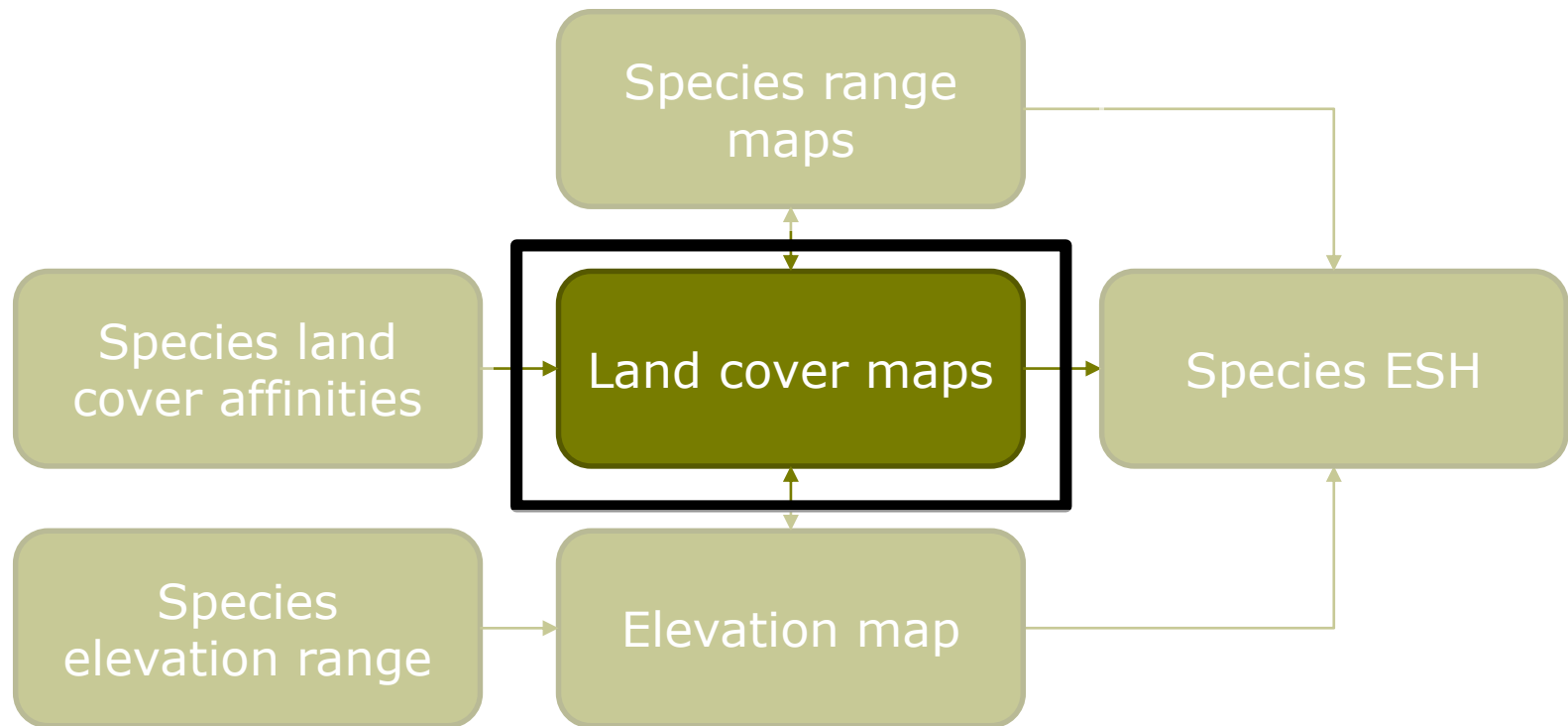
To **quantify** global **changes in habitat extent** per country due to land cover change for **mammals, birds + amphibians**

- Identify:
 - Hotspots of habitat change
 - Highly affected species + species groups
 - Traits + socio-economic factors related to habitat change

Methods



Methods

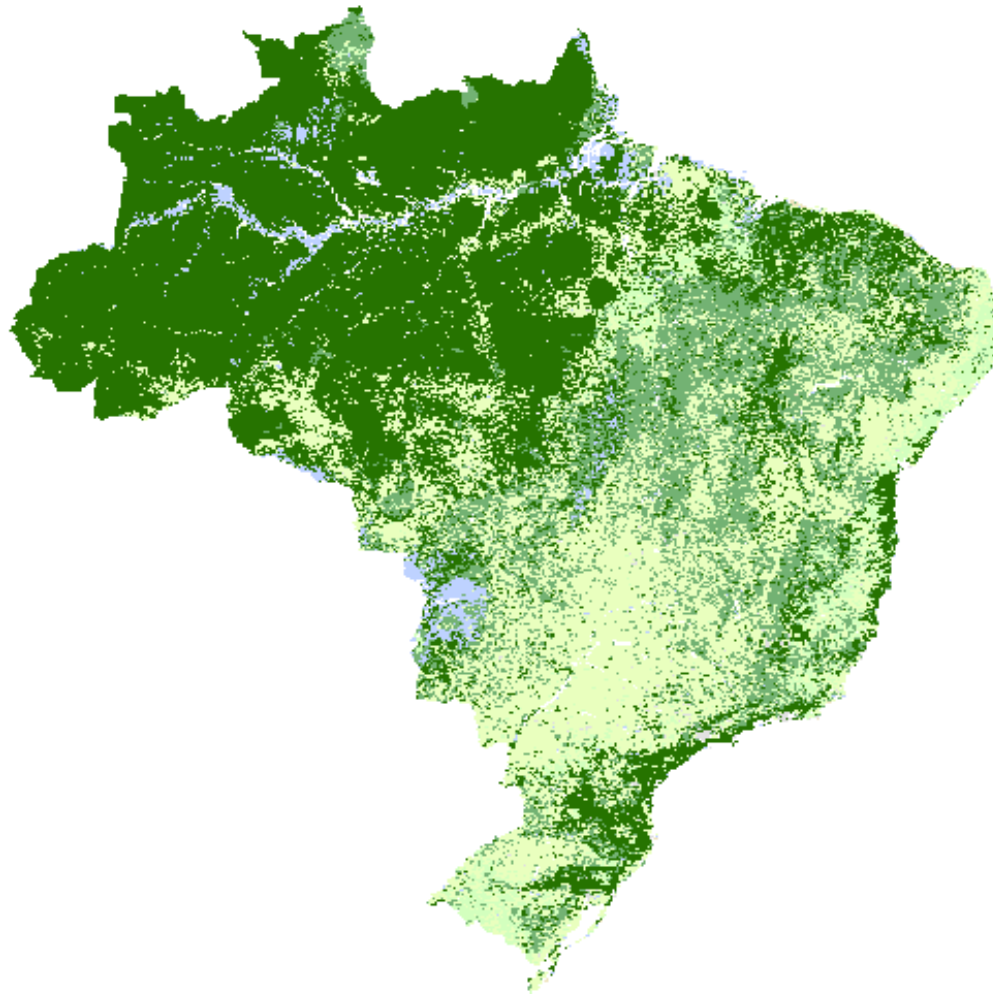




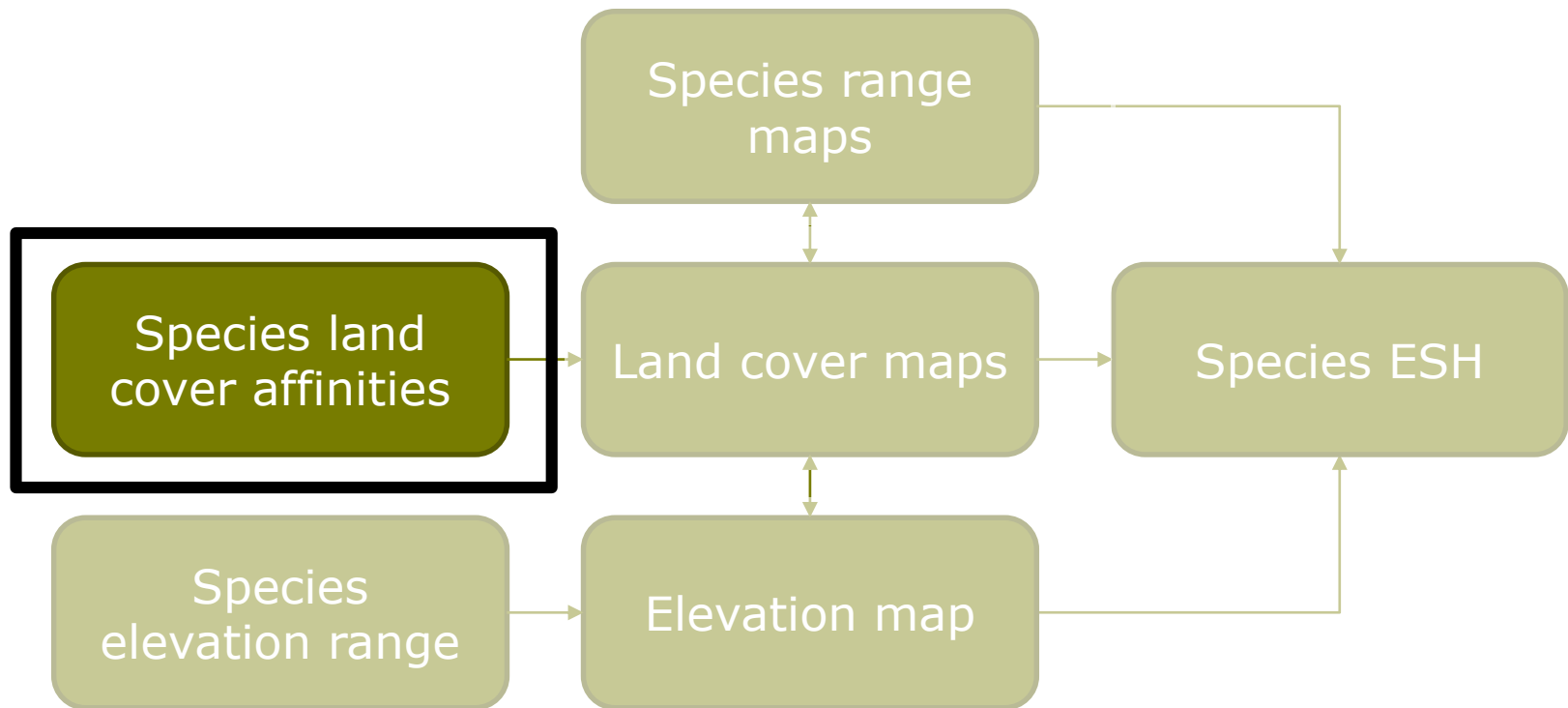
Methods – Land cover maps

▪ **ESA CCI Land Cover maps**

- Released April 2017
- Yearly land cover maps from 1992 - 2012
- 300 m resolution
- Based on (multiple) satellite observations – ‘real’ data
- 22 land cover classes (LCCS): e.g. cropland, grassland, tree cover (broadleaved/needleleaved), urban areas



Methods



Methods – Species land cover affinities

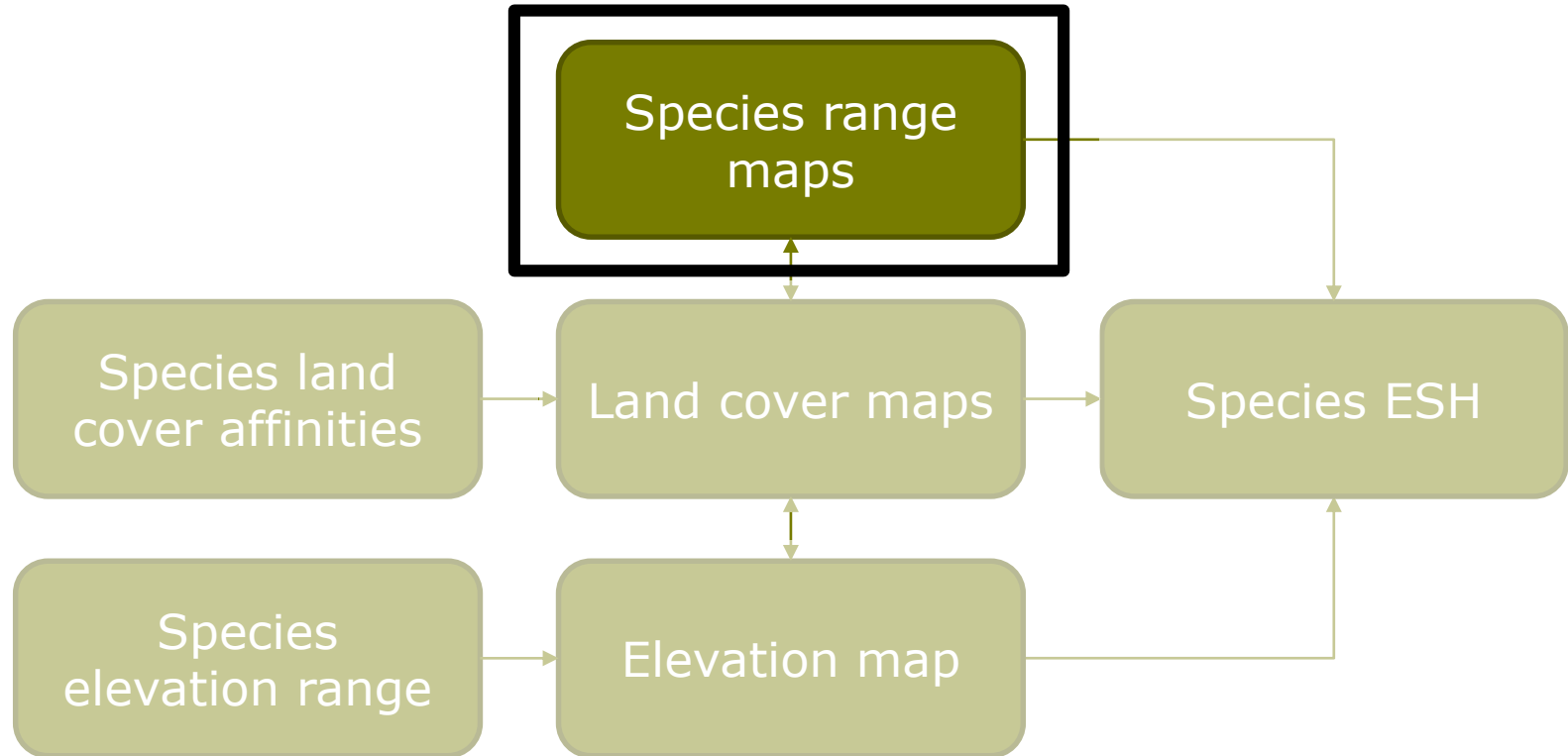
▪ **Habitat Suitability Models (Rondinini et al. 2011)**

- Expert-based, species-specific matrices of suitability of land cover classes
- Highly suitable, medium suitable, not suitable
- Transformed from Globcover to LCCS
- E.g. Bornean Orangutan:



Highly suitable	Medium suitable	Not suitable
Tree cover, broadleaved	Mosaic tree + shrub + herbaceous	Cropland
Tree cover, needleleaved		Shrubland
Tree cover, mixed		Grassland
Tree cover, flooded		Urban areas

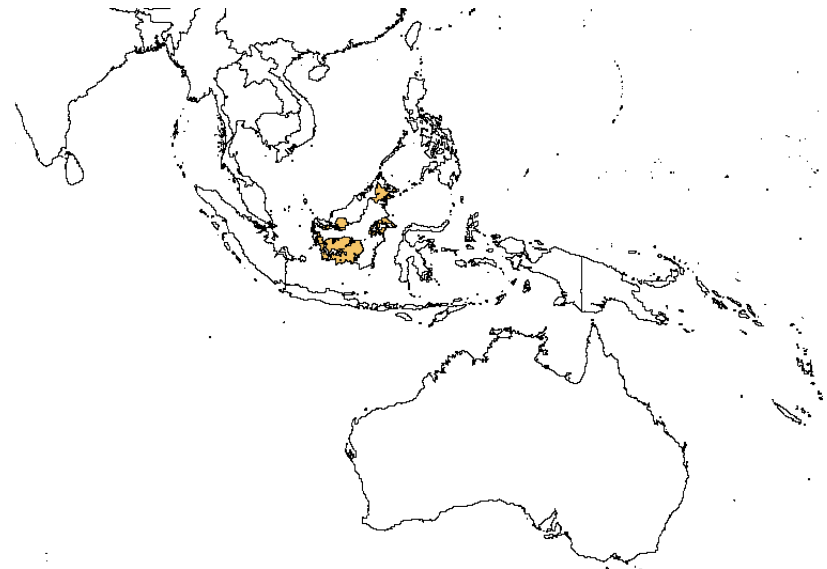
Methods



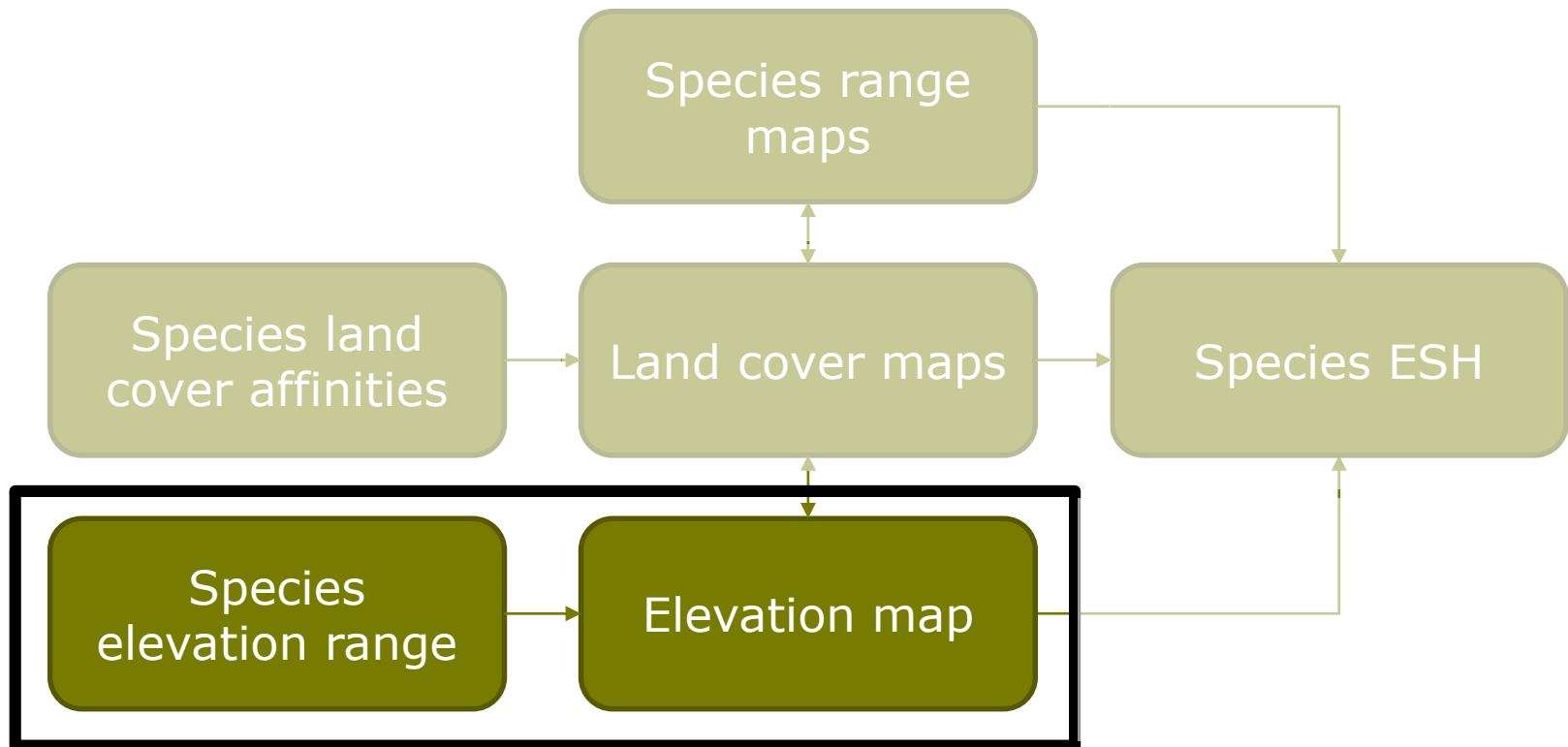
Methods – Species range maps

■ IUCN Red List of Threatened Species

- Occurrence- and expert-based, species-specific maps
- 5,326 mammals, 11,120 birds + 6,437 amphibians
- ‘Potential range of the species’
- E.g. Bornean Orangutan:



Methods

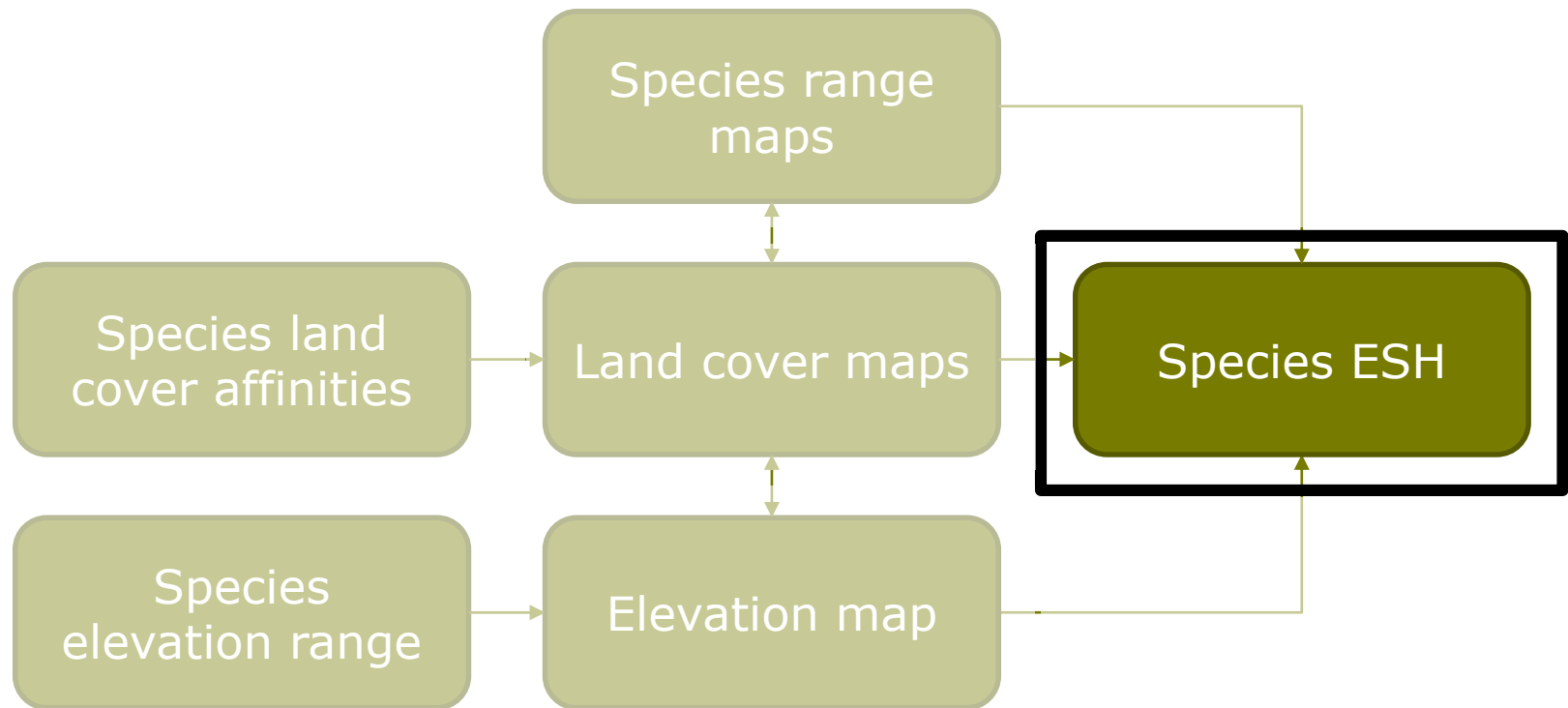




Methods – Species elevation range + map

- **EarthEnv elevation map (Robinson et al. 2014)**
 - Best elevation map at the moment
 - Combines Aster + SRTM data: 90m digital elevation model
- **IUCN Red List of Threatened Species (Rondinini et al. 2011)**
 - Species specific information on min + max elevation
 - E.g. Bornean Orangutan: 0 – 9000 m

Methods



Methods – Species ESH

■ Country level

- ESH for a species i occurring in country j
- Aggregate the entire ESH within a country for 1992 and 2015 (over species i)
- Calculate difference in ESH:

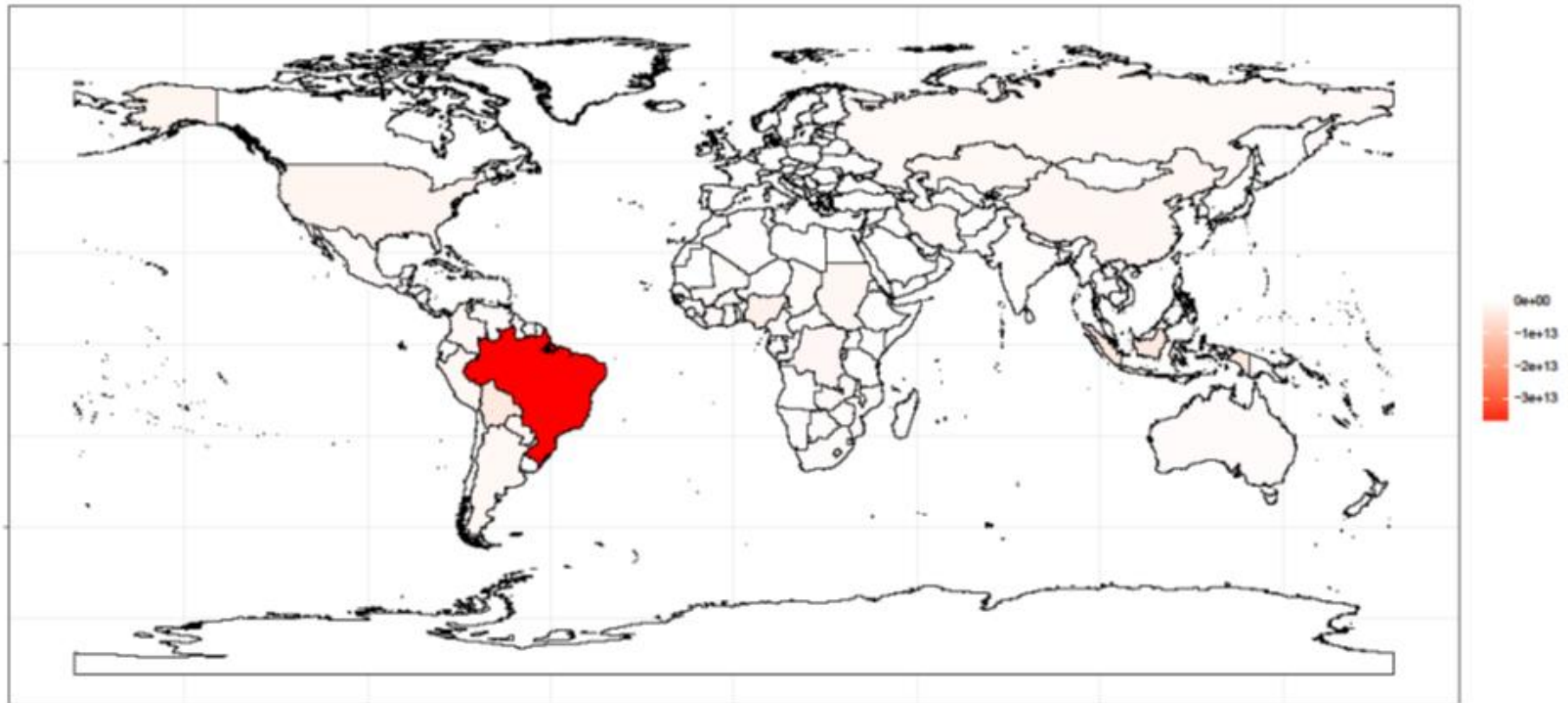
Absolute

$$\Delta ESH_j = \sum_i ESH_{j,2015} - ESH_{j,1992}$$

Relative

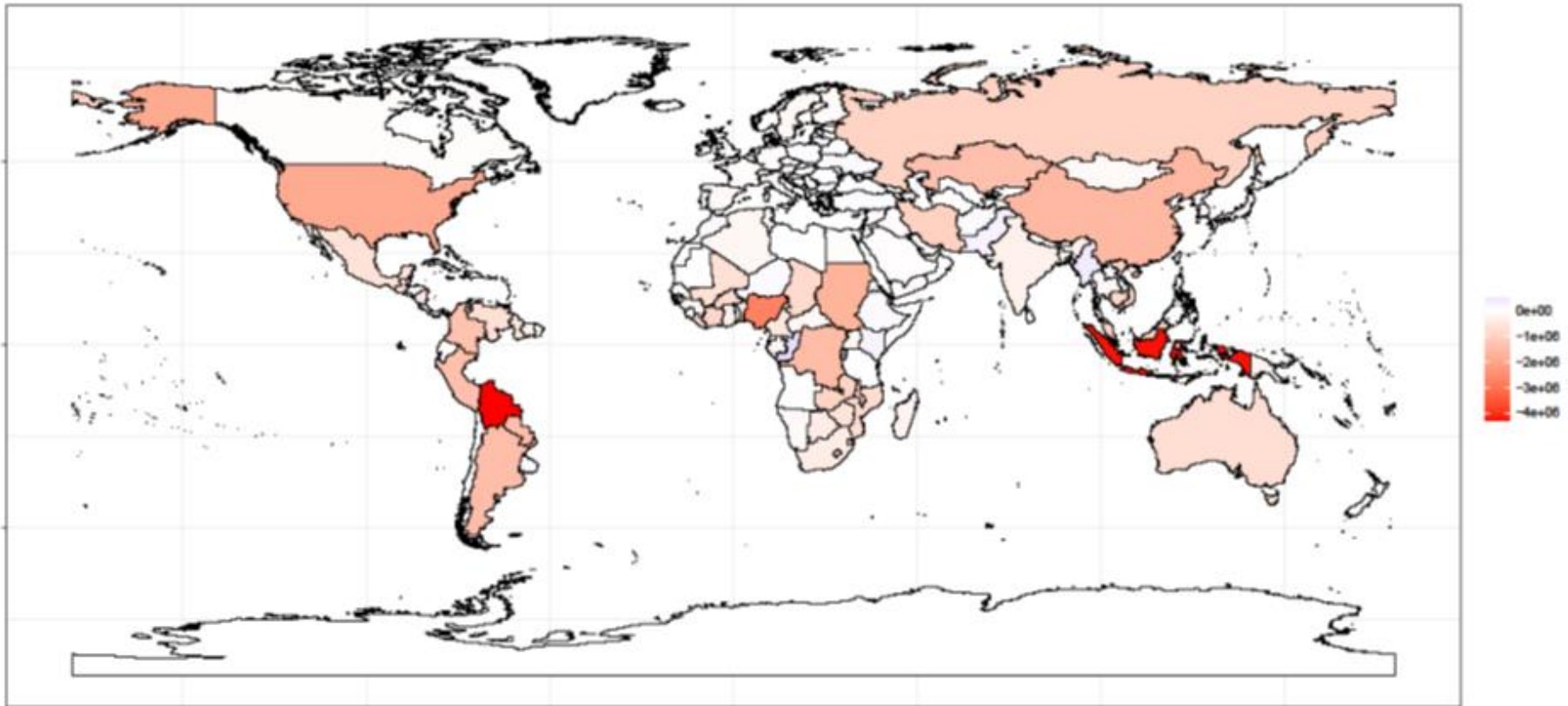
$$\Delta ESH_j = \sum_i \frac{ESH_{j,2015} - ESH_{j,1992}}{ESH_{j,1992}}$$

Results - Absolute

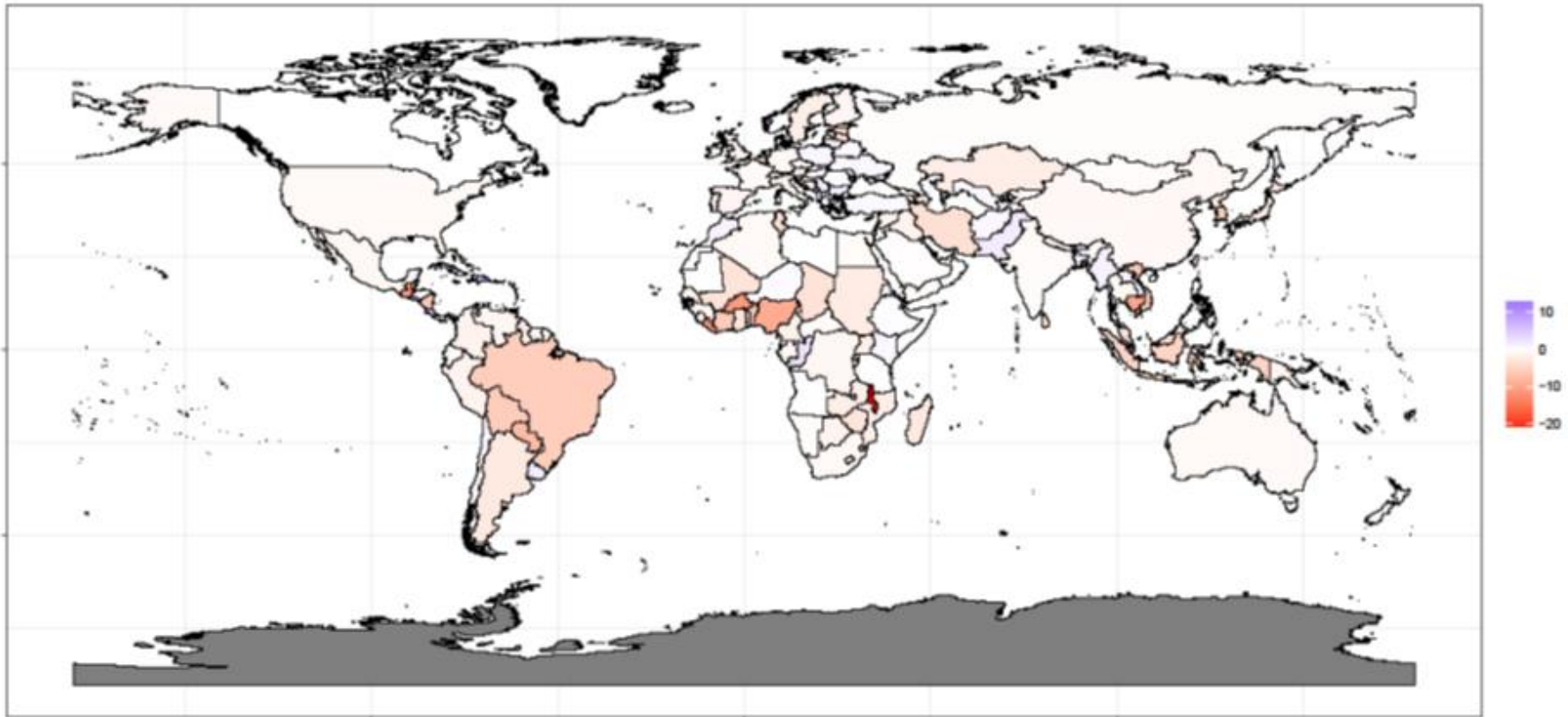


Largest losses in Brazil

Results – Absolute (without Brazil)



Results - Relative





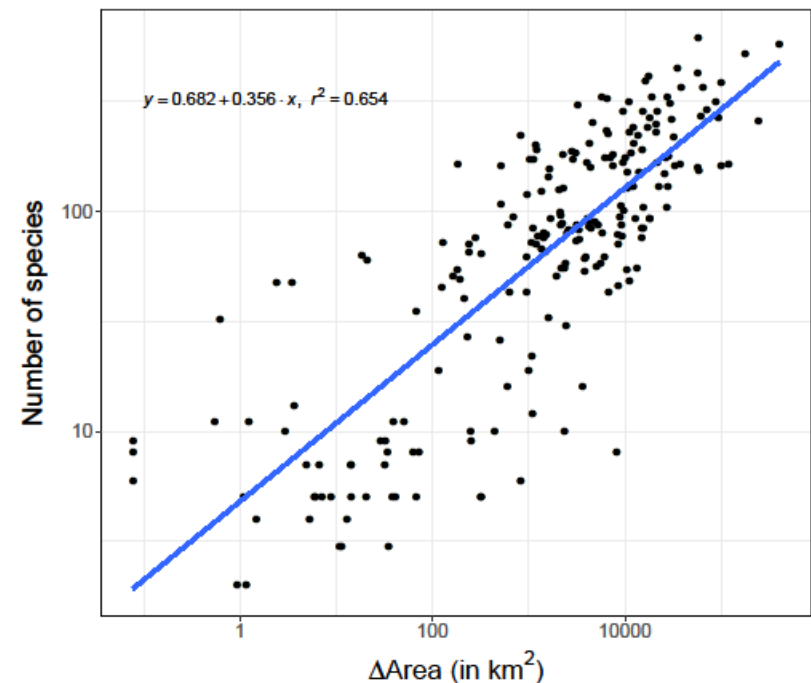
Results

	Absolute		Relative	
	Country	Habitat loss (km ²)	Country	Habitat loss (%)
1	Rep. of Congo	594,083	Hong Kong	12.3
2	Burma	368,381	Vanuatu	11.9
3	Pakistan	225,387	El Salvador	10.1
4	Kenya	208,726	Dominican Rep.	8.4
5	Costa Rica	202,240	U.S. Virgin Islands	8.1

	Absolute		Relative	
	Country	Habitat loss (km ²)	Country	Habitat loss (%)
1	Brazil	-37,964,578	Malawi	-21.4
2	Bolivia	-4,283,357	Singapore	-15.3
3	Indonesia	-4,226,149	Guadeloupe	-14.8
4	Nigeria	-2,703,414	Guatemala	-11.6
5	United States	-1,857,969	Liberia	-11.5

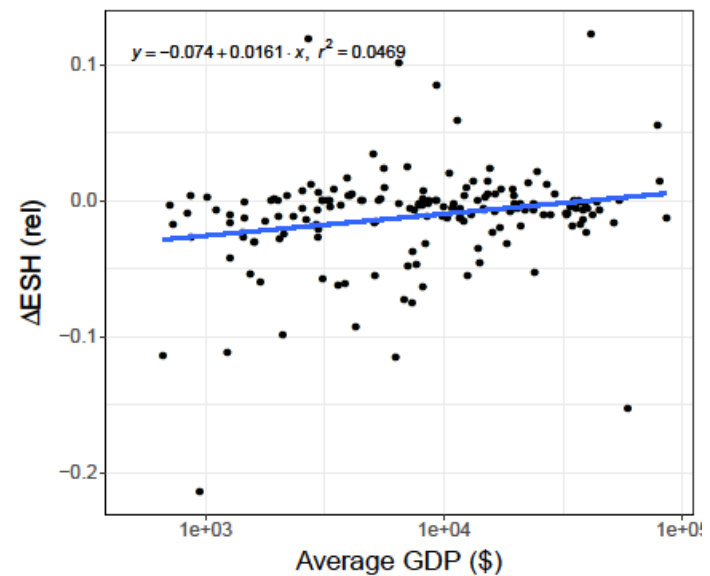
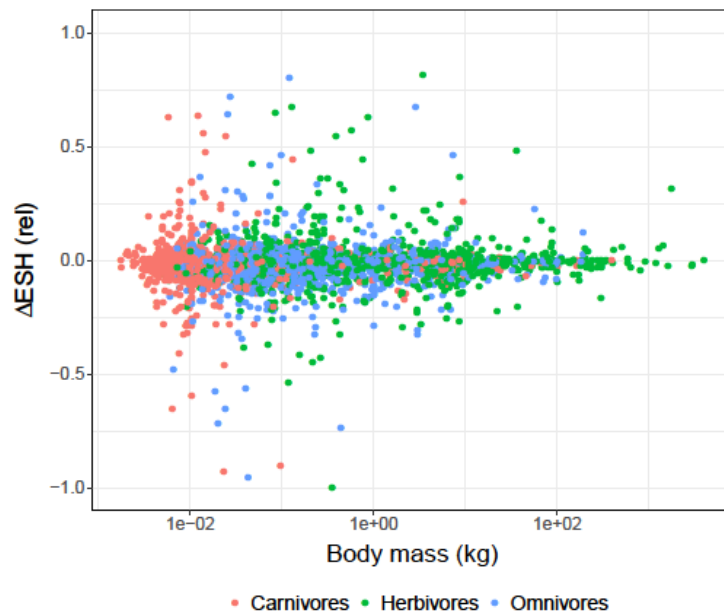
Conclusions

- Suitable method for country-based biodiversity accounting
 - Applicable across scales: from grid cell to global
- Complementary to MSA-based assessments
 - Species-specific
- Highest problems: tropical countries
 - Species pool
 - Extent of land cover change



Next steps

- Birds + amphibians
- Link with IO-models -> biodiversity footprints
- Relate traits + socio-economic factors to habitat change





Questions?