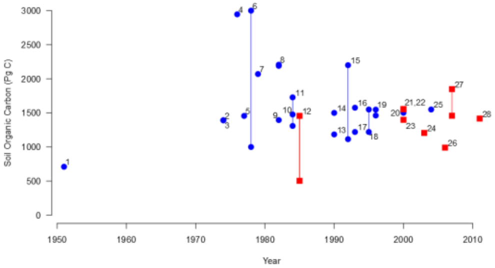
Global patterns of carbon stocks

Available datasets and open questions

UNFCCC Workshop on technical and scientific aspects of ecosystems with high-carbon reservoirs not covered by other agenda items under the Convention
Bonn, 24-25 October 2013

Cordula Epple, UNEP-WCMC

1) What types of scientific and technical knowledge are relevant to ecosystem-based mitigation?



Types of relevant information

A. Current carbon stocks
B. Maximum potential carbon stocks
C. Typical flows of greenhouse gases under different types and intensities of human impact
D. Current and projected pressures / vulnerability of carbon stocks
E. Alternative management practices
F. Practicalities (quality of data for planning, cost-benefit ratio incl. non-climate benefits, political feasibility, etc.)

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GLOBAL SCALE

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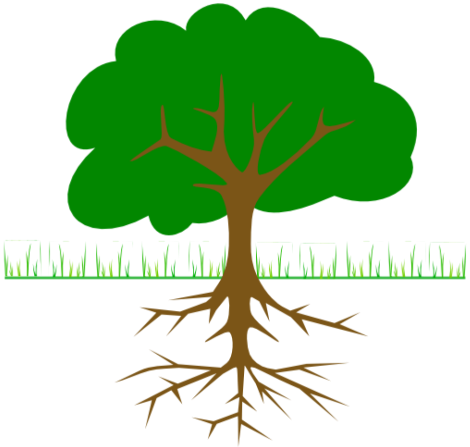
2) Available overviews on the global distribution of carbon stocks

Major carbon pools

A. Above-ground biomass
B. Below-ground biomass
C. Soil organic carbon



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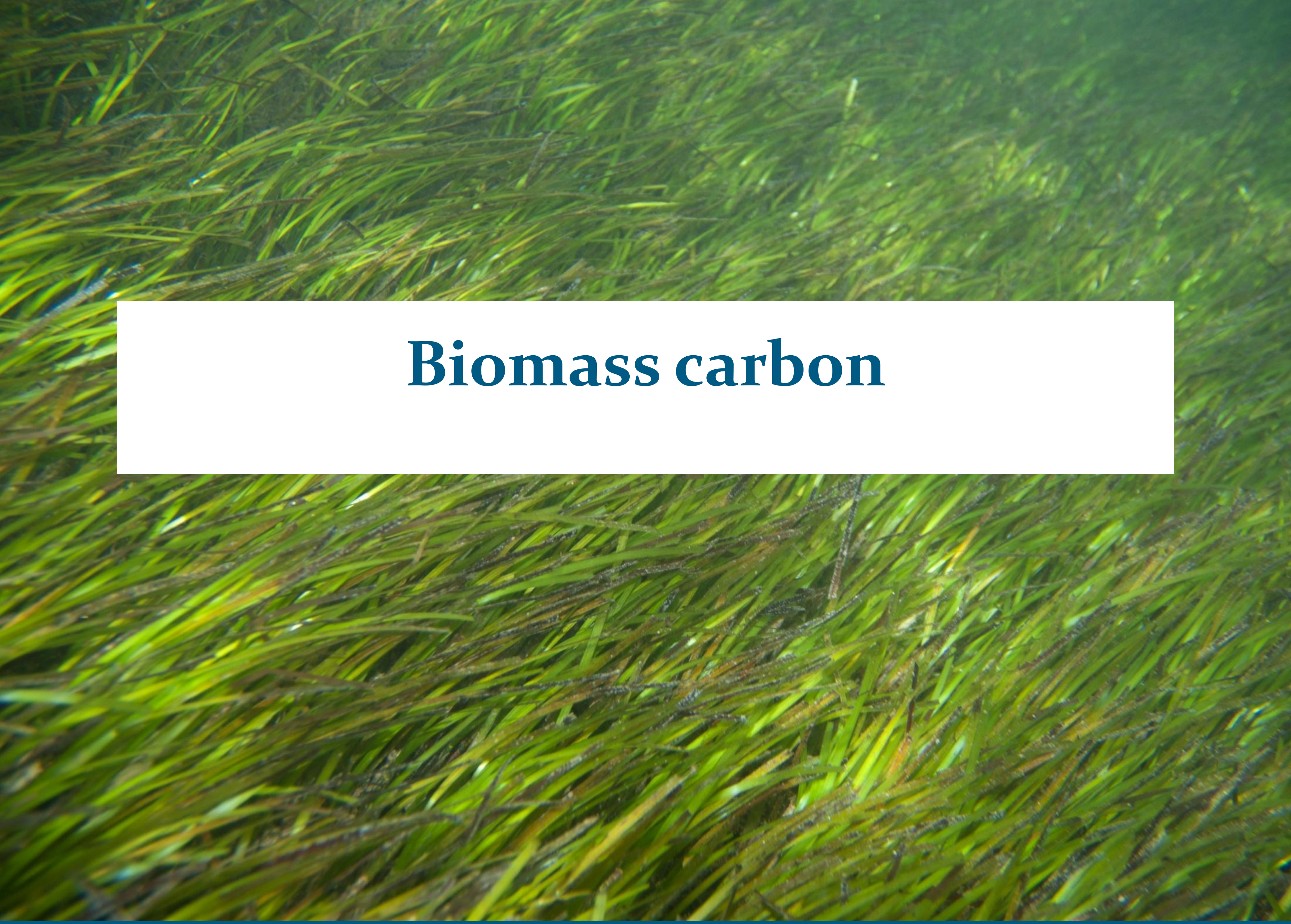
Biomass carbon



Available global or biome-wide biomass carbon datasets derived with consistent methodologies across ecosystems

A. Ruesch & Gibbs 2008

B. Saatchi et al. 2011

C. Baccini et al. 2012

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Ruesch & Gibbs 2008

- Above- and below-ground biomass
- Global coverage
- Forest and non-forest ecosystems (shrubland, grassland, cropland, mosaic systems)
- Based on **IPCC Tier-1 default values**, global land cover map (GLC 2000)

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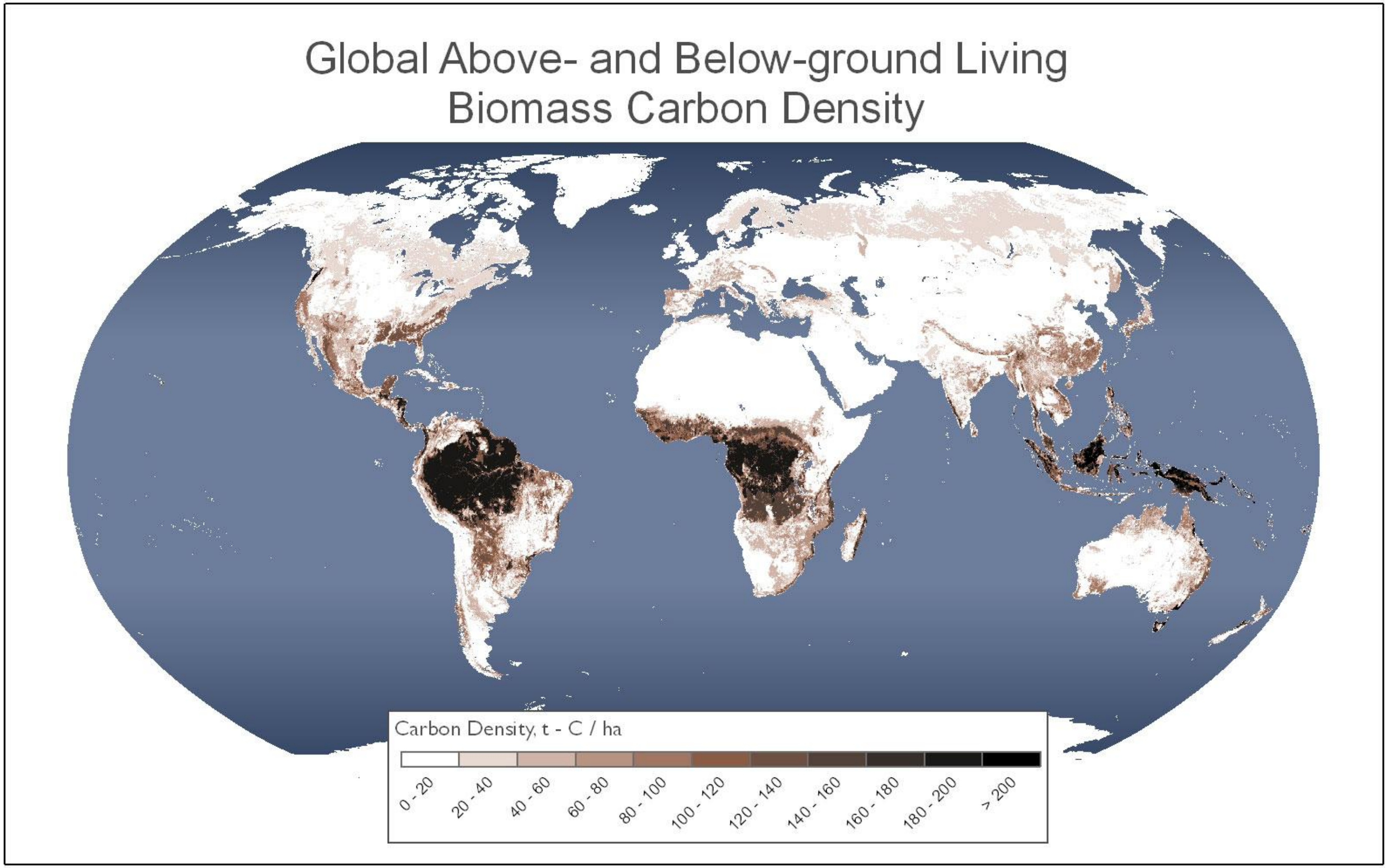

Ruesch & Gibbs 2008

Saatchi et al. 2011 / Baccini et al. 2012

- Combination of remote sensing data (GLAS LiDAR, MODIS, etc.) and field measurements (inventory plots)
- Tropical regions
- Focus on woody vegetation

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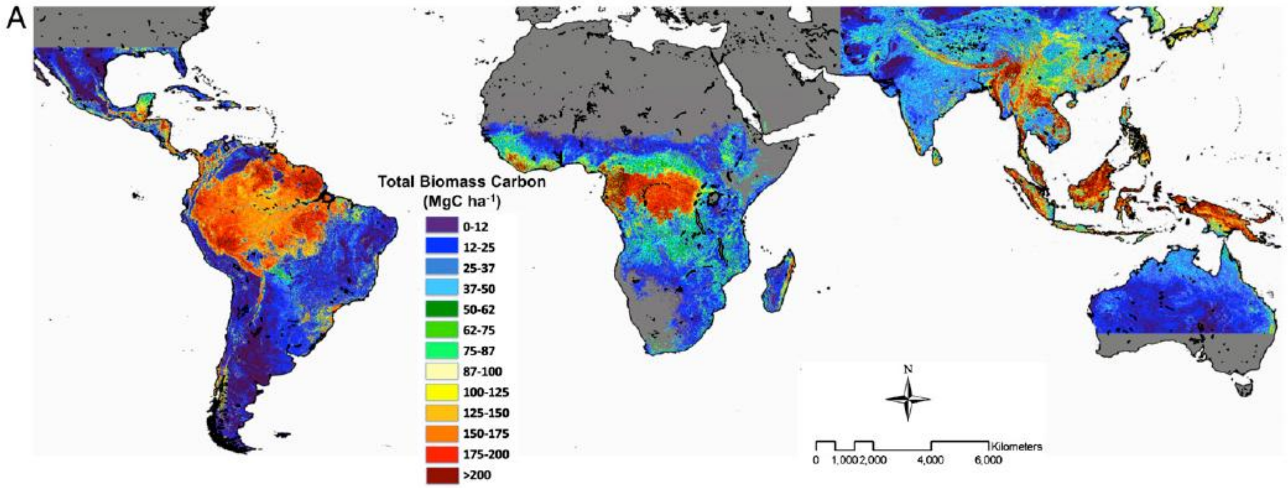
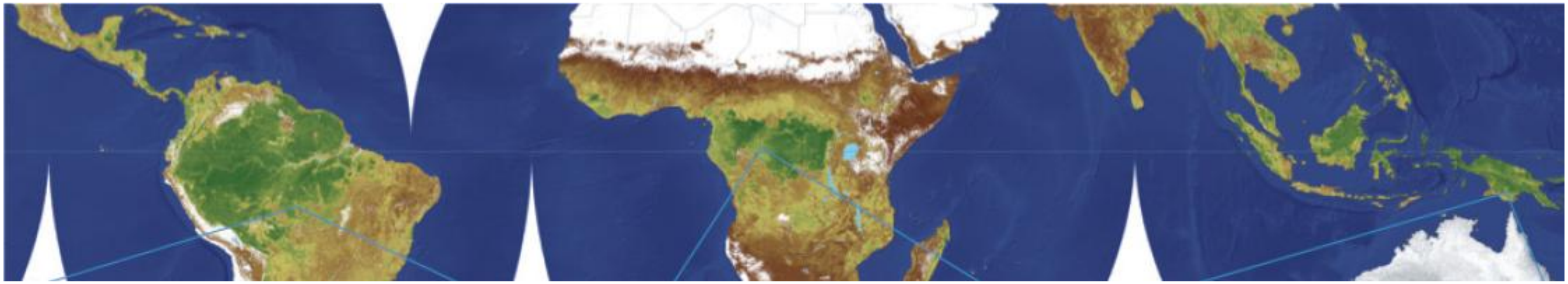
Maps of tropical (forest) carbon



Saatchi et al. 2011



Baccini et al. 2012

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Uncertainties still considerable

Even more so for ecosystems dominated by non-woody plants!

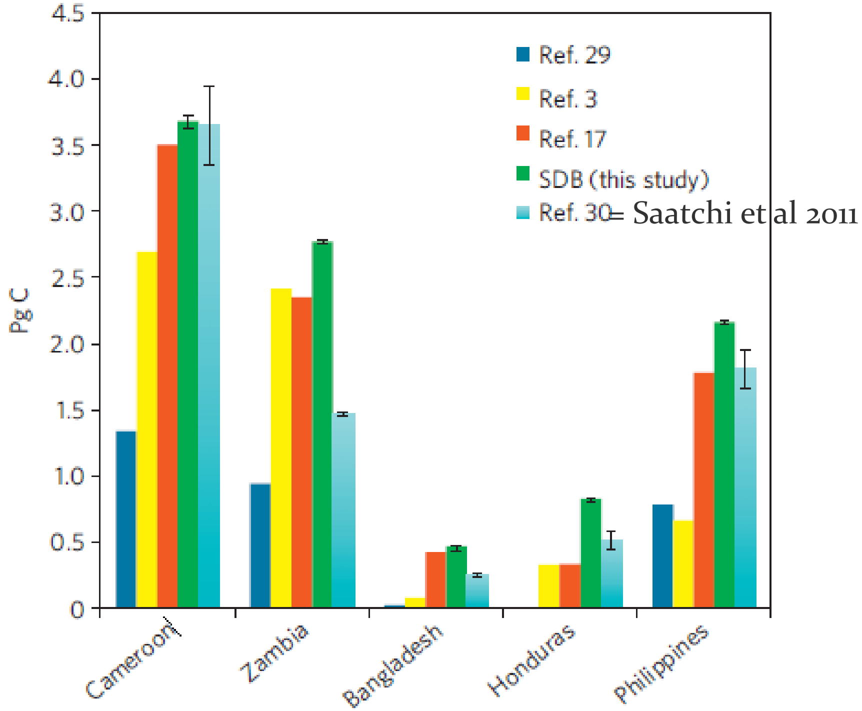

Figure 2 | Comparison of national aboveground carbon stock estimates. The figure shows five tropical nations for which FAO FRA 2005 (ref. 29), FAO FRA 2010 (ref. 3), FAO National Forest Monitoring and Assessment (NFMA) (ref. 17) and SDB estimates are available. Alternative carbon stock estimates[30] are shown for comparison. The error bars indicate the uncertainity in national level estimates (at 95% CI for SDB data).

Baccini et al. 2012

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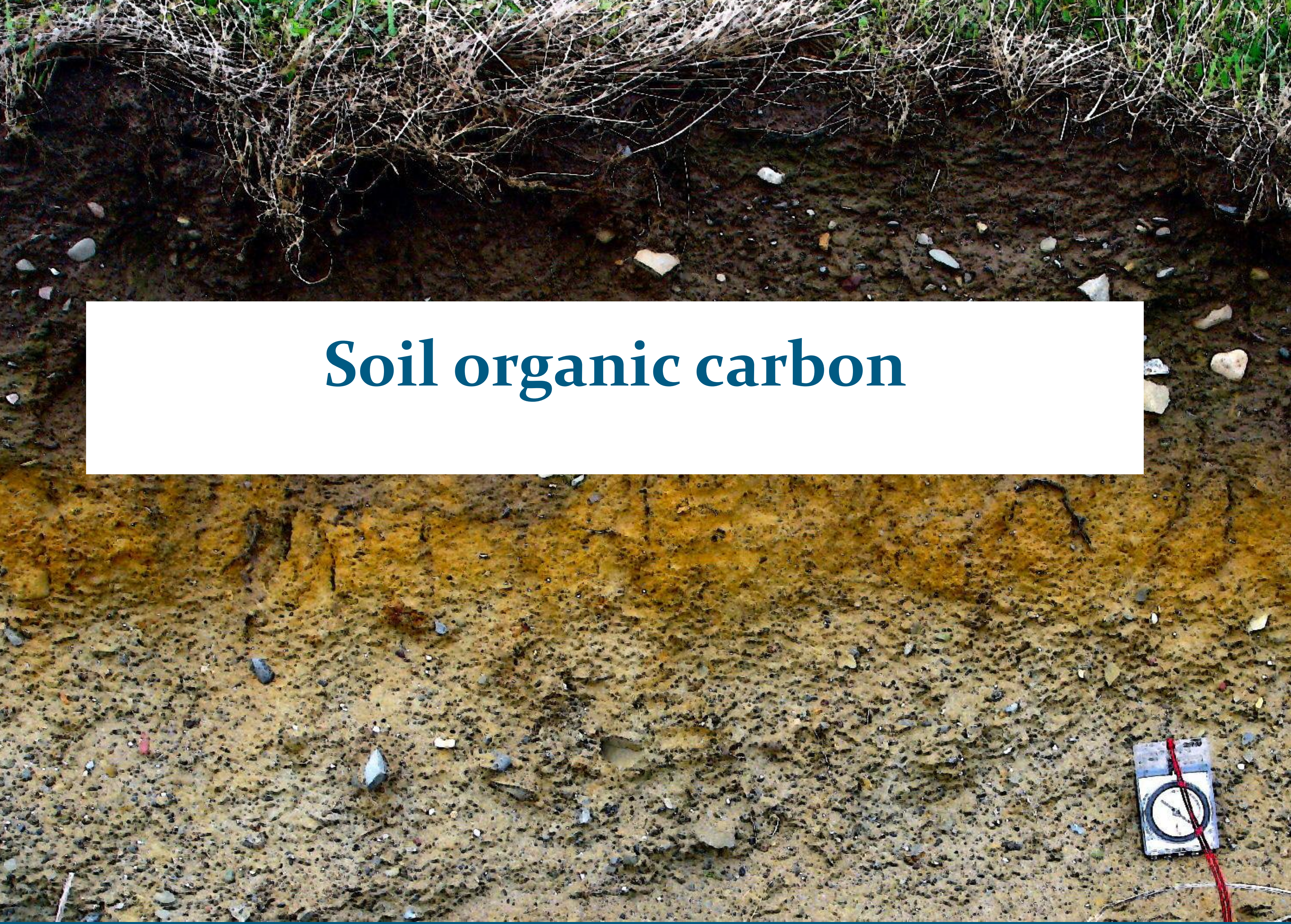
Soil organic carbon



Importance

- Soil organic pool is 2-3 times the size of that of atmospheric carbon - most studies estimate ~ 1500 Gt
- Considerable uncertainty: estimates range between 504-3000
- Information particularly scarce about soils with high carbon contents below 1 m (e.g. permafrost, peatlands, some coastal sediments)

Scharlemann et al. 2013 (submitted)

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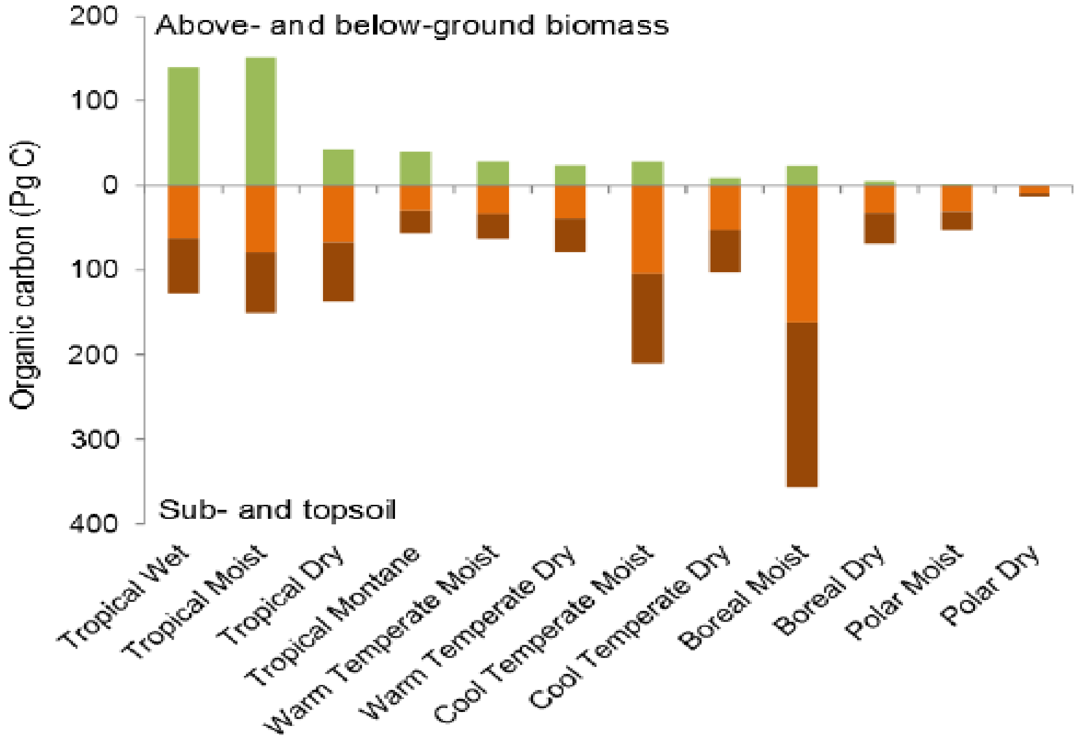
Contribution of soil organic carbon to total ecosystem carbon varies – high for boreal regions and most non-forest ecosystems



Scharlemann et al. 2013 (submitted)

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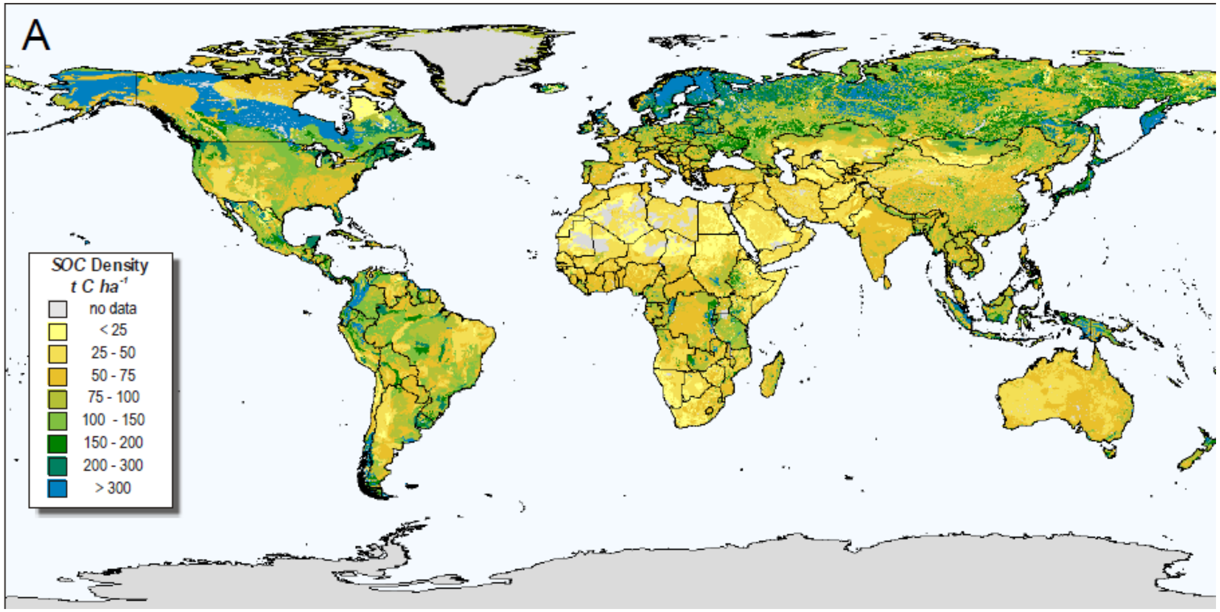
Comparison of soil carbon distribution with distribution of biomass carbon



Hiederer & Köchy 2011

3) Current knowledge on vulnerability of carbon stocks and carbon sequestration opportunities

Vulnerability of carbon stocks

Possible basis for assessment:

- Historic patterns of conversion and degradation
- Land use scenarios

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Assessing historic conversion and degradation patterns

- Significant uncertainty about extent of degraded areas; e.g. estimates for dryland area affected by desertification between 10 – 70 %
- Uncertainty about current extent of ecosystems and croplands
- Uncertainty about changes in carbon stocks, especially soil carbon
- Resulting uncertainty about cumulative emissions from land use change

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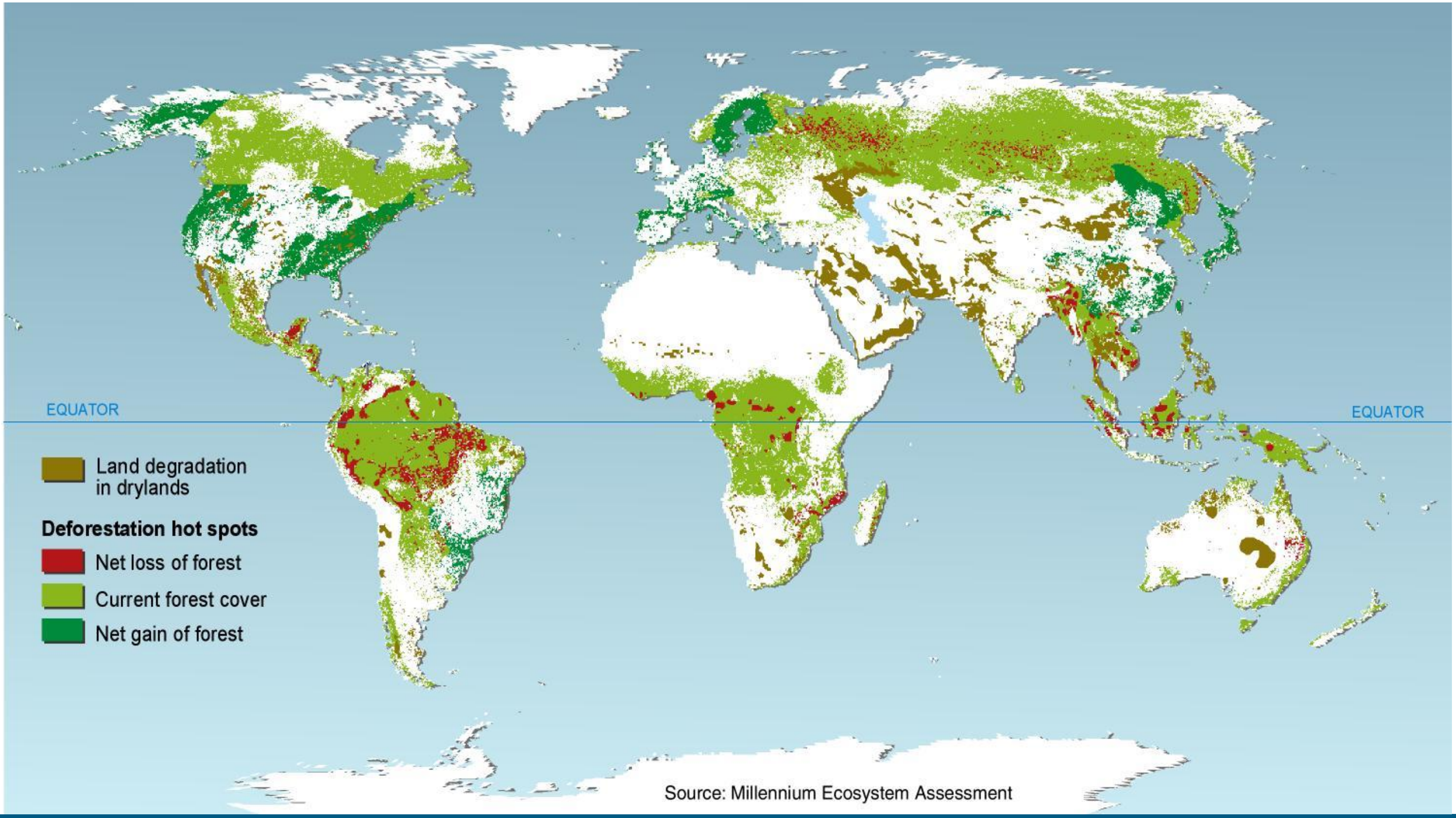
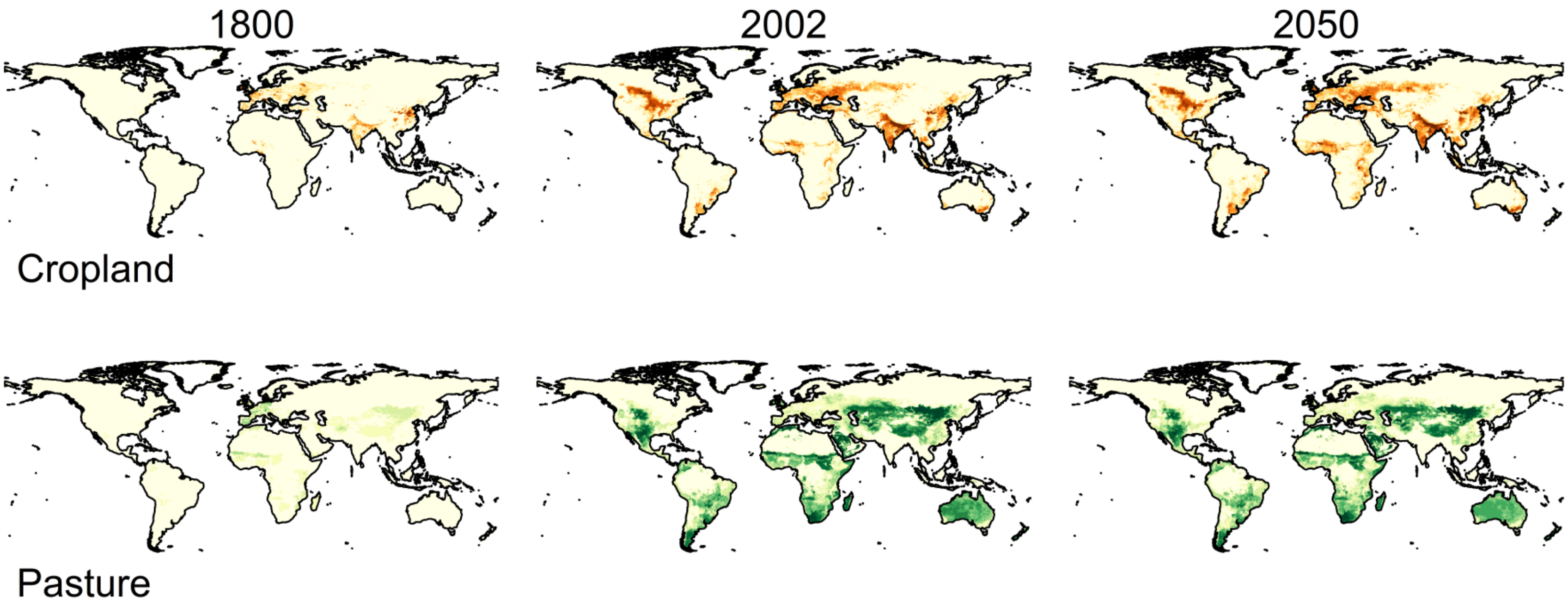
Shortened from Epple 2012

Areas of recent deforestation and land degradation



Projections – e.g. HYDE model



For description of the model see Goldewijk et al. 2010

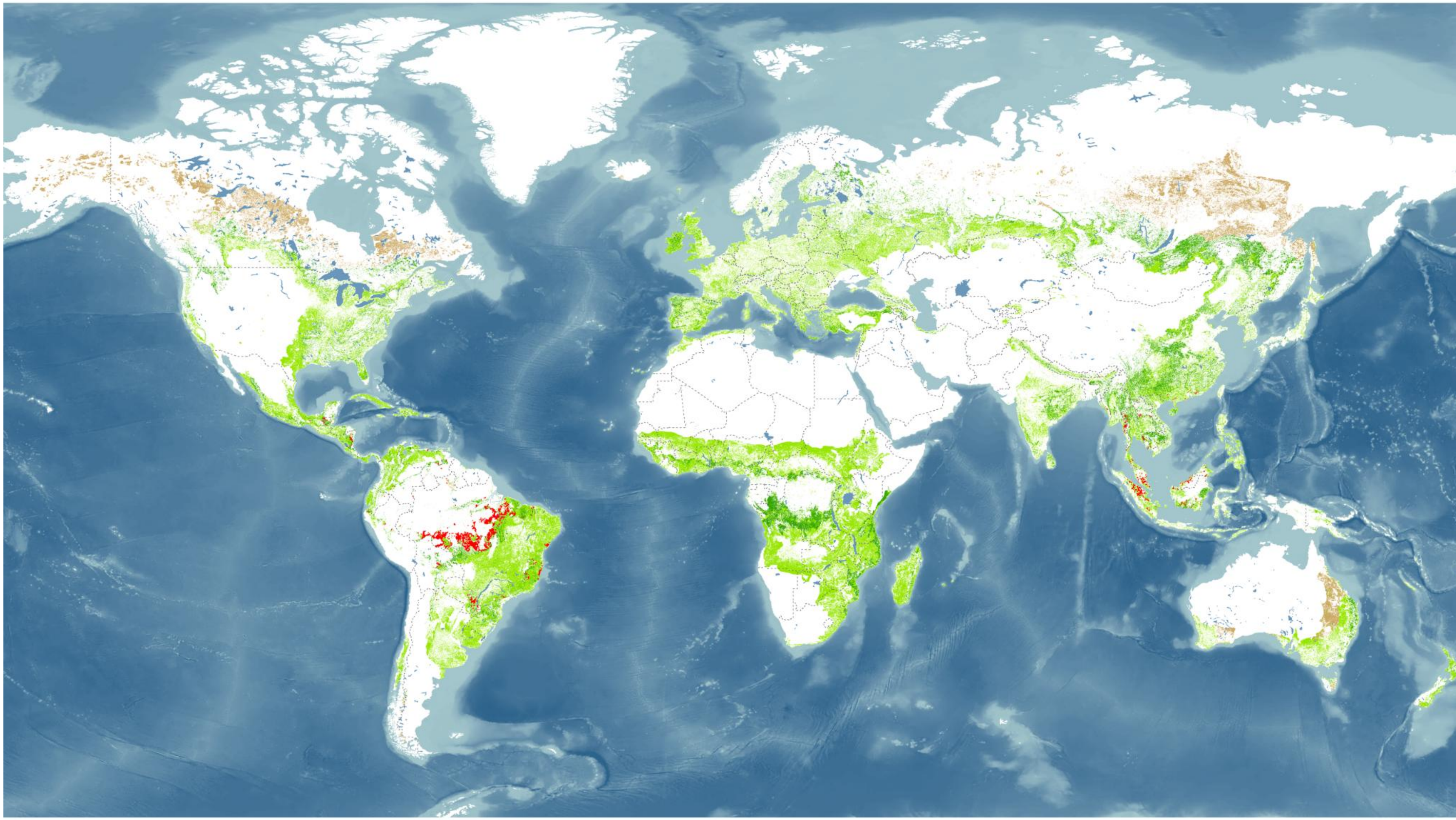
Restoring lost carbon stocks

Factors to consider in assessment of carbon sequestration opportunities:

- Current and potential carbon stock
- Constraints on restoration: current and expected population, land use

BONN CHALLENGE
on forests, climate change and biodiversity 2011

A World of Opportunity
for Forest and Landscape Restoration



FOREST AND LANDSCAPE RESTORATION OPPORTUNITIES

- Wide-scale restoration
- Mosaic restoration
- Remote restoration

OTHER AREAS

- Recent tropical deforestation

WRI 2011

4) Conclusions

- For most non-forest ecosystems, soil organic carbon is key; but significant data gaps on spatial distribution

- To identify possible mitigation actions, information on vulnerability of carbon stocks and restoration opportunities is as important as information on the size of carbon stocks themselves

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4) Conclusions

- Improved understanding of spatial variation in soil organic carbon stocks, as well as of impacts of different forms of land use on soil carbon, should be a priority
- This should include coastal soils / sediments
- Even in forests and agricultural areas, soils are only partly addressed by the Convention – are soils themselves an "ecosystem not covered by other agenda items"?

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Thank you!

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