International Sakharov Environmental University
Minsk, Belarus

LIFE CYCLE IMPACT ASSESSMENT: FEASIBILITY OF IMPACT CATEGORIES AND INDICATORS FOR PALUDICULTURES ASSESSMENT

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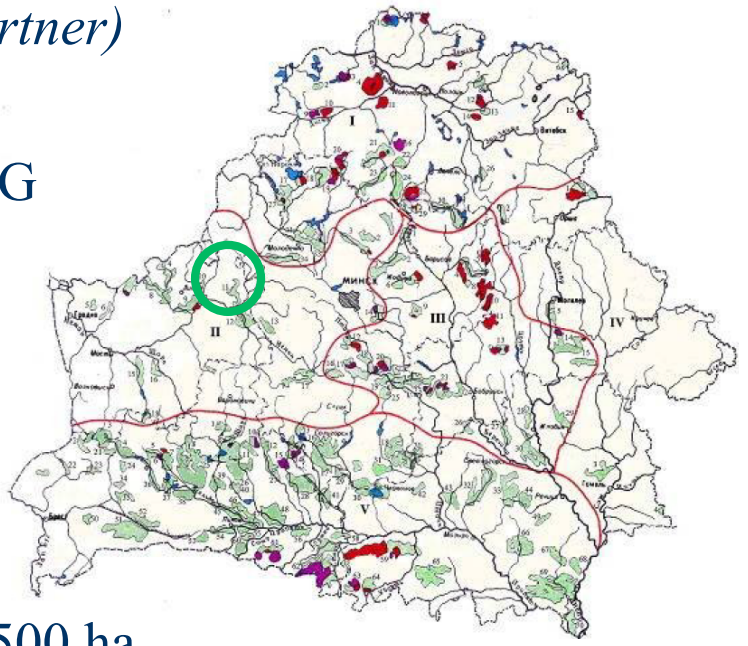
CONTENT

1. PROJECT DESCRIPTION. LCA OF OBTAINING RENEWABLE BIOFUELS (BIO-BASED BRIQUETTES) FROM REWETTED FORMERLY DEGRADED PEATLANDS
2. LAND USE ASSESSMENT WITHIN LCA. IMPACT CATEGORY “LAND CONVERSION TO PALUDICULTURES”
3. CONCLUSION
4. DISCUSSION

[1] GENERAL INFORMATION ABOUT THE PROJECT

- ***Project title:*** Implementation of new concepts for wet peatland management for the sustainable production of biomass-based energy (wetland-energy)
- ***Management structure of the project:***
  - *Michael Succow Foundation (project coordinator)*
  - *International Sakharov Environmental University (partner)*
  - *Institute for Nature Management of the NAS (partner)*
  - *Lida peat factory (subcontractor)*
- ***Main goal:*** to demonstrate the reduction of GHG and the related biodiversity benefits through restoration and sustainable management of large degraded peatlands and substitution of peat briquettes by bio-briquettes based on wetland biomass
- ***Project area:*** Dokudovskoe peatland
  S_{total}= 7 811 ha, $S_{depleted}$= 4 989 ha, $S_{rewetted}$ ≈ 3 500 ha



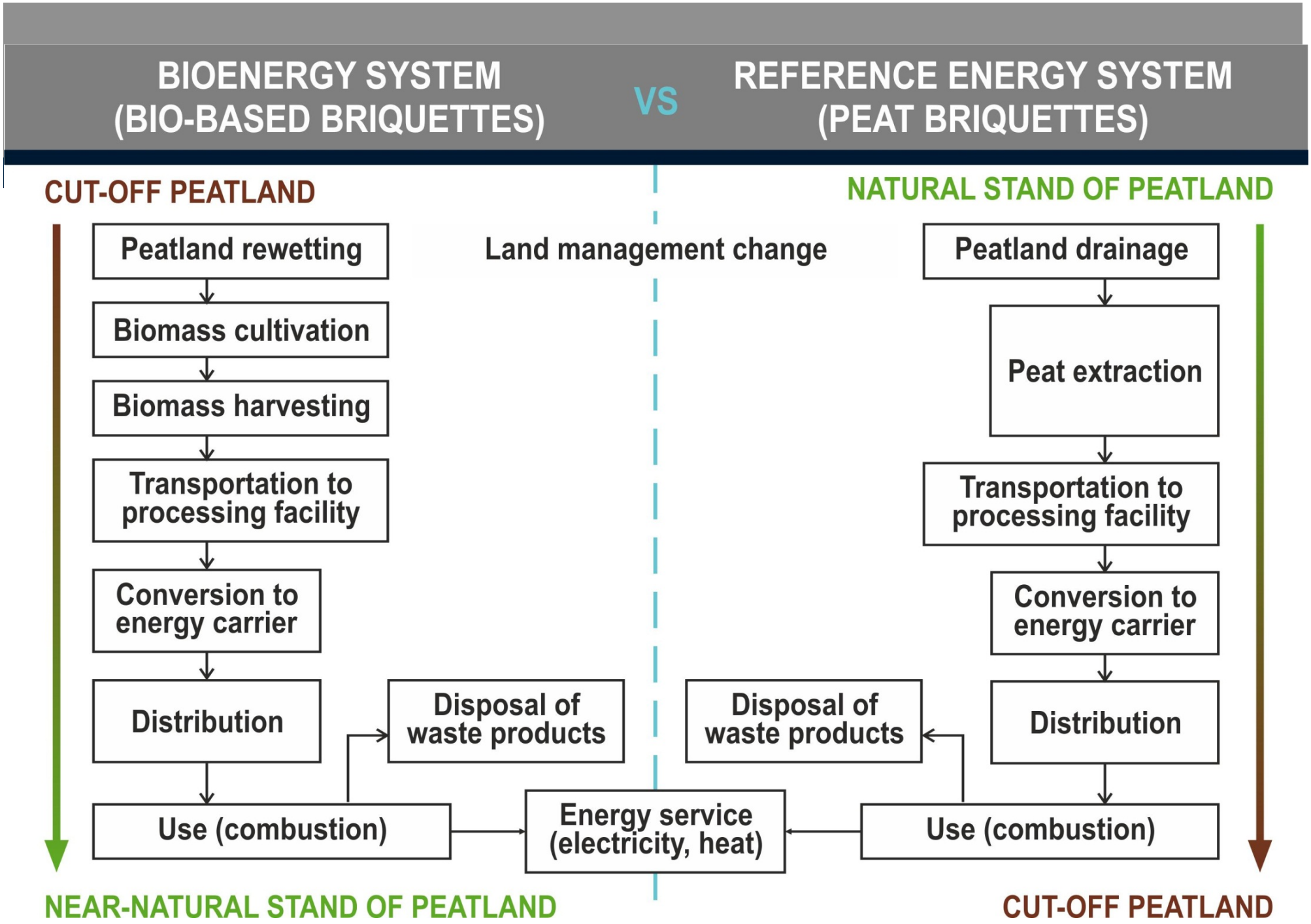
[1] LCA. GOAL AND SCOPE DEFINITION

Action 4.7 Life cycle analysis of biomass from wet peatlands

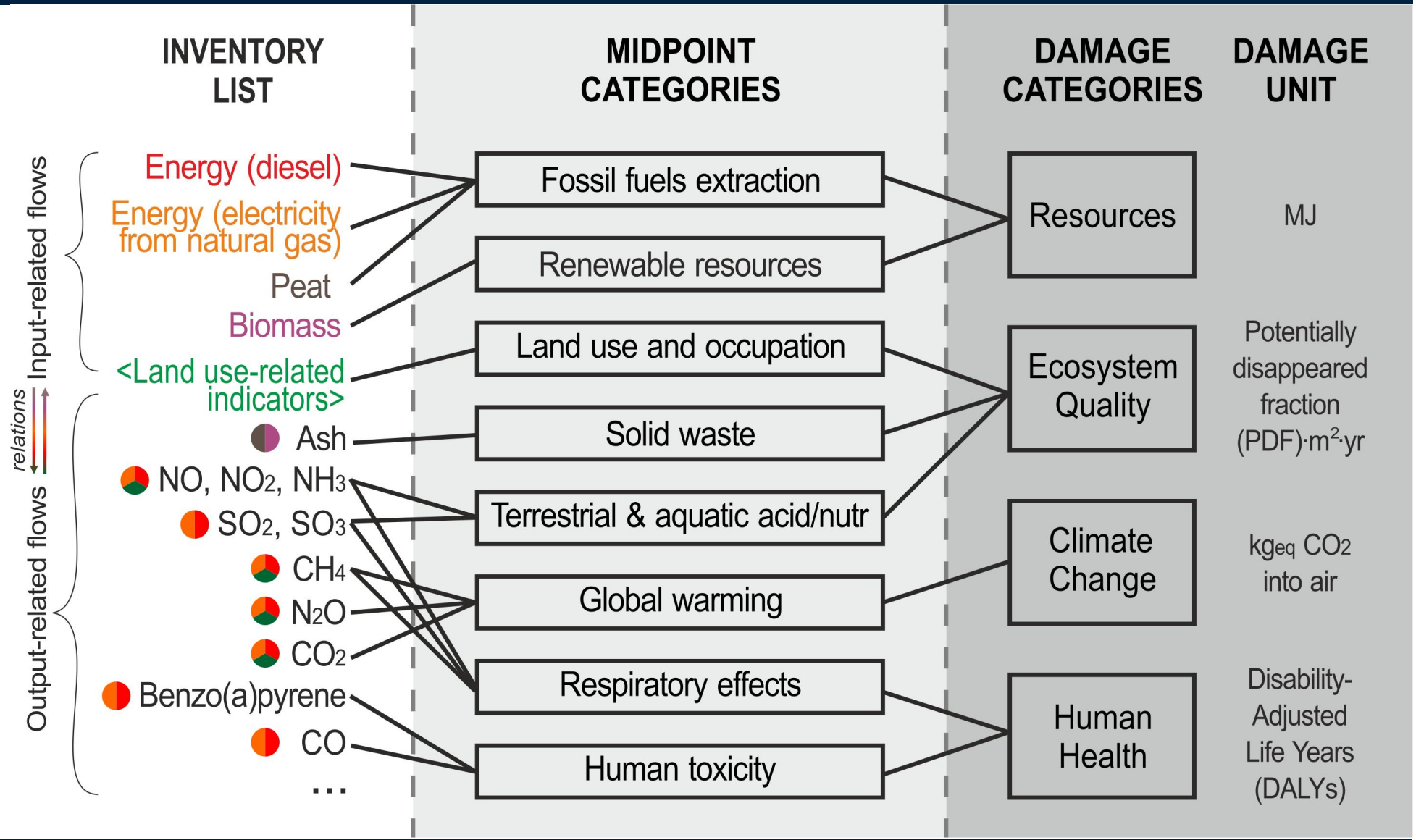
- **Production** – 1 ton of bio-briquettes (based on wetland vegetation)
- **Chosen function of biomass for LCA** – energy crop
- **Functional unit** – 1 ton of standard fuel
- **Goal of an LCA**: to investigate ***all impacts*** of bio-briquettes on the environment along with cost-benefit analysis.

Comparison with peat briquettes production

- **System boundaries:** from peatland rewetting to energy production (briquettes combustion) + after-treatment of peatland

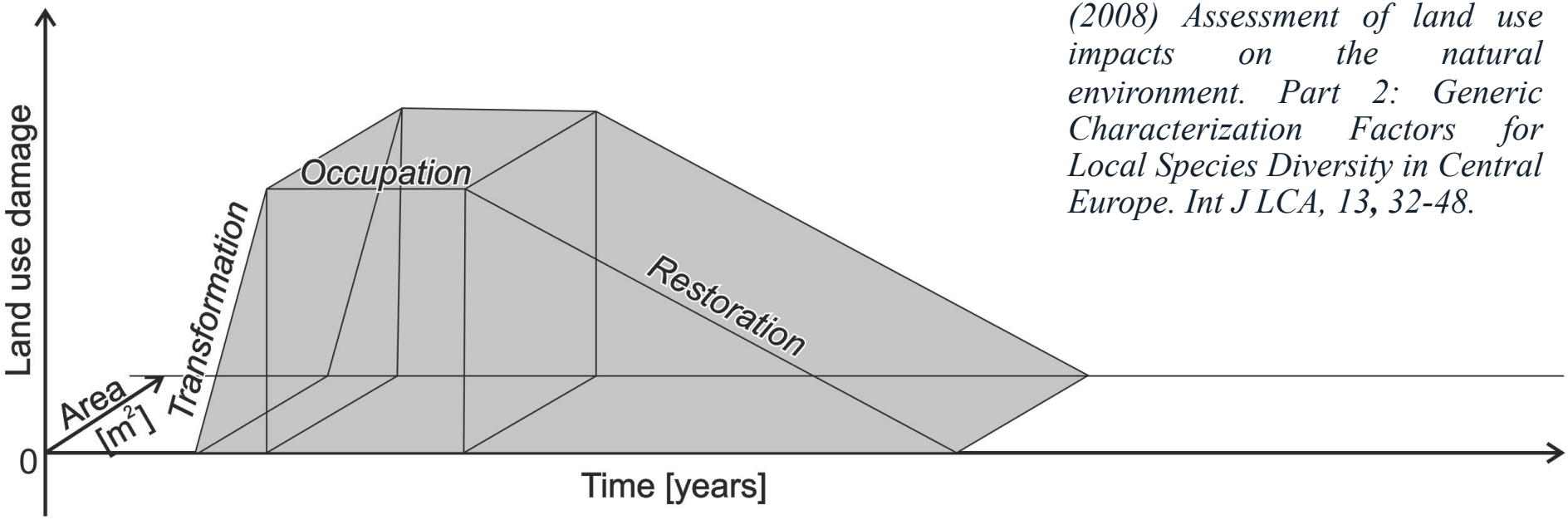

BIOENERGY SYSTEM (BIO-BASED BRIQUETTES)
VS
REFERENCE ENERGY SYSTEM (PEAT BRIQUETTES)
CUT-OFF PEATLAND
NATURAL STAND OF PEATLAND
Peatland rewetting
Land management change
Peatland drainage
Biomass cultivation
Peat extraction
Biomass harvesting
Transportation to processing facility
Transportation to processing facility
Conversion to energy carrier
Conversion to energy carrier
Distribution
Disposal of waste products
Disposal of waste products
Distribution
Use (combustion)
Energy service (electricity, heat)
Use (combustion)
NEAR-NATURAL STAND OF PEATLAND
CUT-OFF PEATLAND

[1] LCA. IMPACT ASSESSMENT



[2] LAND USE ASSESSMENT WITHIN LCA

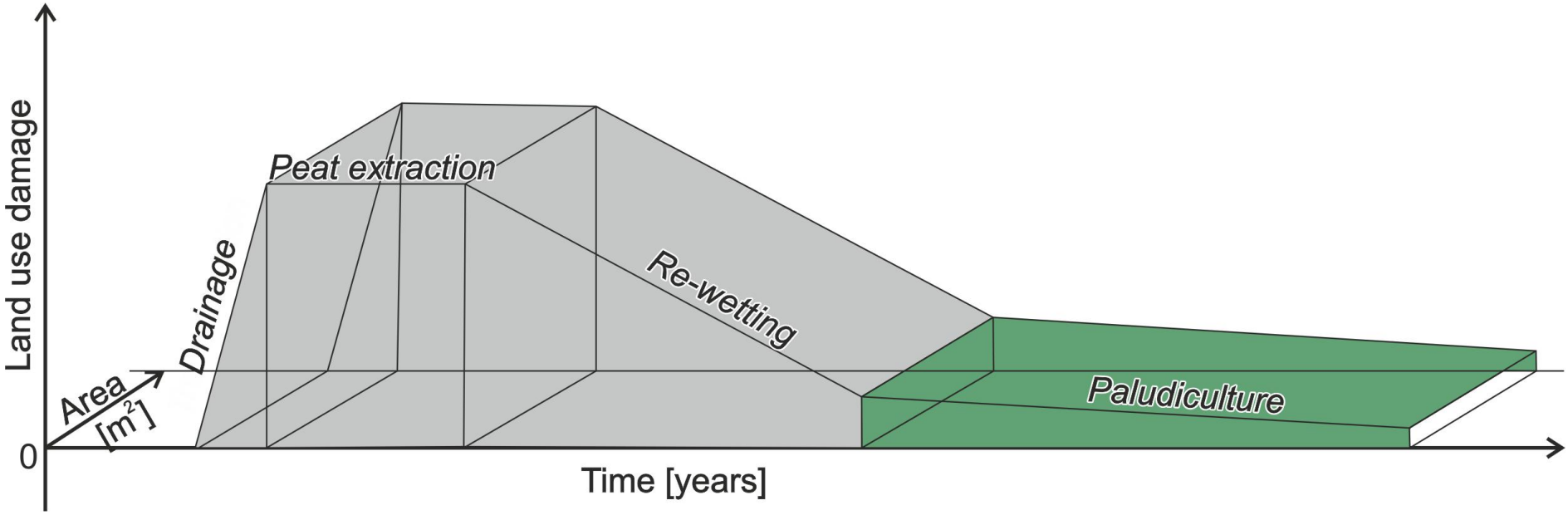
- Absence of commonly accepted methodology for including land use impacts in LCA
- Land use = Land transf. + Land occup. + Land restoration



Source: Koellner, T. & Scholz, R. (2008) Assessment of land use impacts on the natural environment. Part 2: Generic Characterization Factors for Local Species Diversity in Central Europe. Int J LCA, 13, 32-48.

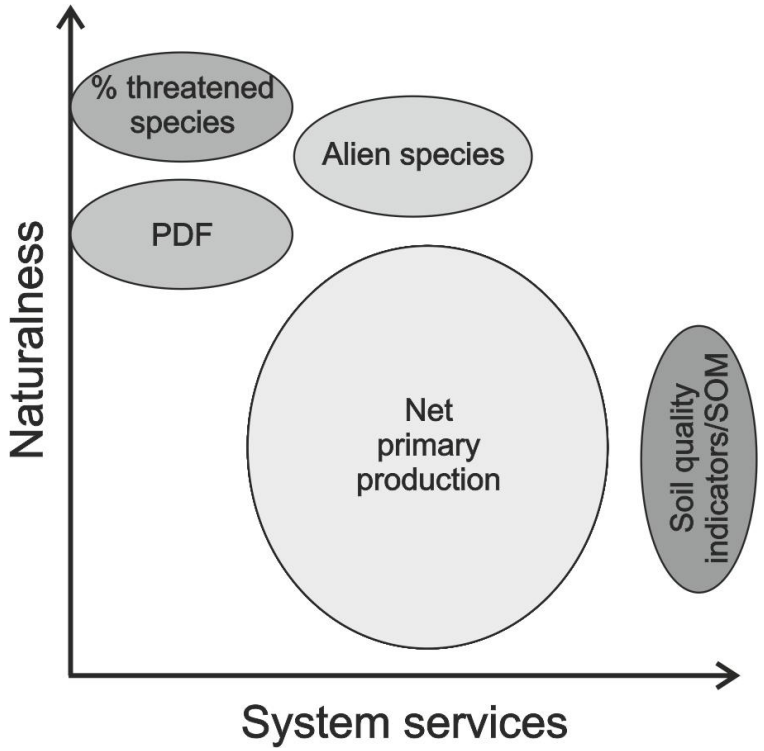
[2] LAND USE ASSESSMENT WITHIN LCA

- Absence of commonly accepted methodology for including land use impacts in LCA
- Land use = Land transf. + Land occup. + Land restoration
- Baseline? — Untouched peatland



[2] LAND USE ASSESSMENT WITHIN LCA

- Absence of commonly accepted methodology for including land use impacts in LCA
- Land use = Land transf. + Land occup. + Land rehabilitation
- Baseline? — Untouched peatland
- What do we need to preserve?
  - ➢ "Naturalness"?
  - ➢ Ecosystem service?



Source: Value choices in life cycle impact assessment (PhD-thesis). De Schryver, A. M. 2010.

[2] LAND USE ASSESSMENT WITHIN LCA

- Absence of commonly accepted methodology for including land use impacts in LCA
- Land use = Land transf. + Land occup. + Land rehabilitation
- Reference status? — Untouched peatland
- What do we need to preserve? — "Naturalness"
- What to take into account?

Indicators should be:

- consistent with the goal and scope of the LCA study,
- environmentally relevant,
- internationally accepted,
- qualitative.

[2] LAND USE ASSESSMENT WITHIN LCA. INDICATORS APPLICABLE TO PALUDICULTURES

LAND USE INDICATORS

- Soil quality
  - Loss of nutrients (SOC/SOM)
  - Microbiotic transformation (enzymatic activity)
  - Peat layer thickness (cm)
- Disturbance of soil structure
  - Soil compaction (pressure in kg/cm^2)
  - Soil sealing (share of sealed area in m^2)
  - Soil density (g/cm^3)
  - Soil porosity (%)
  - Soil moisture content (%)
- Biodiversity
  - Naturalness of vegetation (%)
  - Spontaneity of vegetation development (ha)
  - Continuity of vegetation development (ha)
  - Plant society (number of species)
  - Net primary production (t DM per ha)
- Emission protection → GHG balance (t CO_2-eq)
- Groundwater recharge (mm of GWL)
- Land use efficiency (m$^2 \cdot$a^{-1})
- Competition of land use types (qualitative analysis)
- Employment impact (number of people employed)
- Cultural & landscape values (qualitative analysis)

[3] CONCLUSIONS

- Land use impacts are of a great importance, but are often not addressed in LCAs, including for different biofuels pathways

- There is no widely accepted methodology for including land use impacts in LCA → need to be developed

- When assessing paludicultures (for biofuels):

– "Naturalness" of ecosystem should be preserved
– Baseline – untouched peatland
– An advisable set of indicators has been developed

Thank you
for your attention!

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