

Implications of global biomass trade on the human appropriation of net primary production

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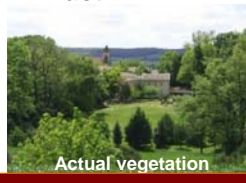
The HANPP framework

NPP0

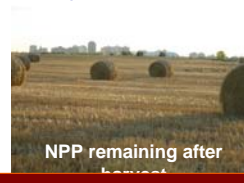


Annual energy of
the potential ve
(without human
use, e.g. Forest
Grasslands,
Savannahs, etc

NPPact

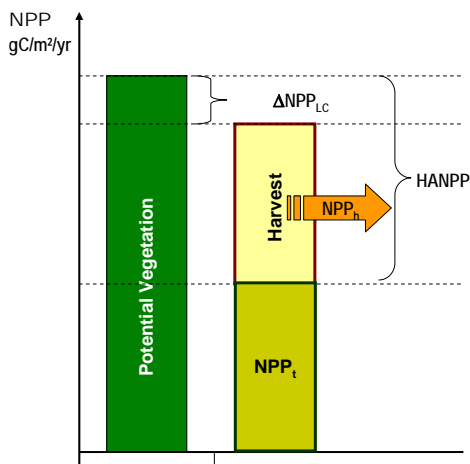


NPPt



- Indicator of land-use intensity
- Integrated socio-ecological perspective
- ‚Pressure‘ indicator, useful to analyze drivers of land use: can be directly related to socio-economic activities: land use activities (harvest, land conversions) in agriculture, forestry, infrastructure

HANPP definition



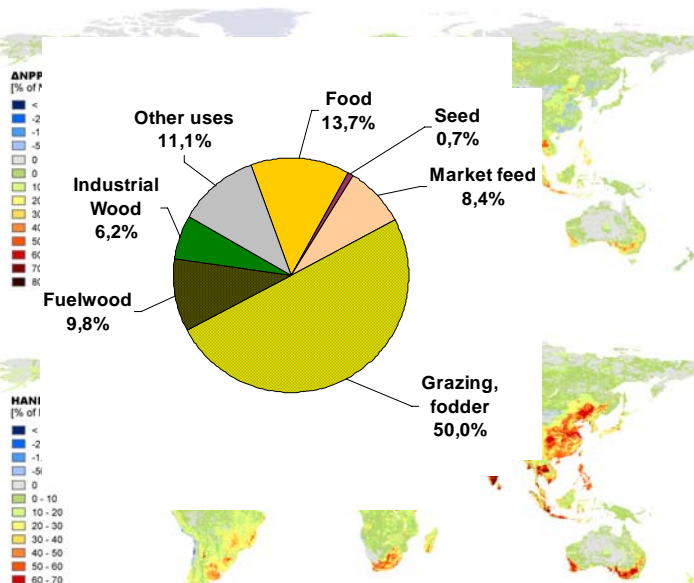
- Links natural with socioeconomic processes
- Integrated socio-ecological perspective
- HANPP can be directly related to socio-economic activities: land use activities (harvest, land conversions) in agriculture, forestry, infrastructure



Global HANPP 2000

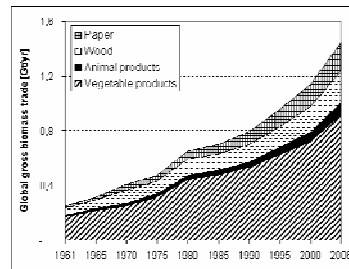
$\Delta NPP_{LC}\%$:
Productivity changes
due to land
coverings
<< 10% >>

HANPP%:
Aggregated effect of
land use and
harvest
<< 24% >>

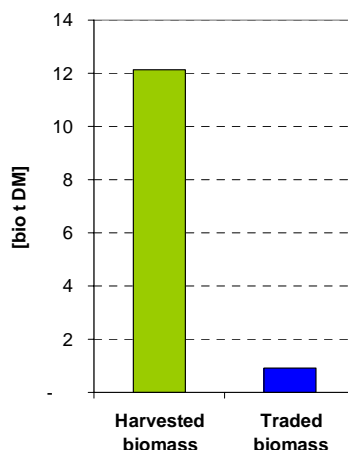


Linking drivers & impacts

- HANPP maps refer to biomass production and thus **locate environmental pressures and ecological impacts** (→ valuable to assess effects of land use on biogeochemical cycles, biodiversity, etc.)
- HANPP does not directly relate to biomass **consumption**, a major **socio-economic driver** of land use)
- Biomass trade results in an increasing spatial disconnect between biomass production and consumption (“**teleconnections**”, “**lateral fluxes**”)

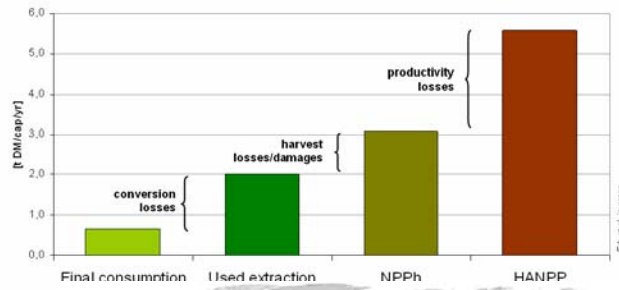


HANPP and internationale Trade

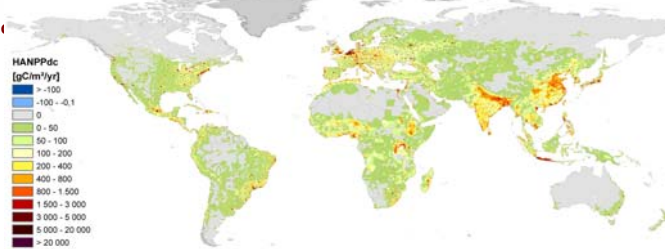


- Only 7% of harvested biomass are trade internationally
- HANPP upstream factors are large and vary widely (3 to 20, global average 6)
- Trade statistics are not sufficient to analyse these teleconnections: upstream requirements of biomass products are **type specific** and vary largely between different locations of production (**land use systems**)
- Standardized accounting frameworks needed:
 - → ,embodied HANPP“
 - the amount of HANPP resulting from the consumption of biomass products

Embodied HANPP: Linking drivers & impacts



Soci

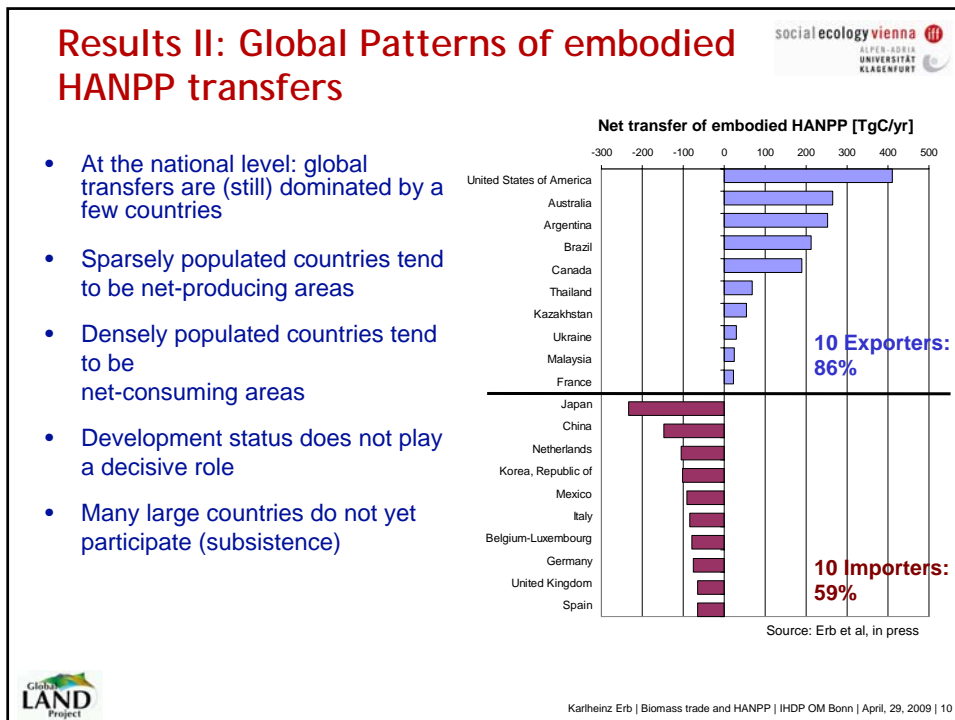
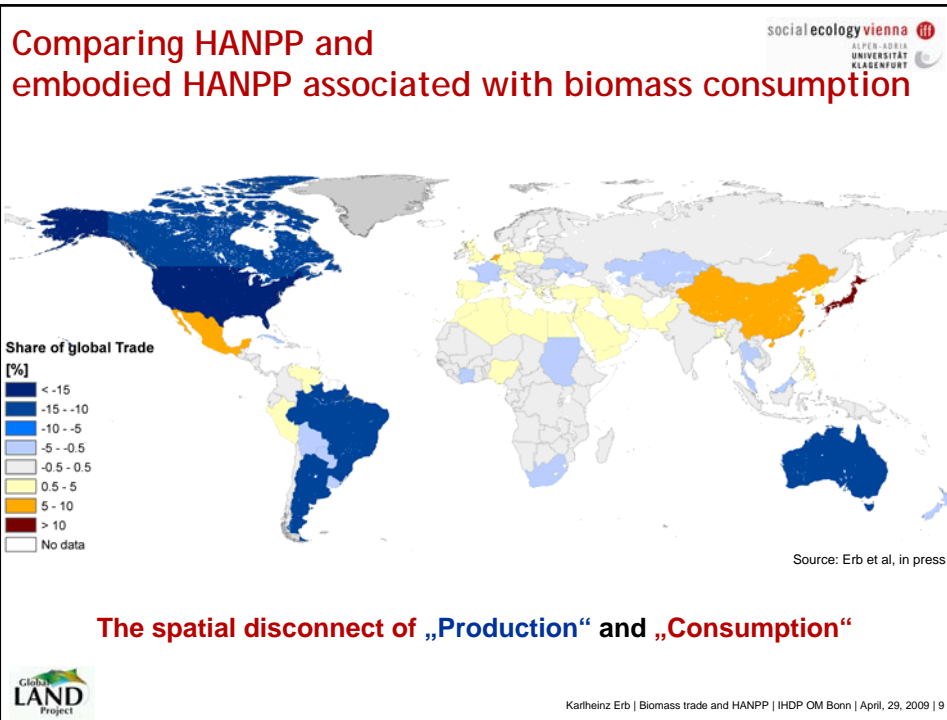


Based on per capita consumption, factors for upstream requirements, and population density (similar: LPR-Ecological Footprint, or Imhoff et al. 2004)



Comparing HANPP and embodied HANPP associated with biomass consumption





Conclusions

- The spatial disconnect is considerable: international “transfer” of 1.7 PgC/yr in 2000 [global deforestation: 1.5 PgC/yr], and is bound to increase
- Large, densely populated countries, which do not yet participate, will soon do so (e.g. China, India)
- Drivers AND consequences of land use are global. No simple causal chains between drivers and associated impacts
 - relevant: increased demand for bioenergy in industrialized regions
- Challenge for sustainability science and management:
 - High degree of international interdependence (vulnerability, resilience)
 - high risk of shifting the environmental burdens to distant locations and withdrawing it from environmental legislation
 - markets will not minimize burdens, as many ecosystems services have no price
 - → need for global monitoring and management of biomass demand & supply

The End

Thank you for your attention!

Further information/maps/data:
<http://www.uni-klu.ac.at/socec/>

- Future biomass demand will surge: population growth (8-9 bill. 2050), surges in animal fractions in diet (strongly correlated with income), bioenergy strategies
- Supply side: Options/potentials for sustainable biomass utilization are limited
 - Land use expansion to areas with currently small HANPP (where? Amazon, boreal regions? What about biodiversity endangerment?)
 - Intensification of production (yield increases e.g. in agriculture)
 - Gains in land-use efficiency: fostering the use of „backflows to nature“, reducing fires, or productivity losses
 - → all strategies may come at high socio-ecological costs: requires integrated perspectives