

# IMEA

## WP 6

# „Environmental Footprints: Land and Water Assessments“

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# Outline

- Overview of land and water use methods
  - System description
  - Spatial coverage
  - Data requirements
- Transboundary issues for application to imports

# EAMs discussed in WP6

- EF:** The Ecological Footprint (Wackernagel & Rees 1996, Monfreda et al. 2004, Kitzes et al. forthcoming)
- HANPP:** Human Appropriation of Net Primary Production [HANPP] (Haberl et al. 2007, Vitousek 1986)
- ALD:** Actual Land Demand (Erb 2004, Gerbeens-Leenes & Nonhebel 2002, Haberl et al. 2001)
- WF:** Virtual Water Trade, Water Footprint (Hoekstra & Hung 2002)

# Focus of the EAM

EF	Flows (production, import, export) of materials (biomass inputs, CO2 outputs) converted to share of global stocks (area) in each year. Also built-up land and some commercial energy flows.	gha/yr
HANPP	Flows (production, import, export) of biomass compared to flows in the absence of human intervention. Also built-up land.	gC/m2/yr
ALD	Flows (production, import, export) of materials (biomass inputs, CO2 outputs) converted to actual area required for its production in each year.	ha/yr
WF	Flows (production, import, export) of biomass materials, along with selected household and industrial processes.	m3/yr

# System description: EF

Selective national apparent consumption of

- biomass,
- fossil, hydro, nuclear energy
- built-up land.

Some consumption is addressed through

- its inputs (biomass),
- though outputs (CO<sub>2</sub> emissions for fossils)
- hypothetical CO<sub>2</sub> emissions required for replacement for nuclear.

The goal is the estimation of upstream (biomass) and downstream (CO<sub>2</sub>) land required by the consumption. However, the result mixes real land used for biomass production, and hypothetical land necessary for CO<sub>2</sub> sequestration.

CO<sub>2</sub> sequestration is considered a temporary solution at best by Kyoto CDM.

# System description: HANPP

- Several layers:
  - national apparent consumption and production of biomass
  - Land removed from biomass production by urbanization and infrastructure.
  - Net Primary Production in the absence of human intervention (but with current state of land degradation, erosion etc).

# Spatial coverage and resolution

EF	Global terrestrial coverage, national resolution. Combines national data on apparent consumption with <a href="#">global yield average</a> .	Annual 1961-2003
HANPP	Global terrestrial coverage, spatially-explicit. Combines national data on apparent consumption with <a href="#">spatially explicit data</a> on land use, land cover and ecosystems productivity.	3-5 year average Year 2000
ALD	Individual national studies exist, require bilateral trade matrices and <a href="#">national yield factors</a> .	Annual
WF	Global terrestrial coverage, national resolution. Combines national data on apparent consumption of water in industry and households, and water used in agriculture. Uses <a href="#">national averages</a> of agricultural yields and water requirements per crop and area.	Annual Some time- series.

# Data basis and available results

- EF      FAO, UNECE, FRA, TBFRA, Global Fibre Supply Study, Corine land cover, CDIAC, IEA, IPCC, BP, UN Comtrade  
NPP Casa model  
Upstream factors: assumptions of GFN and SEI  
GFN provides global data, national level, yearly updates
- HANPP   FAO, FRA, TPFRA  
NPP: Lund-Postdam-Jena DGVM  
Upstream factors from national biomass production, HANPP flow and trade flows (one study).  
Institute of Social Ecology provides 2000 global data, indicator considered by EEA.
- ALD      FAO, national databases on biomass.  
Individual studies exist.
- WF      Agricultural statistics, Water statistics, Trade statistics  
Evotranspiration models  
Individual studies exist, Living Planet Report is the flagship reference.

# Transboundary issues in EF

- The footprint demand for imported goods is calculated separately. Using bilateral trade matrices, the resulting global area demand can be related to countries of origin (currently not implemented). In this context, two major caveats are warranted:
  - the EF of imported biomass is expressed in “global hectares” and has no direct relation to the use of ecosystems or to land use in countries of origin.
  - The land under use for the production of biomass products in agriculture (cropland and pastures) is assumed to be of the same extent of the biocapacity area, i.e. sustainable, no overshoot is possible through agricultural land use (conservative approach).
- These two aspects impede the establishment of links between imports and global ecosystem impacts.

# HANPP and transboundary issues

- Can quantify the HANPP associated with imported biomass products. A first global study of transboundary effects of biomass flows on global HANPP patterns shows that:
  - a small fraction of **6%** of all harvested biomass is exported,
  - global biomass trade is associated with **21%** of global HANPP.
  - In some countries, more than **50%** of the HANPP associated with domestic biomass consumption is related to imports.
- A quantification of the HANPP associated with (imported) biomass products requires country and product specific factors to calculate
  - a) the upstream biomass requirements for the production of a certain biomass product (or an aggregate of products) and
  - b) the  $\Delta\text{NPP}_{\text{LC}}$  associated with the provision of this biomass in the exporting country.

These factors can be derived from national HANPP accounts or life cycle assessments of specific biomass products, but further research to improve the quality of these factors is required.
- Currently, imports treated as aggregate (not related to country of origin). Could change (using bilateral trade matrices), data intensive.

# Transboundary issues and WF

- WF was designed to treat transboundary issues of water implications of traded goods.
- Goal is to determine upstream factors – “virtual” or embodied water, based on national factors.
- Explicitly accounts for countries of origin and destination.