Experiences of linking 2 European LCI databases and 3 LCIA methods for land use impacts

TNO Industrial Technology

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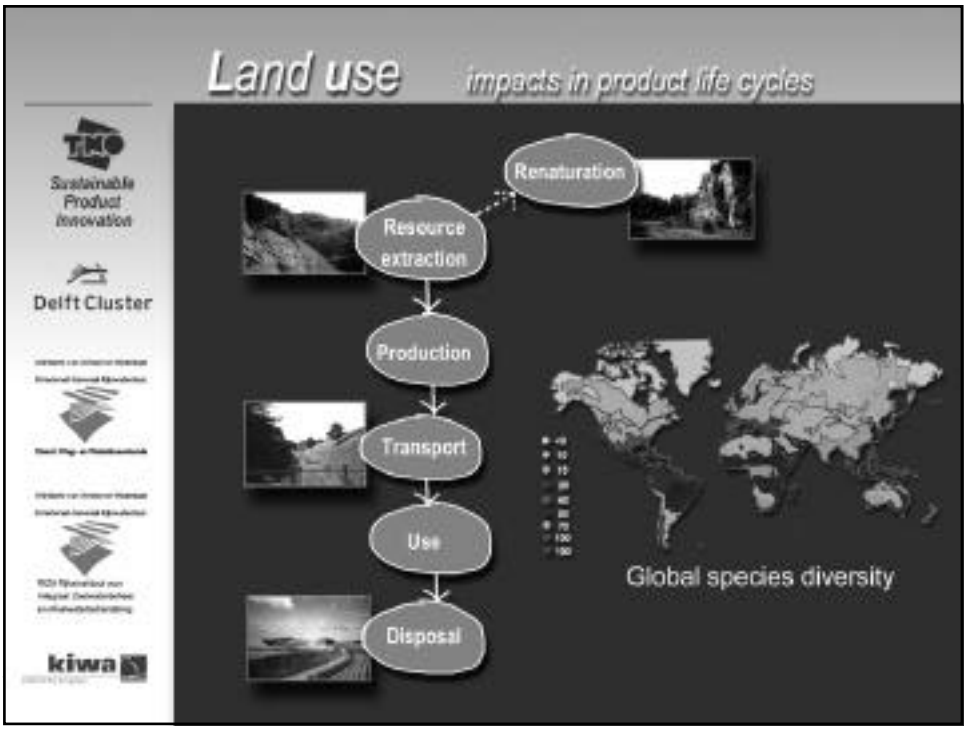
Erwin Lindeijer, Project manager Sustainable Innovation & LCA



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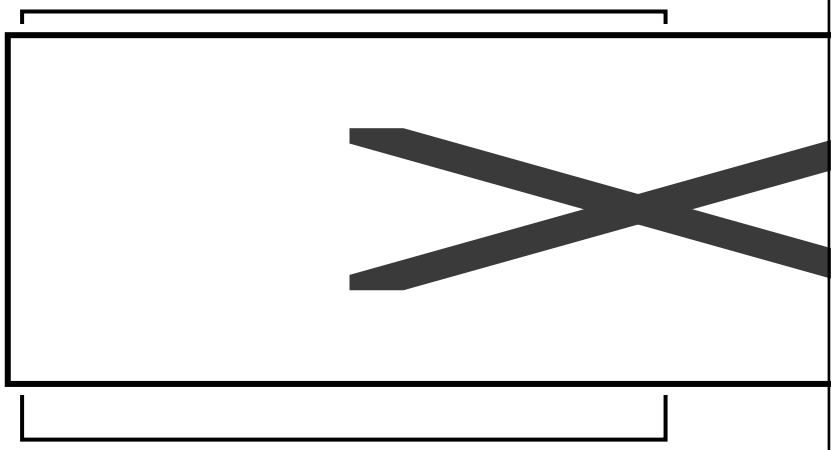
Basic methodological issues in LC project

Different situations of land use:

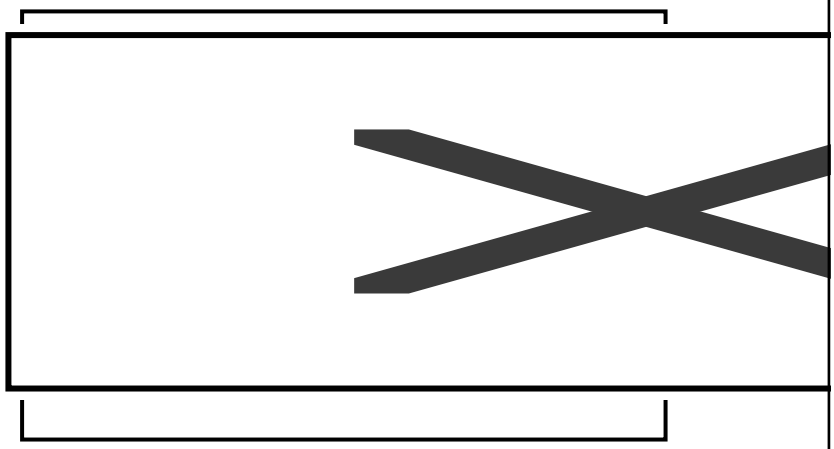
Occupation with equilibrium reference



project

Different situations of land use:

Occupation with average reference (here with higher quality level)



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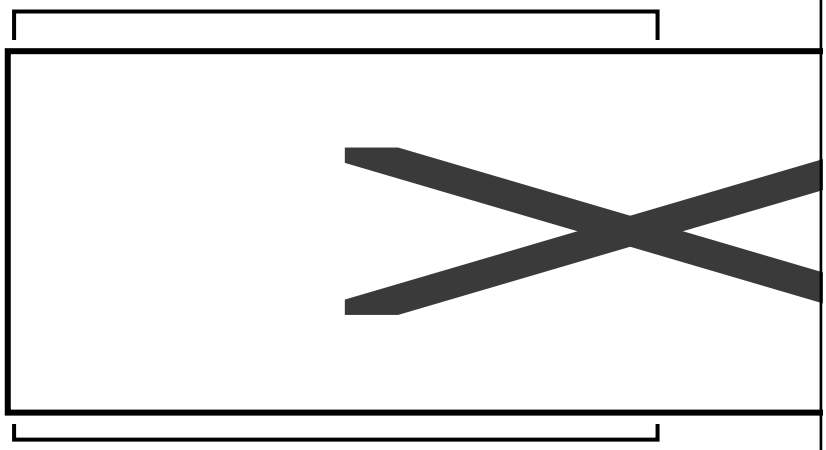
Different situations of land use:

Occupation during renaturation (with different end levels)



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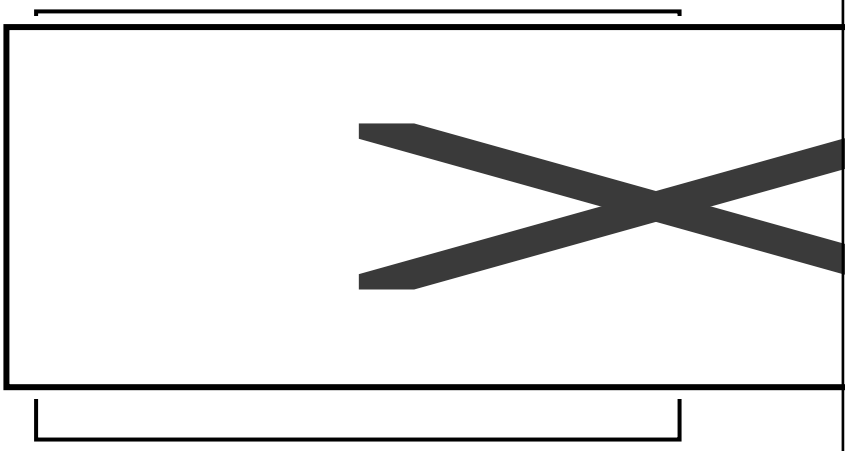
Different situations of land use:

Transformation (with different end levels)



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Different indicators and impact factors:

Biodiversity

- **local plant species diversity (SD_i)**
- **global ecosystem scarcity (ES_i)**
- **global ecosystem vulnerability (EV_i)**

Ecosystem Occupation EO = A x t x SD_i x ES_i x EV_i

Ecosystem Transformation ET = A x ΔSD_i x ES_i x EV_i

(for each biome i)

Life support systems

- **Net primary (biomass) productivity (NPP)**

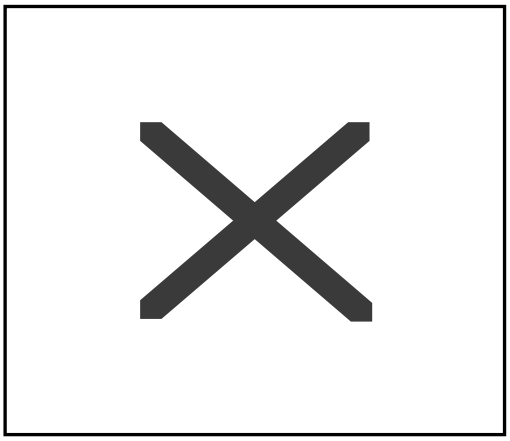
Biomass Occupation BO = A x t x (f)NPP

Biomass Transformation BT = A x Δ(f)NPP

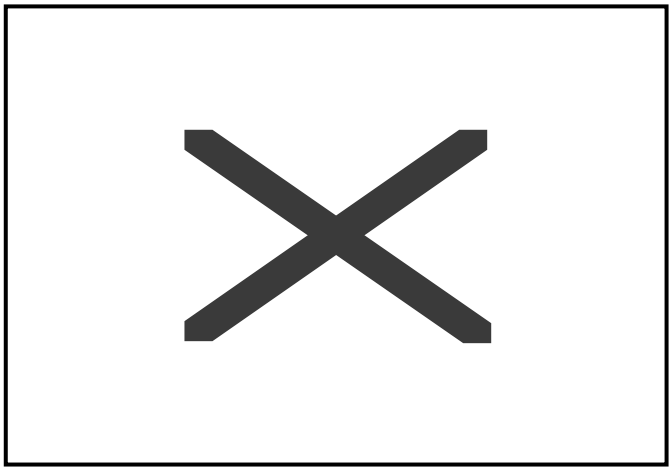
Experiences with the Ecoinvent 1996 database

- **Mixing of occupation and transformation**
- **Mixing of occupation and renaturation**
- **Hard to find all imformation to determine ETH values for occupation, renaturation and transformation**
- **Hard to perform a dominance analysis**

Experiences with the EcoInvent 1996 database



Experiences with the EcoInvent 1996 database



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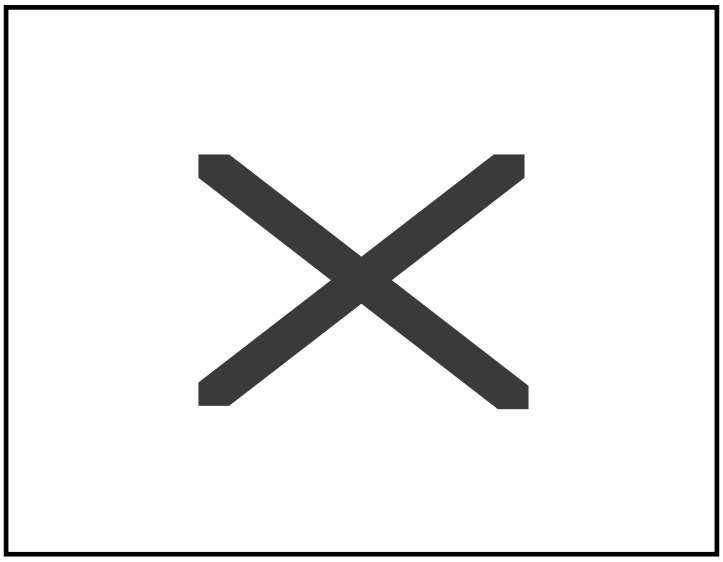
Results from the EcoInvent 1996 database

Analysis of 'Strom ab Steinkohle Kraftwerk NL' type II>III

- **About 70 % directly related tothe following process cards:**
  - **'Steinkohle aus Tagbau ab Bergwerk' 52%**
  - **'InfraSchiene' 2%**
  - **'Steinkohle aus Untertagebau ab Australisches Bergwerk' 4%**
  - **'Steinkohle aus Untertagebau ab Ost Europa Bergwerk' 3%**
  - **'Steinkohle aus Untertagebau ab Sud afrika Bergwerk' 3%**
  - **'Steinkohle aus Untertagebau ab Nord amerika Bergwerk'**

Results from the EcoInvent 1996 database



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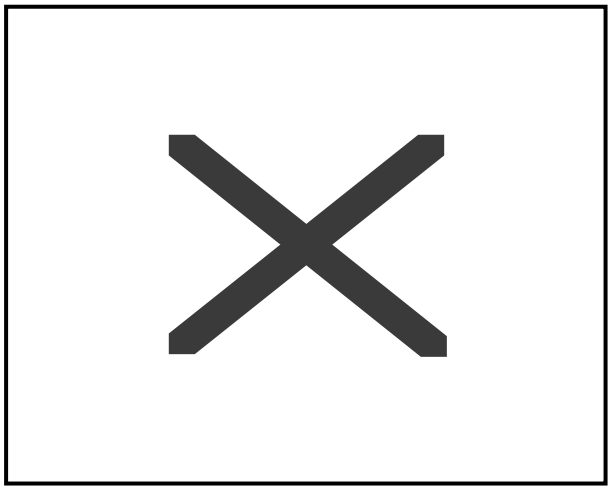
Experiences with the IVAM ER database

- Hard to include different land use data when basic databases do not offer an adequate format or no data
- Repeating the procedure for data collection from statistics with more effort results in lower uncertainty ranges and higher confidence in data
- Direct occupation figures for NL seem much lower than those of ETH

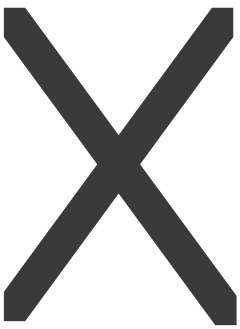
Data collection and -treatment in TNO project



Procedure for dealing with transformation of 'unended' land uses in TNO project

- **Determine an increasing trend** in land use for the concerning activity. Apply various time ranges to determine the variability of the trend over time. If there is no relevant or a negative trend, no transformation is attributed to that type of activity.
- Determine via land cover change statistics the **type(s) of land use before the activity** in case of a relevant trend, **and their contribution in percentage**. When there are stock-type land users (storage, barren building area, etc.) look further back to determine what was the previous user.
- **Calculate the national transformation from each previous user** in m2/y (gross transformation data are preferred over net data).
- **Determine the productivity** (e.g. in either kg/y or tkm/y) using statistics, based on the average (and last) years performance (giving a range).
- Allocate the productivity to the relevant output use in case of multi-functionality
- Divide the land transformation for each previous user separately by the (allocated) productivity of that activity, This gives the **transformation per FU**.

Interim results land occupation TNO project



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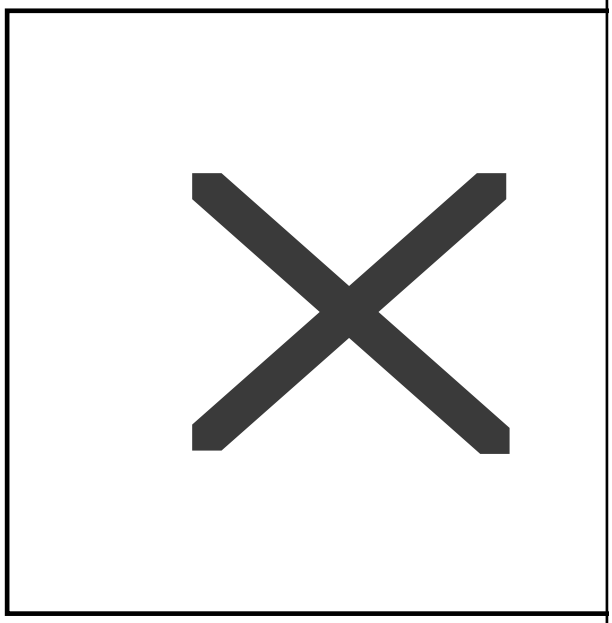
Interim results land transfor-mation TNO projec



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Requirements of the TNO method for inventory data

- Separate occupation and transformation
- Separate the renaturation part of occupation
- Separate interventions of emissions and land use
- Differentiate at least between regions in continents
- Distinguish 20 occupation types and about 15

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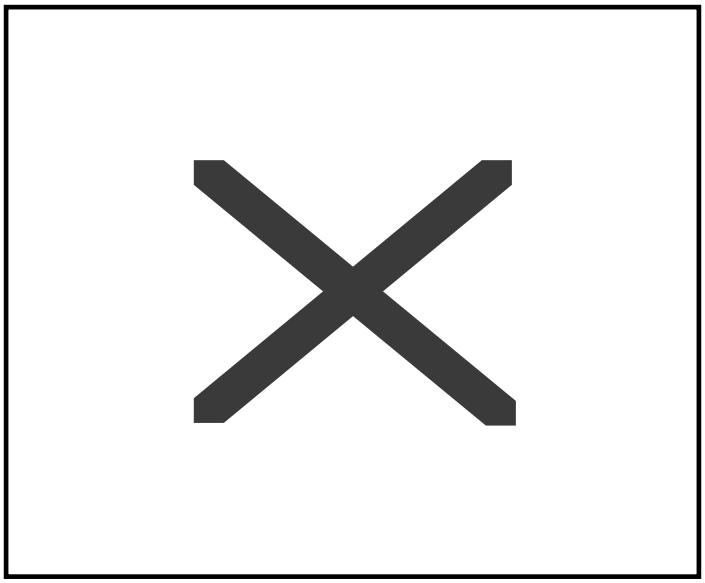
differentiation



Some consequences of only using the 13 land use types proposed in [Frischknecht & Koellner, 2001]

- Agriculture and forestry can not be included
- No distinction possible between impacts of organic and traditional agriculture
- No distinction possible between impacts of different types of forest
- Transformations due to water barrages can not be included

Conclusions

- **Land use data collection is very time consuming =>**
  - **get land use data adequately in the EcoInvent 2000 database**
- **An adequate land use format must include regional differentiation => proposed format:**
  - **occupation ([type], [country code])**
  - **transformation ([type initial]>[type final], [country code])**
- **Differentiate at least 20 different land occupation types and about 15 different transformation types**