Accounting for GHG Emissions from Indirect Land Use Change: The iLUC Factor Approach

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Indirect LUC

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- **Displacement: problem of truncated system boundaries**
  - Accounting problem of partial analysis (only biofuels, no explicit modeling of agro + forestry sectors, or other land uses)
  - **All** incremental land uses imply indirect effects
- **Analytical and political implications**
  - Analysis: which displacement when & where?
  - Policy: which instruments? Partial certification schemes do not help, but have „spill-over“ effects; “adder“ or “malus“ for iLUC GHG
  - Sourcing priorities: favor low-iLUC biomass feedstocks
- **Future global GHG regime with cap for all sectors & countries: no leakage = no indirect effects!**
- **Similar for biodiversity regime (CBD)**

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The iLUC Factor Approach (1)

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- assumes potential release of CO_2 from LUC caused by displacement is **function of land used** to produce agro products for exports (displacement "works" along **trade flows**)
- takes into account key countries trading agro-products being subject to displacement which can impact **different land with different C stocks**
- shares of displaced land **derived from land used for agro exports** (rape, corn, palm, soy, wheat in Brazil, EU, Indonesia, and US, year 2005 yields: FAO data)

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The iLUC Factor Approach (2)

- Deterministic, average impacts; explicit assumptions which dLUC is likely where (e.g. grassland to maize)
- IPPC-based dLUC factors coupled with regional land use shares for each agro commodity
- average CO_2 emission factor per ha of displaced land derived + discounted over 20 years

→ **Calculated theoretical global average iLUC factor: 20 t CO_2/ha/yr if displacement risk would be 100%.**

→ **Real risk lower (set-aside/ abandoned land, intensification etc.)**

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The iLUC Factor Approach (3)

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- **Indicative values for iLUC factor (2005)**
  - "low", assuming 25% of biofuels subject to theoretical full iLUC factor = 5 t of CO_2/ha/year
  - "medium", i.e. 50% of feedstock subject to theoretical full iLUC factor = 10 t of CO_2/ha/year, and
  - "maximum", representing 75% share* of feedstock = 15 t of CO_2/ha/year

- **Translating iLUC factor to biofuel: divide by fuel-specific yield, e.g. 25% iLUC factor for 170 GJ/ha/yr (SRC/SG) = 29 g/MJ$_{biofuel}$**

***= maximum case not 100% of theoretical iLUC factor as 25% of all biofuels come from yield increases (average 1% per year until 2030)**

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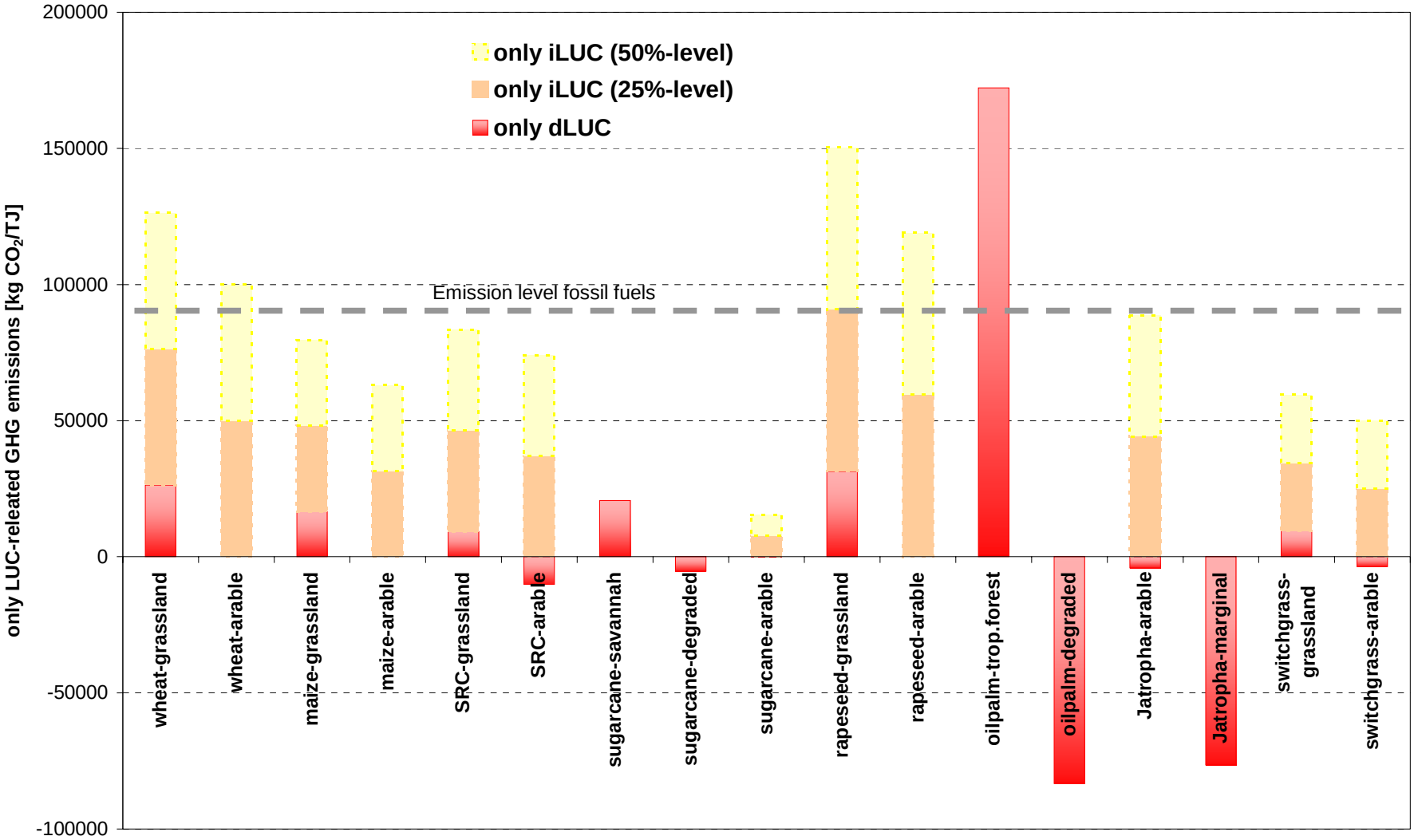
Direct + Indirect GHG from LUC



Data only for LUC-induced GHG emissions, excluding life-cycles

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Indirect GHG: “iLUC Factor“

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Accounting for CO_2 from indirect LUC using the “iLUC factor“ to extend life-cycle GHG balance of biofuels*

	kg CO_{2eq}/GJ with iLUC factor			relative to fossil diesel/petrol		
Biofuel, incl. allocation	**max**	**med**	**min**	**max**	**med**	**min**
Rapeseed to RME, EU	260	188	117	201%	118%	35%
Palm oil to PME, Indonesia	84	64	45	-3%	-25%	-48%
Sugar cane to EtOH, Brazil	48	42	36	-44%	-52%	-59%
Corn to EtOH, USA	129	101	72	50%	17%	-16%
Wheat to EtOH, EU	144	110	77	67%	28%	-11%
SRC/switchgrass to BtL, EU	109	75	42	26%	-13%	-51%

Source: own calculations

SRC = short-rotation coppice; BtL = biomass-to-liquid, i.e. Fischer-Tropsch synthetic diesel

*= By-product allocation using lower heating value; only arable land assumed (dLUC = 0 or negative for SRC); iLUC factor is zero for residues/wastes and for biocrops from unused/degraded lands

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Further Work

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- Derive **2010 estimate** for iLUC factor (late 2009)
- Better understanding of dLUC characteristics of displacement: e.g., Gibbs (2009) mapping of past LUC (1980-2000) → revise iLUC factor?
- "**Risk mapping**": identify potential countries/areas under thread of iLUC using CGE model results (GTAP etc.) + suitability maps + infrastructure + biodiversity/carbon maps, OECD/JRC/EEA workshop Jan. 09 Paris + own work CN,ZA,IN,BR
- More research **beyond EU** (with UNEP, GBEP): include developing countries views

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Conclusions

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- Indirect LUC: **all incremental biomass** – electricity, heat, transport, biomaterials, food, feed, fiber…
- Unused/degraded land → higher costs, **incentives needed** (RED bonus, CDM, REDD) + biodiv/social safeguards
- **Investor alliance** for sustainable supply: build on country study results (late 2009) to bundle investment in degraded land + infrastructure "overhead" (CN, ZA, IN, BR); incentives for zero-iLUC supply from govmts (DE, NL…)
- Long-term: Strengthen **global conventions** (FCCC, CBD) to **"cap"** iLUC effects → only real solution!
- Medium-term: UN sustainability standards (CSD?)
- Short-term: EU + US + BR (GBEP?) scheme for iLUC

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More Information

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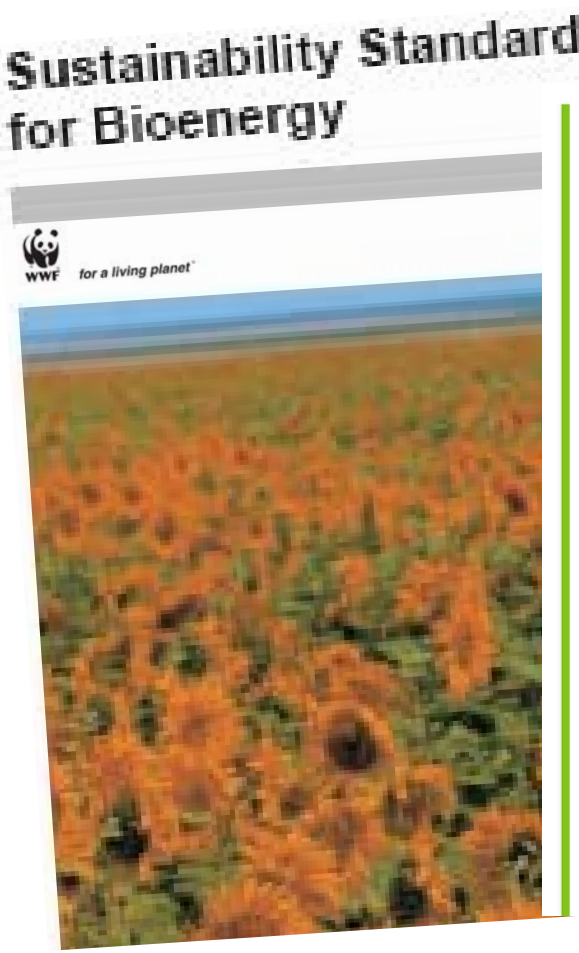

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Environmental Research Plan of the Federal Ministry for Environment, Nature Protection and Nuclear Safety
Interim Report FKZ 37 07 93 100

"Development of strategies and sustainability standards for the certification of biomass for international trade"

Sustainable Bioenergy: Current Status and Outlook

Summary of recent results from the research project

Darmstadt, Heidelberg, March 2009

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