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Copernicus Institute of Sustainable Development
Energy & Resources



Setting things straight on indirect land use change

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E&R seminar series – Bioenergy - 29 January 2015

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Overview of presentation

- What is indirect land use change (ILUC) and why is it a concern?
- How large is the ILUC effect and what are the challenges in modelling it?
- Can we minimize or prevent ILUC and if so, how? What are the challenges for that?

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What is ILUC?

Forest
Agri. land

No bioenergy production

Forest
Agri. land
Biofuels

Direct land use change

Forest
Agri. land
Biofuels
ILUC

Indirect land use change

Based on Vad, E4Tech, 2011

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Why is ILUC a concern?

Deforestation, destruction of natural habitat, conversion of peatland forest,...

Searchinger et al. 2008 on ILUC:
"... we found that corn-based ethanol, instead of producing a 20% savings, nearly doubles greenhouse emissions over 30 years and increases greenhouse gases for 167 years."



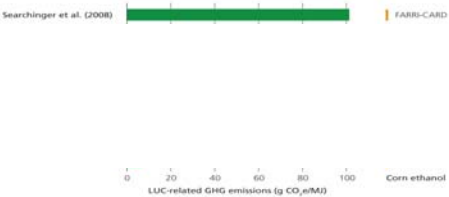
Use of U.S. Croplands for Biofuels Increases Greenhouse Gases Through Emissions from Land-Use Change
Timothy Searchinger et al.
Science 319, 1238 (2008);
DOI: 10.1126/science.1151861

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ILUC modelling results

Example corn ethanol



Searchinger et al. (2008)

FAIR-CARD

LUC-related GHG emissions (g CO₂e/MJ)

Corn ethanol

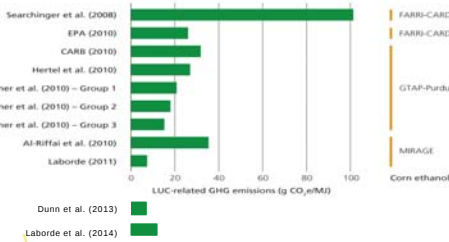
Adapted from Wicke et al. 2012

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ILUC modelling results

Example corn ethanol



Searchinger et al. (2008)

EPA (2010)

CARB (2010)

Hertel et al. (2010)

Tyner et al. (2010) – Group 1

Tyner et al. (2010) – Group 2

Tyner et al. (2010) – Group 3

Al-Riffai et al. (2010)

Laborde (2011)

Dunn et al. (2013)

Laborde et al. (2014)

FAIR-CARD

FAIR-CARD & FASOM

GTAP-Purdue

MIRAGE

LUC-related GHG emissions (g CO₂e/MJ)

Corn ethanol

Adapted from Wicke et al. 2012

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Still, ...

- Despite these uncertainties
- Even if ILUC is a lot lower than originally thought
- ILUC is still a problem that needs to be addressed for biofuels (bioenergy and biomaterials) to be sustainable!

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(How) can we minimize or even prevent ILUC?

- Need to take a pro-active position and figure out how to minimize ILUC and try to even prevent it from happening
- Underlying concept
 - Indirect LUC of bioenergy is the direct LUC of another activity

➔ Address all crop production - whether for food or non-food purposes

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What are the options?

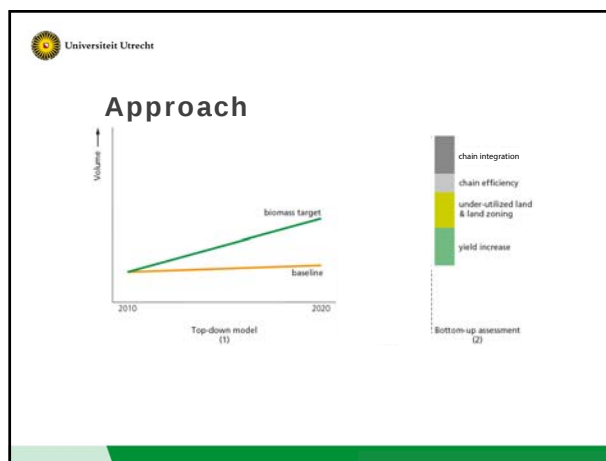
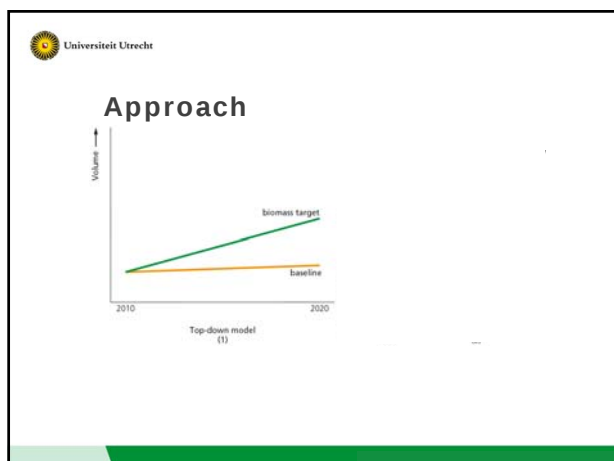
- Use of biofuels co/by-products
- Increased chain efficiency/reduced losses in chain
- Increasing agricultural (and forestry) yields
- Multi-cropping systems
- Bringing under-utilized land into production and demarcating land that should not be converted

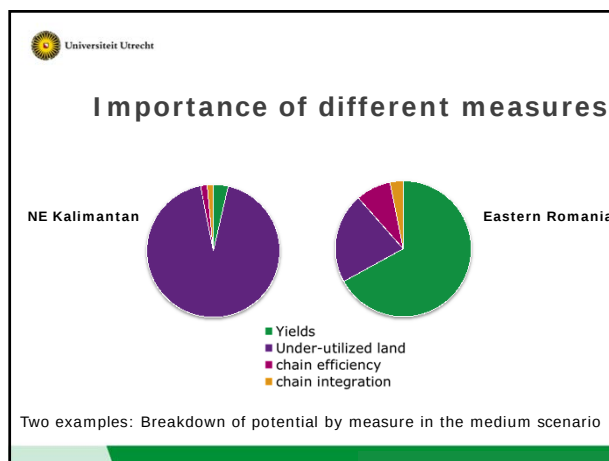
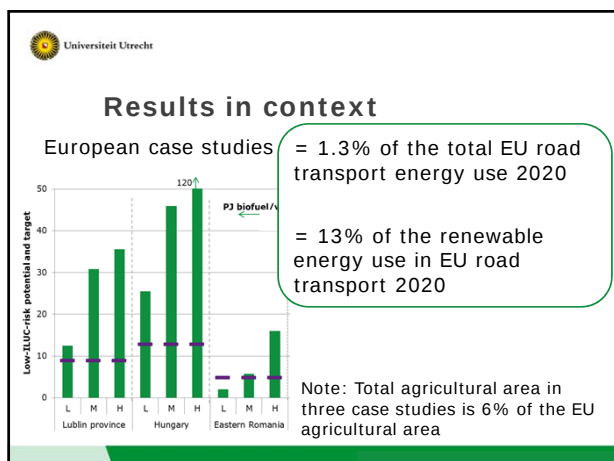
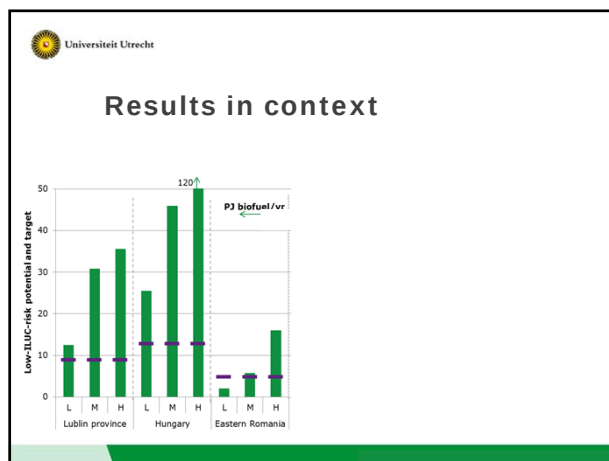
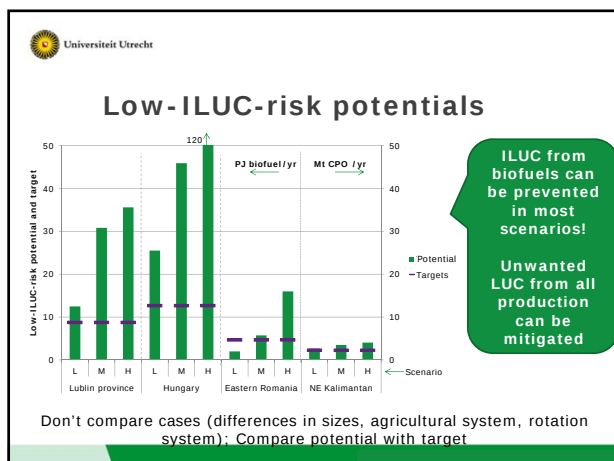
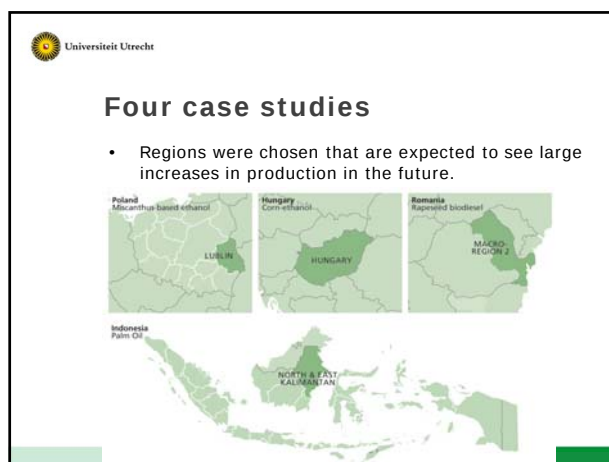
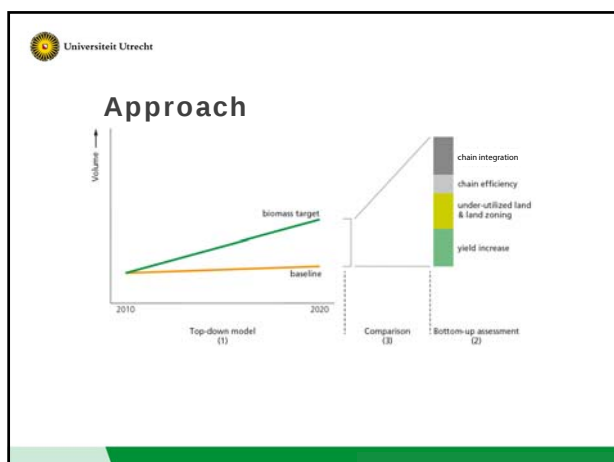
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Assessment of regional low ILUC risk biofuel production potential

... by quantifying options

... in order to better understand the options and how they can contribute to ILUC mitigation and unwanted LUC in general







Generalizability of results

- Results are also generalizable to the broader regions in which the cases are located
 - Eastern Europe & rest of Indonesia
- Untapped low-ILUC-risk potentials in other regions – For example:
 - mixed production systems in Europe, such as double cropping;
 - pasture intensification in Latin America;
 - yield increases in Africa and Latin America.



Conclusions

- ILUC as determined in economic models is not an irreversible fact, but is a risk that can be mitigated and in some cases even prevented
- To do so, we need to take a sustainable approach to all crop production, whether for food, feed, fiber and fuels.

➔ Substantial investment in the modernization and sustainable intensification of the agricultural sector (incl. strengthening and enforcing land use policies)



Project recommendations

- Increase **productivity and resource efficiency** in the agricultural sector in a sustainable manner;
- Support and incentivize production on currently **under-utilized land**; and
- Implement **land zoning** that excludes high carbon stock, high conservation value and important ecosystem service areas from conversion to any agricultural use and incentivize forest maintenance.



Setting things straight on ILUC

1. Economic model assessment of ILUC useful
 - Science is still not well developed (false sense of precision)
 - $ILUC > 0$
2. Need to act in order to tackle ILUC (whether for biofuels or other biobased economy purposes)
3. ILUC mitigation/prevention is possible

➔ Need to take a sustainable approach to all crop production – whether for food and non-food applications (incl. biomaterials)



Ongoing research

- Sustainable perspective on all crop production
 - Large-scale investments in food, fibre and energy: Sustainable options that work for forests and the poor (Zoomers & van Westen, UU-IDS)
 - Project proposal on multi-cropping
- Integrated modelling for defining sustainable pathways for biobased economy
 - Linking economic model MAGNET with integrated assessment model IMAGE and feed them with more bottom-up data to find sustainable pathways for the biobased economy (van Vuuren UU-Copernicus/PBL, Smeets/van Meijl WUR-LEI)
 - Environmental impacts of (sustainable) intensification of EU agriculture (PhD project Kluts, together with WUR)



Thank you for your attention!

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References

- Searchinger, T., Heimlich, R., Houghton, R. A., Dong, F., Elobeid, A., Fabiosa, J., ... Yu, T.-H. (2008). Use of U.S. Croplands for Biofuels Increases Greenhouse Gases Through Emissions from Land-Use Change. *Science*, 319(5867), 1238–1240
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