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Institute for Applied Ecology

Status of science and policy regarding ILUC

Uwe R. Fritsche
Oeko-Institut (Institute for applied ecology)
Energy & Climate Division

presented at the
Capacity Building Workshop on GHG LCA and Policy Applications
Tokyo International Forum, November 15, 2011

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ILUC and Bioenergy

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- Overview of status of ILUC **science** and scientific discussion around the world
- ILUC-relevant **policy measures** being implemented or discussed
- Relevance of the ILUC discussion to policymakers and scientists in countries **just starting** to work on GHG LCA of bioenergy

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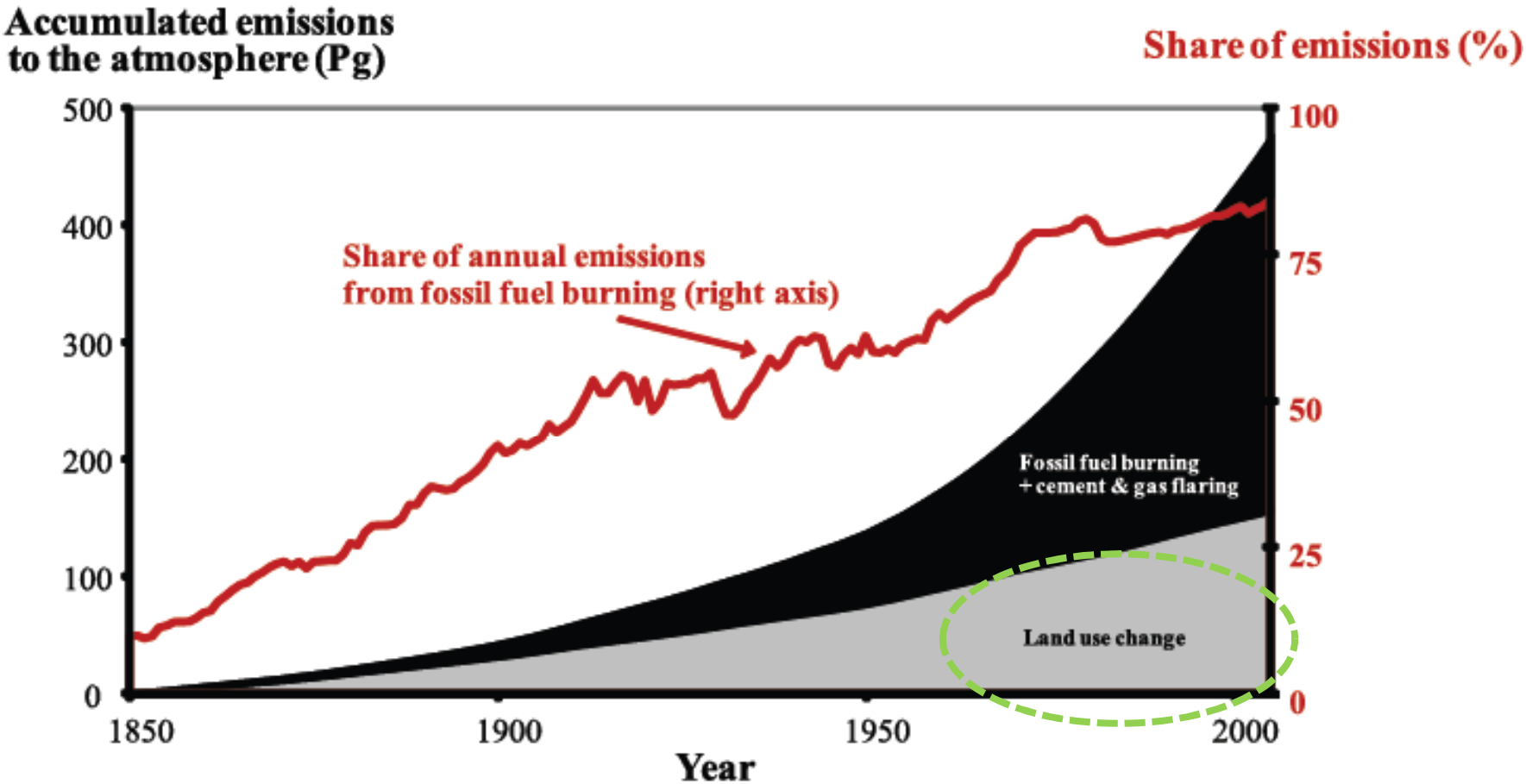
LUC and GHG Emissions



Accumulated anthropogenic C emissions to the atmosphere since 1850. Cement and gas flaring is 1-2% of total accumulated emissions. Source: Carbon Dioxide Information Analysis Center (CDIAC) of US DOE

GHG from direct LUC

C stock prior to LUC

C stock after LUC

$$e_l\left[\frac{gCO2}{MJ}\right] = \frac{CS_R\left[\frac{gC}{ha}\right] - CS_A\left[\frac{gC}{ha}\right]}{P_{final\,product}\left[\frac{MJ}{ha * yr}\right] \bullet 20[yr]} \bullet 3{,}664$$

C to CO_2

yield of biofuel product

distribution of dLUC over 20 years

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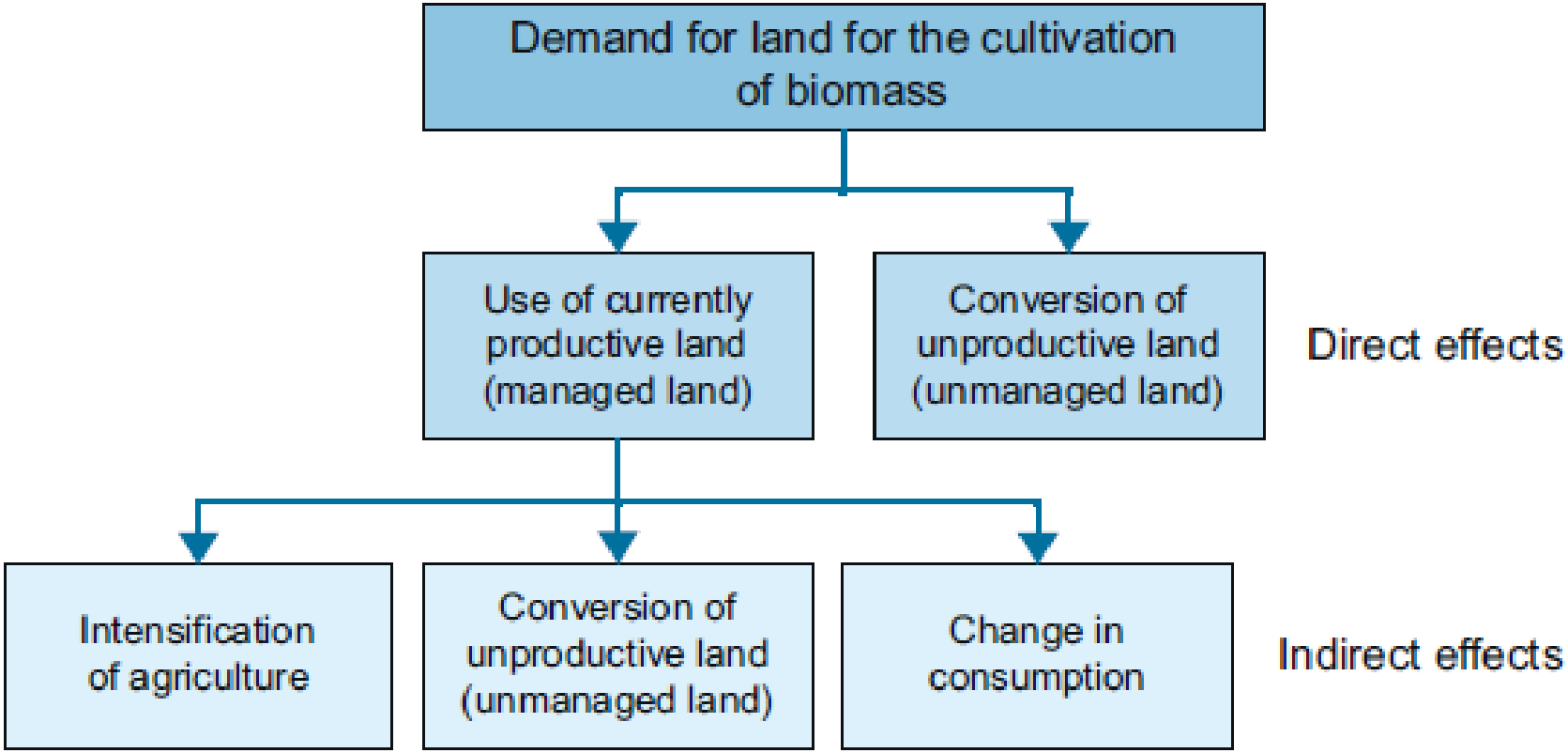
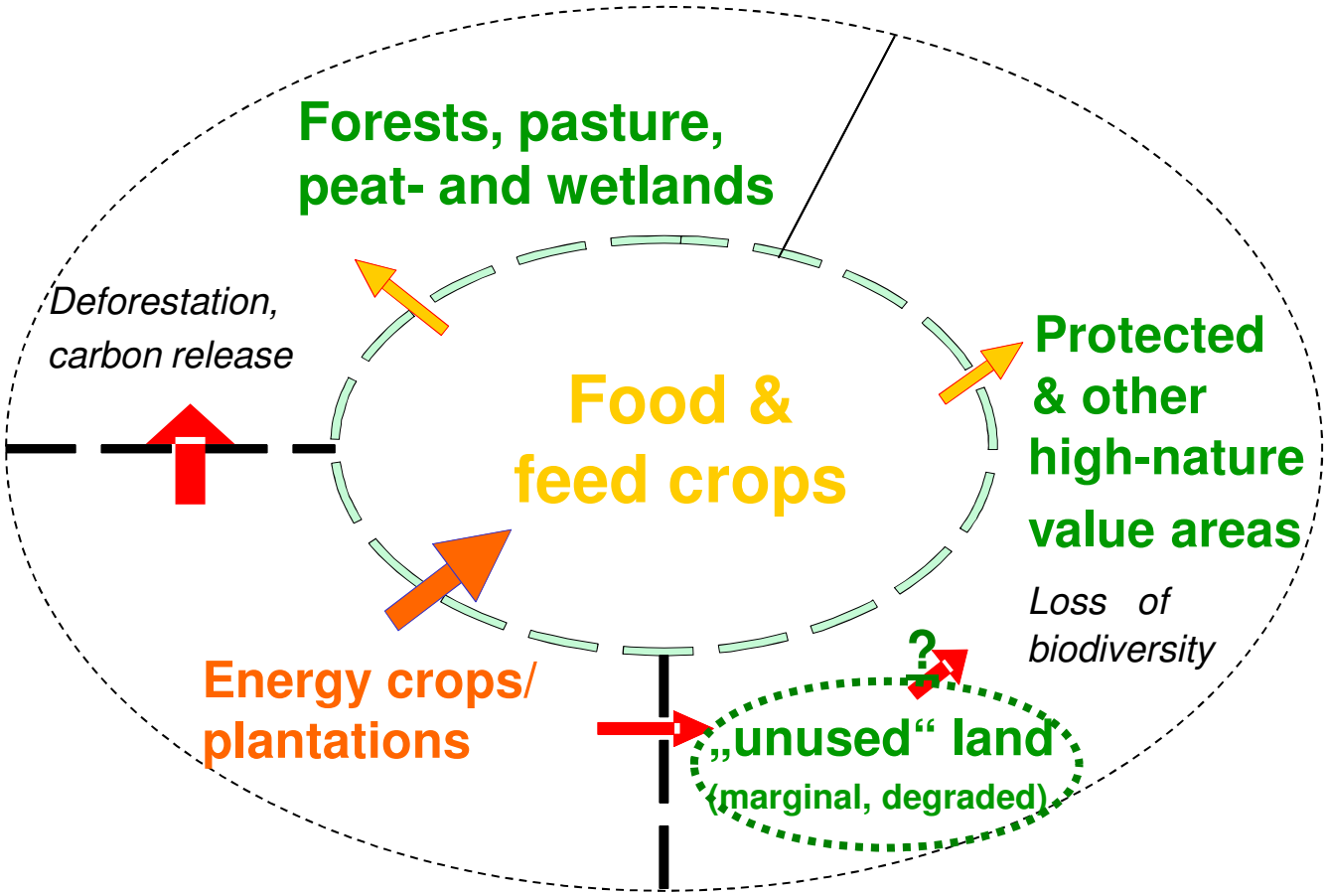
Direct and Indirect Effects



Source: PBL (2011) Indirect land use change emissions related to EU biofuel consumption: an analysis based on historical data; Overmars, K. et al.; in: Environ.Sci.Policy(2011),doi:10.1016/j.envsci.2010.12.012

Indirect Effects (Displacement)



Indirect LUC

- All incremental use of fertile land imply indirect effects if system boundaries of analysis < total land use of all sectors
- real world: only direct LUC
- indirect LUC of bioenergy = direct LUC of agriculture/forestry
- Distinguish between analytical (science) vs. regulatory (policy)

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ILUC: Four Questions…

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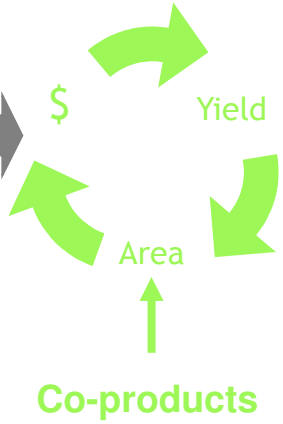
Biofuel Mandates

RED, EISA etc.

1. Market response?



2. Which LUC?

3. Carbon stocks?

C stocks

t/ha

above/below-ground

4. Time/allo-cation?

20, 30 or more years

g CO_2/MJ

based on presentation of Bart Dehue (Ecofys) at GBEP ILUC Workshops, May 2009 in NYC

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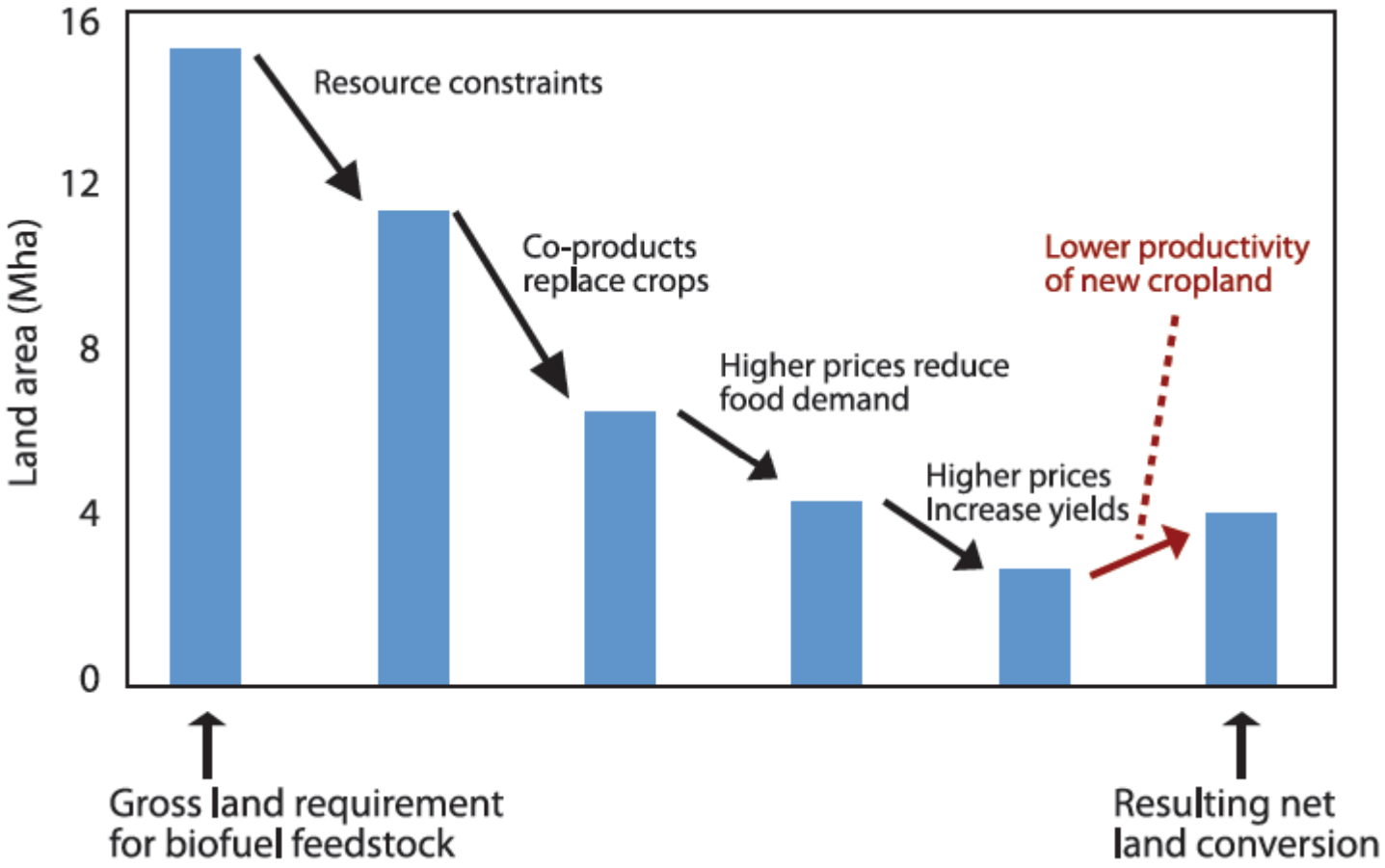
ILUC: Market Responses...



Source: IEA Bioenergy (2011) based on Hertel (2010)

ILUC: many studies…

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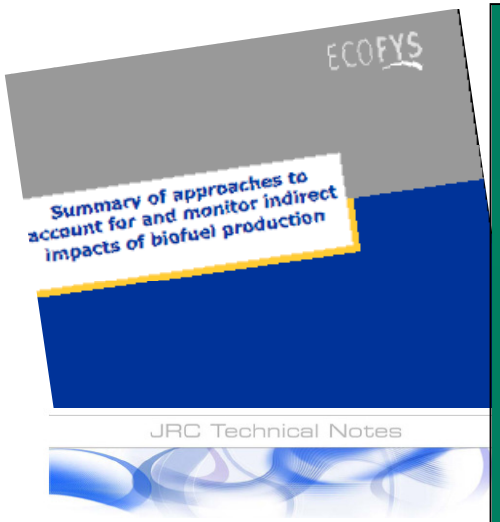

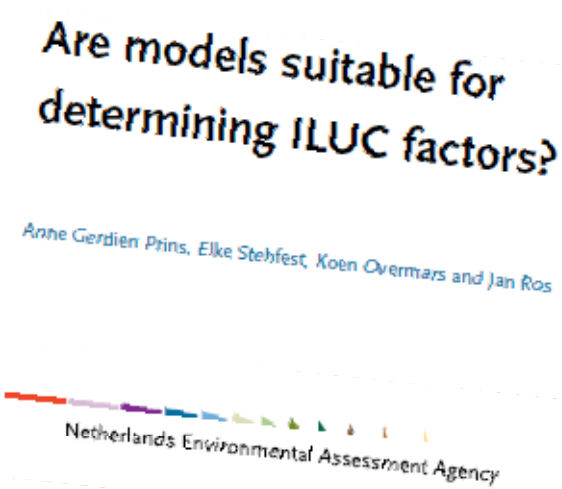

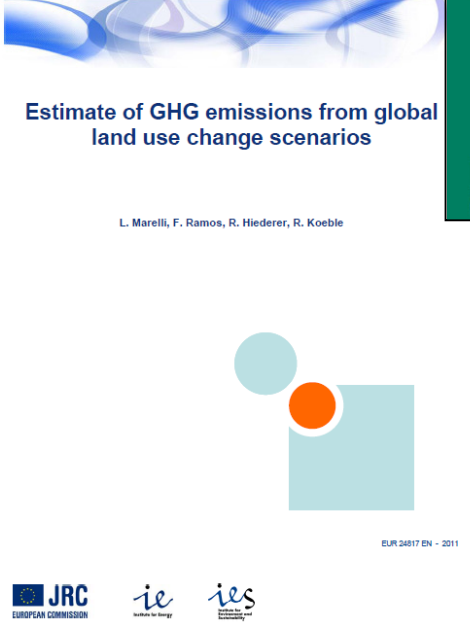

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ILUC Policies in EU and US

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- **EU**: many studies, EC report on ILUC in Dec. 2010, no recommendations; impact assessment for ILUC policy options (Jan 2012?)
- **US**:
  - Federal level: EPA regulated GHG emissions of biofuels (RFS2) incl. ILUC
  - California: Low Carbon Fuel Standard (LCFS) also incl. ILUC, ongoing work on updates (International Expert Group)

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ILUC in the EU

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Renewable energy

RSS

Land use change

On 22 December 2010, the Commission published a report on indirect land use change related to biofuels and bioliquids.

The report acknowledges that indirect land use change can reduce greenhouse gas emissions savings associated with biofuels, but also identifies a number uncertainties associated with the available models. The report announces that the Commission will conduct an impact assessment, thereby taking into consideration potential changes to the existing legislation. If needed, the Commission will recommend to address this issue under a precautionary approach. In addition the Commission will continue to conduct work in this area in order to ensure that policy decisions are based on the best available science and to meet its future reporting obligations on this matter.

Related documents

Commission adopts Report on indirect land use change

Report from the Commission on indirect land-use change related to biofuels and bioliquids [COM(2010)0811, 22/12/2010]

Press room

Biofuels: Commission adopts Report on indirect land use change [IP/10/1772, 22/12/2010]

Studies

Land use change studies and reports

Public consultation

Indirect land use change and biofuels (closed since October 2010)

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Günther Oettinger
Commissioner for Energy

Philip Lowe
Director-General for Energy

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http://ec.europa.eu/energy/renewables/biofuels/land_use_change_en.htm

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ILUC in US: Federal Level

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U.S. ENVIRONMENTAL PROTECTION AGENCY

Fuels and Fuel Additives

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Renewable Fuel Standard (RFS)

Renewable Fuel Standard (RFS) Home | Regulations & Standards | Compliance Help | Notices

EPA is responsible for developing and implementing regulations to ensure that transportation fuel sold in the United States contains a minimum volume of renewable fuel. The Renewable Fuel Standard (RFS) program regulations were developed in collaboration with refiners, renewable fuel producers, and many other stakeholders.

The RFS program was created under the Energy Policy Act (EPAct) of 2005, and established the first renewable fuel volume mandate in the United States. As required under EPAct, the original RFS program (RFS1) required 7.5 billion gallons of renewable fuel to be blended into gasoline by 2012.

Under the Energy Independence and Security Act (EISA) of 2007, the RFS program was expanded in several key ways:

- EISA expanded the RFS program to include diesel, in addition to gasoline;
- EISA increased the volume of renewable fuel required to be blended into transportation fuel from 9 billion gallons in 2008 to 36 billion gallons by 2022;
- EISA established new categories of renewable fuel, and set separate volume requirements for each one.
- EISA required EPA to apply lifecycle greenhouse gas performance threshold standards to ensure that each category of renewable fuel emits fewer greenhouse gases than the petroleum fuel it replaces.

RFS2 lays the foundation for achieving significant reductions of greenhouse gas emissions from the use of renewable fuels, for reducing imported petroleum, and encouraging the development and expansion of our nation's renewable fuels sector.

To learn more, click on the tabs above.

EnviroFlash
Sign up for Fuels Programs alerts
Sign up for alerts

For more information, please contact the EPA Fuels Programs Support Line at 202-343-9755 or EMTS Support at 800-385-6164.

http://www.epa.gov/otaq/fuels/renewablefuels/index.htm

ILUC in US: California

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California Environmental Protection Agency
Air Resources Board

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Friday, April 15, 2011

UP LINKS

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      - **Low Carbon Fuel Standard**

PROGRAM LINKS

- Background
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- Modeling Softwares
- Other Information
- Peer Review
- Public Comments
- Regulations
  - Current Regulation
  - Formal Rulemaking Documents
- Reporting Tool
- What's New

Low Carbon Fuel Standard Expert Workgroup

This page last reviewed April 1, 2011

This page provides information regarding ARB's Low Carbon Fuel Standard Expert Workgroup (EWG).

On April 23, 2009, the California Air Resources Board (ARB/Board) approved the Low Carbon Fuel Standard (LCFS) regulation. As part of the Board Hearing, the Board approved Resolution 09-31 (Resolution). The Resolution includes a number of provisions related to ongoing work on the LCFS. One such provision relates to land use and indirect effect analysis of transportation fuels.

The Board-approved resolution reads: "BE IT FURTHER RESOLVED that the Board directs the Executive Officer to convene an expert workgroup to assist the Board in refining and improving the land use and indirect effect analysis of transportation fuels and return to the Board no later than January 1, 2011 with regulatory amendments or recommendations, if appropriate, on approaches to address issues identified. This workgroup should evaluate key factors that might impact the land use values for biofuels including agricultural yield improvements, co-product credits, land emission factors, food price elasticity, and other relevant factors. The Executive Officer shall coordinate this effort with similar efforts by the U.S. Environmental Protection Agency (U.S. EPA), European Union, and other agencies pursuing a low carbon fuel standard."

Workgroup Information

- Subgroup Membership List (PDF)
- Expert Workgroup Guidelines (PDF)
- Expert Workgroup Member's Information (PDF)
- Requirements for Subgroup Draft Work Plans (PDF)
- LCFS Proposal for an Expert Workgroup (PDF)
- Solicitation Letter for the LCFS Expert Workgroup (PDF) and Application (PDF) (Closed)

http://www.arb.ca.gov/fuels/lcfs

Mitigating ILUC…

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Current Opportunities	Limitations to Addressing iLUC	Practical Challenges
Use underutilized land, sometimes referred to as degraded, abandoned, or marginal land.[1]	Increasing productivity requires increased water. Within one watershed changes in hydrology could deliver water availability problems for other users and trigger land use change elsewhere as a result. On social side, the "unused" or marginal land could be in use for example as land for foraging and firewood. Displacing this activity elsewhere is an iLUC impact.	Developing universally applicable definitions and criteria for 'underutilized' land. Defining appropriate baselines and business as usual projections to determine productivity increases.
Improve productivity of biofuel feedstocks on lands where they are currently grown to increase yields through improved fertilization and irrigation techniques, crop rotations, double-cropping, etc.[1]		Defining appropriate baselines and business as usual projections to determine productivity increases
Improve productivity through crop-livestock and other integrated bioenergy systems, such as integrating sugarcane or soy with cattle and biofuel crops with other crops. Biofuel crops are essentially "new" in such a system and do not reduce productivity of the existing crop.[1]	As above.	As above for determining baselines. Determining procedures for allocating increased productivity to non-biofuel outputs (cattle and soymeal) and biofuel outputs (soy oil).
Use wastes and residues as a feedstock.	Largely expected not to encounter limitations but in some cases could have negative impacts if the waste has existing uses.[2]	
Increased efficiency through reducing supply chain losses.	Largely expected not to encounter limitations.	Complex supply chains create tracking and measurement problems.
Increased efficiency through integrated processing systems such as co-location of ethanol production and cattle lots.	Largely expected not to encounter limitations.	Defining appropriate baselines and business as usual projections to determine efficiency increases.
Carbon offsets.	Biodiversity in one area less likely to be 'swapped' and compensated by another.	Stakeholder buy-in to offset concepts.

Source:
Winrock International: Biofuels and Indirect Land Use Change - White paper: Challenges and opportunities for improved assessment and monitoring; Chalmers, J. et al.; Arlington VA

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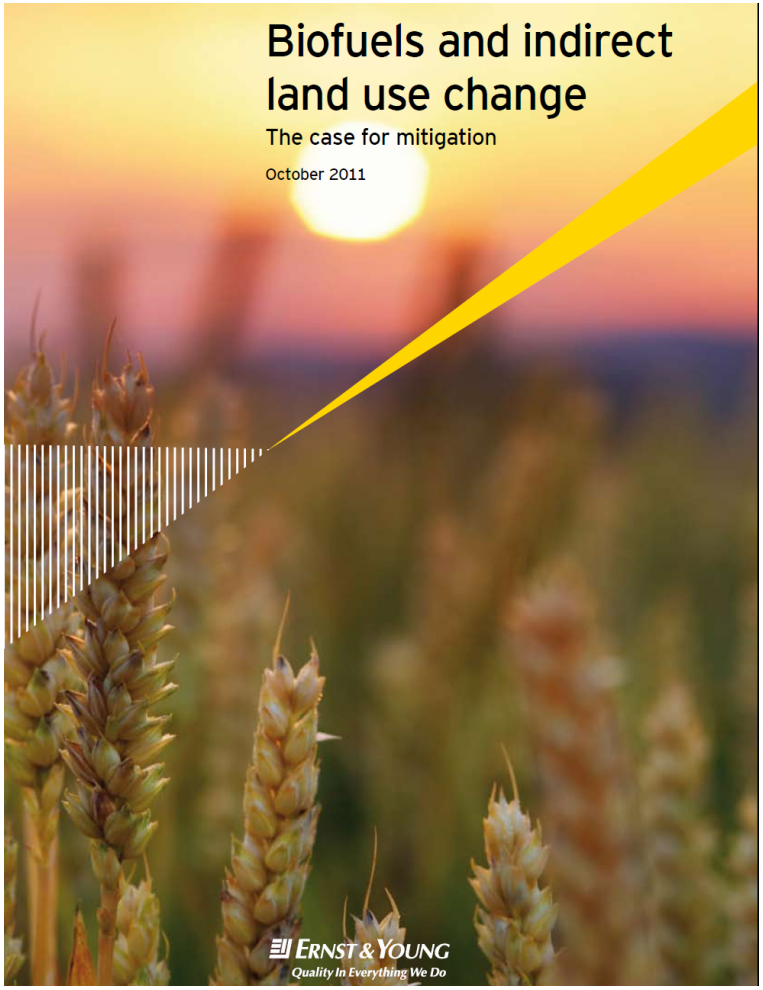
Mitigating ILUC…



commissioned by:

ePURE (European Renewable Ethanol Association)

IUCN (International Union for Conservation of Nature)

Neste Oil

PANGEA (Partners for Euro-African Green Energy)

Riverstone Holdings

Shell

...argues for a market-baded approach, i.e. incentivising low-ILUC biofuels through a "mitigation credit"

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no-ILUC Biomass Potentials

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Land type	Area	energy	reference
degraded land	**0.4-0.6 billion ha**	**8 - 110 EJ/a**	**Hoogwijk et al. (2003)**
	2.50 billion ha (19% of land area)	**~ 500 EJ/a**	**Metzger/ Hüttmann (2009)**
abandoned land	**0.4 billion ha**	**27 EJ/a**	**Field et al. (2008)**
marginal and degraded land	**1.1 – 1.4 billion ha**	**150-200 EJ/a**	**Cai, Zhang, Wang (2011)**
		90 EJ/a	**Wicke (2011)**
water-scarce, marginal + degraded lands		**70 EJ/a**	**ECN et al. (2009)**

Global primary energy demand in 2010 ca. 550 EJ

Data above without ground truthing – country studies indicat need for correction factor (20% conservative estimates) **→ 5% of global energy**

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low ILUC land for biomass...

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BIOMASS AND BIOENERGY 35 (2011) 2268–2279

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BIOMASS & BIOENERGY

Identification of potential areas for biomass production in China: Discussion of a recent approach and future challenges

Wilko Schweers [a,*], Zhanguo Bai [b], Elliott Campbell [c], Klaus Hennenberg [d], Uwe Fritsche [d], Heinz-Peter Mang [e], Mario Lucas [e], Zifu Li [e], Andrew Scanlon [f], Haoran Chen [f], Qin Zhihao [a,g], Dianxiong Cai [a], Yunxiang Jin [a], Jun Zhang [g], Lili Tu [g], Marco Gemmer [h], Tong Jiang [h], Nannan Zhang [i]

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[b] ISRIC, World Soil Information, Box 353, 6700 AJ Wageningen, The Netherlands
[c] Department of Global Ecology, Carnegie Institution, Stanford, CA 94305, USA
[d] Institute of Applied Ecology, 64295 Darmstadt, Germany
[e] University of Science and Technology, 100083 Beijing, China
[f] Jiuzhaigou National Park Administration, 623400 Aba Prefecture, Sichuan, China
[g] School of Geographic and Oceanographic Sciences, Nanjing University, 210093 Nanjing, Jiangsu, China
[h] National Climate Centre, China Meteorological Administration, 100081 Beijing, China
[i] Centre for Geoinformation, Wageningen University, The Netherlands

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Climate Negotiation: REDD

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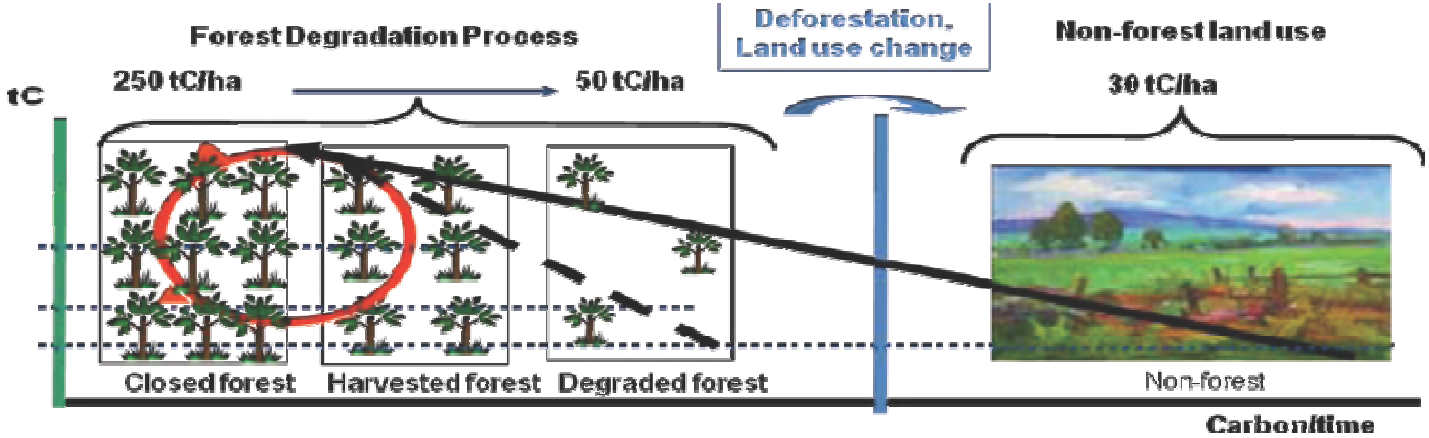
Financial rewards for reduced emissions from deforestation and forest degradation

- If financially viable, deforestation could be reduced significantly
- Could reduce GHG emissions from ILUC if implemented effectively



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GHG from LUC: Dynamic View

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- Future iLUC **can** become low:
  - Dampening ILUC through REDD (if adequately implemented and financed)
  - "free" land through intensification (tradeoffs!)
  - LUC policies in key countries (AR, BR, ID…)
- **Prioritizing** low-iLUC feedstocks:
  - wastes/residues (2nd generation)
  - **un- and underused + degraded** land (with biodiversity/social safeguards)

→ **iLUC is no "fate"**

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Workstream in Indirect Effects

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- International Workshop on ILUC May 15, 2009 in New York collected knowledge and thoughts on future work from GBEP partners, observers, and interested parties
- GBEP's role is to help prepare common knowledge about and increase transparency on ILUC. Collaboration on working level with GBEP partners (esp. EU, IEA, UNEP)
- **Work should not only focus on quantification of the problem but also on practical measures to minimize the risk of negative indirect effects**
- Internal GBEP briefing on ILUC at Sustainability Task Force meeting in Oct. 2010 in Rome

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GBEP and indirect effects

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- **Inventory** of national policies on LUC, focus on developing country experiences (e.g. land use planning/zoning laws, feedstock restrictions) – draft by end of 2011
- **Briefing Paper** for GBEP on substance of ILUC and possible responses (update 2012?)
- **2nd International ILUC Workshop**, possibly b2b with GBEP WG meeting (May 2012)?

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Conclusions on ILUC

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- iLUC has international consequences
  → **involve developing countries**
- iLUC goes beyond biofuels
  → issue for **all additional** land uses
- Science substantiates ILUC as significant, but **uncertainty** in models; different **political** views on maturity of science for ILUC **regulation**

→ focus on **minimizing risk** and reduce ILUC rather than being "accurate"

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More Information

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GBEP
Global Bioenergy Partnership

WORKING TOGETHER FOR SUSTAINABLE DEVELOPMENT

GBEP Workshop on Indirect Land Use Change (iLUC): Status of and Perspectives on Science-Based Policies
New York, 15 May 2009
Millennium UN Plaza Hotel

Workshop Summary

www.globalbioenergy.org/events1/gbep-events-2009/other-events-2009/en/

Info on sustainable bioenergy

www.oeko.de/service/bio

Contact: u.fritsche@oeko.de

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