

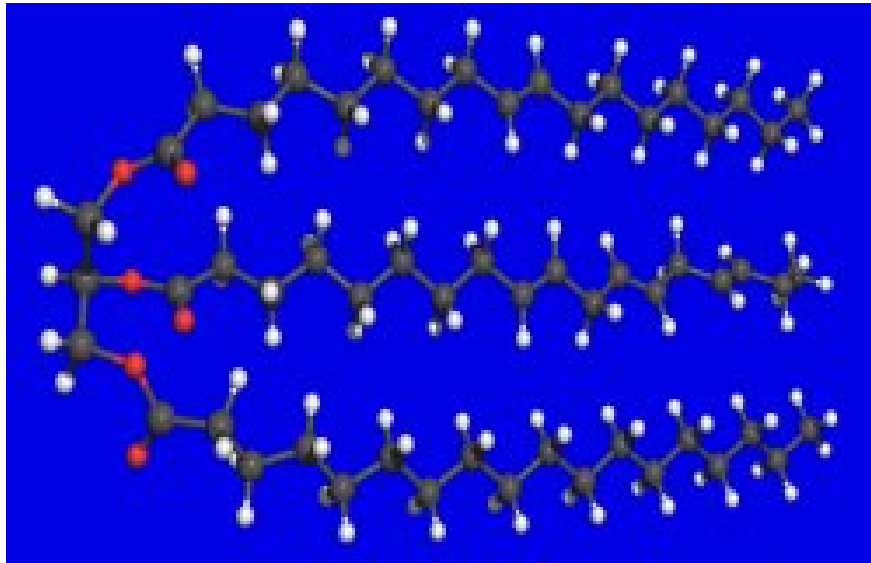
An old idea

“The use of vegetable oil as a fuel product maybe insignificant today. However, in time, such products will become just as important as petroleum and tar-coal products are today.”

Rudolf Diesel, 1912

So... 90 years later, are we really any closer???

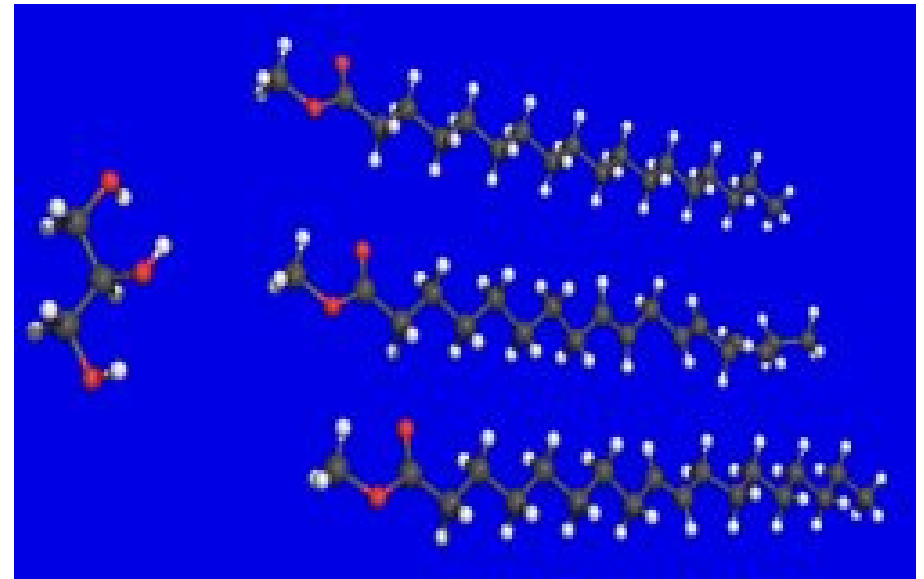
What is biodiesel?



Glycerin →

← Long Chain Fatty Acid +
Alcohol (Eth/Methanol)

↘ Biodiesel



What does biodiesel do?

- Renewable 'green' fuel.
- Recycles CO₂
- Reduces overall emissions:
 - *Greatly reduced particulate, CO and hydrocarbon (THC) exhaust gas emissions.*
 - *95% reduction in carcinogenic compounds*
 - *Massive reduction in net greenhouse gas emissions.*
- Works with existing infrastructure.
- Non toxic in the environment:
 - *Eliminates storage and handling environmental risk.*
- Occupational health and safety benefits.
- But: things do not always go as they should.....

What will make biodiesel?

- Food Grade Cooking oils
 - **soy, rape, canola, palmoil, peanut, coconut, jatropha....**
- Off quality and rancid vegetable oils
- Animal fats
 - Lard, tallow, chicken fat
- Used cooking oils from restaurants
- ***Diversity of feedstocks is the key for large scale processing***

What makes it Happen?

- **Interest of the industry**
- **Interest of the government**
- **Some “activism”**
- **Tax structures**
- **Grants for research and a stakeholder process**
- **Standard setting and compliance procedures**
- **Lots of talking and applied research**

What one learnt

- Absolute importance of standards and compliance.
- Fear of anything “new”.
- Variability of easily available feedstocks.
- Issues of developing new sources of feedstocks – ***In a truly sustainable manner.***
- The need to work with petroleum fuel industry.
- Challenges of engine manufacturer and OEM support.
- Need for government support and incentives.
- Support and interest is good but the road ahead is far from easy or smooth!

Sustainability criteria (generated by the European Transition task Force, 2007)

- Green house gas balance
- Competition with food, medicinal plants, local energy supply, building material
- Biodiversity
- Economic prosperity
- Social well-being
- Environment

Current Dynamics

- Criteria are ever tightening, 2007 still somewhat open, 2011 more tight.
- Energy prices fluxes create uncertainty regarding assumption of price level
- Irreversible damage to resources happens, because of wrong land use.
- Industry is more interested in urban markets than rural areas
- Still a yoyo flux between local energy capacity and desired economies of scale in the processing plants
- Price levels, tax structure in many countries not yet in running order.
- Other?

Palm oil and jatropha

- Palm oil is the biggest source of bio-diesel.
- It has a well established industry behind it
- The break even point with the current energy prices has been reached, but there is still uncertainty
- Jatropha grows well under dry conditions, takes 3 to 4 years to mature. Difficult for small growers to get credit.
- Can not be eaten by cattle, which why it is a border crop. It is not preferred by small farmers.
- Harvesting, mechanisation and processing still needs R & D. Yields are low. Price subsidies are needed.
- Collection from small holders is a problem vis-à-vis scale of processing

The environmental effects of land use changes in
Indonesia and future sustainability of palm oil
production:
a case study in Riau, Sumatra, with CAPSA

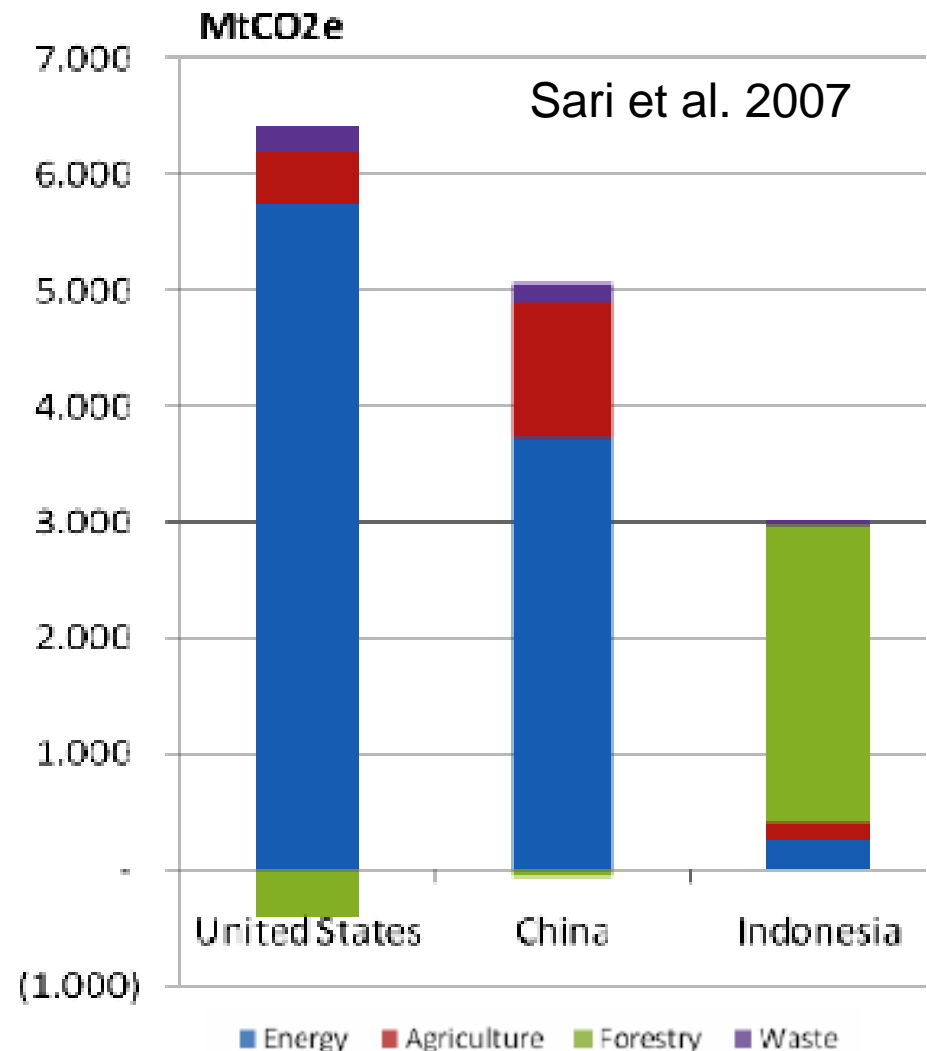
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Yale School of Forestry and Environmental Studies

A. Ariane Kaper
MSc Program Energy Science
Utrecht University, the Netherlands
aakaper@gmail.com

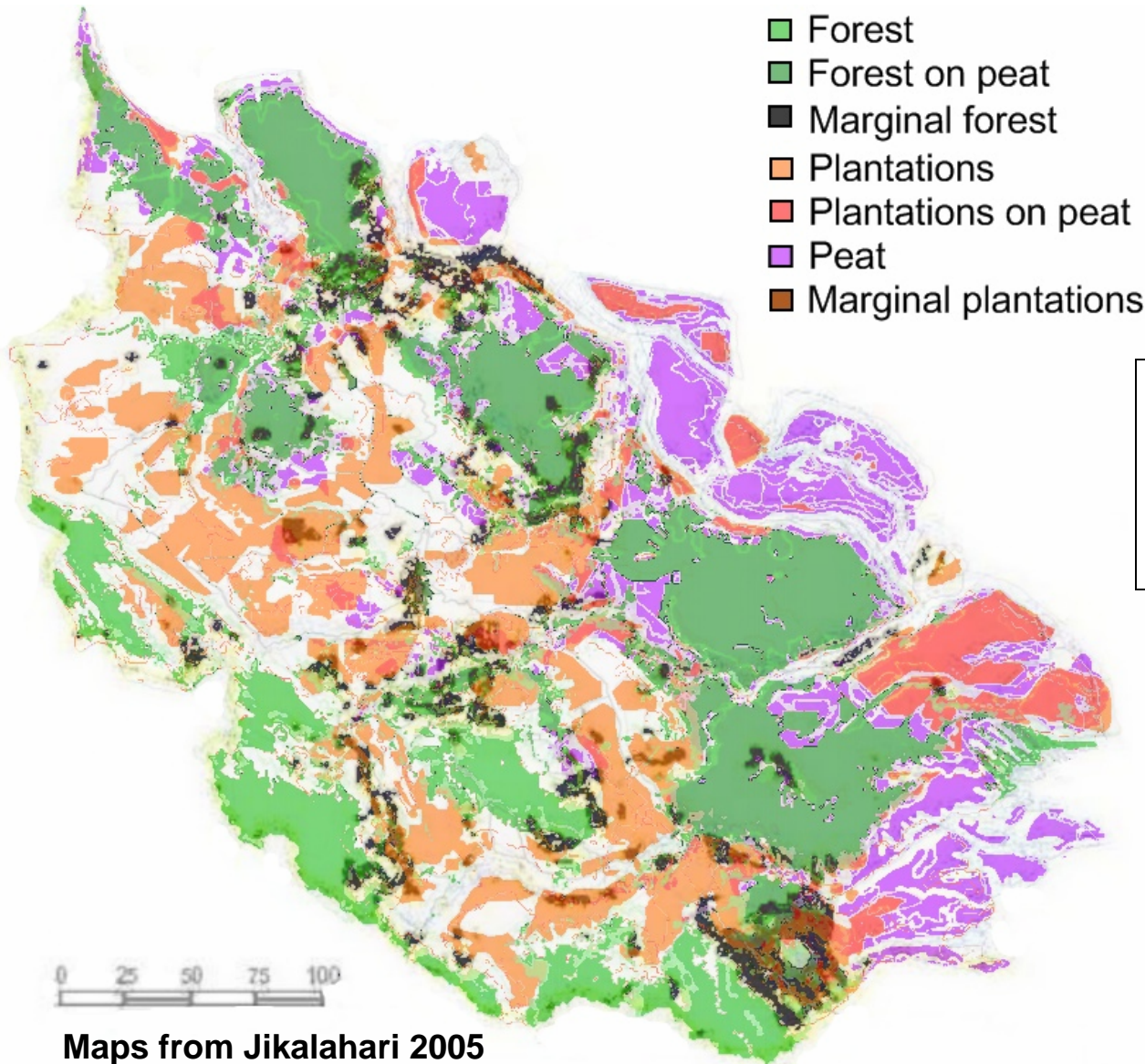
Introduction

- LUC and resulting GHG emissions: Including emissions from LUC and forestry, Indonesia became the third largest emitter of GHG emissions in 2005
- Palm oil took a share in this: conversion of natural rain forest and peat swamp forest to palm oil plantations
- But palm oil production could also be a carbon sink if degraded land was used for conversion





Current Land Use Overlap



Of the 1.41 Mha OP

- 0.01 Mha marginal land
- 0.50 Mha forest land
- 0.65 Mha peat land

Past emissions

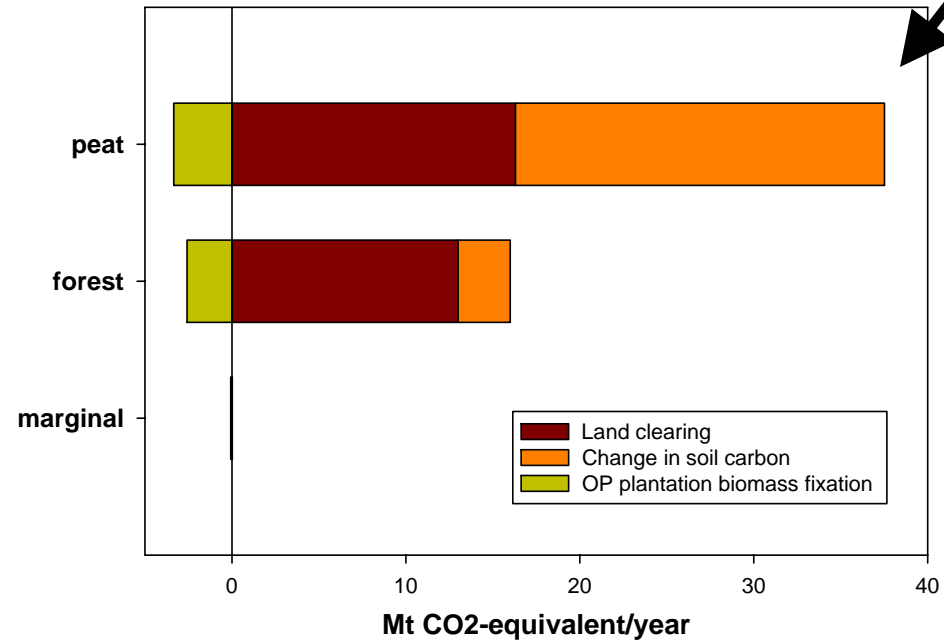
Of the 1.41 Mha OP

- 0.01 Mha marginal land
- 0.50 Mha forest land
- 0.65 Mha peat land

X

[Germer & Sauerborn 2007]

	Marginal Land	Mineral Forest	Peat Forest
	average t CO ₂ -equivalent / yr		
Land Clearing	1,70	25,50	25,08
Change in soil carbon	-1,92	6,00	32,64
OP plantation biomass fixation	-5,16	-5,16	-5,16
total	-5,38	26,34	52,56



Past emissions

- 1982-2005 emissions from OP expansion:
 - LUC only:
 - 47.3 Mt CO₂ per yr
 - 13.9 t CO₂eq per tonne CPO
 - Full life cycle of PO production:
 - 405 g CO₂eq / MJ

22%



For comparison:	
1990-2007 emissions from deforestation, forest degradation, peat decomposition and peat fire in Riau [Uryi <i>et al</i> 2008]	220 Mt CO ₂ /yr

Diesel fuel expended energy whole cycle [Well-to-Wheels European Commission update 2006]	88.9 gCO ₂ -eq/MJ
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Observations on Palm Oil

- Order of preference for LUC for oil palm (lowest to highest emissions):
 - **Marginal, forest, peat**
- In the past, forest and peat have been used the most for OP expansion.
- Past emissions of LUC due to OP expansion in Riau are high

Conclusions overall

- The price increase of energy is a boon in disguise, but stability is badly needed
- There is bound to be overinvestment in processing facilities
- Especially for jatropha supply is still very limited in Asia
- The policy process is by no means completed in the developing world. This matter is urgent
- In palm oil we see wrong land use. Moving to marginal lands will require higher investments, regulation and compliance.
- We should not forget bio-diesel on a large scale competes with ethanol, derived from sugar cane, maize, cassava. We will see increasing patterns of crop competition for rainfed and irrigable land
- Small scale bio-diesel (coconut, jatropha, rape), gasification and hydropower offer potential in isolated areas and islands
- More?
 - Ngatur Nuhun!