What is the carbon footprint and opportunity cost of oil palm production in Indonesia?

Project title:	The carbon footprint and opportunity cost of oil palm production in Indonesia
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Oil palm plantation (Photo: Ni'matul Khasanah)

The World Agroforestry Centre (ICRAF) has been researching the carbon footprint and opportunity costs associated with oil palm plantations in nine provinces on the islands of Sumatra, Kalimantan and Sulawesi, Indonesia.

Activities

Since the project's inception in 2009, we liaised with the Indonesian Palm Oil Commission to develop the research design, plan activities and assign responsibilities and held a workshop with participants from various palm oil companies to prepare them for the project.

Further liaison was done as we developed the different research methods we were to use and then field work was instigated. Field research took place in plantations in Sumatra, Kalimantan and Sulawesi, visiting a total of 22 companies.

The methods we developed were then taught to staff from palm oil companies who attended our workshop on estimating the carbon footprint of oil palm.

Left: Soil sampling (photo: Ni'matul Khasanah). **Middle:** Necromass sampling (photo: Ni'matul Khasanah). **Right:** Palm height measurement (photo: Harti Ningsih)

We are now completing analysis of all the data and finalising reports.

Key findings to date

Three groups of producers can be distinguished (nucleus plantation managed by companies; plasma managed by smallholders under contact with the company; and independent smallholders), which differ in management styles and incentives.

At the assessment scale of a single mill, the product flows of the three groups of producers need to be aggregated. For assessments at company or national scale, further aggregation across the various mills is necessary.

Emissions need to be considered in the context of the socioeconomic impacts of the full range of production systems for the various producers. Further data collection is needed to make this assessment.

A key result of the study was that the time-averaged aboveground carbon stock of oil palm on mineral soils under 'nucleus' management regimes is about 40 t C/ha. This means that where oil palm replaces vegetation with more than 40 t C/ha, a carbon debt is incurred that can be substantial relative to the annual flow of carbon-rich products in palm oil. If oil palm replaces vegetation of less than 40 t C/ha, a net sequestration will take place that comes on top of the carbon flow in products. Where these products offset fossil-fuel emissions, this can lead to a net benefit for the global carbon cycle. In a second rotation, oil palm replaces vegetation of 40 t C/ha as time-averaged carbon stock and the focus can fully be on the emissions caused by the production system (nitrous oxide emissions linked to fertiliser use, ongoing peat decomposition and methane emissions in the palm oil mill versus the potential fossil fuel CO_2 emission offset of use of the palm oil.

Oil palm distribution in Indonesia in 2006, covering 10–15% of the area in Riau, North Sumatra and Jambi; 5–10% of the area in Bangka, South Sumatra, Bengkulu and West Sumatra; 1–5% of the area in Banten, Lampung, Aceh, Kalimantan and West Sulawesi; and < 1% of the area in the rest of Indonesia

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