# Comparative Life Cycle Assessment: - RSPO-certified vs non-certified


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# Background

- Sustainable palm oil: Certification is the most acknowledged choice
- But what is the benefit?
  - GHG emissions
  - Biodiversity and nature conservation
  - Other impacts

- Crowdfunded project: https://lca-net.com/clubs/palm-oil/
- Launched November 2016
- Finalized August 2019
- 16 members

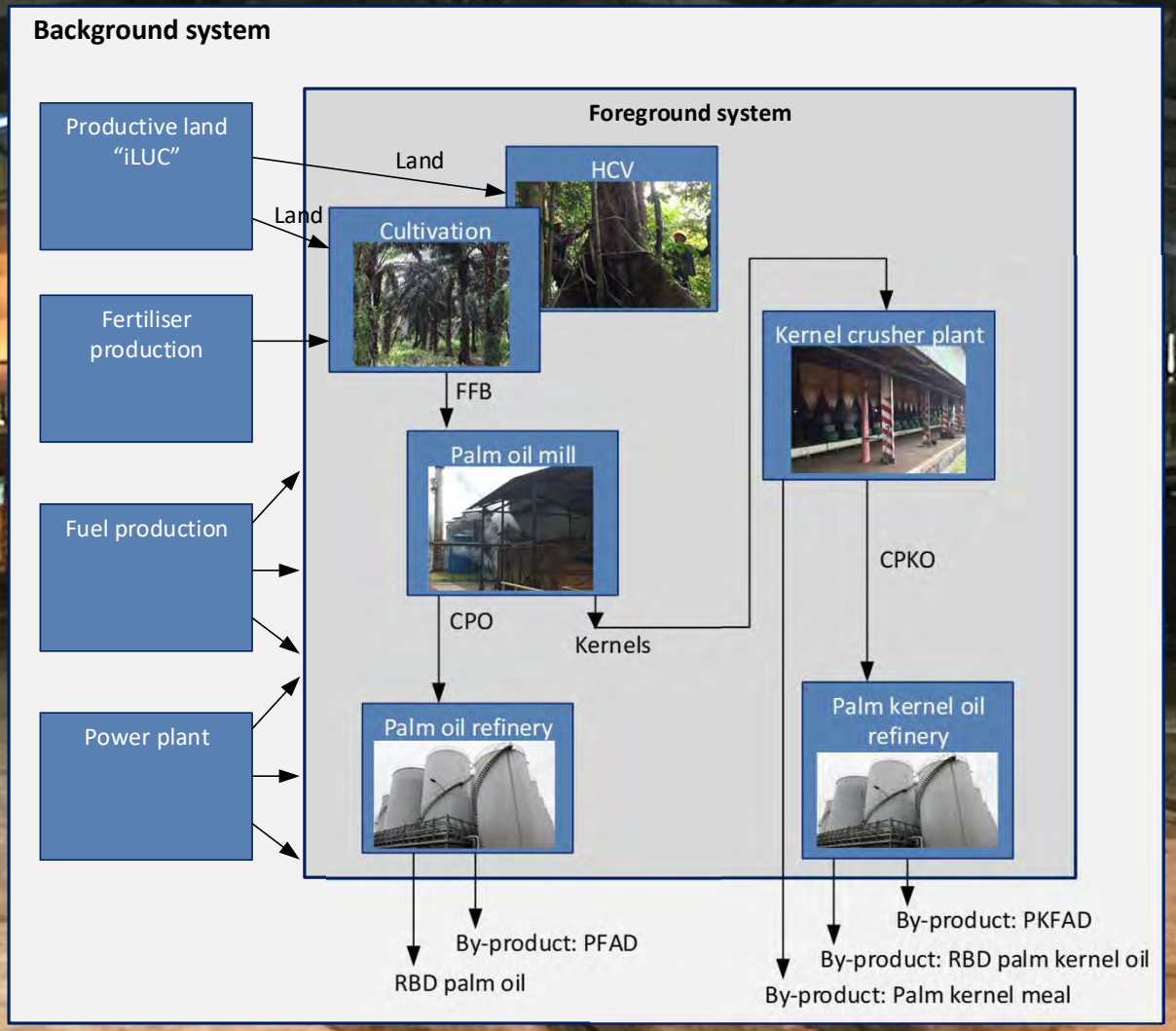
Beiersdorf, ERASM, FERRERO, sinarmas, Unilever, DUPONT, novozymes Rethink Tomorrow

Project promoted and supported by RSPO
Carried out independently of RSPO

CERTIFIED SUSTAINABLE PALM OIL RSPO

Picture: Jannick Schmidt. Sinarmas, Central Kalimantan 2018

# Life cycle assessment (LCA)




Picture: Jannick Schmidt. Hanau palm oil mill, Sinarmas, Central Kalimantan 2018

# Methods

- Functional unit = 1 kg refined palm oil
- Scope: 2016 and Indonesia and Malaysia
- Land use changes and nature conservation included
- Consequential and attributional LCA model
- Very detailed models
  - N-balances
  - Peat emissions
  - Oil mill boiler energy balance and stack emissions
  - Palm oil mill effluent (POME) model

Picture: Jannick Schmidt. Sinarmas, Central Kalimantan 2018

# Data collection

| Input data<br>Industry total | | Input data<br>RSPO certified | | Input data<br>Non-certified |
|---|---|---|---|---|
| **Estates** | | **Estates** | | **Estates** |
| Yield | | Yield | | Yield |
| Fertiliser | | Fertiliser | | Fertiliser |
| Peat | | Peat | | Peat |
| Fuels | minus | Fuels | = | Fuels |
| Conservation | | Conservation | | Conservation |
| **Oil mills** | | **Oil mills** | | **Oil mills** |
| OER | | OER | | OER |
| KER | | KER | | KER |
| Fuels | | Fuels | | Fuels |
| POME | | POME | | POME |

- Total industry
  - Statistics and GIS
  - LCA coefficients to close gaps
- RSPO certified: Assessment reports
  - 634 estates (58% of all certified FFB)
  - 165 oil mills (58% of all certified CPO)

Picture: Jannick Schmidt. Hanau palm oil mill, Sinarmas, Central Kalimantan 2018

# What do the data show?

## Estates

Key performance indicators for oil palm cultivation

| Flows | Unit | Total industry (ID & MY) | RSPO-certified | Non-certified |
|---|---|---|---|---|
| Total planted area | Million ha | 14.4 | 2.44 | 12.0 |
| Share of oil palm on peat | % | 18% | 11% | 19% |
| Drainage depth (DD) of peat | cm | 73 | 57 | 75 |
| FFB yield, mature | t/ha | 18.9 | 21.1 | 18.5 |
| Fuel use | MJ/ha | 2,940 | 2,940 | 2,940 |
| Applied mineral N | kg N/ha | 82 | 170 | 64 |
| Applied organic N | kg N/ha | 21 | 24 | 21 |
| Applied mineral $P_2O_5$ | kg $P_2O_5$/ha | 41 | 103 | 28 |
| Applied organic $P_2O_5$ | kg $P_2O_5$/ha | 28 | 31 | 27 |
| Applied mineral $K_2O$ | kg $K_2O$ | 156 | 245 | 138 |
| Applied organic $K_2O$ | kg $K_2O$ | 138 | 153 | 135 |

## Oil mills

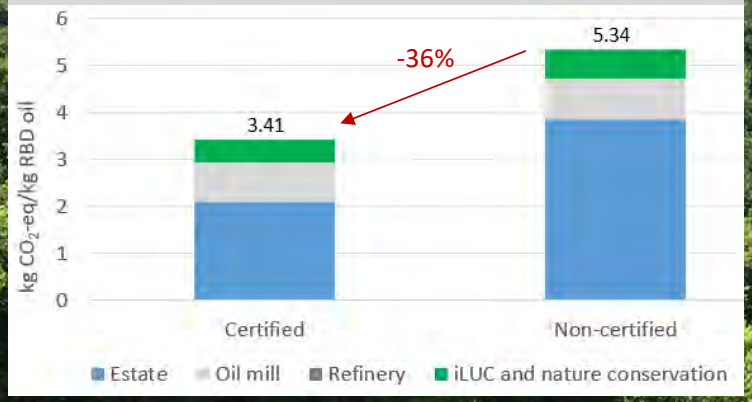
Key performance indicators for palm oil mills

| Flows | Unit | Total industry (ID & MY) | RSPO certified | Non-certified |
|---|---|---|---|---|
| OER | % | 20.2% | 21.9% | 19.8% |
| KER | % | 5.4% | 5.6% | 5.4% |
| Share of POME treated with biogas capture | % | 5.0% | 16% | 2.4% |
| Share of landbank in supply base set-aside as HCV | % | 0.6% | 3.1% | 0% |

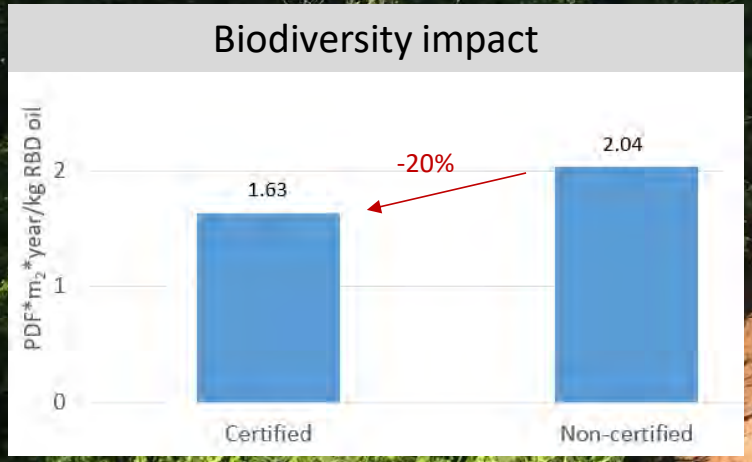
Picture: Jannick Schmidt. UIE palm oil mill, United Plantations, Peninsular Malaysia 2017

# Where do the LCA results take us?

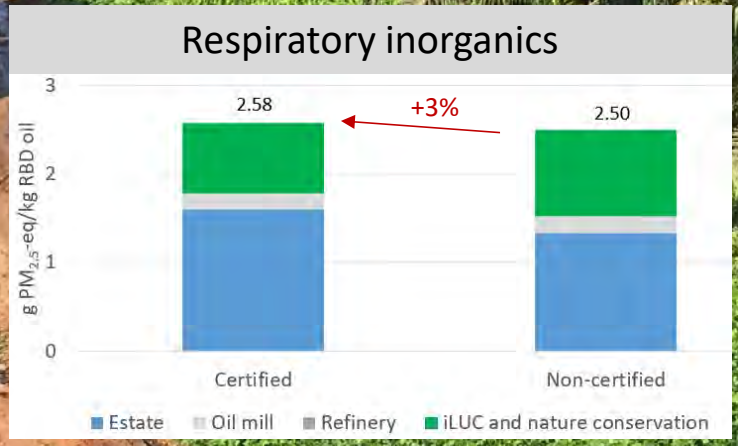
## GHG emissions




## Biodiversity impact




## Respiratory inorganics




Picture: Jannick Schmidt. Nature conservation, Sungai Rungau estate, Sinarmas, Central Kalimantan 2017

# The devil lies in the detail...
## - GHG emissions

Low peat share
Low drainage depth

High yield

More biogas capture

Higher fertiliser

| Life Cycle Stage | Contribution | Certified | Non-certified |
|---|---|---|---|
| **Oil crop cultivation** | | | |
| | Field emissions (related to nutrient cycle) | 0.72 | 0.92 |
| | Field emissions (related to peat drainage) | 0.77 | 2.36 |
| | Indirect Land Use Changes (iLUC) | 0.49 | 0.62 |
| | Material inputs: fertiliser, pesticides, capital goods etc. | 0.33 | 0.21 |
| | Energy | 0.07 | 0.08 |
| | Other (transport, waste treatment, assets and services) | 0.20 | 0.27 |
| | **Total crop cultivation stage** | **2.58** | **4.46** |
| **Palm oil mill** | | | |
| | POME treatment | 1.19 | 1.51 |
| | Energy inputs | -0.03 | -0.06 |
| | Other (transport, waste treatment, assets and services) | 0.17 | 0.18 |
| | By-product: kernel | -0.43 | -0.70 |
| | By-product: energy and EFB to field application | -0.04 | -0.04 |
| | HCV nature conservation | -0.01 | 0.00 |
| | **Total palm oil mill stage** | **0.85** | **0.89** |
| **Refinery** | | | |
| | Materials: chemicals, water etc. | 0.02 | 0.02 |
| | Energy | 0.03 | 0.03 |
| | Other (transport, waste treatment, assets and services) | 0.02 | 0.02 |
| | By-products: PFAD/PKFAD | -0.08 | -0.08 |
| | **Total refinery stage** | **-0.01** | **-0.01** |
| **All stages** | | | |
| **Total** | | **3.41** | **5.34** |

Picture: Jannick Schmidt. Nature conservation, Hanau estate, Sinarmas, Central Kalimantan 2018

# What matters? Peat and water management

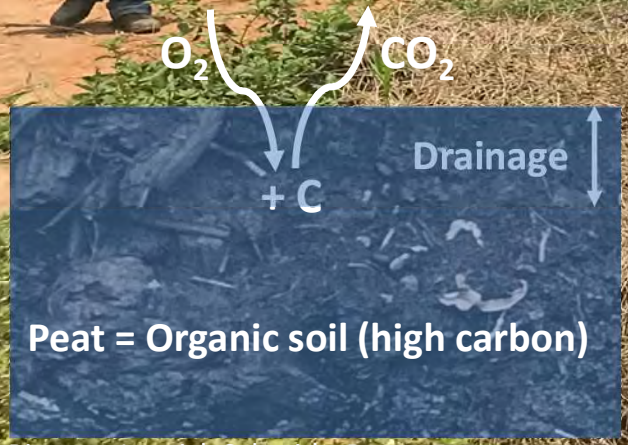
Account for 22-45% of GHG emissions
Average: 73 cm ⇒ 41 t $CO_2$/ha*year
Certified: 57 cm ⇒ 32 t $CO_2$/ha*year

Good water management
RSPO certified grower

0.3 m

Poor water management
non-certified grower

1.2 m




Picture: Jannick Schmidt. Peat water management, Central Kalimantan 2018

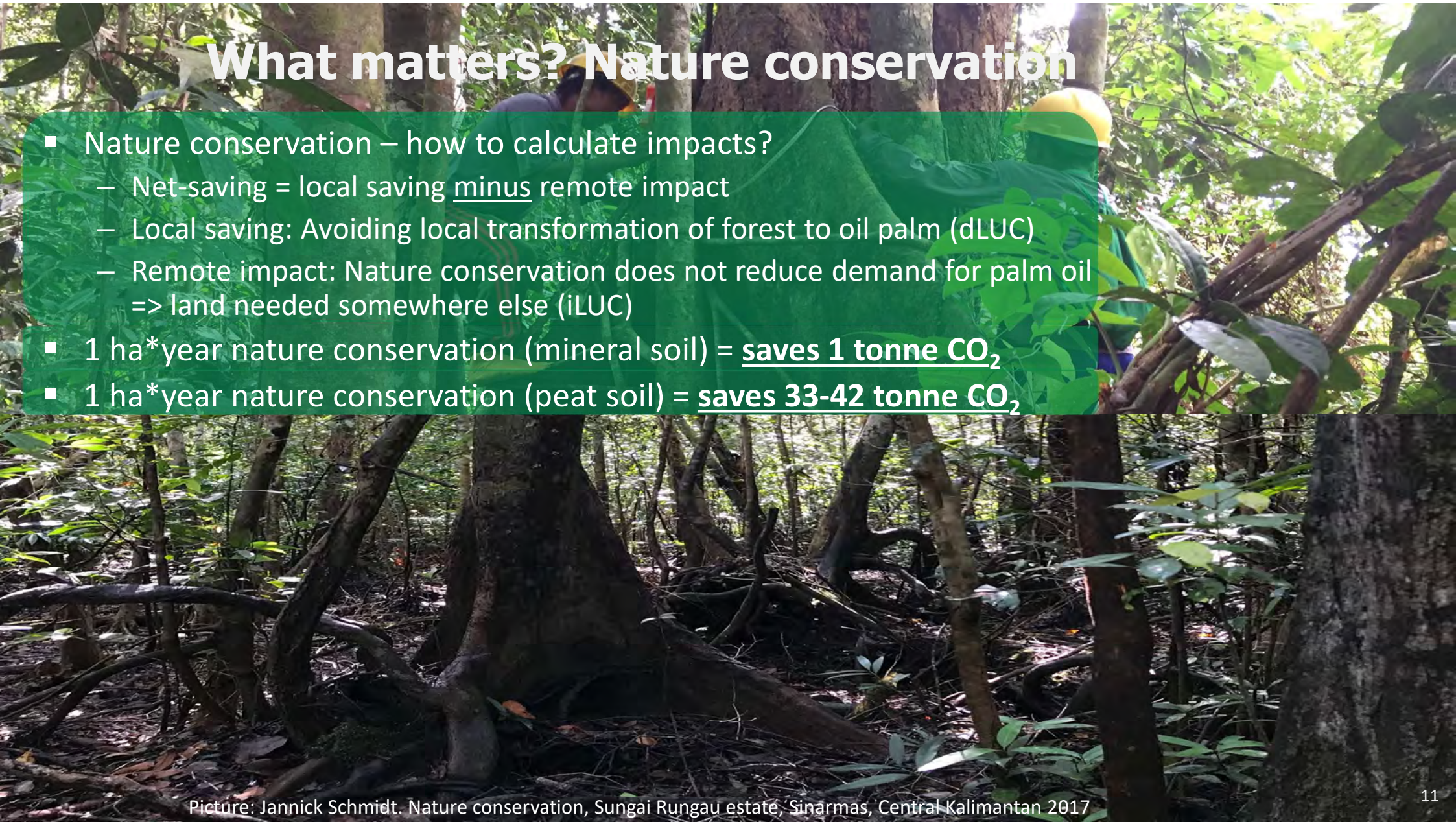
# What matters? Biogas capture

- Anaerobic ponds ⇒ methane
- POME emissions account for around 1/3 of GHG emissions
- Can be more than eliminated by biogas capture

Picture: Jannick Schmidt. Biogas digester tank and POME treatment at mill, United Plantations, Peninsular Malaysia 2017

# What matters? Nature conservation

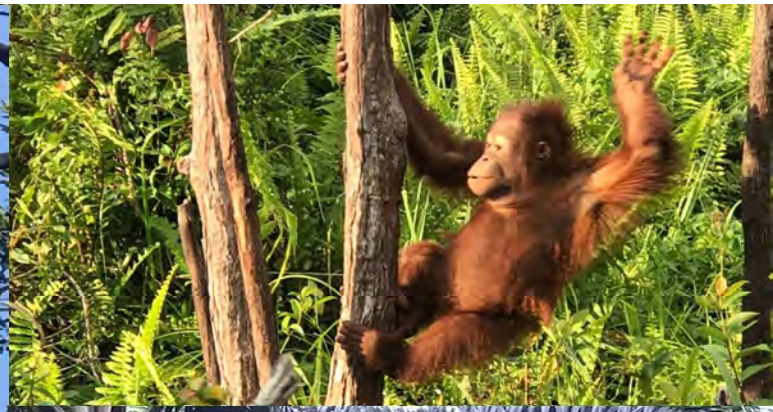
- Nature conservation – how to calculate impacts?
  - Net-saving = local saving minus remote impact
  - Local saving: Avoiding local transformation of forest to oil palm (dLUC)
  - Remote impact: Nature conservation does not reduce demand for palm oil => land needed somewhere else (iLUC)
- 1 ha*year nature conservation (mineral soil) = **saves 1 tonne $CO_2$**
- 1 ha*year nature conservation (peat soil) = **saves 33-42 tonne $CO_2$**



Picture: Jannick Schmidt. Nature conservation, Sungai Rungau estate, Sinarmas, Central Kalimantan 2017

# Conclusions

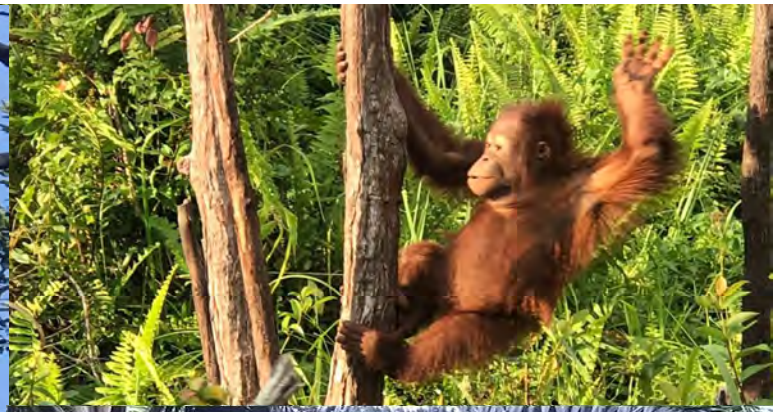
- Model
  - Detailed and compatible with SimaPro
  - Runs with >600 estates and >150 oil mills
  - Two sets of results:
    - Consequential (cause-effect)
    - Attributional (similar to PalmGHG)
- Results: RSPO certified vs. non-certified
  - 36% lower GHG emissions
  - 20% lower nature occupation
  - 3% higher respiratory inorganics
  - LCA guides what matters



Pictures: Jannick Schmidt. Tanjung Puting, Central Kalimantan 2018

# Conclusions

- What can the results be used for?
  - Now the impact of certification can be measured!
  - Companies can include the benefits of committing to certified oil in their environmental accounts
  - The industry can document that palm oil can be produced more sustainable
  - Inputs for next criteria for certification
  - Now RSPO can set measurable targets for reductions in GHG emissions and biodiversity impacts



Pictures: Jannick Schmidt. Tanjung Puting, Central Kalimantan 2018

# What is next?

- New crowdfunded project
  https://lca-net.com/clubs/palm-oil/
- Features
  - 2016 ⇨ Time-series
  - ID&MY ⇨ ID, MY, TH, CO, NG etc.
  - All growers ⇨ estates, smallholders
- Become a member and:
  - Shape the scope of the study
  - Get access to all data and materials


Pictures: Jannick Schmidt. Tanjung Puting, Central Kalimantan 2018

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Pictures: Jannick Schmidt. Tanjung Puting, Central Kalimantan 2018