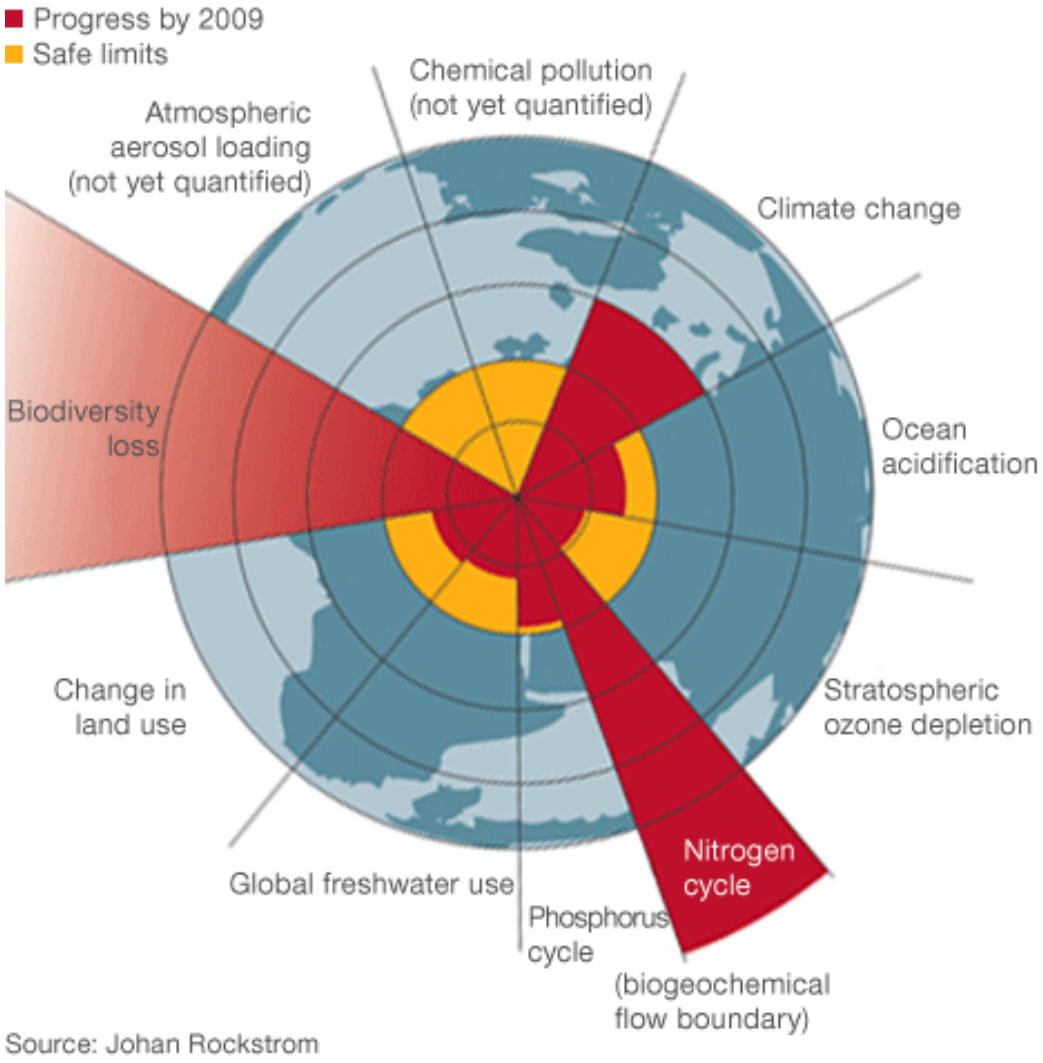
The environmental impacts of palm oil products

What can we learn from Life Cycle Assessment (LCA)?

Dr. Cécile Bessou

cecile.bessou@cirad.fr

Planet boundaries Rockström et al. 2009



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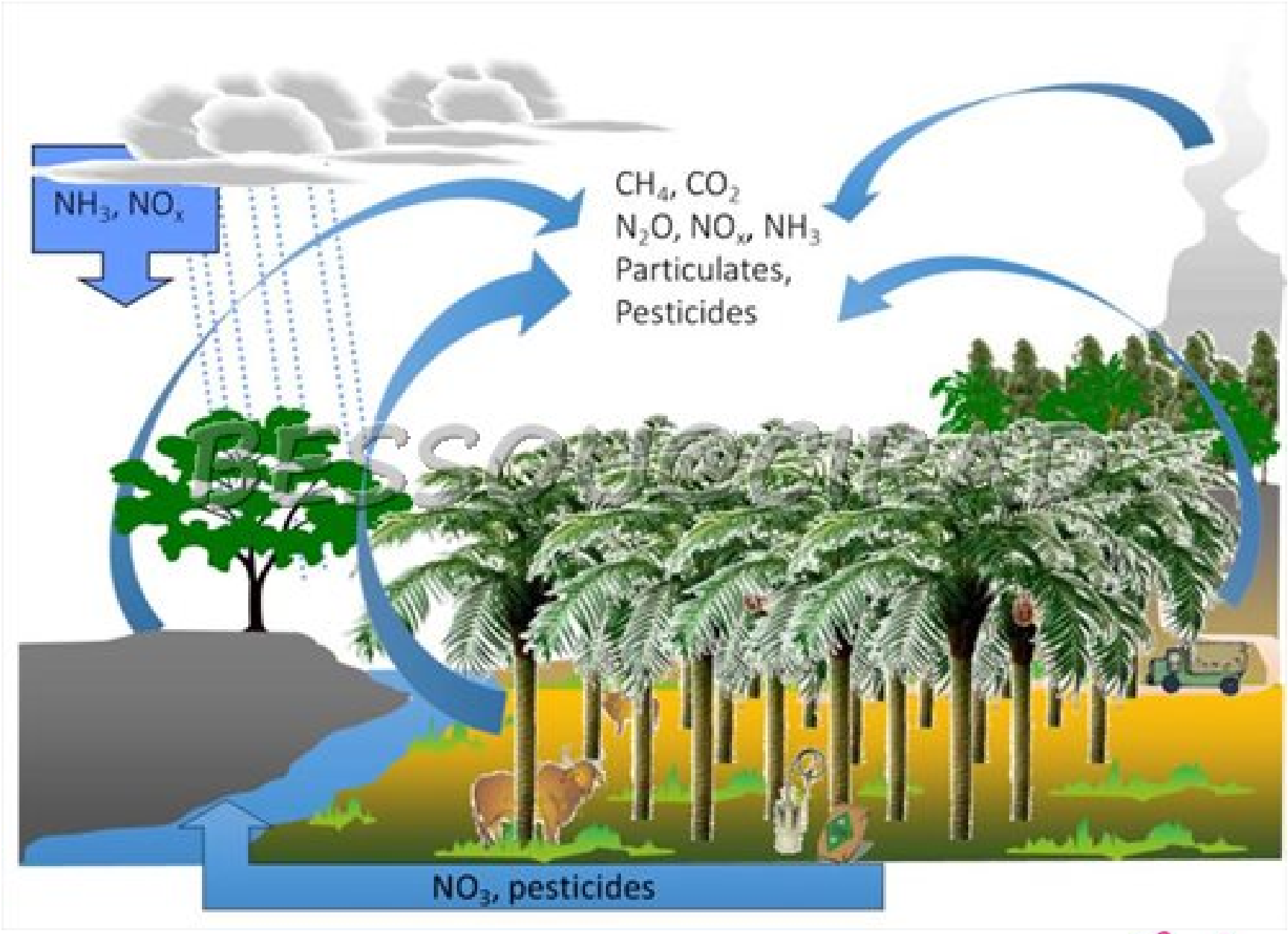

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The life cycle perspective

cecile.bessou@cirad.fr

Why using LCA?

- **Comprehensive**: complete system & various impacts
  ⇨ avoids problem shifting
- Based on a **reference flow** (functional unit)
  ⇨ can account for productivity
  ⇨ avoids problem shifting
- **Standardised** by ISO norms (14040 series)

⇨ To identify impact hotspots and room for improvement
⇨ To design improved practices

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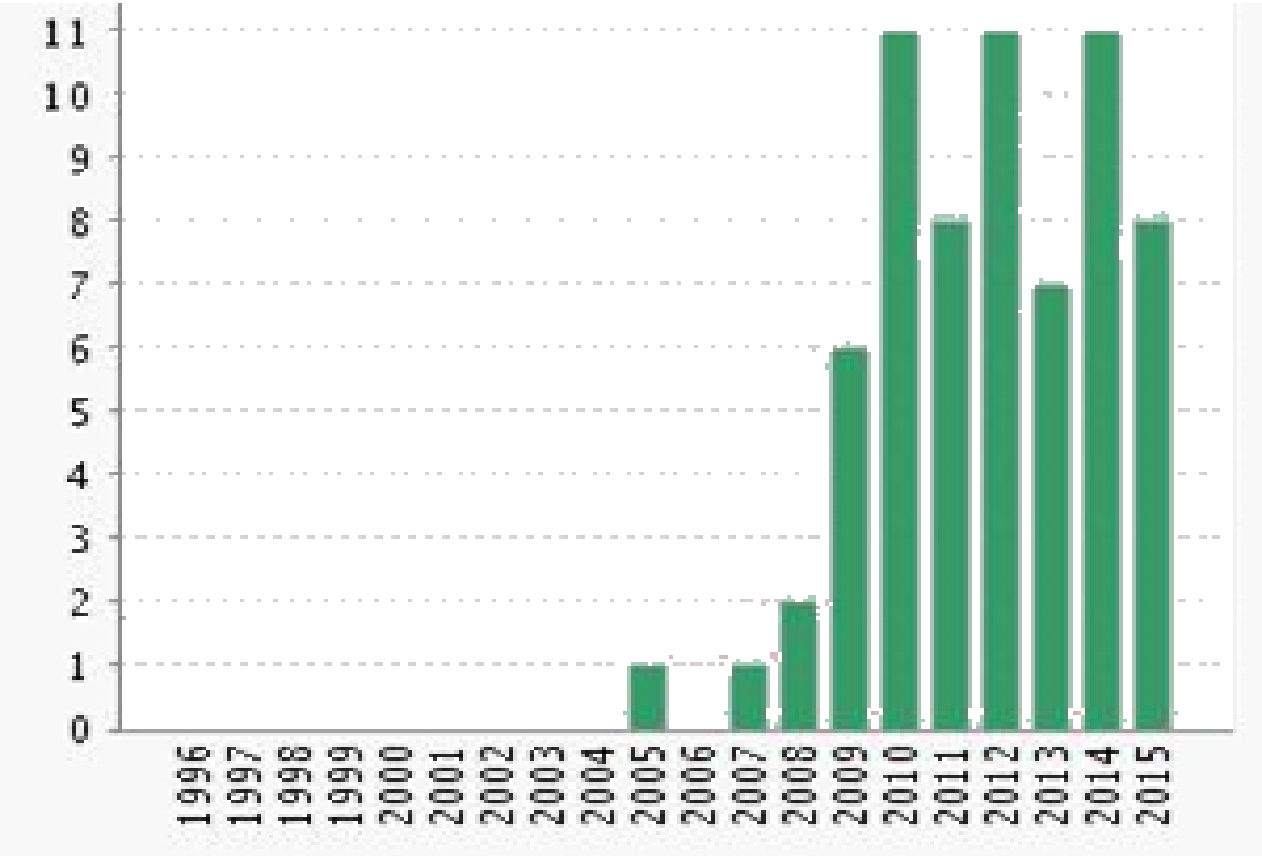
Increasing number of palm LCA



- Web of Science Sept. 2015, TOPIC:(LCA+palm oil)

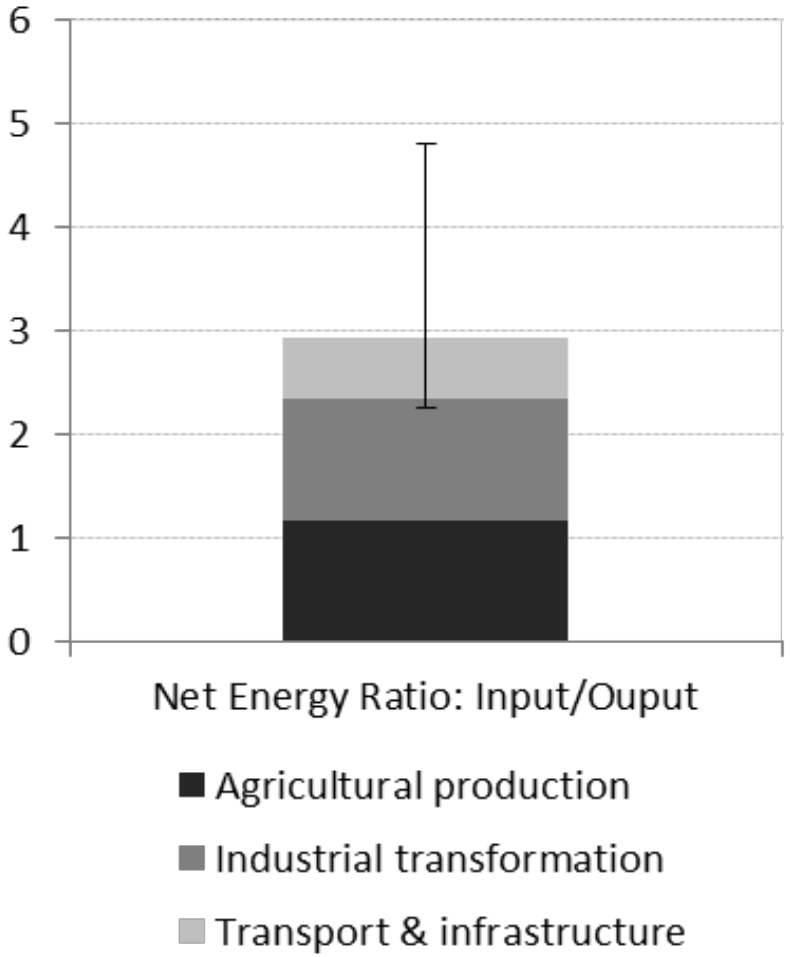
cecile.bessou@cirad.fr

What do LCA tell us about palm biodiesel?

cecile.bessou@cirad.fr

Net Energy Ratio

Adapted from Manik & Halog 2013



- Energy output/input
- 2.9 [2.3-4.8]
- Potential >6
- Main contributors:
  - Fertilisers
  - Methanol
  - Energy inputs

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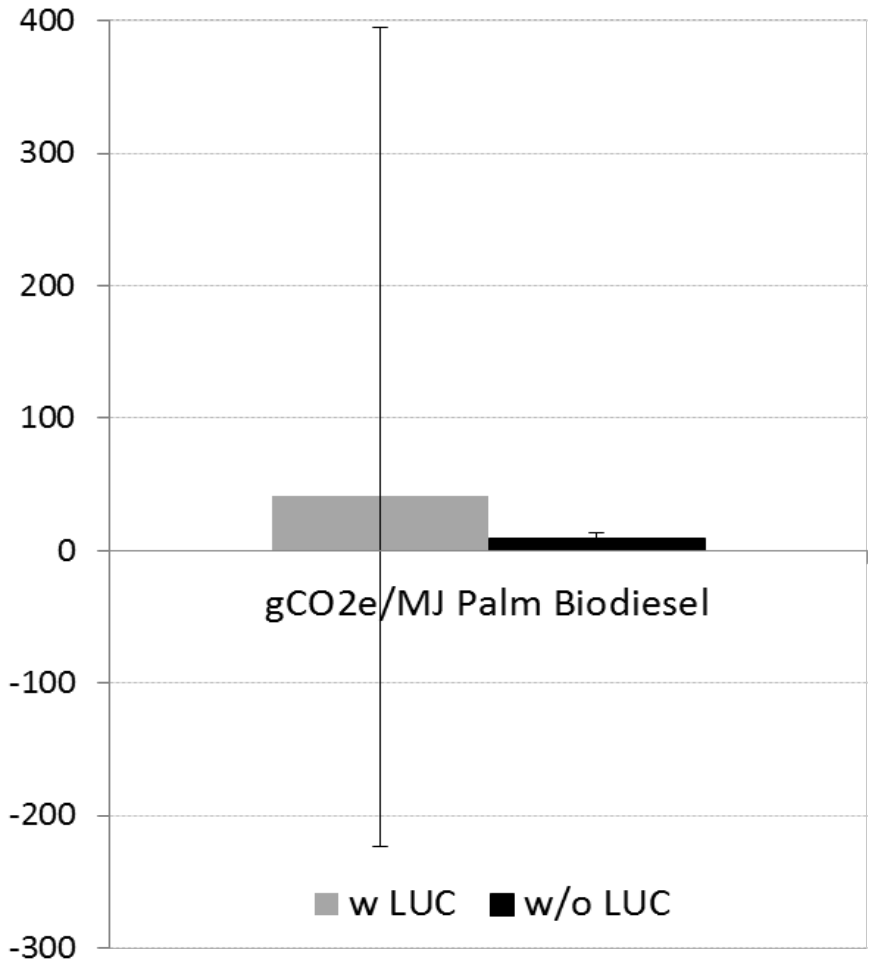
GHG balance

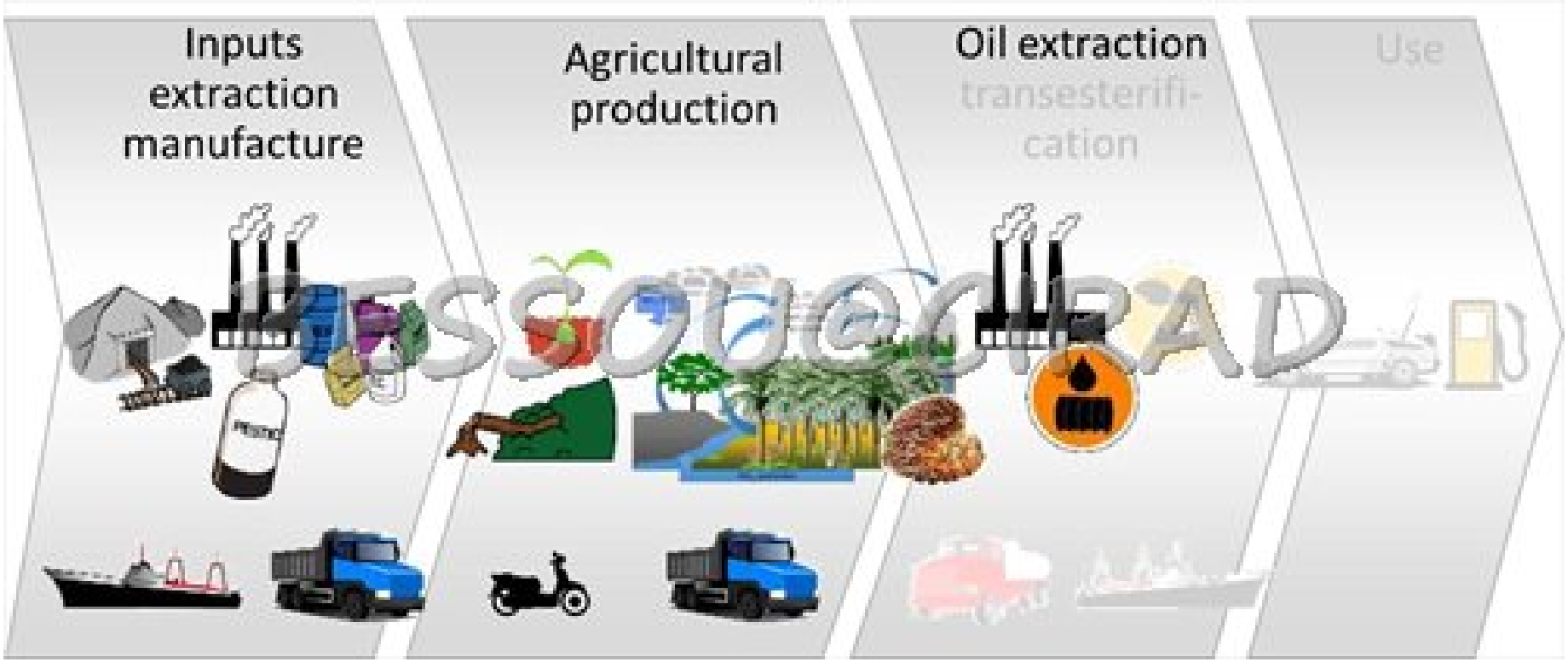
Adapted from Manik & Halog 2013



- 40 gCO2e/MJ with LUC
  9 gCO2e/MJ without LUC
- [-200, 400 gCO2e/MJ]
- Main contributors:
  - LUC, Peat oxidation
  - Fertilisers
  - POME emissions
  - Transesterification
- 55-89% GHG savings /fossil fuel if no deforestation, no peat oxidation

cecile.bessou@cirad.fr

What do LCA tell us about palm oil?



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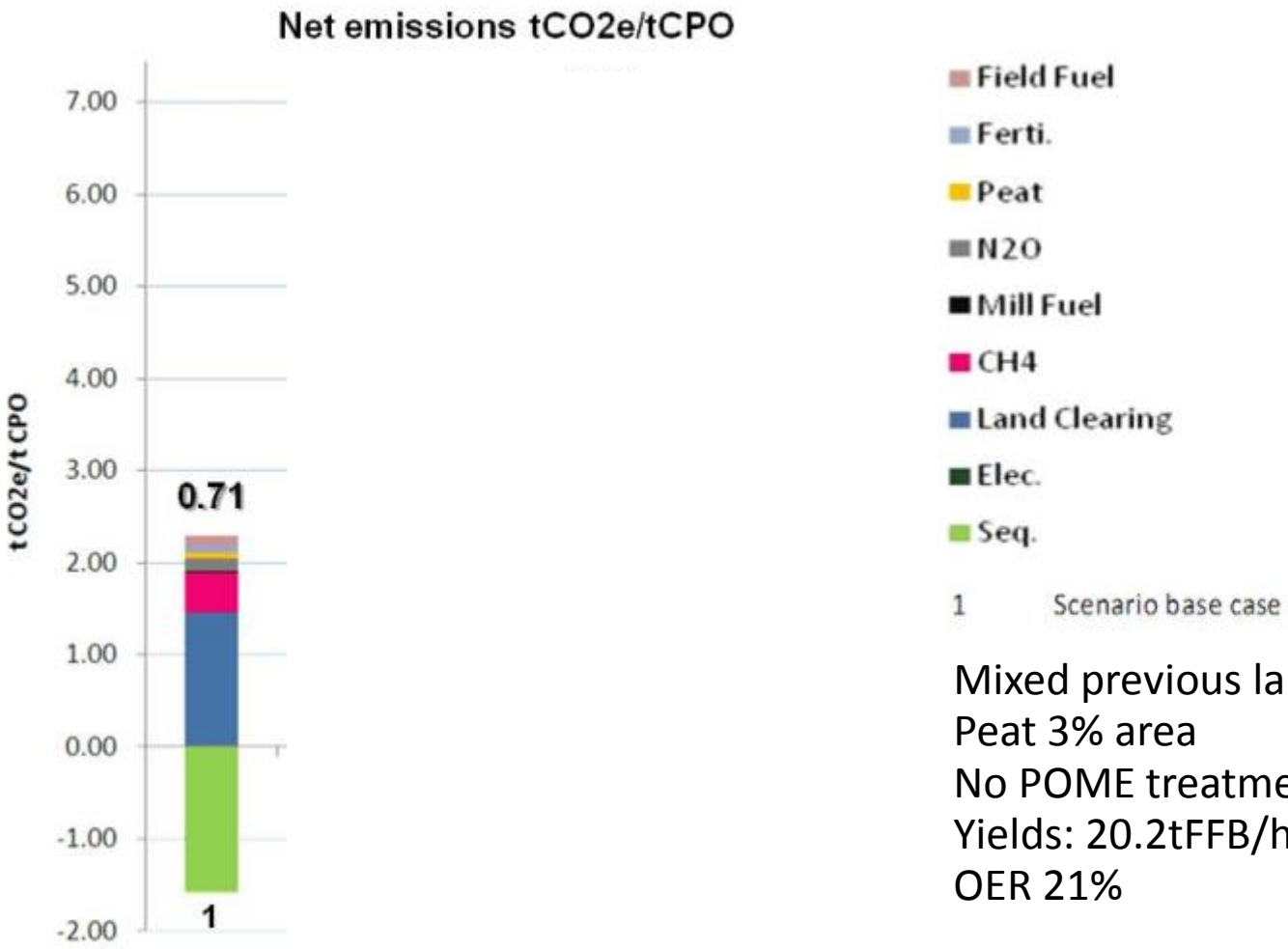
GHG balance with RSPO PalmGHG

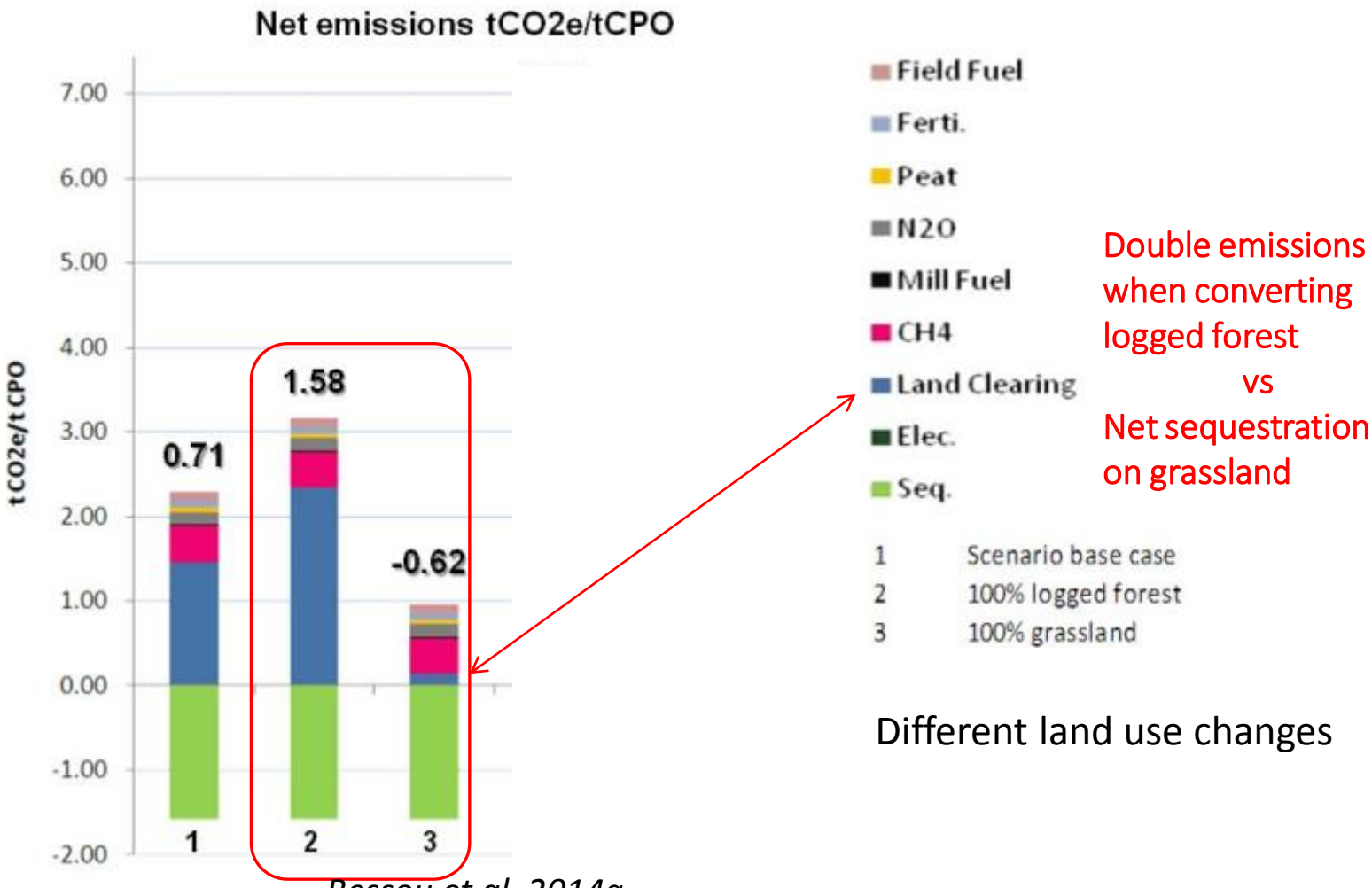


Mixed previous land uses
Peat 3% area
No POME treatment,
Yields: 20.2tFFB/ha-14.2tFFB/ha
OER 21%

Bessou et al. 2014a

cecile.bessou@cirad.fr

Impact of Land Use Change



Bessou et al. 2014a

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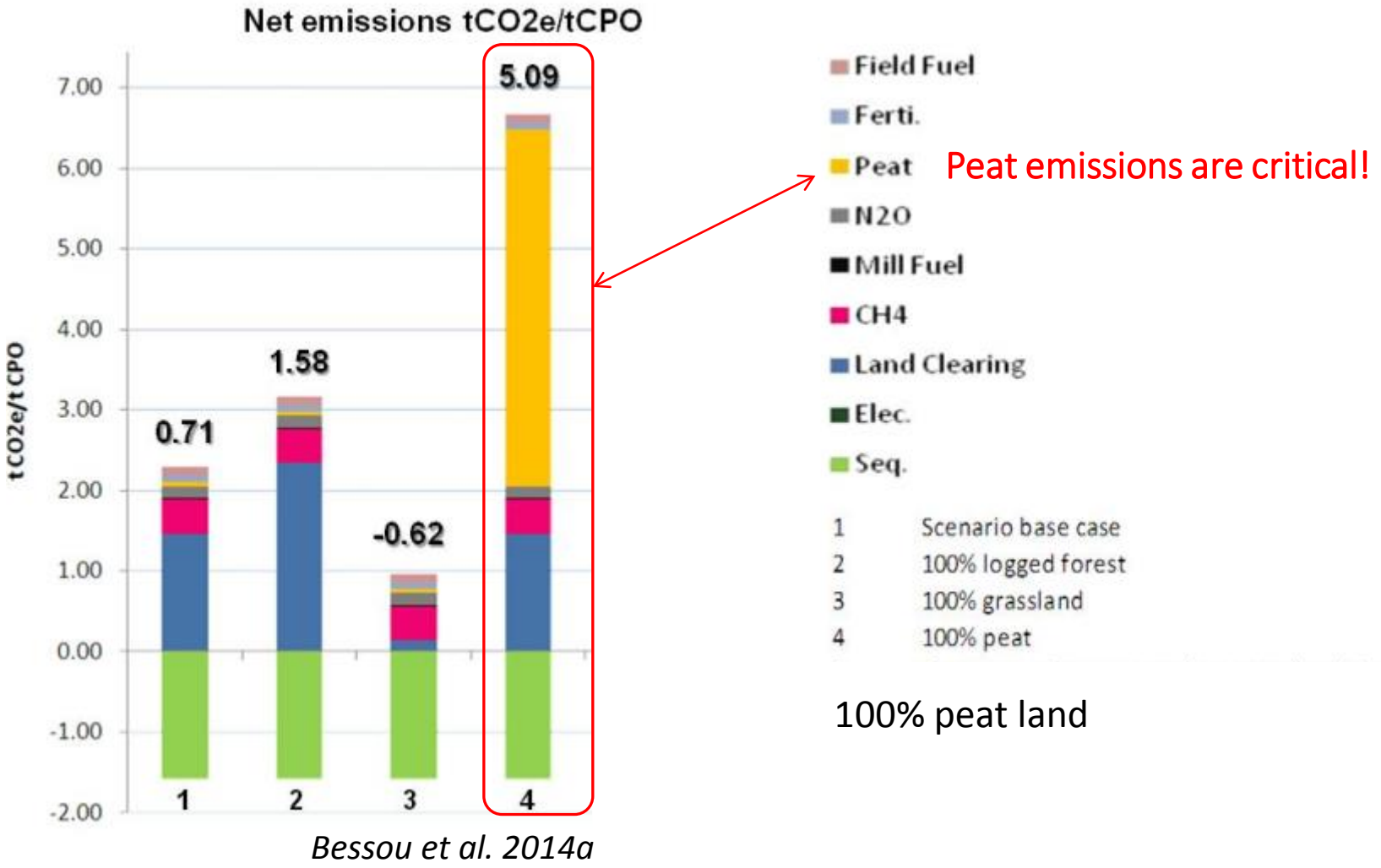
Impact of peat cultivation



Bessou et al. 2014a

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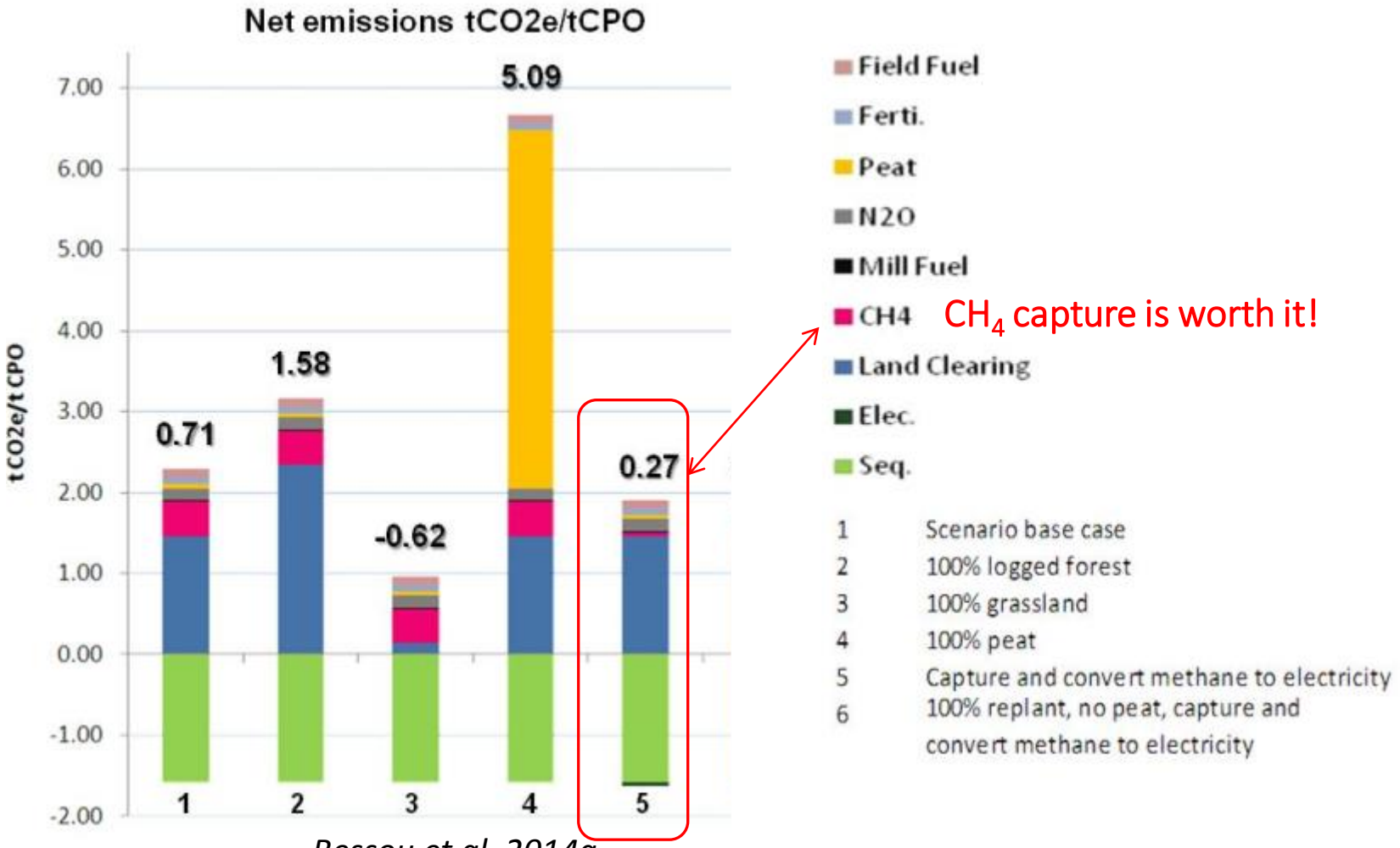
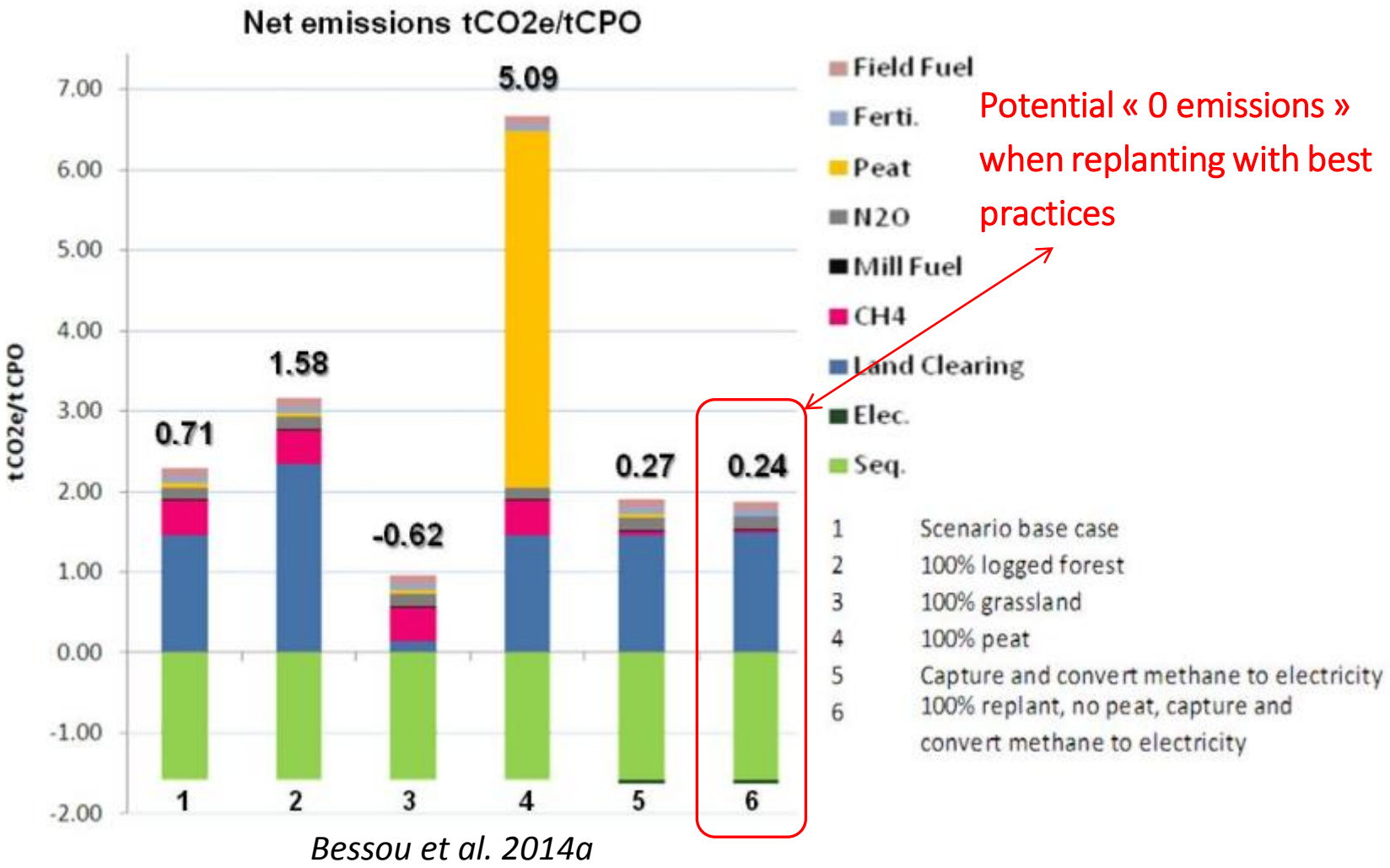
Impact of POME advanced treatment



Bessou et al. 2014a

Replanting towards « O emissions »



Bessou et al. 2014a

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Palm oil environmental impacts

- GHG balance (median values w/o deforestation or peat oxidation): 1-2 tCO2e/tCPO

5400-10800km

ADEME 2008

4000-8000km

ADEME 2008

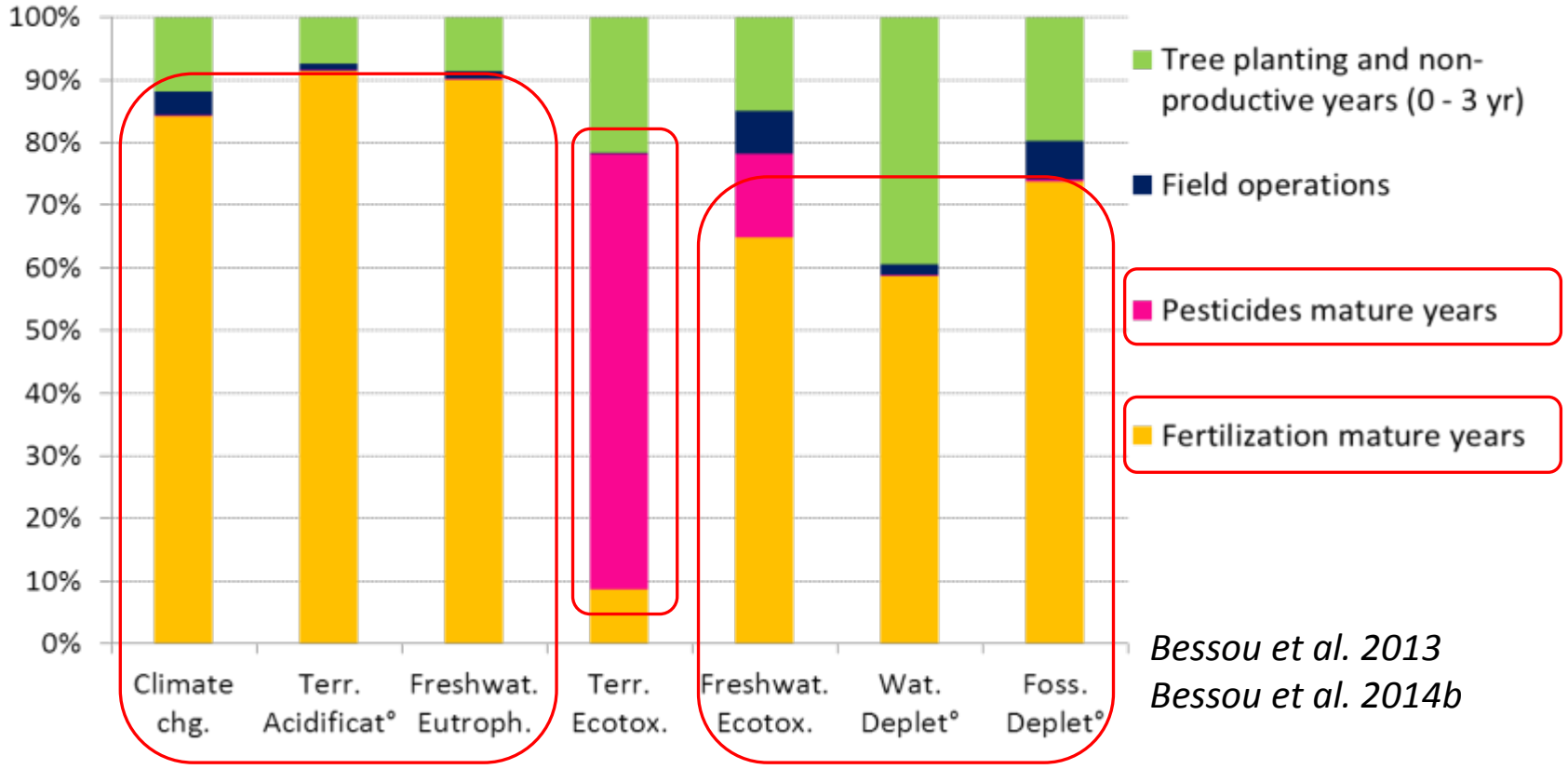
- Fertilisers impact GHG, eutrophication, acidification…
- Mill stage:
  - POME methane impacts GHG
  - Boiler emissions impact “Human toxicity”

cecile.bessou@cirad.fr

What does LCA tell us about FFB?

cecile.bessou@cirad.fr

Palm fruits (FFB) impacts



Bessou et al. 2013
Bessou et al. 2014b

- Importance of encompassing the whole cycle in LCA
- Fertilisers, pesticides: main contributors

cecile.bessou@cirad.fr

Agricultural LCA limits so far

- Limited dedicated models to quantify field emissions
- Limited data availability: cropping systems, other processes
- Impacts not yet all assessed:
  - Under development: water use, salinisation…
  - Complex concepts: biodiversity, soil quality

⇨**Result uncertainty still high**

⇨**Model sensitivity to practices still low**

⇨**Need for research in partnership**

cecile.bessou@cirad.fr

Take home messages

- Life Cycle Assessment (LCA) is a **comprehensive unavoidable approach** to quantify environmental impacts and reduce them
- **GHG** emissions from palm are driven **by land use change**, methane from **POME and fertilisers**
- **Fertilisers** are a main source of environmental impacts
- There are **improvement** opportunities
- The more knowledge we gather, the more precise LCA is, the more **efficient** practice adaptation can be

cecile.bessou@cirad.fr

Terima kasih!

Thank you very much!

Dr. Cecile Bessou, Cirad
cecile.bessou@cirad.fr

References

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cecile.bessou@cirad.fr