



Agroecological practices adopted by Malagasy farmers to reduce farms carbon footprint

Central and East Coast of Madagascar

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Malagasy Context

- ▶ Madagascar is an island of 580 000 km² located in the Indian Ocean
- ▶ High diversity of biophysical conditions



- ▶ Madagascar is one of the poorest countries
- ▶ Population 20 millions: 80% living in rural area
- ▶ Households: 67% are farmers
- ▶ Agricultural productions : for auto consumption local market



Smallholders with low performance

- ▶ Land = 1,4 ha/farmer
- ▶ Rice yield= 2,5 t.ha⁻¹



Threat of food insecurity

Malagasy Context



High pressure on natural resources

- ▶ Mismanagement of soil fertility and water resource
- ▶ Deforestation and slash and burn practices



Agriculture highly dependents on climate variation

- ▶ Climate disturbance: farmers shift cropping calendar, ...
- ▶ Decrease of production



Vulnerable to climate change

Agricultural practices and alternatives

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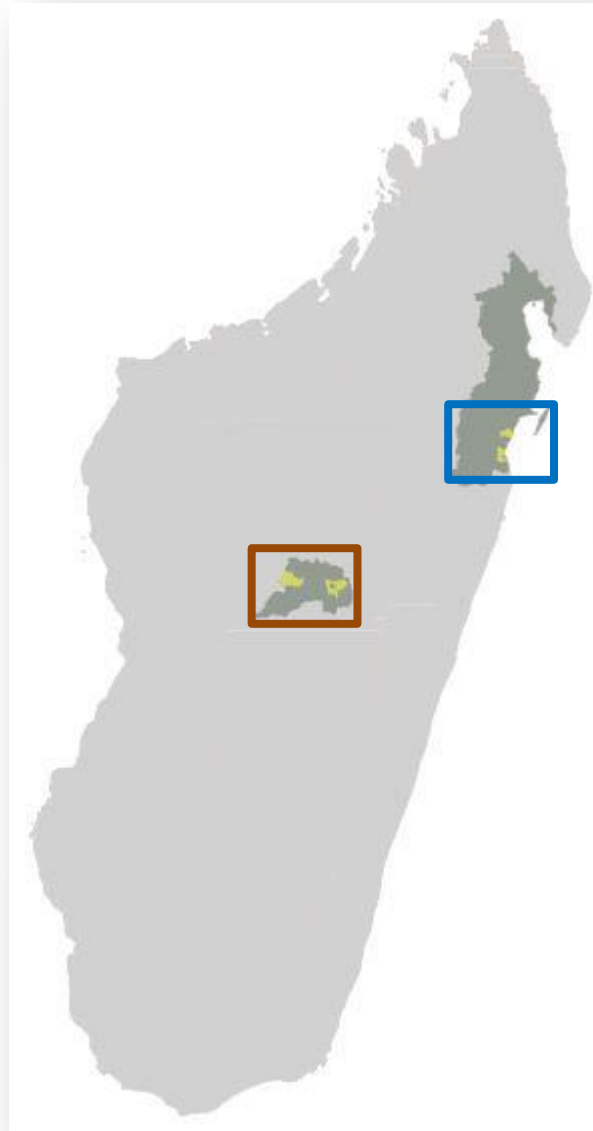
System of Rice intensification



Composting OM



Agroforestry



EAST COAST

Agroforestry



Traditional twice-a-year rice cropping



Main Objectives

- ▶ **Estimate farms carbon footprint (CF)** in two regions of Madagascar: Central and East Coast
- ▶ Assess the **contribution of agroecological practices** to farms carbon footprint

Approach

Annual flux of greenhouse gas (GHG) at farm scale

- **Emission and storage** of GHG from livestock, agricultural practices and energy consumption,...

Consideration of the main three GHG in agricultural sector: **CO₂, CH₄ and N₂O**

- Carbon footprint expressed in CO₂ equivalent

$$\text{Carbon Footprint (tCO}_2\text{ eq)} = \sum \text{Emissions (tCO}_2\text{ eq)} - \sum \text{Storage (tCO}_2\text{ eq)}$$

Farms studied

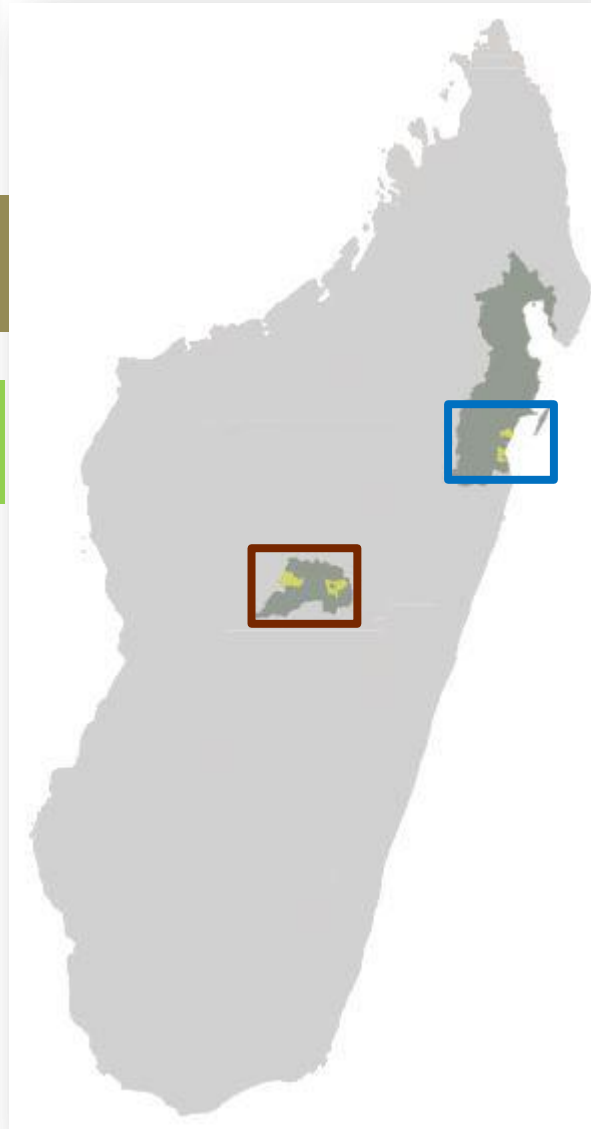
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12 farms

Farms based on traditional practices

Farms based on agroecological practices

- High tropical altitude climate
- Temperature= 17°C
- Rainfall= 1150mm
- Soil type dominated by ferralsols and andosols



EAST COAST

8 farms

Farms based on agroforestry with multiple tree species

Farms based on agroforestry with simple tree specie

- Hot and humid climate
- Temperature= 24°C
- Rainfall= 2500mm
- Soil type dominated by ferralsols and hydromorphic soils

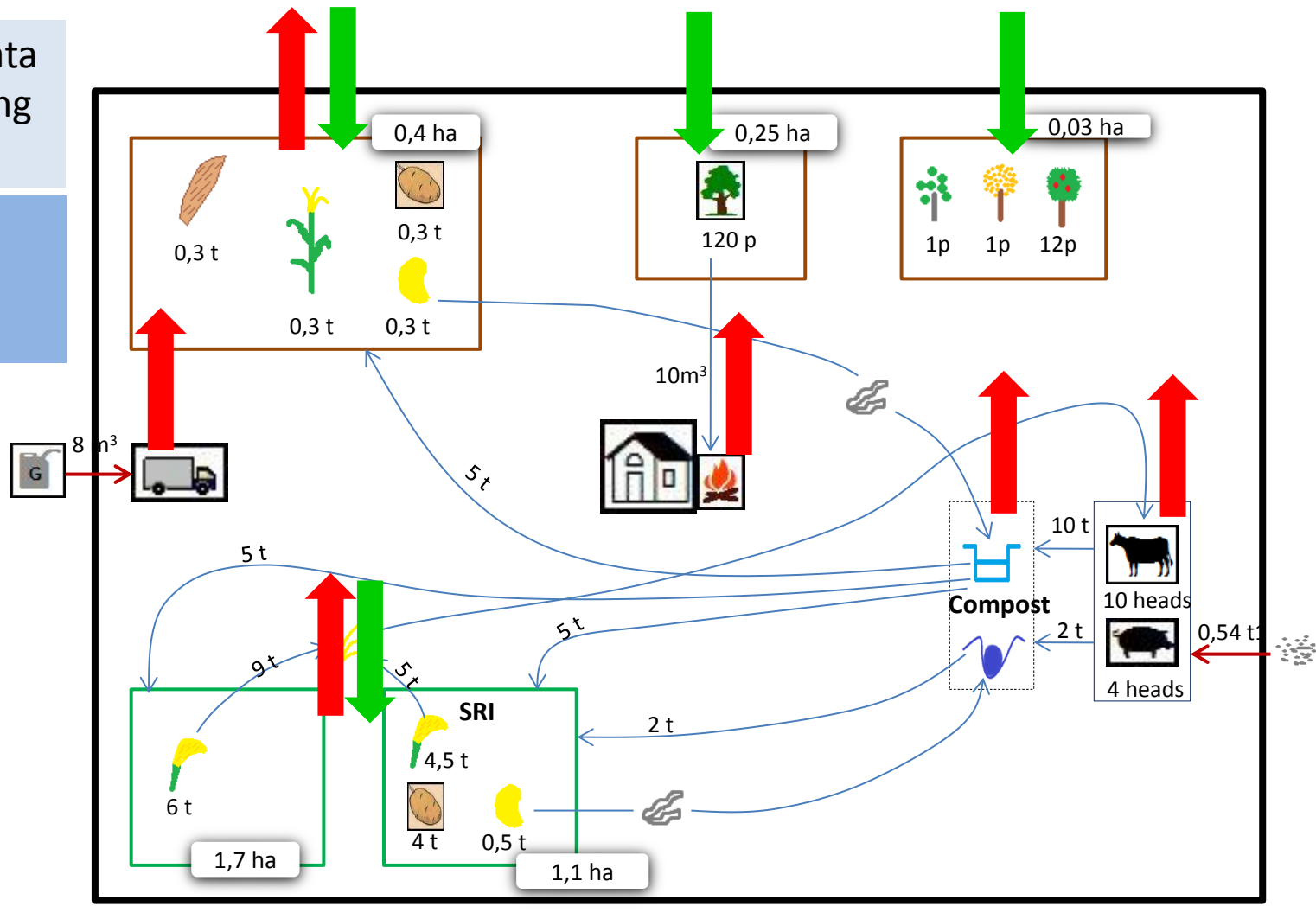
Farm resource flow maps

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Inspired from P. Titttonell (2006)

➤ Synthesis of data collecting during survey

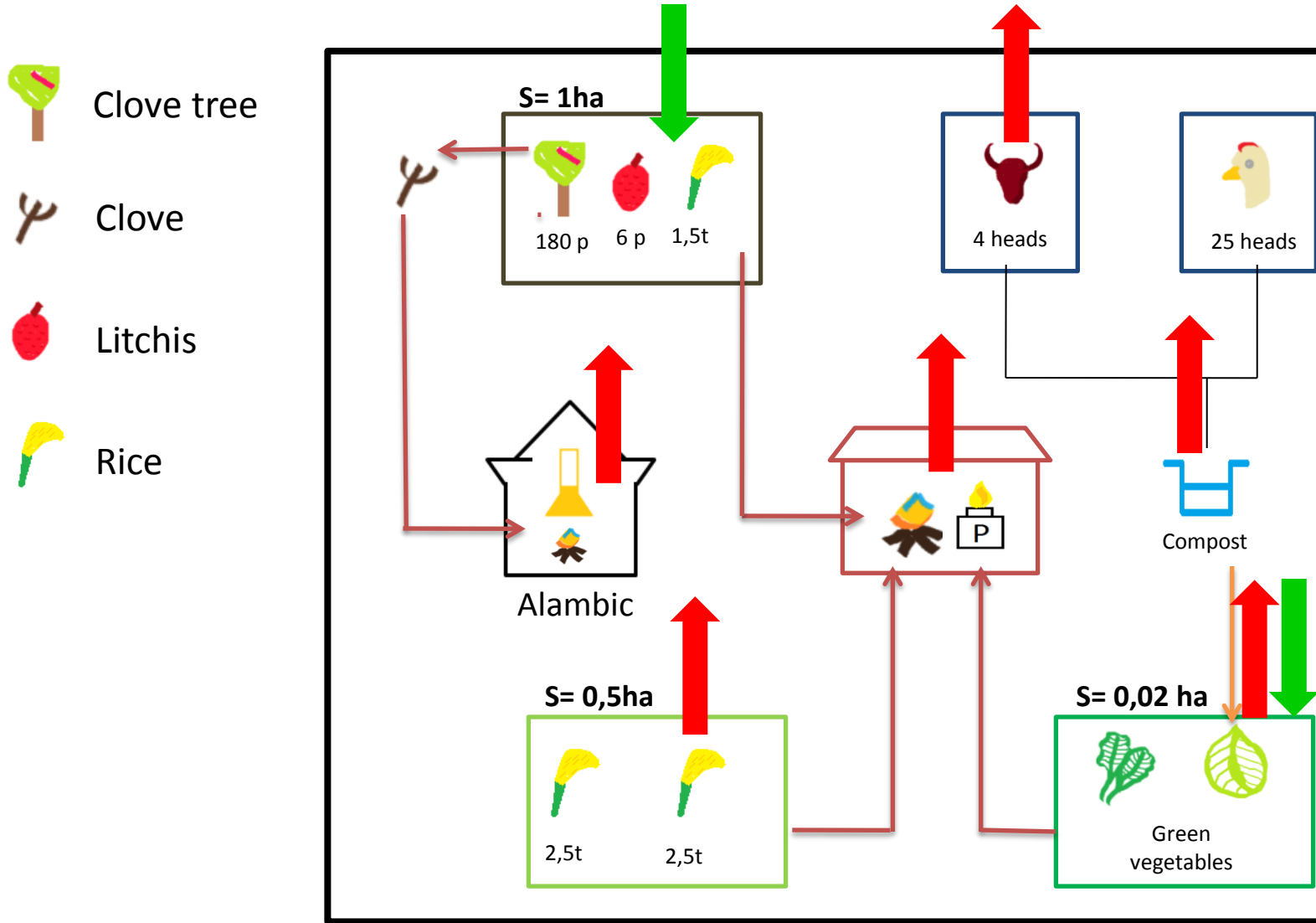
➤ Annual value: production, inputs,...



Example of farm resource flow map from Central of Madagascar

Farm resource flow maps

EAST COAST



Example of farm resource flow map from East Coast of Madagascar

Calculator of farm carbon footprint

Selection of emission factors the most appropriate to Malagasy conditions
Literature IPCC (2006),...

AGRICULTURAL PRACTICES

- Emission of CH_4 and N_2O from rice cultivation
- Direct and indirect N_2O emission
- GHG emission from use of inorganic fertilizer and pesticide
- GHG emission from burning biomass
- Carbon storage from perennial biomass (trees)
- Carbon restored into soil after Humification

LIVESTOCK

- Emission of CH_4 from enteric fermentation
- GHG emission from manure management

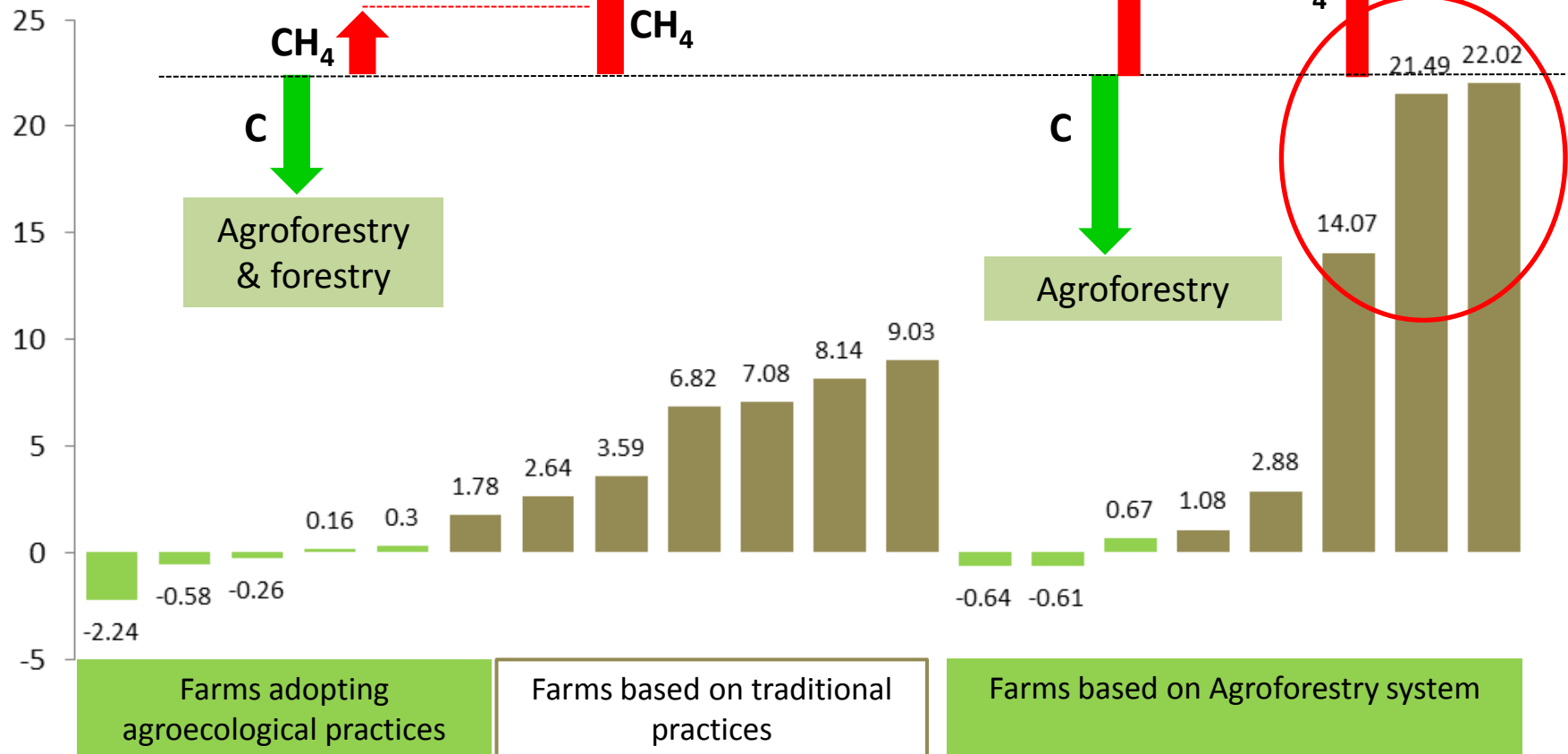
ENERGY CONSUMPTION

- GHG emission from renewable energy
- GHG emission from fossil energy

Carbon Footprint of farms

tCO₂
Eq/ha

- SRI
- Compost



Traditional **twice-a-year** rice cropping

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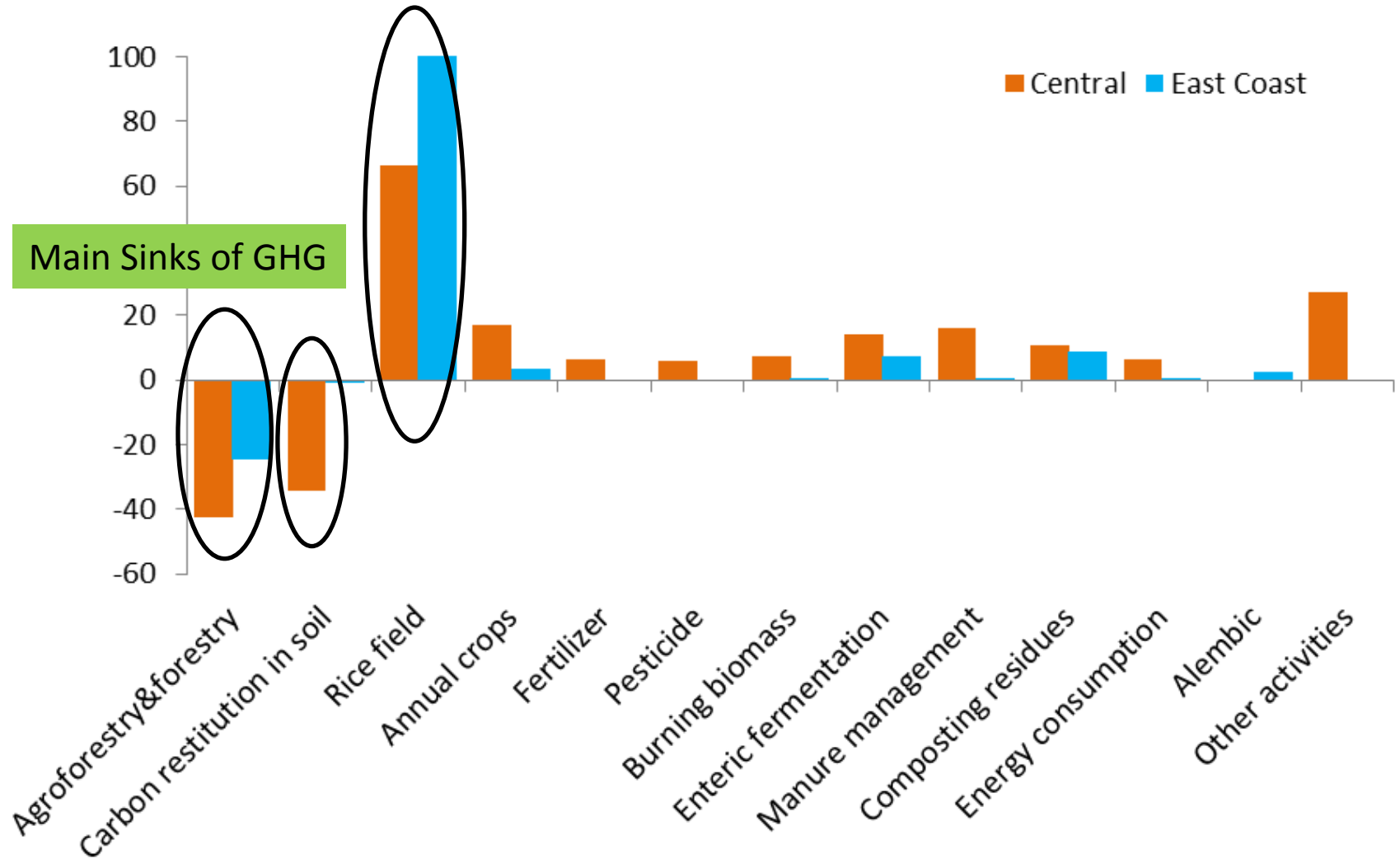
Contribution of practices to Farms Carbon Footprint

Contribution %

Main sources of GHG

Central East Coast

Main Sinks of GHG



Conclusion



Agrisud International, 2010

Compared to traditional rice system, SRI reduced CH_4 emission up to 50 %

*Rice yield from 2,5 to 5 t.ha⁻¹
(Itasy Region)*



Razakaratriko, 2011

Agroforestry and Forestry
Reduced Farms CF up to 20 to 40%

*Increase income: fruit trees
(litchis, oranges,...)*



Rakotondramanana, 2011

Composting organic matter reduced Farms CF up to 30%

Improve soil fertility, SOC storage...

***Agroecological practices adopted by Malagasy farmers:
more income and less emissions***

Thanks for your attention!!

