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Rapid assessment of climate-smartness

2nd Knowledge Exchange Workshop of the programme "Soil protection and rehabilitation for food security"

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Birthe Paul, Celine Birnholz,

Juliet Braslow, Jessica Koge, An

Notenbaert, Rolf Sommer

GIZ Soil country teams

b.paul@cgiar.org

CSA rapid assessment – rationale

- Low data availability
- Mitigation as a co-benefit not objective, but interest for GHG monitoring and low carbon development
- New field of interdisciplinary science, still little quantification
- Studies often take long, and come too late to inform project design
- Agro-ecological and socio-economic diversity is high, impacts differ

→ Rapid, quantitative assessment of CSA indicators and trade-offs across farming systems and countries to support prioritization and targeting

CSA rapid assessment - methodology

1. Stakeholder workshops
   -> Farming systems types
   -> Shortlist of soil technologies
2. Case study farmer interviews

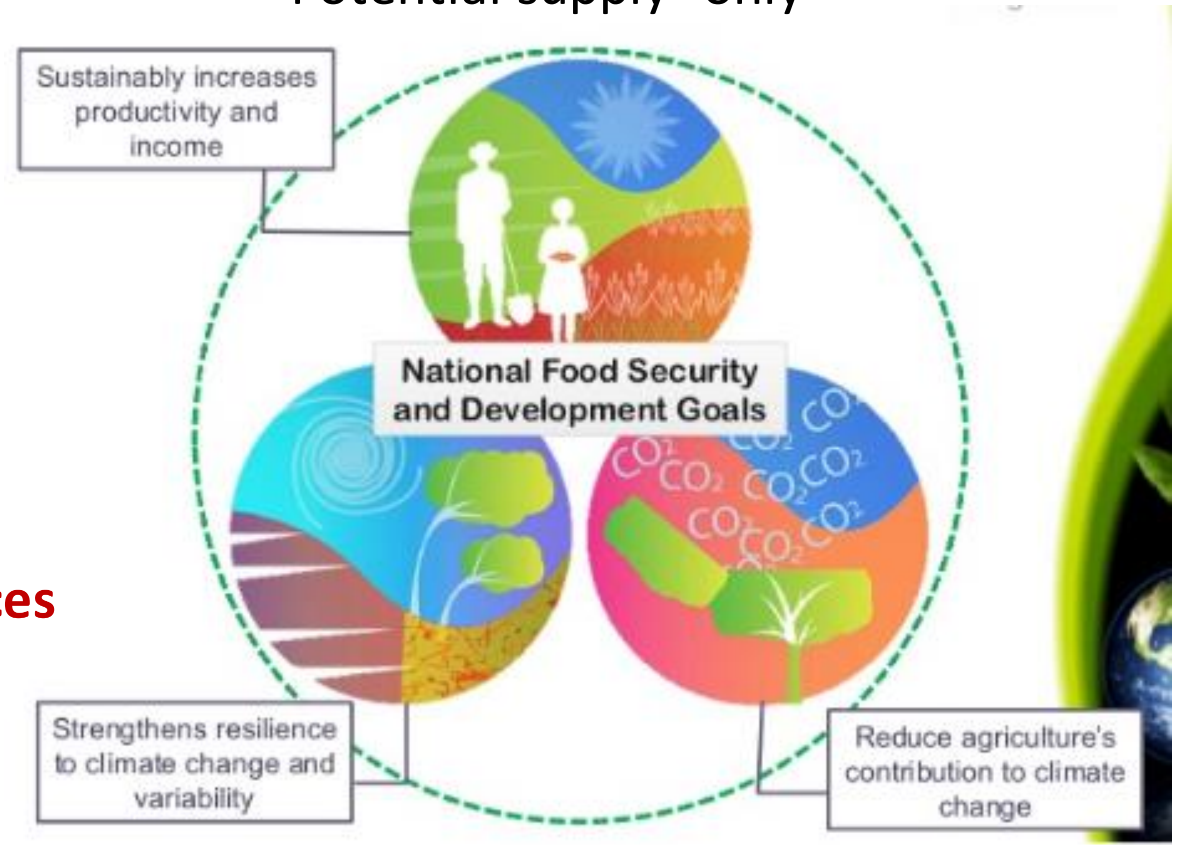
Input data

3. Quantifying CSA indicators for baselines and scenarios

Modelling of CSA indicators – baseline vs. scenarios

Calories produced on farm/hectare

- Cash crops and meat not taken into account
- 'Potential supply' only



a) Soil nitrogen balances per farm/hectare

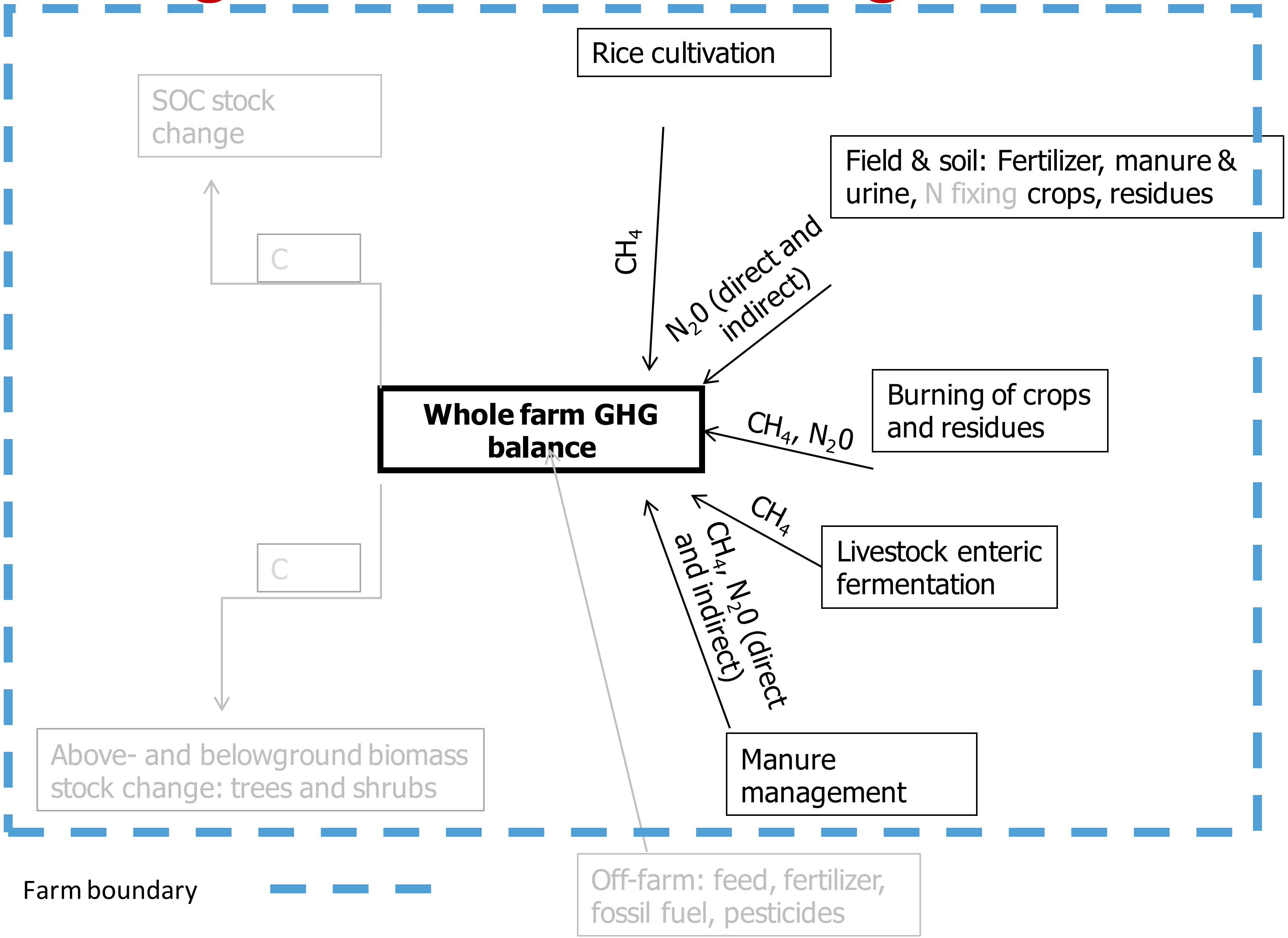
b) Soil erosion per farm/hectare

- Simplified, non-holistic indicators

GHG emissions from agriculture per farm/hectare

- Soil C stock changes not included
- IPCC tier 1/2 overestimating for SSA

Greenhouse gas emission modeling



GHG balance counts, not single sources or sinks only

Farming system types

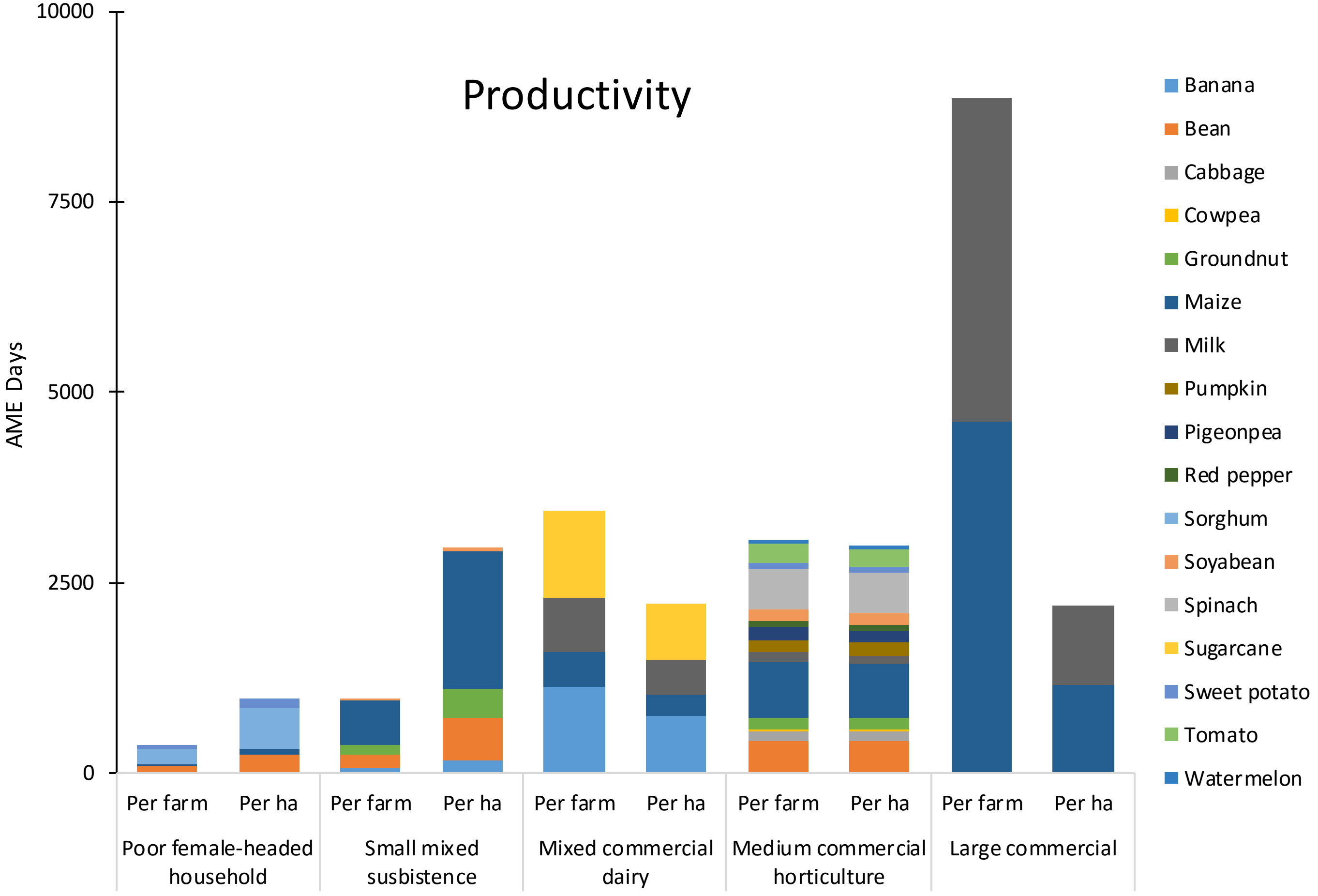
- Benin
  - Small scale farm (60%)
  - Lowland farm (10%)
  - Integrated farm (5%)
  - Medium scale farm (20%)
  - Large scale farm (5%)
- Burkina Faso
  - Large scale, modern farm
  - Medium scale, semi-modern farm
  - Small-scale, traditional farm
  - Small-scale, female-headed farm
- Ethiopia
  - Poorest farmer
  - Small mixed cereal farmer
  - Medium mixed cereal farmer
  - Double cropping farmer
  - Coffee based commercial farmer
- Kenya
  - Resource-poor female-headed (NA)
  - Small mixed subsistence (60%)
  - Medium dairy commercial (7%)
  - Medium horticulture commercial (13%)
  - Large commercial (20%)
- India
  - Dryland farmer (5%)
  - Dryland diversified farmer (50%)
  - Rice farmer (20%)
  - Specialized irrigation farmer (25%)

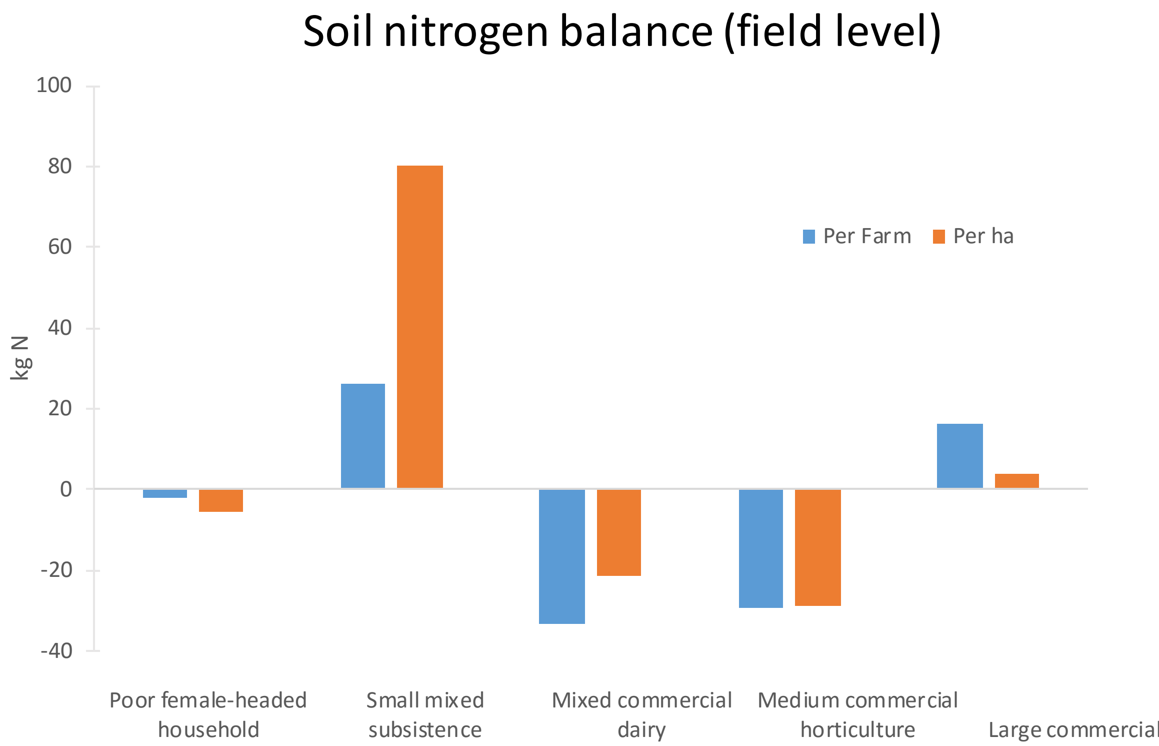
Shortlisted/tested soil technologies

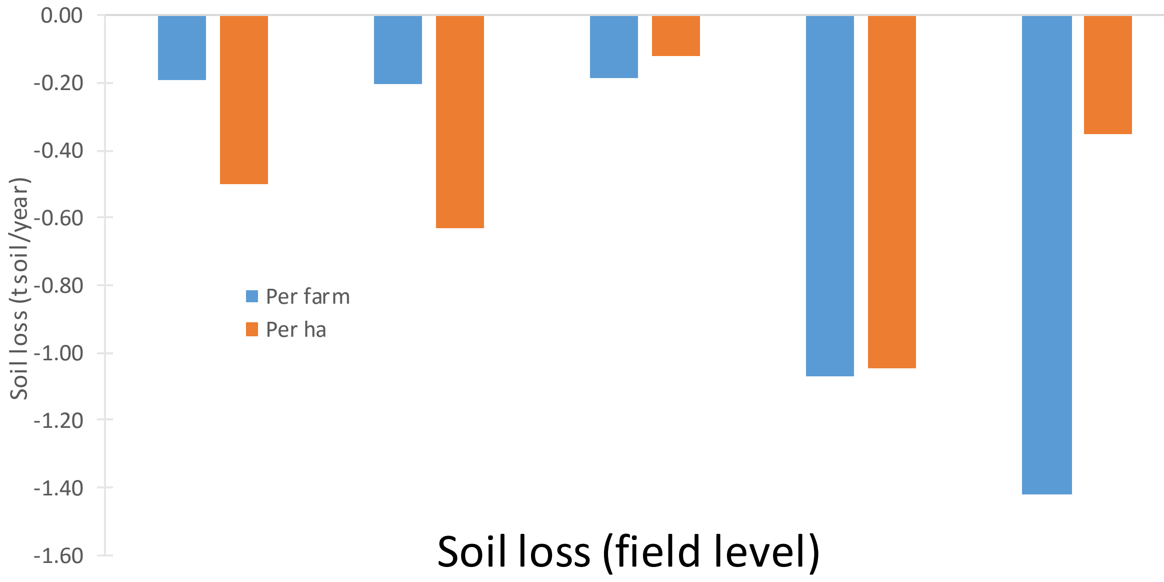
- **Benin**
  - Intercropping with pigeon pea
  - Mucuna
  - Improved variety of drought tolerant maize
  - Orchard rehabilitation
- **Burkina Faso**
  - Stone bunds
  - Composting with manure
  - Intercropping sorghum/maize with cowpea
  - Relay cropping with mucuna
- **Ethiopia**
  - Reduced tillage and mulch
  - Intercropping, double cropping and rhizobia
  - Small-scale mechanization
  - Quality seeds & improved agronomy (including fertilizer and liming)
- **Kenya**
  - Liming and DAP
  - Compost only
  - Lime and compost
  - Conservation Agriculture
  - Vegetative strips
- **India**
  - Composting, green manure, FYM
  - Intercropping, crop rotation, rhizobium
  - Reduced tillage and mulching
  - System of rice intensification

Picture: Stephanie Malyon, CIAT

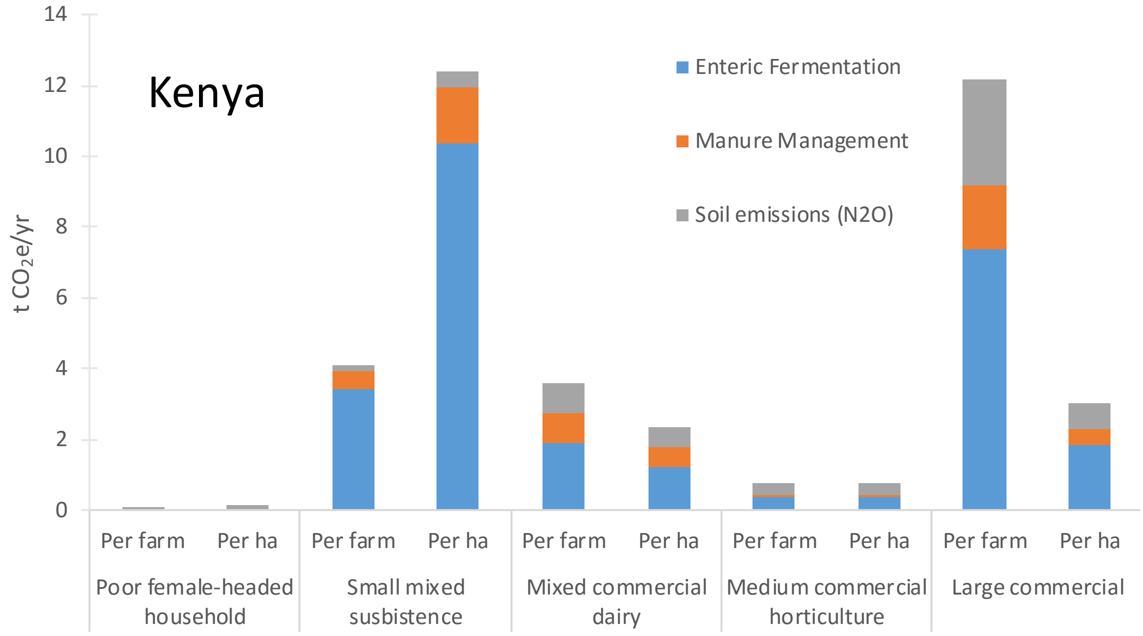
Kenya results - baseline

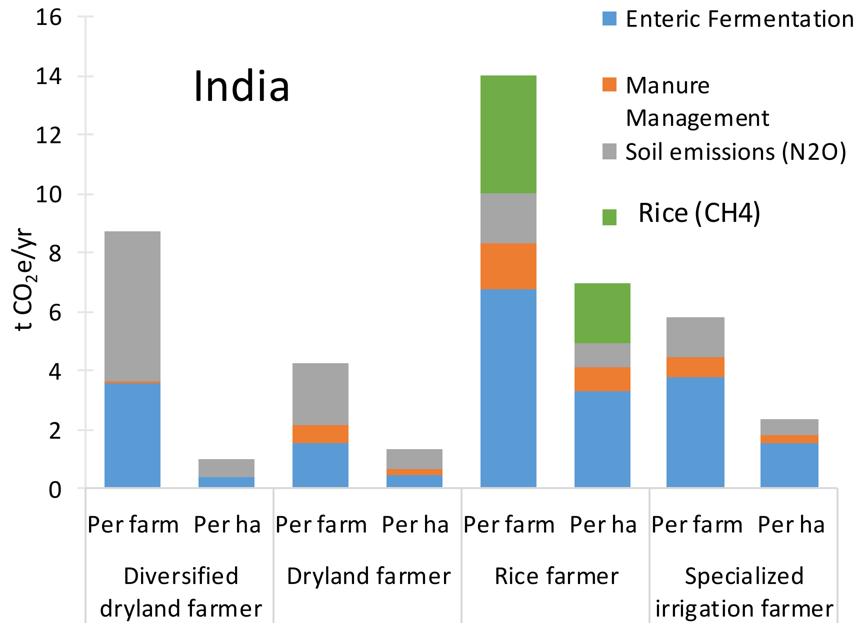


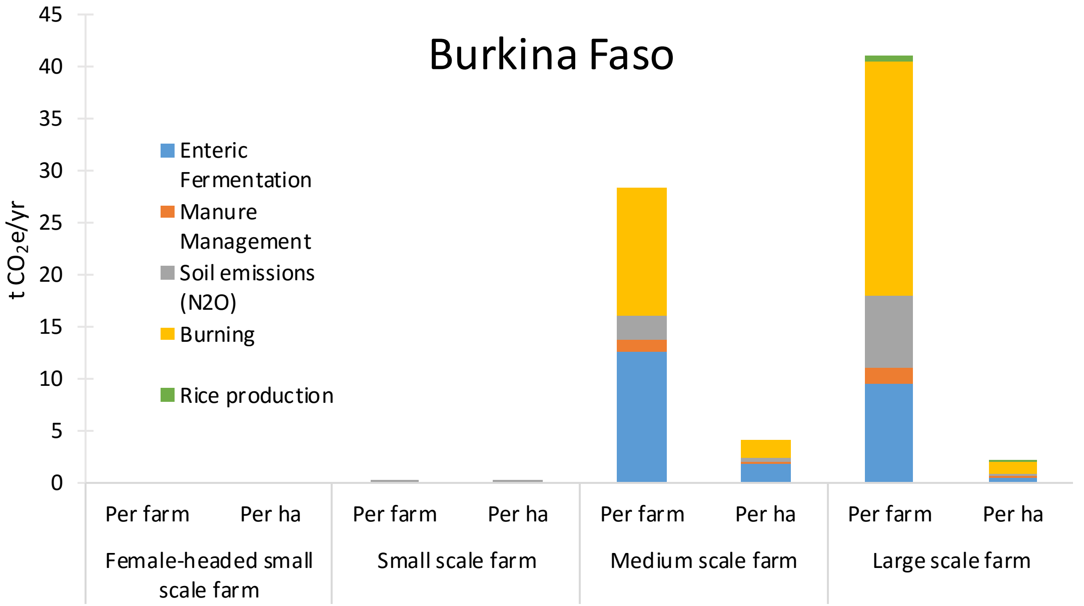


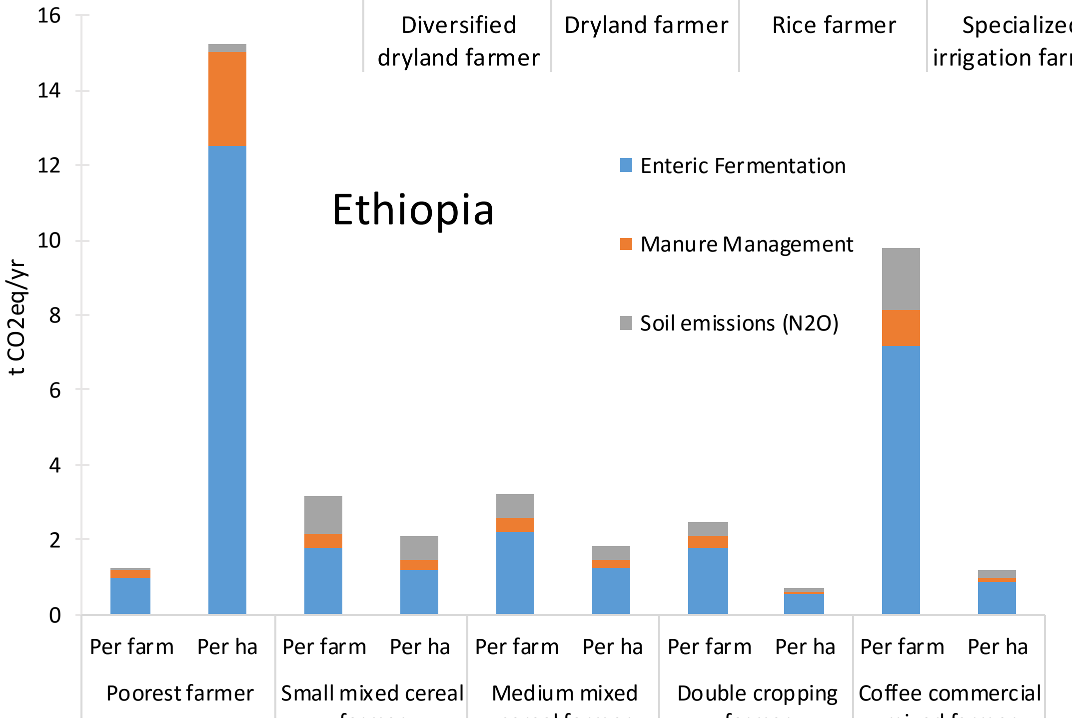


Greenhouse gas emission results - across countries

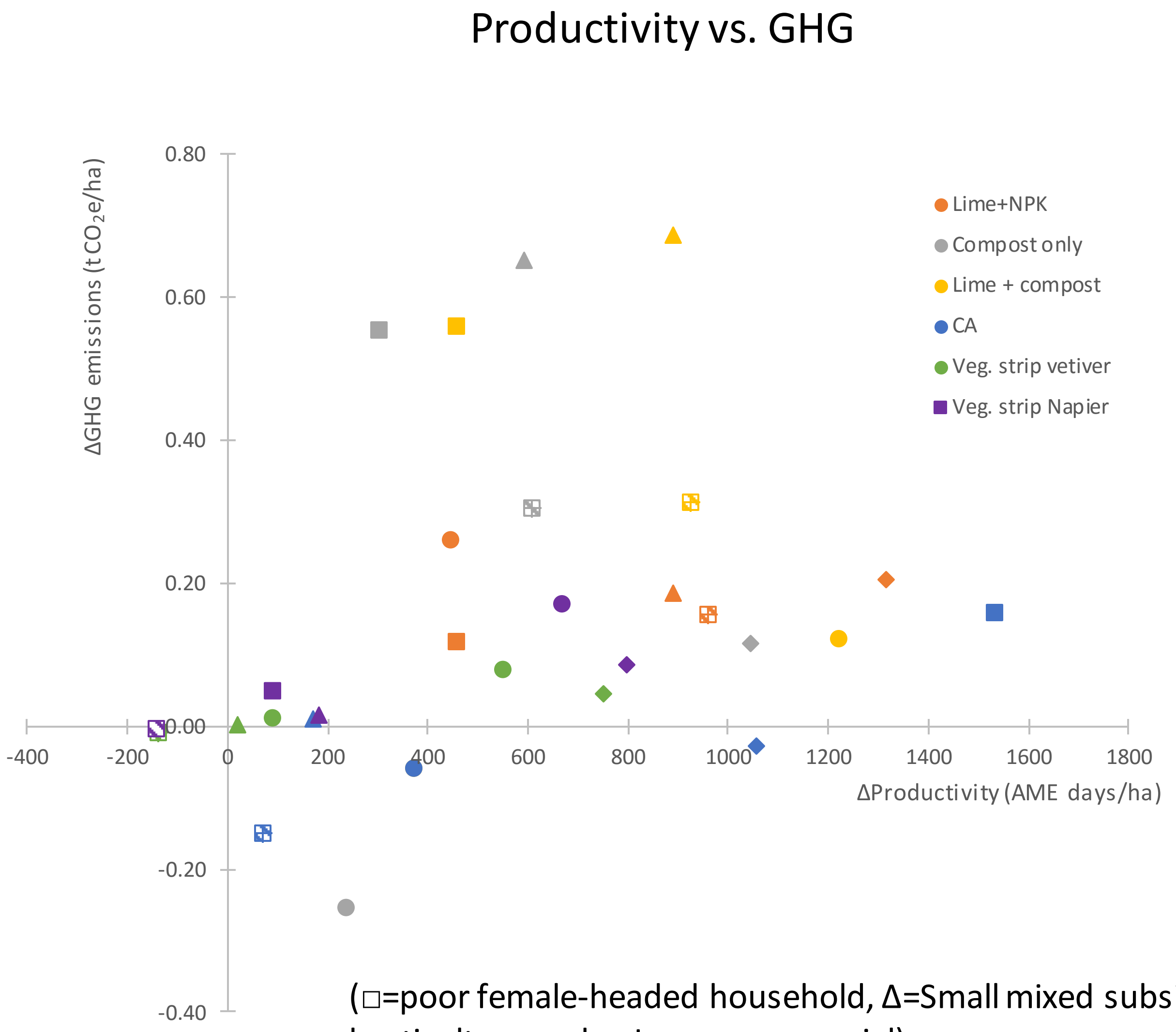


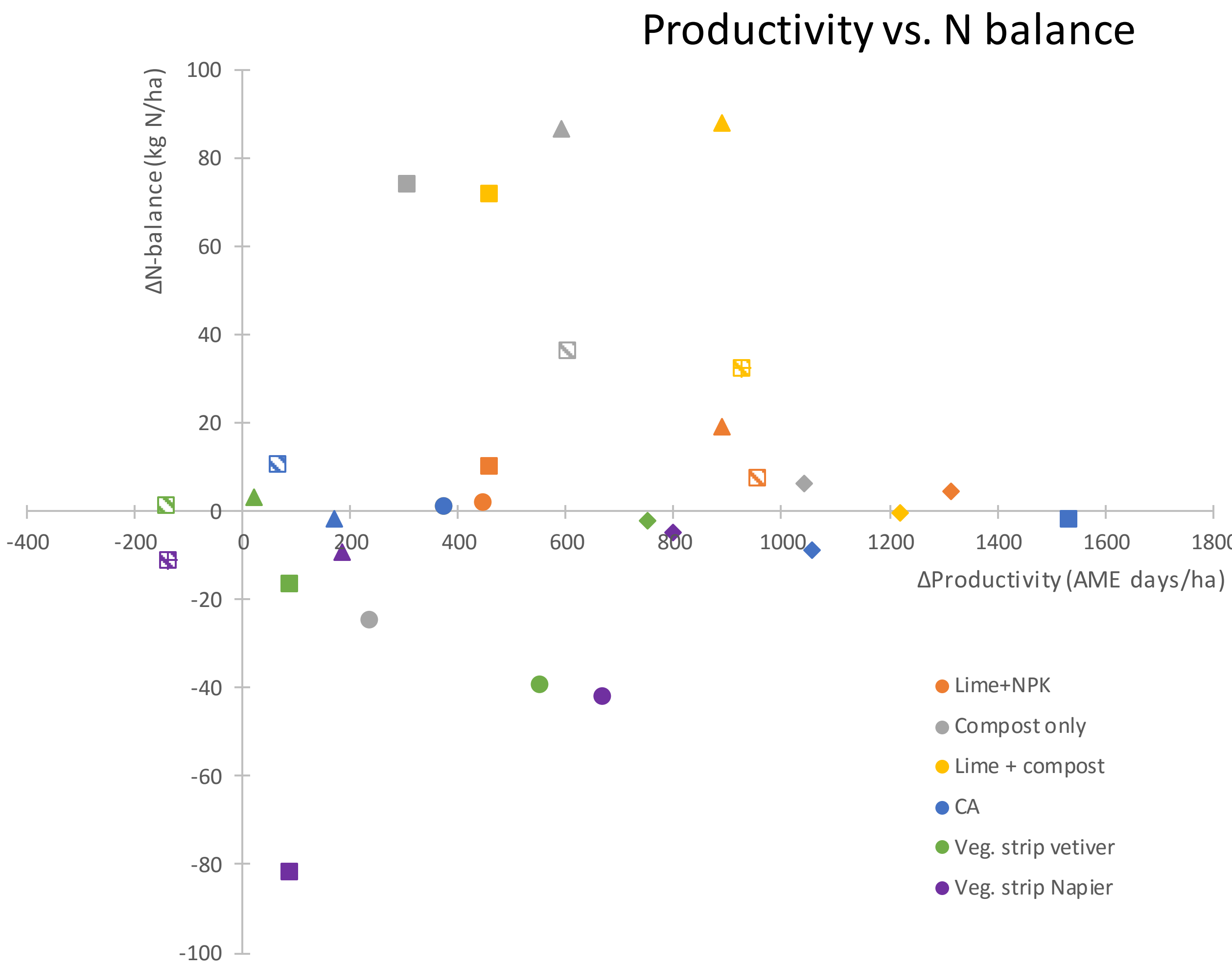






Kenya results – scenarios and tradeoffs





(□=poor female-headed household, Δ=Small mixed subsistence, ◊=Mixed commercial dairy, □ with patterns=Medium commercial horticulture and ○=Large commercial)

Insights, conclusions

- Farming systems vastly different across countries – eg farm size, manure use, livestock density, residue use.
- Impacts and trade-offs did not only vary by technology, but also farming system. No one size fits all! Targeting is key, and rapid quantifications can help decision makers to prioritize
- Small farms have lower overall productivity, but higher productivity per hectare
- Small farms tend to have negative nutrient balances, thus less resilient. But also large farms with cash crops (=nutrient export) tend to have negative nutrient balances
- If productivity is increased, often trade-off with nutrient mining. Intercropping alone is not likely to be enough

Insights, conclusions

- In global comparison, GHG emissions are low. No intervention should be promoted here solely because of climate change mitigation
- GHG (trade-offs) can still be quantified and monitored due to global interest in low carbon development pathways
- Mitigation is not automatically a co-benefit – true triple wins are rare. If production increases, often GHG also increase. But the important is efficiencies…
- C sequestration potentially important, but difficult to measure/quantify
- Livestock keeping, paddy rice and residue burning are largest contributors to GHG emissions - not soil N2O emissions
- If target is climate change mitigation, attention could be paid to interventions that don’t target at soils primarily (but could be synergetic). Eg improved forages, reducing livestock herd, alternatives to residue burning, alternate wetting and drying for rice, dual/triple purpose legumes, manure management…

Thank you!

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