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International Center for Tropical Agriculture
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CLEANED – Validation Workshop

Pork Value Chain Uganda

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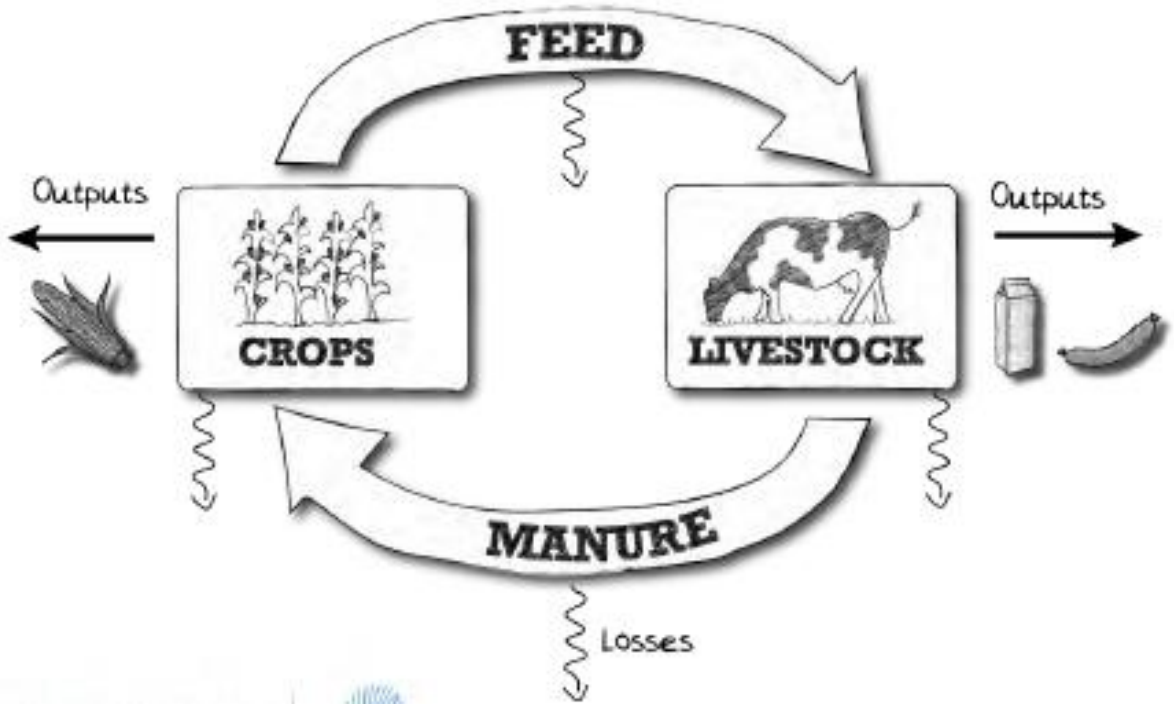
CLEANED Validation Workshop: 16th and 17th March

CGIAR

Bioversity International and the International Center for Tropical Agriculture (CIAT) are CGIAR Research Centers.
CGIAR is a global research partnership for a food-secure future.

Welcome

- Introduction and Objectives – Jess
- Opening remarks – Pius
- Program overview
- Introduction + Expectations
- Start of Workshop



Objectives

Verify and discuss preliminary model results of the model CLEANED model to reflect intensive dairy livestock systems

To **assess** the relevance of CLEANED results and key decision **identify** makers/experts

Develop future best-bet integrated packages and scenarios to be modelled in CLEANED

Opening Remarks

Project goal

More meat, milk and eggs by and for the poor

To improve incomes of pig value chain actors through marketing arrangements and sustainable integrated technology package in Uganda

Motivation/setting

- Best-bet interventions pilot tested singly since 2012
- Low uptake due to financial constraints and market inefficiencies
  - Dione et al (2020) – Training of smallholder pig farmers on biosecurity: impact on KAP
  - Asindu et al (2019) – Farmer demand and willingness to pay for sweet potato silage-based diets as pig feed (60:40 ration)
  - Ouma et al (2018) – ASF control and market integration and ex-ante impact assessment

MorePork II approach

- Project focusses on supporting stronger and more profitable market linkages between pig market aggregators (buyers) and pig producers through market arrangements;
  - to incentivise uptake of an integrated package of productivity and climate-smart options
- Heavy focus on private sector involvement
- Utilisation of digital platform to disseminate knowledge and information on pig production
- Elements on environment and climate change included

Integrated technological and institutional innovations

Aggregators

Input and service providers → Producers → Pig collectors, traders, wholesalers → Pork joints → Consumers

Aggregators

PigSmart Platform

Manure management and adaption to heat stress

Genetics – community based pig AI model

Feeds – commercial feeds and forages

Animal Health – capacity building and disease control

Integrated technology and best practices innovations basket

Market arrangements through market systems approaches
- strengthened relationships
- pricing terms
- supply quantities
- supply quality
- timing

Institutional innovation in the form of market arrangements to improve market linkages and relationships to support the VC system

Partnerships: private sector-led

Market pull

Project objectives

- Pilot and evaluate innovative marketing arrangements at the level of pig aggregators to strengthen pig market linkages and link farmers to inputs and service providers
- Implement and evaluate an integrated package for improving pig productivity and performance, through a PigSmart digital platform for farmers participating in the market arrangements
- Develop, test and evaluate best-bet interventions for reducing the environmental footprint primarily through waste (manure) management and adaption to heat stress
  - includes environmental assessments of different packages of interventions (incl. different feed baskets) in terms of water and land, and competition with human food, while considering future climate change

Research design

- Before-after and with-without design– to evaluate the outcomes from the piloting of the market arrangements and integrated technology & best practices
- Project intervention sites and control sites
- Entry point – pig aggregators who source pigs from farmers or middlemen/women
- Target farmers - linked to the aggregators in both control and intervention sites
- Sample size – adjusted for cluster effects (6 farmers/aggregator) and potential drop-outs
  - 438 farmers in the project intervention districts (219 per district) and 252 in the control districts (126 per district)
  - 73 pig aggregators in the project intervention districts (37 per district) and 42 in the control districts (21 per district)
  - 60 input and service providers (ISPs) in the intervention districts (feed and drug stockists) and 30 in the control sites

Project districts

Project interventions

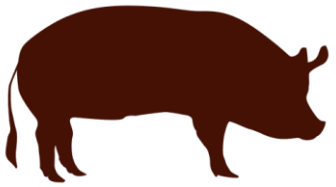
- Implemented through **5 flagships**:
  - Livestock Livelihoods, and Agri-Food Systems (LLAFS)-Gender and youth engagement:
    - creating market pull-through market arrangements that will provide reliable pig markets to men & women farmers
  - Livestock Genetics:
    - In collaboration with a public sector partner (Makerere University) & a private sector partner (Vetline Services), focuses on community based Artificial Insemination (CBAI)
  - Livestock Health:
    - strengthening & disseminating advisory services in herd health & best practices in biosecurity.

Project interventions

- Livestock Feeds and Forages:
  - Piloting & evaluating a training & certification scheme of small-scale commercial feed producers,
  - Enhancing uptake of well-selected & tested superior heat-tolerant food/feed crop cultivars for pig feeding
  - Promoting the adoption of well-balanced & least-cost rations developed through the FeedCalculator App.
- Livestock and Environment:
  - i) estimating & mapping the potential future heat stress of pigs in Uganda,
  - ii) reducing the environmental footprint through improved pig manure management &

Part 1: Intensive livestock enterprise

Why is the livestock Pork value chain is important in Uganda: The facts



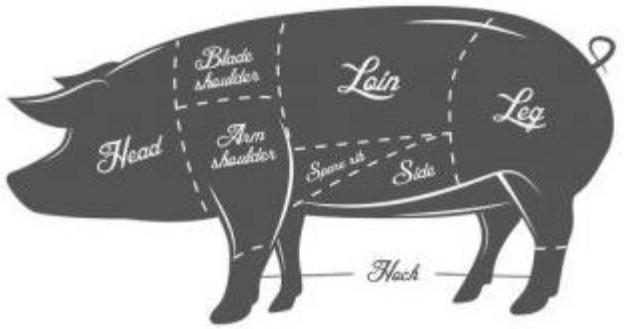
17.8% households engaged in pig production

>1,000,000 people

Pork produced

$6.4 million

70% *from traditional systems, 30% improved pig systems.*



The value of livestock sector accounts for

4.3% GDP

that accounts for some

3.9 Million House Holds with Livestock

Herrero et al., (2013)

Current Environmental impacts

Negative environmental impacts:

EMISSIONS

of greenhouse gases

LAND

degradation and deforestation

WATER

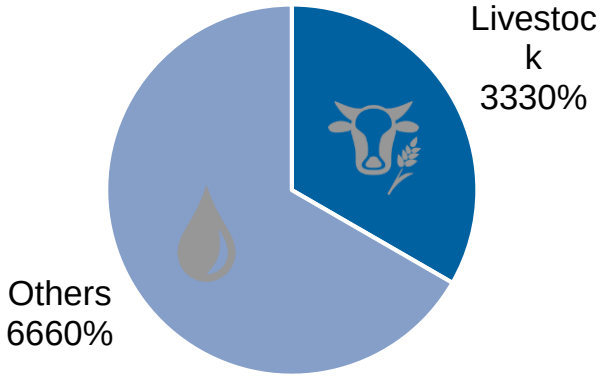
pollution and depletion

DEFORESTATION

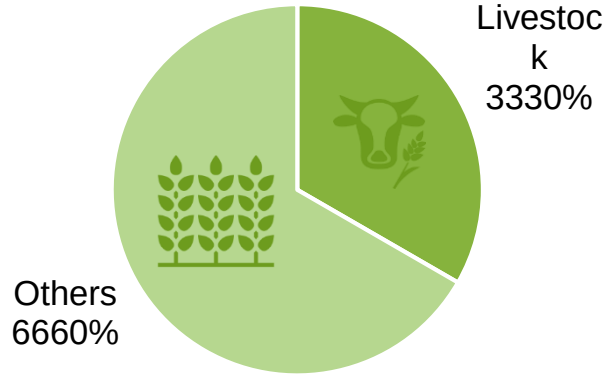
BIODIVERSITY

threatened

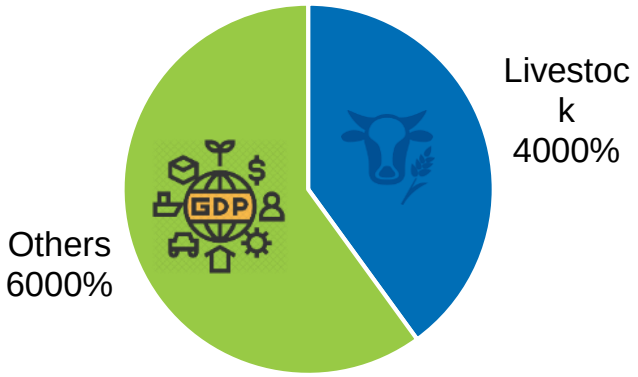
Global fresh water use

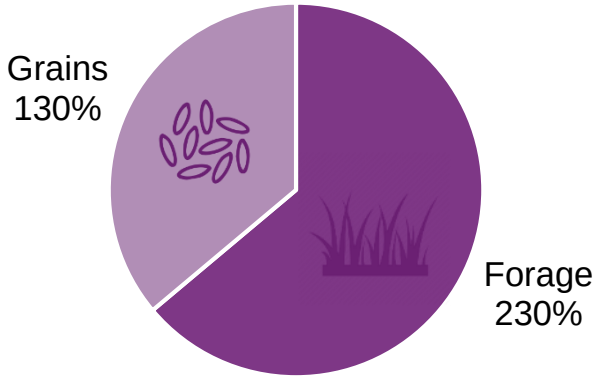


Global crop land



Global agricultural GDP





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Part 2:
CLEANED

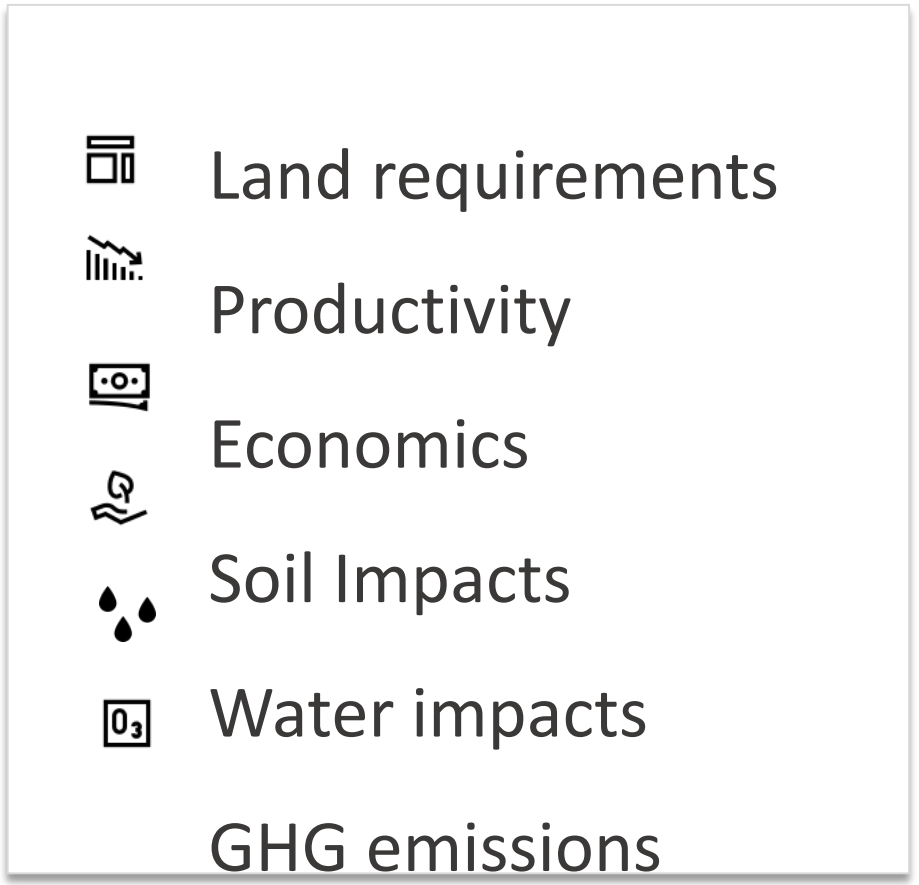
What is CLEANED?

C omprehensive
L ivestock
E nvironmental
A ssessment for Improved
N utrition, a Secured
E nvironment and Sustainable
D evelopment along Livestock and Fish Value Chains.

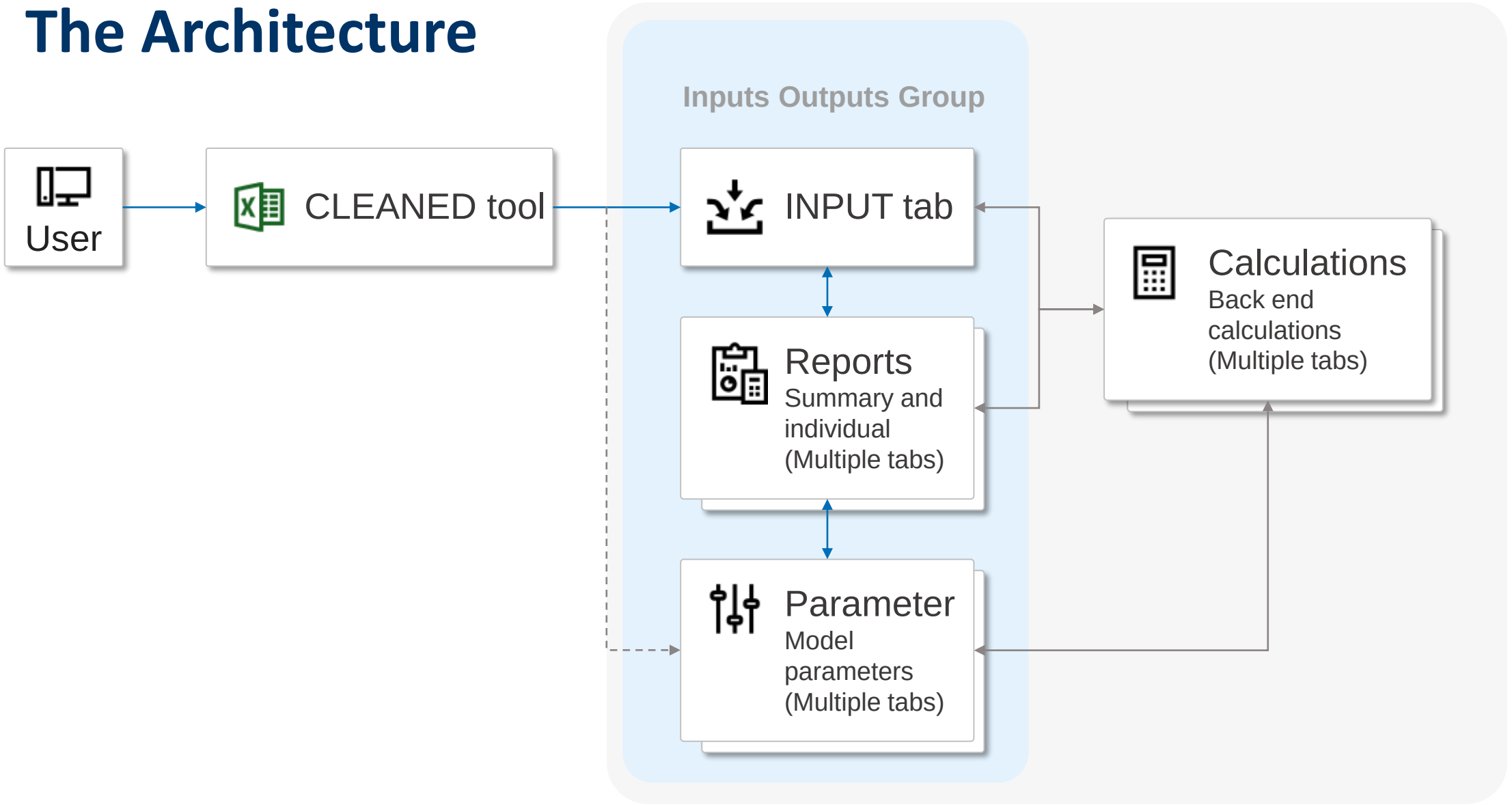
"A rapid ex-ante environmental impact assessment tool that allows users to explore multiple impacts of developing livestock value chains."

What is CLEANED

The CLEANED tool lets users explore **multiple** impacts of developing livestock value chains in explicit ways. It models the impact of intensifying livestock along multiple pathways:



The Architecture



CLEANED Calculations

Land Requirement =

Feed requirement + Feed quality ==> feed amount

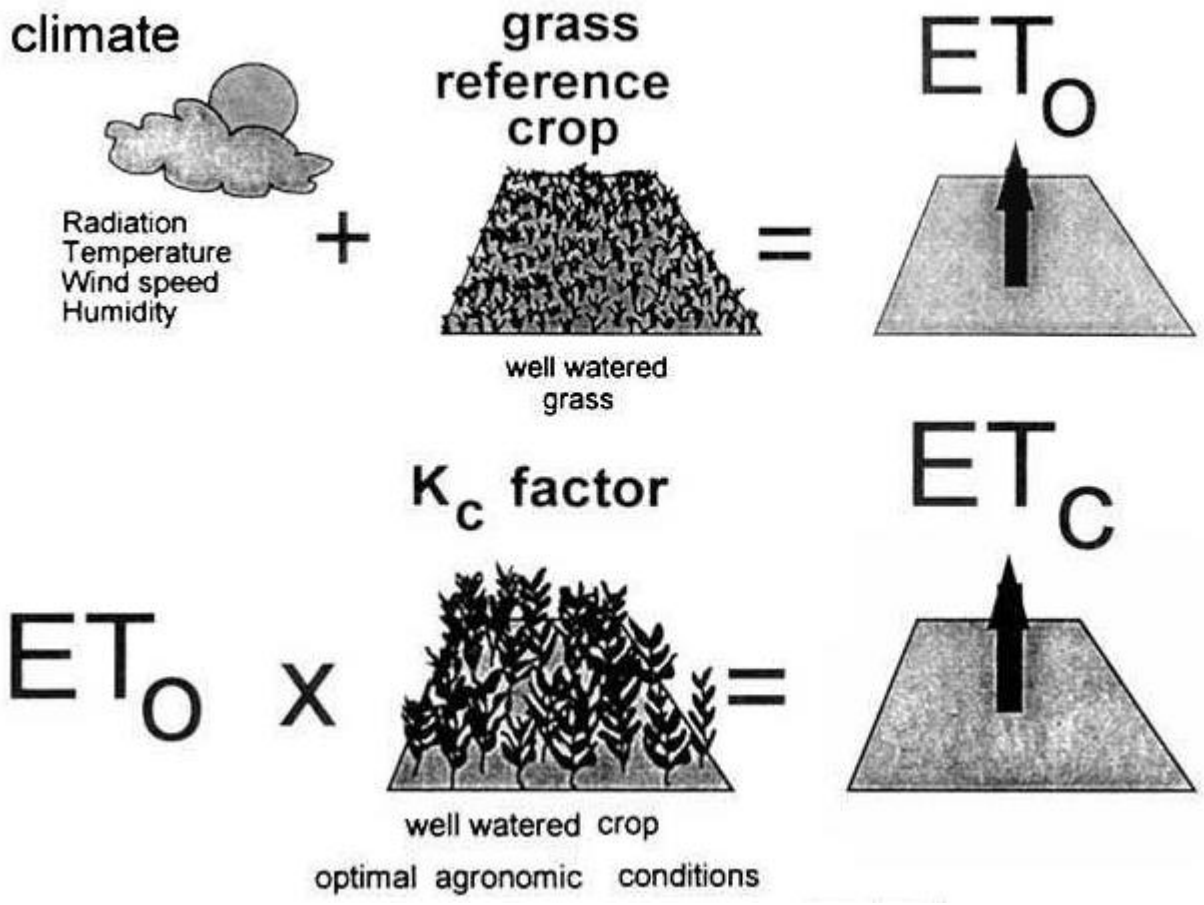
Feed amount + crop yields ==> land size

RUSLE (Revised Universal Soil Loss Equation) is widely used for estimating the rate of soil loss by **water**.

A = R x K x L x S x C x P

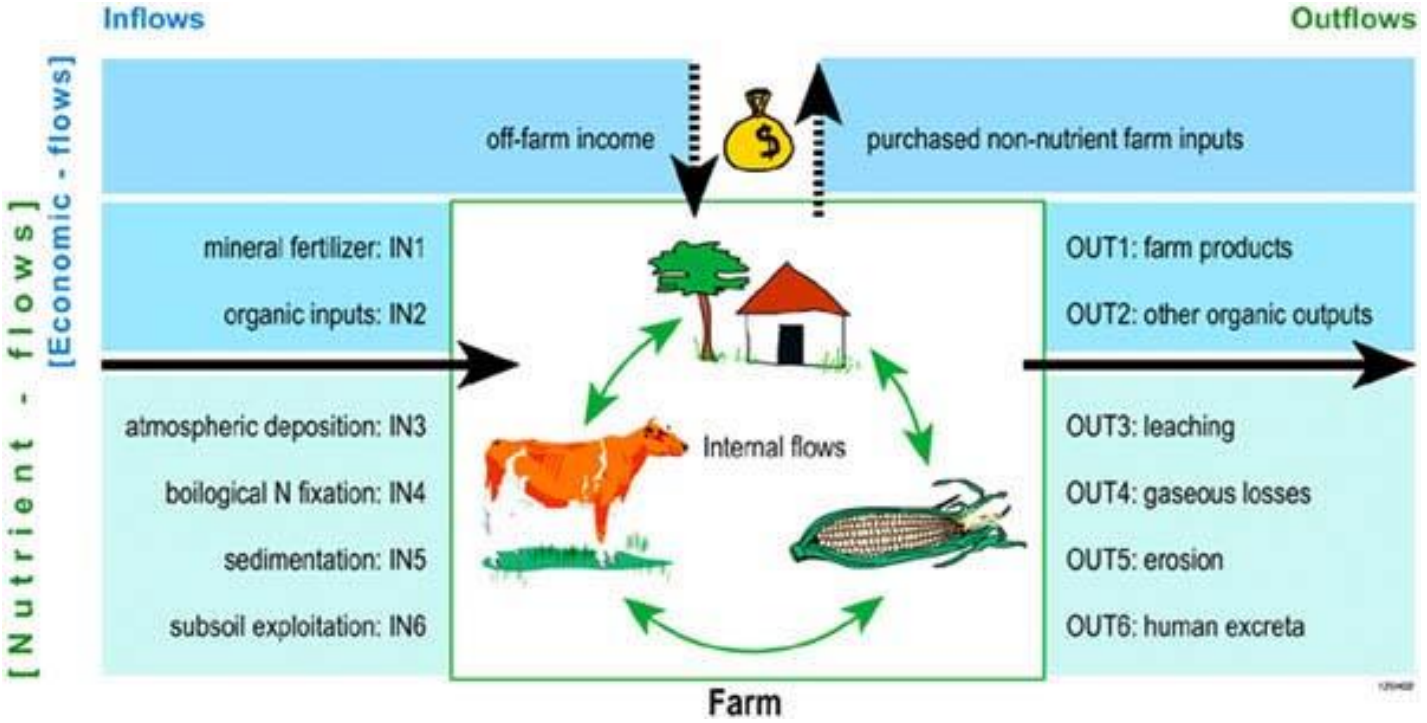
A: annual soil loss per acre
R: **rainfall erosivity**
K: **soil erodibility**
L: **slope length**
S: **slope steepness**
C: **vegetative cover**
P: **erosion control practices**

Water Using -> Evapotranspiration (ET)



N Balance → NUTMON

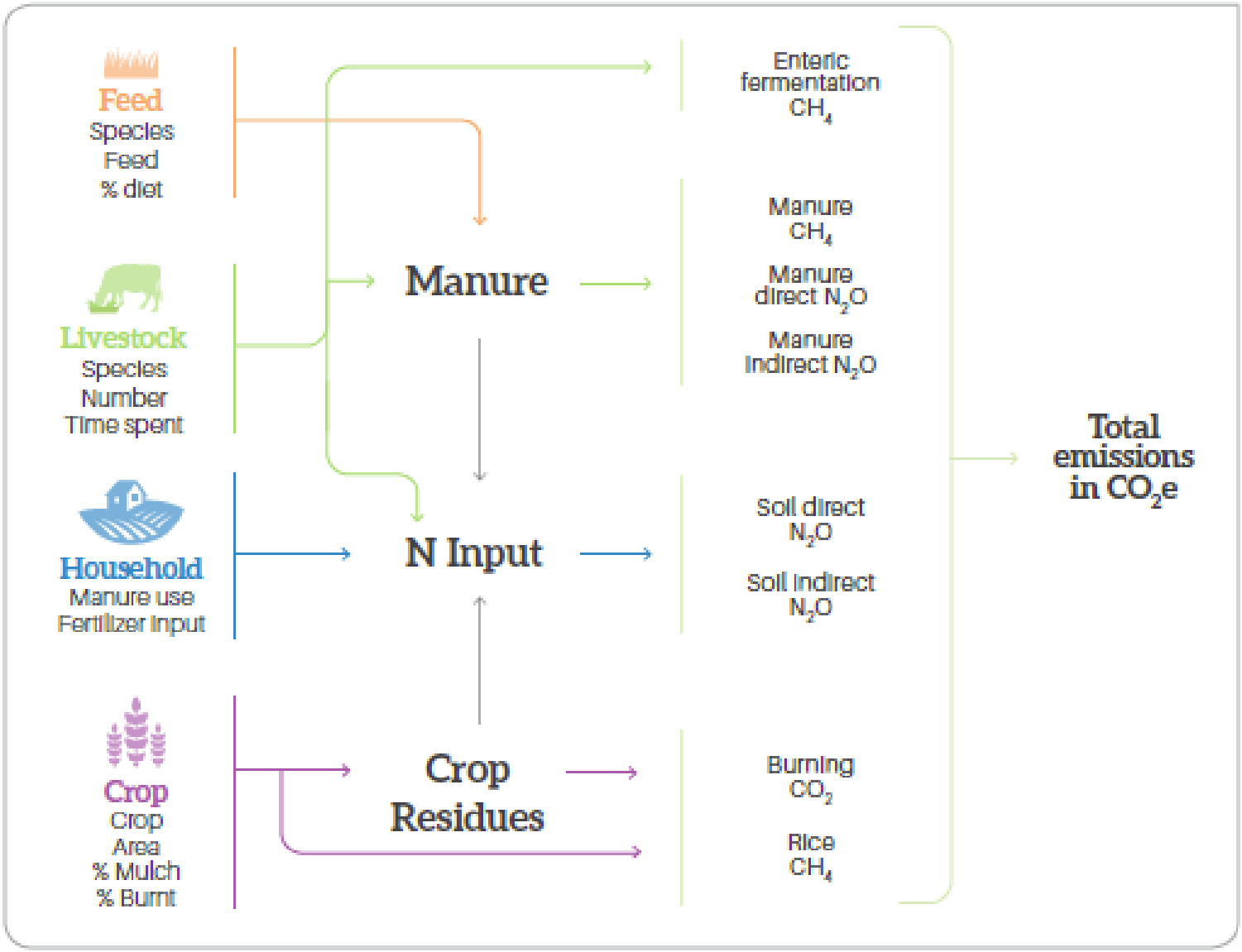
CLEANED		
IN1	→	OUT1
IN2	→	OUT2
IN3	→	OUT3
IN4	→	OUT4



GHG

2006 IPPC Guidelines for National Greenhouse Gas Inventories.

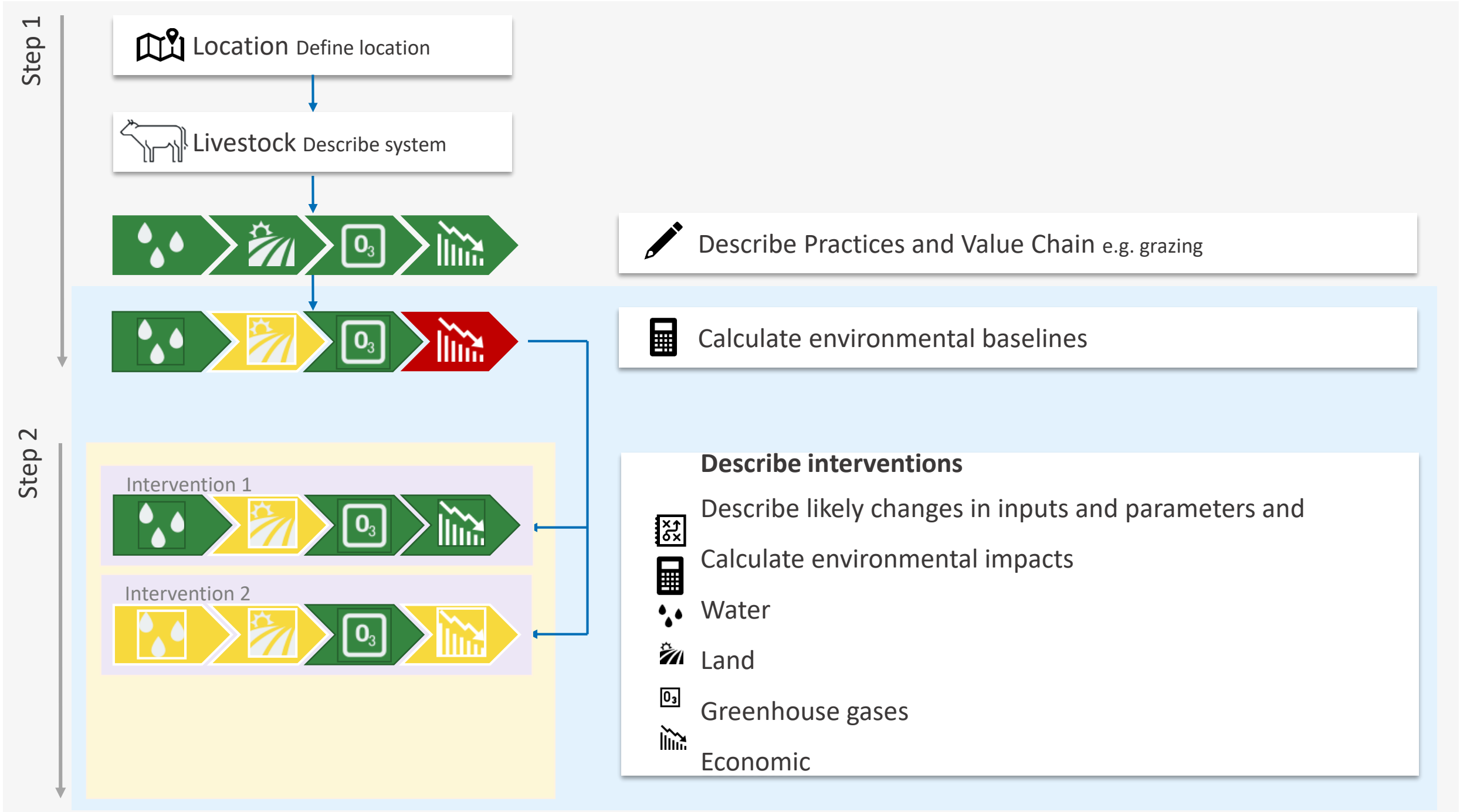
Tier 1 and 2



The process

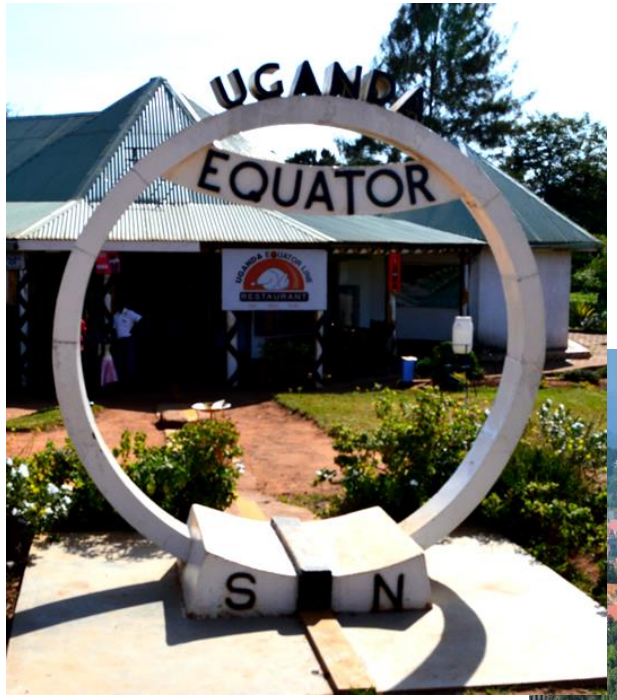
The CLEANED tool process comprises of 2 stages:

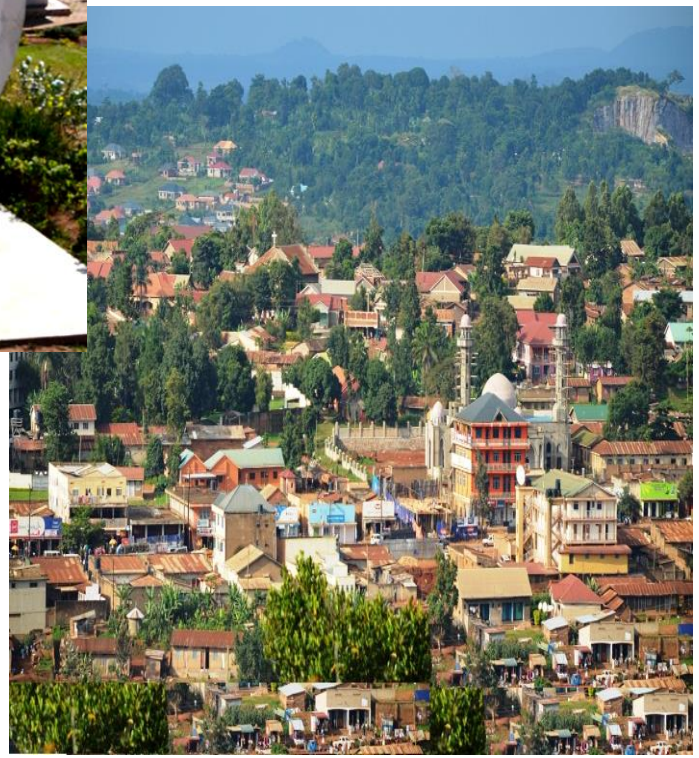
1. Collect and input the baseline data
2. Generate reports for different scenarios of how the livestock production systems might change

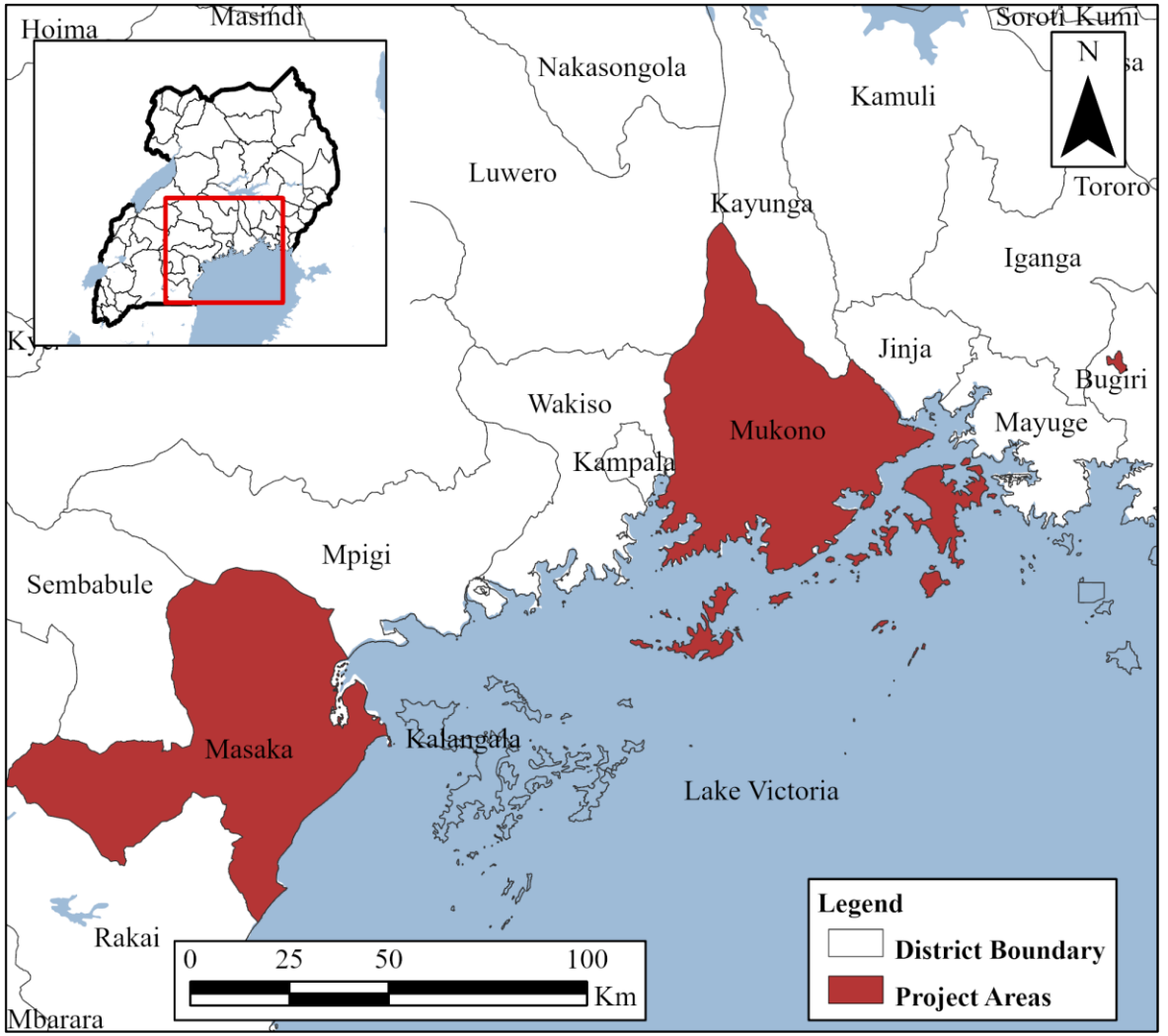

Step 1
Location Define location
Livestock Describe system
Describe Practices and Value Chain e.g. grazing
Calculate environmental baselines
Step 2
Intervention 1
Intervention 2
Describe interventions
Describe likely changes in inputs and parameters and
Calculate environmental impacts
Water
Land
Greenhouse gases
Economic

Methodology

Study Area


UGANDA
EQUATOR
S
N




Hoima
Masindi
Soroti
Kumi
Nakasongola
Kamuli
N
Luwero
Tororo
Kayunga
Iganga
Jinja
Bugiri
Wakiso
Mukono
Mayuge
Kampala
Mpigi
Sembabule
Masaka
Kalangala
Lake Victoria
Rakai
Mbarara
0
25
50
100
Km
Legend
District Boundary
Project Areas

Study Area

Site	GPS coordinates (Lat; Long)	Mean Annual Rainfall (mm)	Mean Annual Temperature(^{0}C)	Land area (sq.km)	Reference
Masaka	-0.29152 31.67208	1064	24 to 27	1603.3	https://www.besttimetovisit.co.za/uganda/masaka-3796466/ https://masaka.go.ug/content/geographical-features
Mukono	0.361144 32.92508	1490	24 to 28	2986.47	https://www.besttimetovisit.co.za/uganda/mukono-4043085/ https://mukono.go.ug/lg/location-size

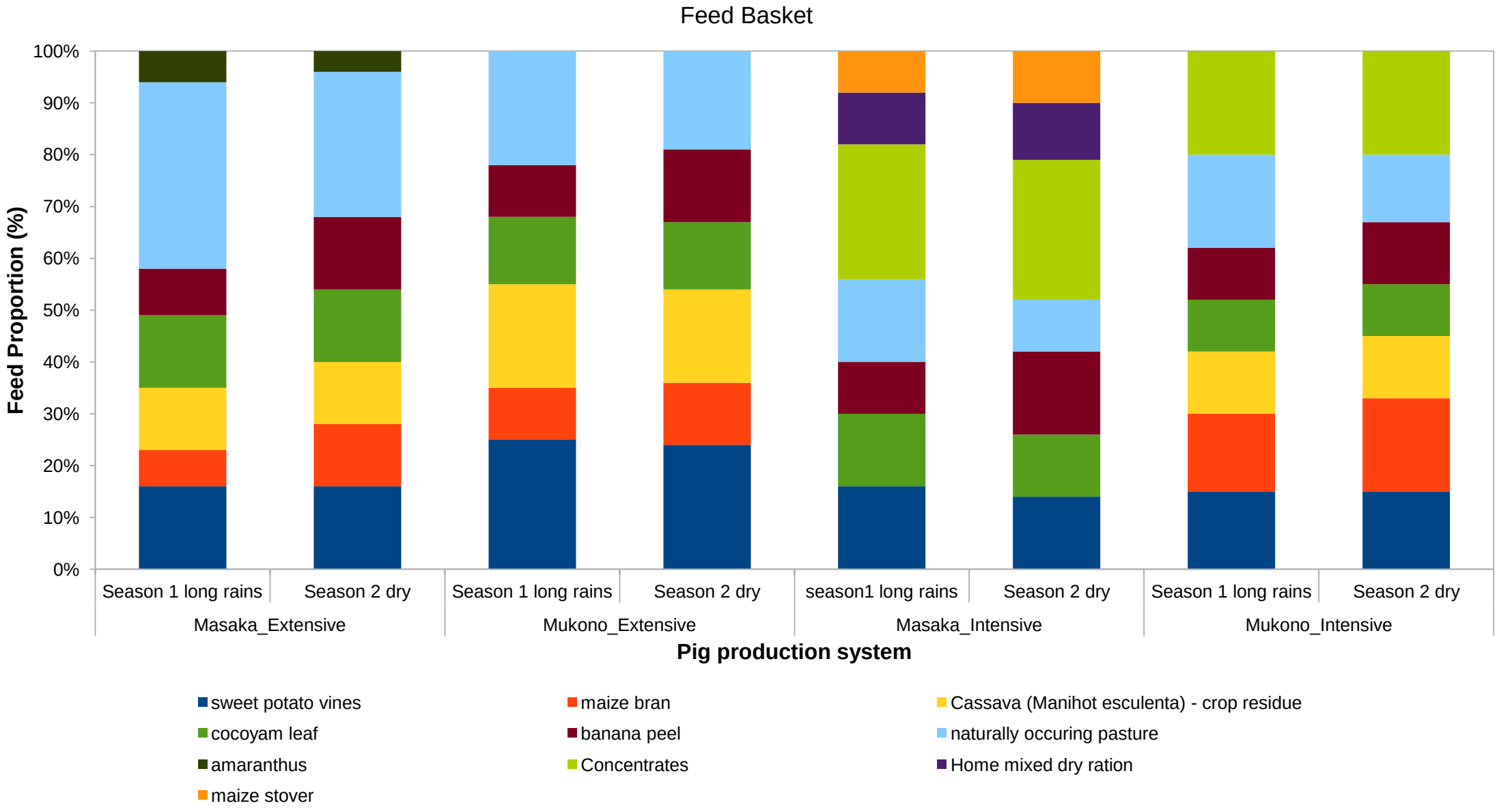
Types – Livestock system

Site	Livestock systems	Production type	Season	Season Months	Management system	Breed type	Type and No. of animals	Type of feed
Masaka	Intensive	Farrow to finish	Wet	Long rains (MAM),Short rains (SON)	confined	Cross breed	Pigs – lactating exotic : 1 pregnant - sows: 2 Pigs - dry sows: 1 Pigs - boars: 1 Pigs - growers : 5	Forages – 30% Concentrates – 35% Crop residues – 20% kitchen leftovers – 15%
			Dry	Dec, Jan, Feb,June, July, Aug				Forages – 17% Concentrates – 36% Crop residues – 25% kitchen leftovers – 22%
	Extensive	Farrow to finish	Wet	Long rains (MAM),Short rains (SON)	scavenging	Local	Pigs – lactating : 1 pregnant - sows: 1 Pigs - dry sows: 1 Pigs - boars: 1 Pigs - growers : 2	Forages – 40% Concentrates – 5% Crop residues – 20% kitchen leftovers – 35%
			Dry	Dec, Jan, Feb,June, July, Aug				Forages – 25% Concentrates – 5% Crop residues – 25% kitchen leftovers – 45%

Types – Livestock system

Site	Livestock systems	Production type	Season	Season Months	Management system	Breed type	Type and No. of animals	Type of feed
Mukono	Intensive	Farrow to finish	Wet	Long rains (MAM),Short rains (SON)	confined	Cross breed	Pigs – lactating : 1 pregnant - sows: 2 Pigs - dry sows: 1 Pigs - boars: 1 Pigs - growers : 5	Forages – 30% Concentrates – 35% Crop residues – 20% kitchen leftovers – 15%
			Dry	Dec, Jan, Feb,June, July, Aug				Forages – 17% Concentrates – 36% Crop residues – 25% kitchen leftovers – 22%
	Extensive	Farrow to finish	Wet	Long rains (MAM),Short rains (SON)	scavenging	Local	Pigs – lactating : 1 pregnant - sows: 1 Pigs - dry sows: 0 Pigs - boars: 0 Pigs - growers : 2	Forages – 30% Crop residues – 35 kitchen leftovers – 15%
			Dry	Dec, Jan, Feb,June, July, Aug				Forages – 50% Crop residues –30% kitchen leftovers – 20%

Animal Diet/ Feed basket



Parameters Used

Livestock

annual_evapo_transpiration
aridity_index_ETO
precipitation
soil Organic Carbon
bulk_density_.kg_per_cubic_meter.
soil clay_content
soil total_nitrogen_.ppm.
Soil_Depth
Soil Type
Rainy season

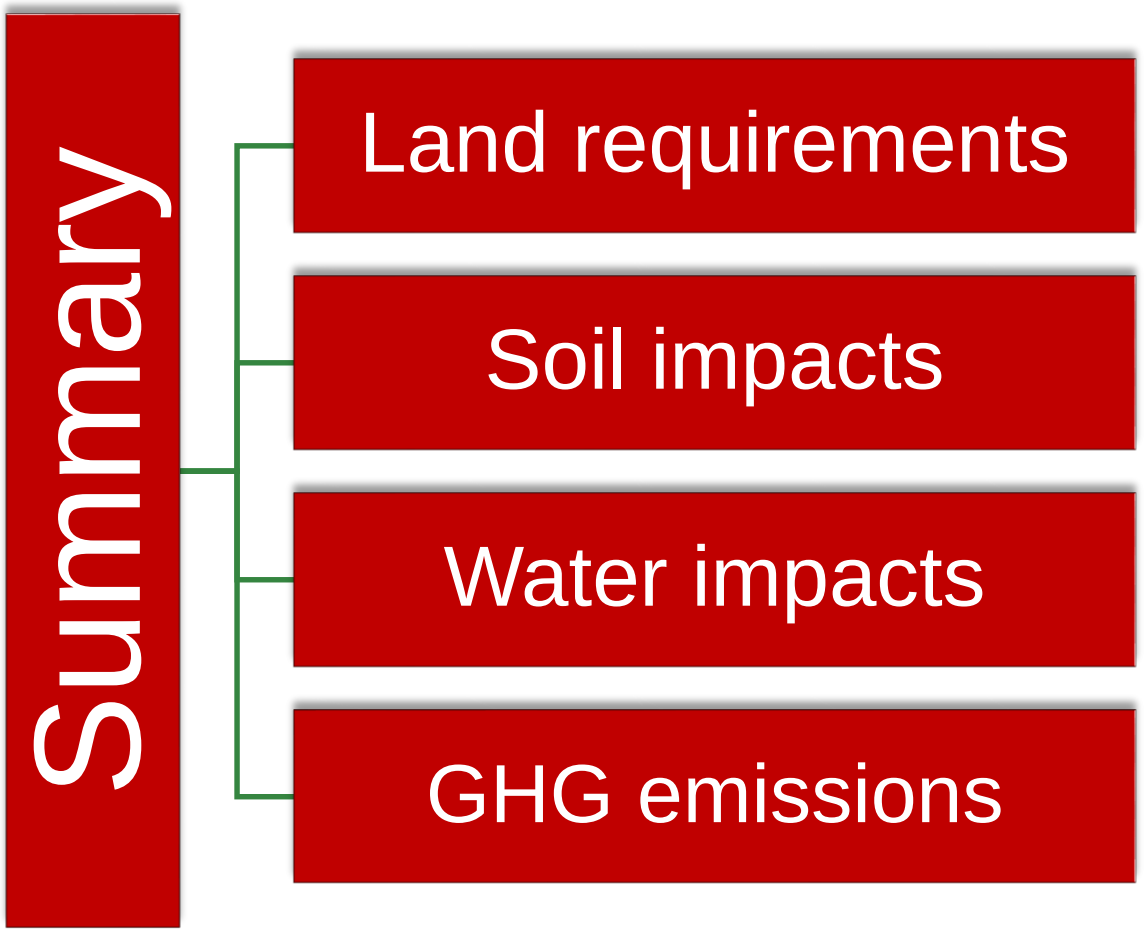
Area

Crop

Feed

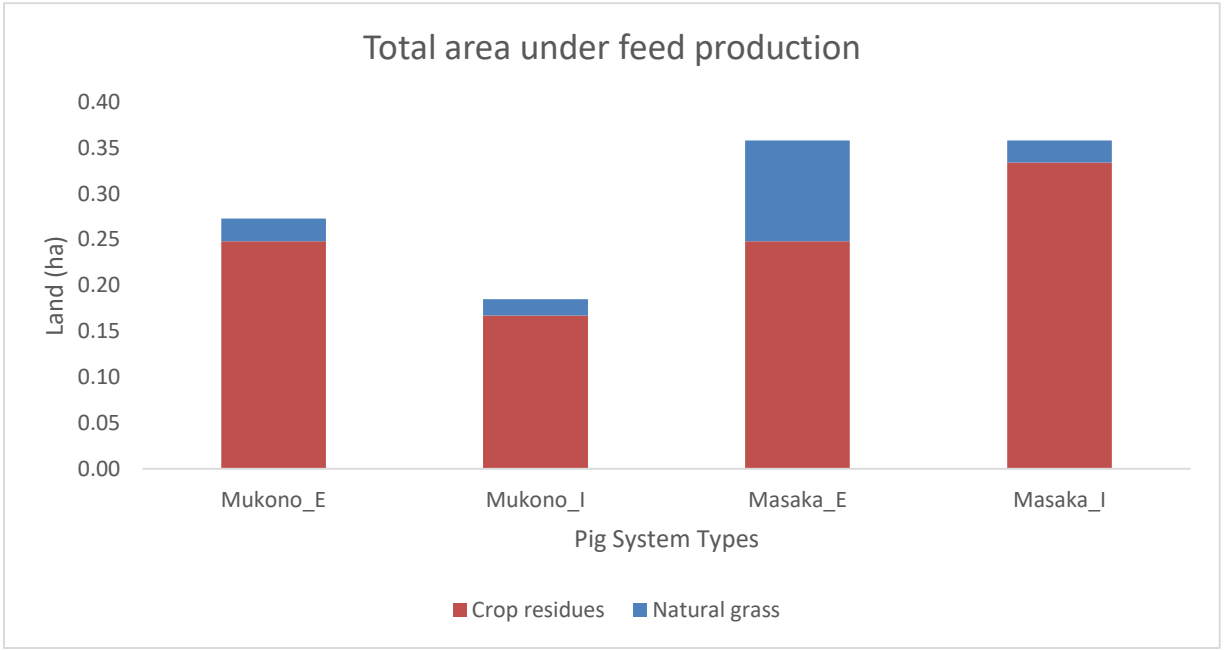
CLEANED Results

Results overview



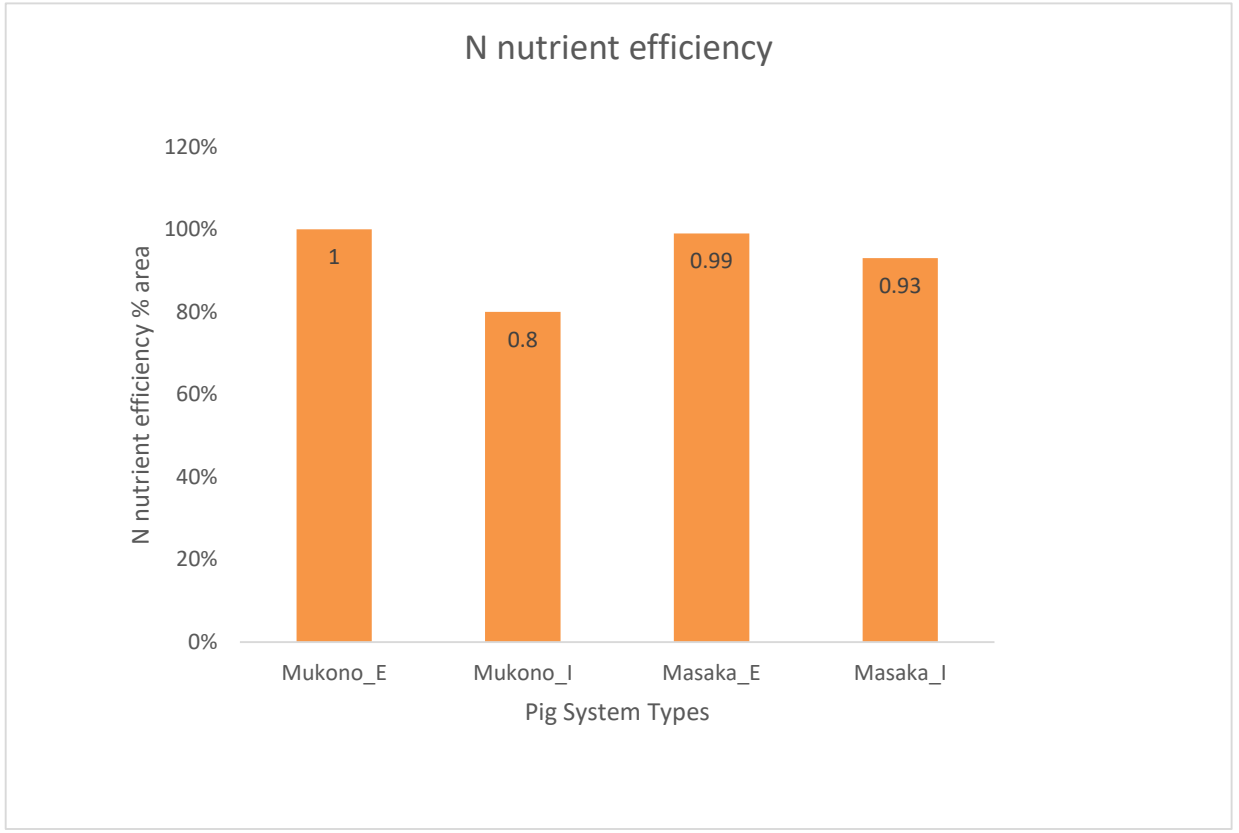
Land

- **For each feed item,** it is indicated how many hectares of the associated crop need to be planted to fulfill the feed requirements of the animals. This encompasses land requirements for feed production for each season.
- **Total area used for feed production:** adds up the area requirements per feed item. This is thus the total area of land that the livestock enterprise should “set aside” for feed production.
- **Purchased feed** items will require 0 hectares of area as these are considered to be outside the system.



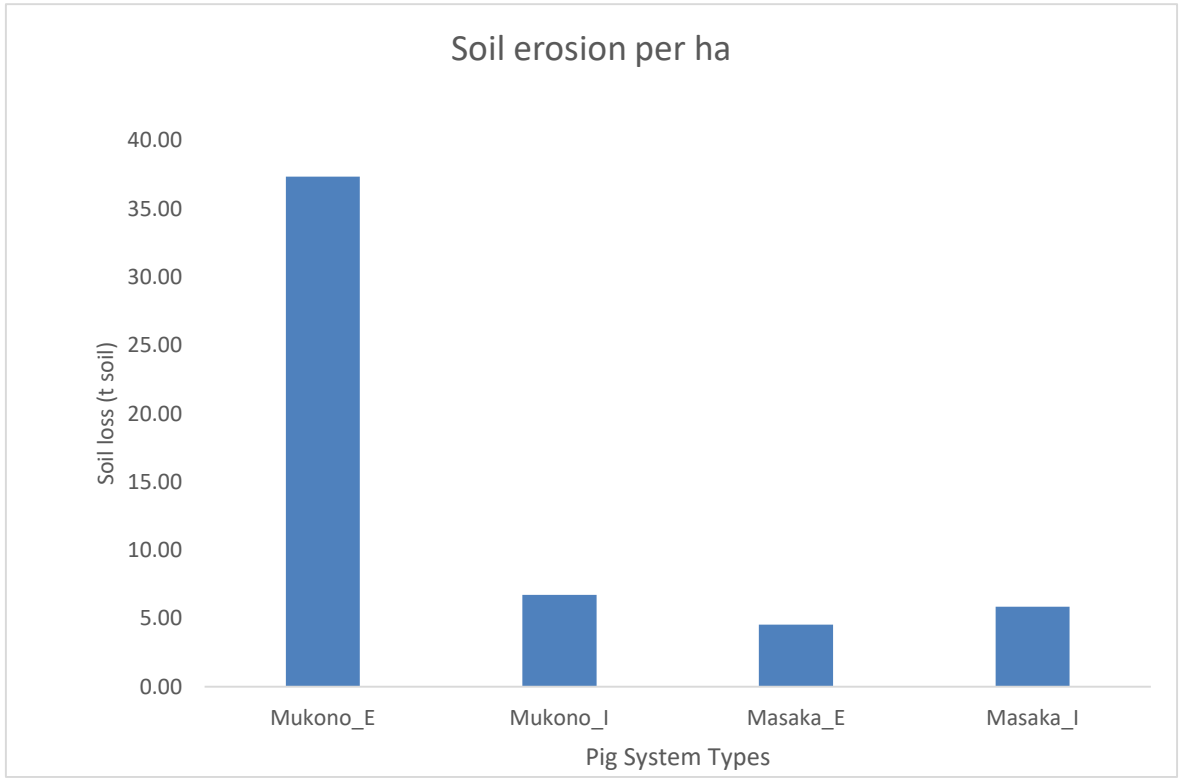
Soil Impacts

- **N balance ;** depends on nutrient monitoring of nitrogen changes in and out of the soil.(in; fertilizers, manure app, out; leaching, crop residue)
- **N balance:** A positive N balance is desired; as otherwise nutrient mining might result in severe soil fertility depletion over time.
- However, a N balance of >150 kg N/ha is also undesirable as this could result in N leaching in groundwater and higher GHG emissions.
- The N balance takes into account the N for feed production used for animal production and also the N balance for food production.



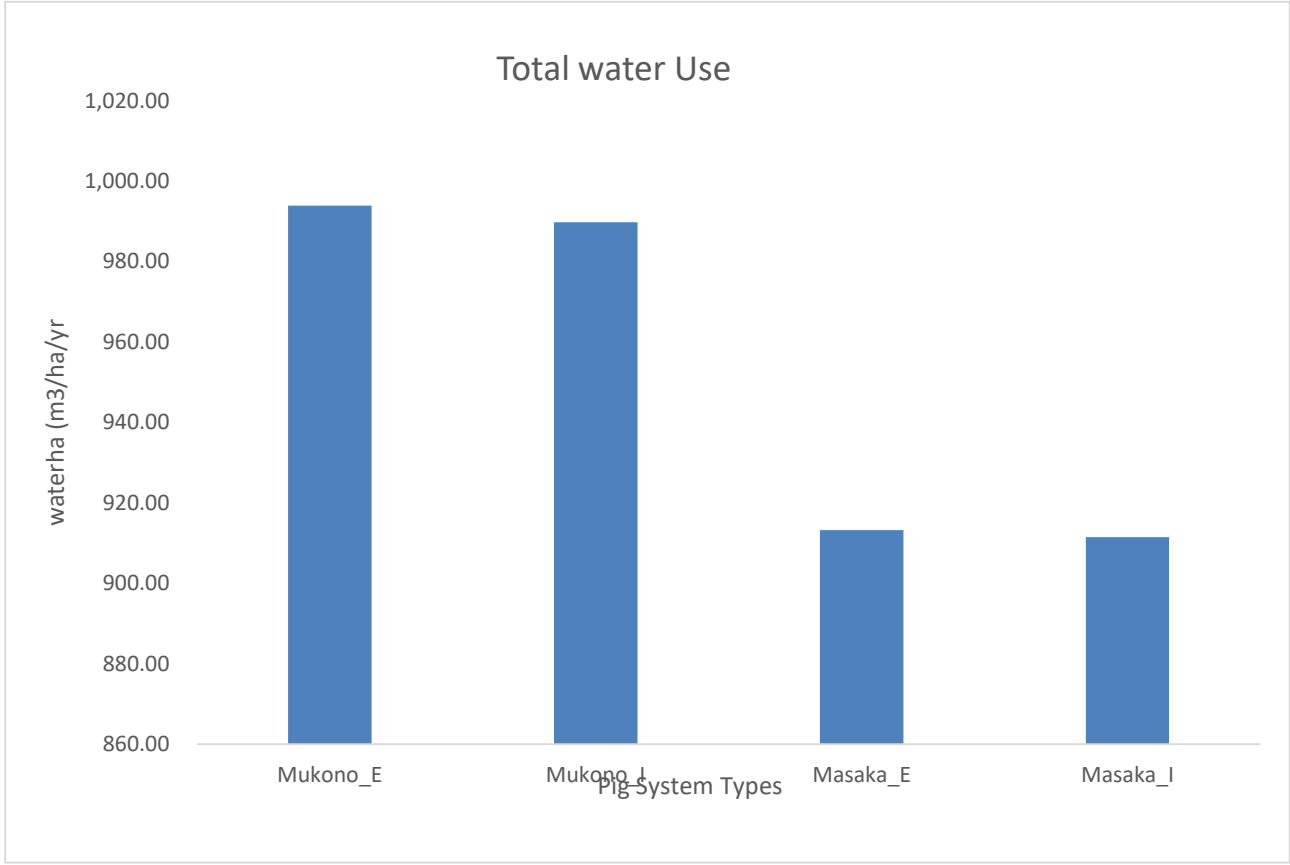
Soil Impacts

- **Erosion:** Erosion is expressed in annual t of soil loss.
- **Soil erosion** is estimated using the amount of rainfall, soil type, length and steepness of slope, crop cover factor and the , land management system(agricultural land).



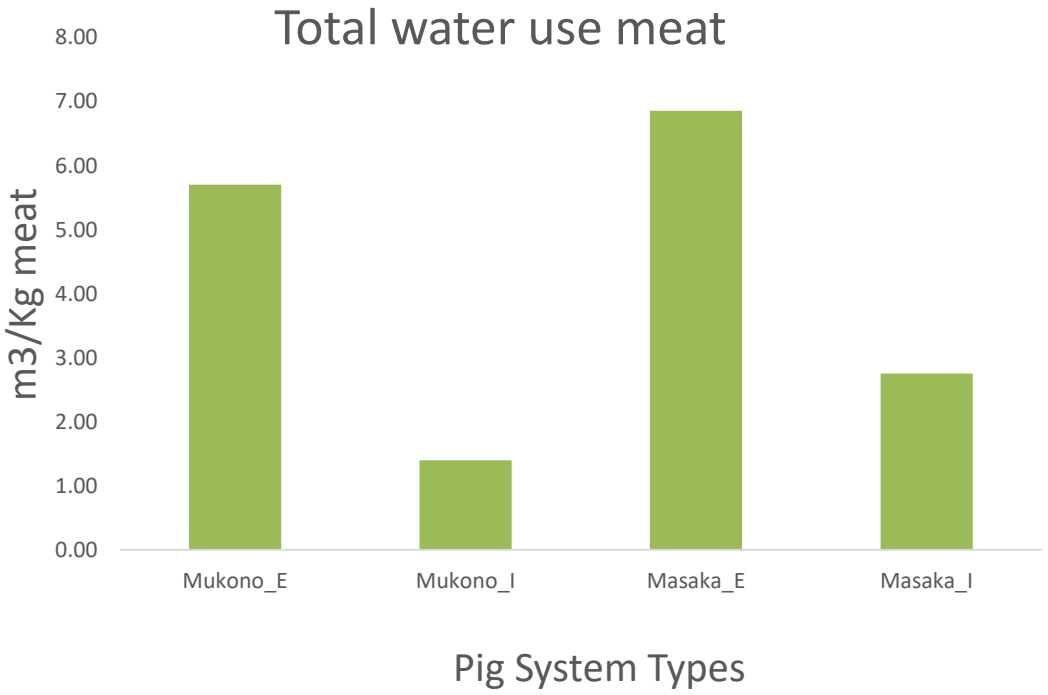
Water Impacts

- The model calculates how much of the water that is available goes into production for feed, how much water is used.
- Crop water requirements are represented by the actual crop evapotranspiration. Evapotranspiration (ET) is a term used to describe the water consumed by plants over a period of time.



Water Impacts

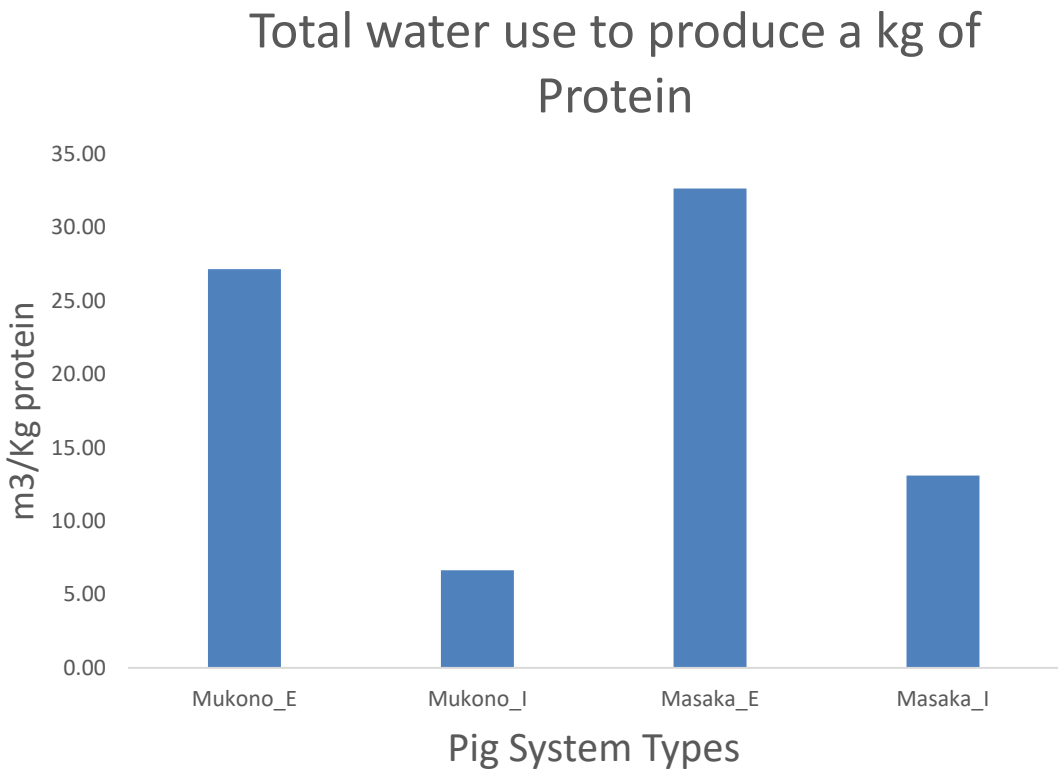
- The model is also used to estimate how much water is used to produce a kg of meat.



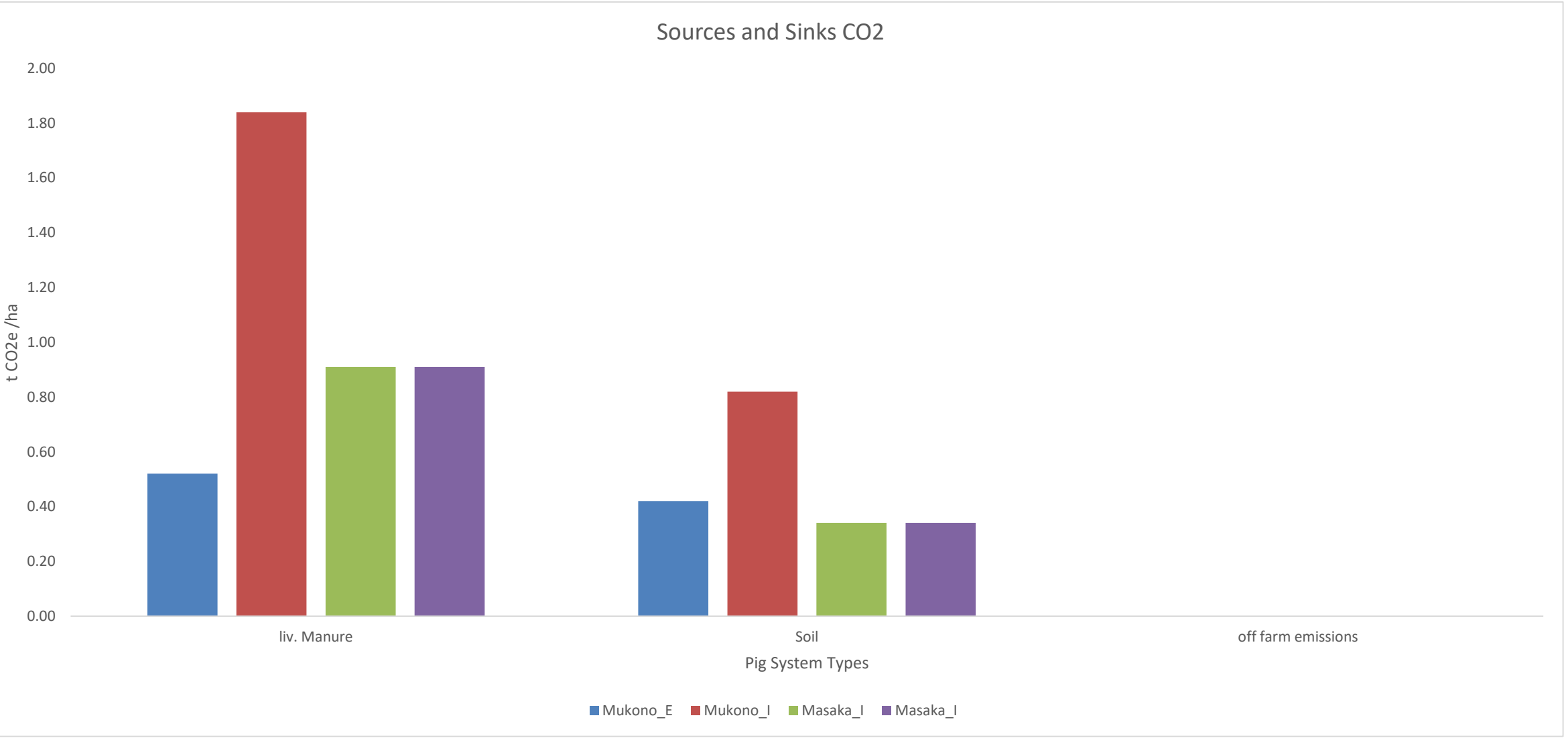
Water Impacts

- This indicator estimated the amount of water used for feed production.

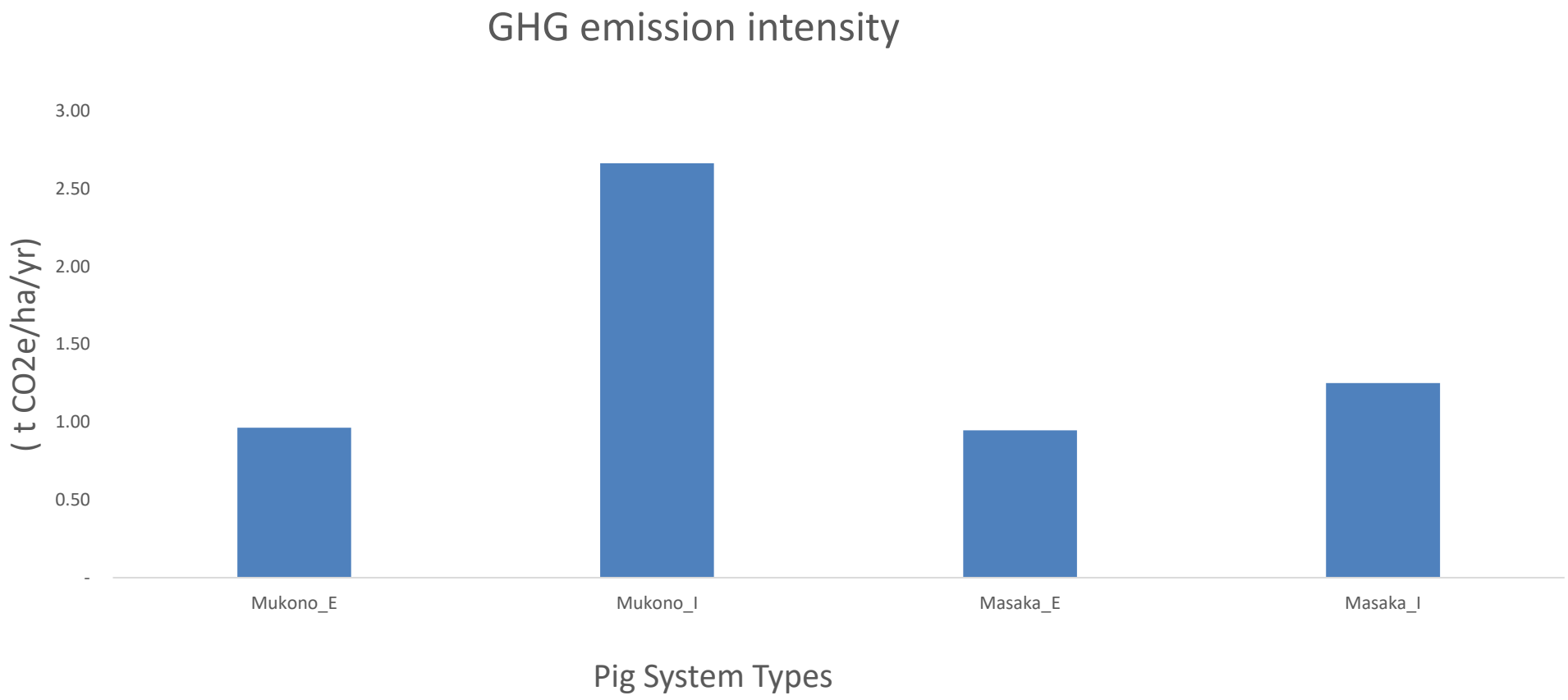
- This indicator is not only expressed as absolute value but also as the fraction of the total rainfall and per kg of proteins produced on the livestock enterprise.



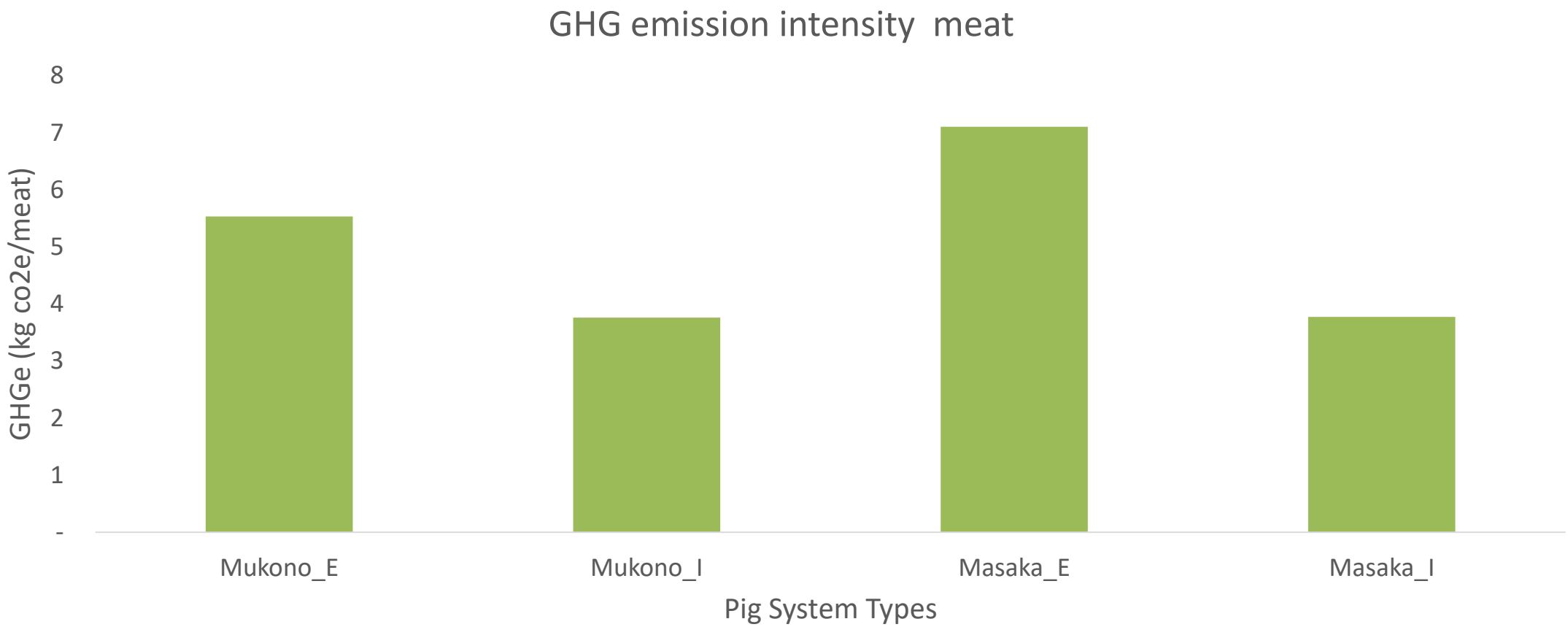
GHG Emissions



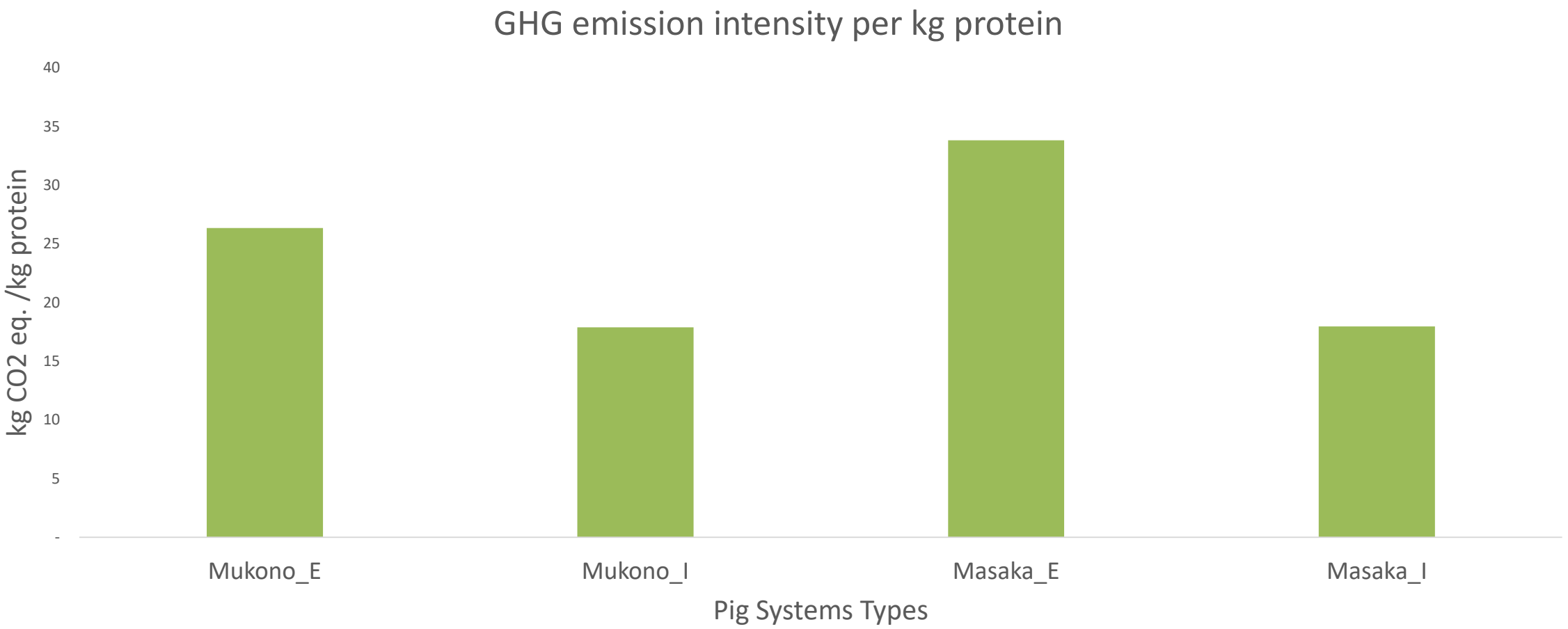
GHG Emissions



GHG Emissions



GHG Emissions



Results Verification

Environmental Impact: CLEANED results	Validate Is this what is expected on the ground		Reasons for yes/no answer What information is needed to further verify the results
	Yes	No	
Total area under feed production			
N nutrient mining			
Soil erosion per ha			
Soil erosion per ha			
Total water Use m3/ha/yr			
Total water use meat			
Total water use to produce a kg of Protein			
Sources and Sinks of CO2			
GHG emission intensity			
GHG emission intensity per kg protein			
GHG emission intensity per meat			

Type Verification

Type	Validate Is this what is expected on the ground		Population involved in Pork VC in Project Area	Reasons for yes/no answer What information is needed to further verify the results
	Yes	No	Percentage (%) Low / Medium / High (0 -29 / 30 -60 / 61 - 100)	

Input and Parameters Verification

INPUT and Parameters	Validate Is this what is expected on the ground		Reasons for yes/no answer Places to get better data?
	Yes	No	
Herd composition (nr)			
Average annual growth per animal (kg)			
Average Body weight (kg)			
Litter size (pigs)			
Feed basket/ Diet			
Animal Whereabouts			
Maize / DM Yield tonne/ha			
Natural pasture/DM Yield tonne/ha			
Cassava/DM Yield tonne/ha			
Sweet potato/DM Yield tonne/ha			
Cocoyam leaf/DM Yield tonne/ha			
Banana/DM Yield tonne/ha			

CLEANED Application

Who will be using CLEANED?

- What is their job?
- Where does it fit into the job role?
- Who will be *their* audience?

What questions do you want to answer?

- Implementing technologies
- Soil impacts in an area
- Alternative processes or practices
- GHG emissions
- Land use
- Water impacts

Feeding a productive dairy cow in western Kenya: environmental and socio-economic impacts

https://hdl.handle.net/10568/97557

Who are the stakeholders?

Use of Results for stakeholder x

Environmental Impact: CLEANED results	Importance of Results to xxx 1 = very low; 2 = low; 3 = medium; 4 = high; 5 = very high	Reasons for answer
Total area under feed production		
N nutrient mining		
Soil erosion per ha		
Total water Use m3/ha/yr		
Total water use per product		
Total water use to produce a kg of Protein		
Sources and Sinks of CO2		
GHG emission intensity		
GHG emission intensity per kg protein		
GHG emission intensity per product		

END of DAY 1

Alliance

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Since 1967 Science to cultivate change

Thank you!

CGIAR

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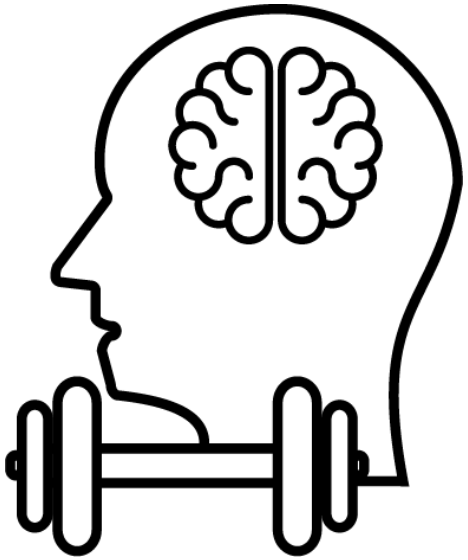
CGIAR is a global research partnership for a food-secure future.

DAY 2: CLEANED Scenarios

Recap



CLEANED Scenarios

Challenges and for Pig value chain

Challenges

- Disease control
- Low quality forage
- Low performance of A.I
- Inbreeding
- Poor Manure Management

The Interventions

Flagship	Summary of intervention	The interventions
Genetics	Community based AI and synchronization	1. Community AI & 2. Synchronization
Environment	Manure management options	1. Composting Manure 2. Fertilization of crops 3. Biogas 4. Fish feed
Feeds	Improved planted forages	Grasses 1. Brachiaria - Mulato 2. Brachiaria – Cayman 3. Brachiaria – Cobra Legumes 1. Crotalaria juncea 2. Desmodium Greenleaf
Animal Health	Herd health package	1. Antimicrobial 2. De-wormers 3. Best animal welfare practices e.g. biosecurity

Example of Scenario/ Intervention

Pork basket of technologies & innovations

Genetics
1. _____

Feeds and forages
i. _____

Herd health
a. _____

Cross-cutting gender, youth, capacity building;

Environmental sustainability

Emphasis on 'demand driven'

Package
1, ii, c, A

Package
3, i

Package
2, iii, b,

Affected by
- Demand by entrepreneur
- Demand by farmer
- Recommendation by experts

- **Packaging technical components**

Mapping challenges to the location

Production Challenges	Is the production challenge affecting your pig system type		If Yes How important is this production challenge in pig system type and location Percentage (%) Mildly important/ Important / Very Important (0 -29 / 30 -60 / 61 -100)	Reasons for answer
	Yes	No		
Feeding				
Health				
Genetics				
Environment/Manure mgmt.				

Formulating the Package

Type	The Package Community AI &Synchronization/Composting, Manure Fertilization of crops ,Biogas, Fish feed/ Grasses:Brachiaria – Mulato,Brachiaria – Cayman.Brachiaria – Cobra & Legumes: Crotalaria juncea Desmodium Greenleaf/Antimicrobial /De-wormer/Best animal welfare practices e.g. biosecurity
A	

How do this(these) package(s) affect the production and input and parameters in your Pig system type?

% increase of production from baseline Meat yield	Input	Parameters
	- Feeding basket what proportion of the basket will change? - Which feed item will be utilized less - What feed it item will be introduced - Does this intervention change the wet and dry season basket?	- What are the yields for the introduced feed items in the location? - What are the nutritional values for introduced feed items in the location? - Will there be any inorganic/organic fertilizer use? How much?
	- If the intervention package is successful, does the herd composition change or remain the same? - If a change, is there an increase or decrease in animal numbers? Specify	- Do the weights of the animal change or remain the same? - Does the birthing interval change?
	- How would the manure be managed if intervention is successful? - Will collection and use of manure change	N/A

Alliance

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Thank you!

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