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CLEANED – Internal Validation Workshop

Small Ruminant Value Chain Ethiopia

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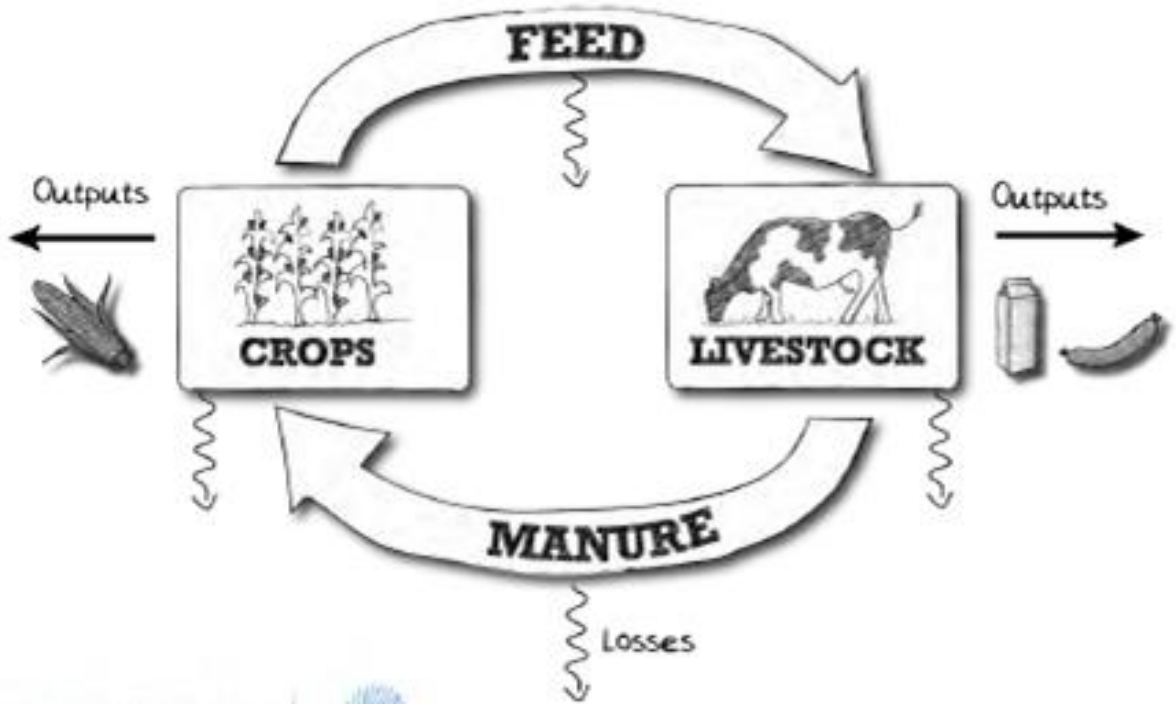
CLEANED Internal Validation Workshop: 25th June 2021

CGIAR

Welcome

- Introduction and Objectives – Jess
- Results
- Package intervention



Objectives

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

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

Part 1: The Livestock & Env

Herrero et al., (2013)

Current Environmental impacts

Negative environmental impacts:

EMISSIONS

of greenhouse gases

LAND

degradation and deforestation

WATER

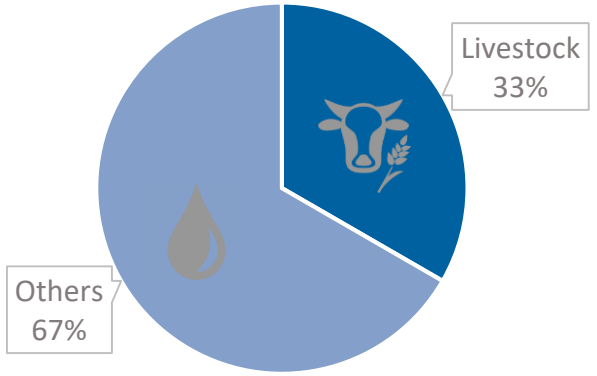
pollution and depletion

DEFORESTATION

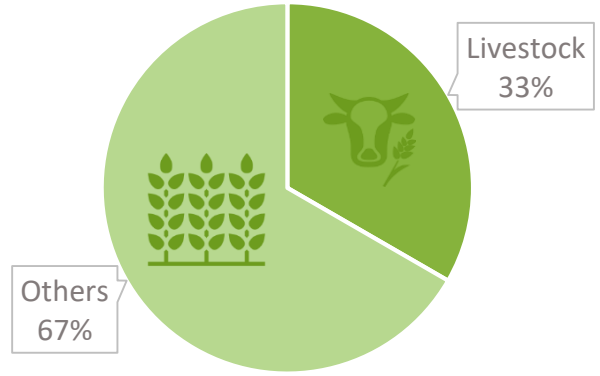
BIODIVERSITY

threatened

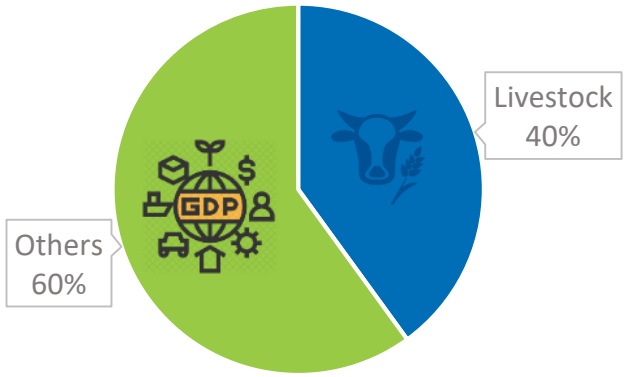
Global fresh water use

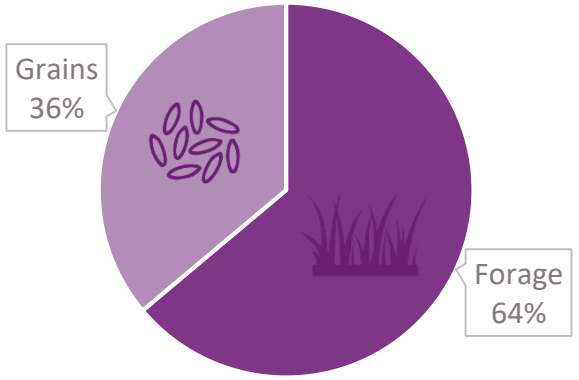


Global crop land



Global agricultural GDP





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Part 2:
CLEANED

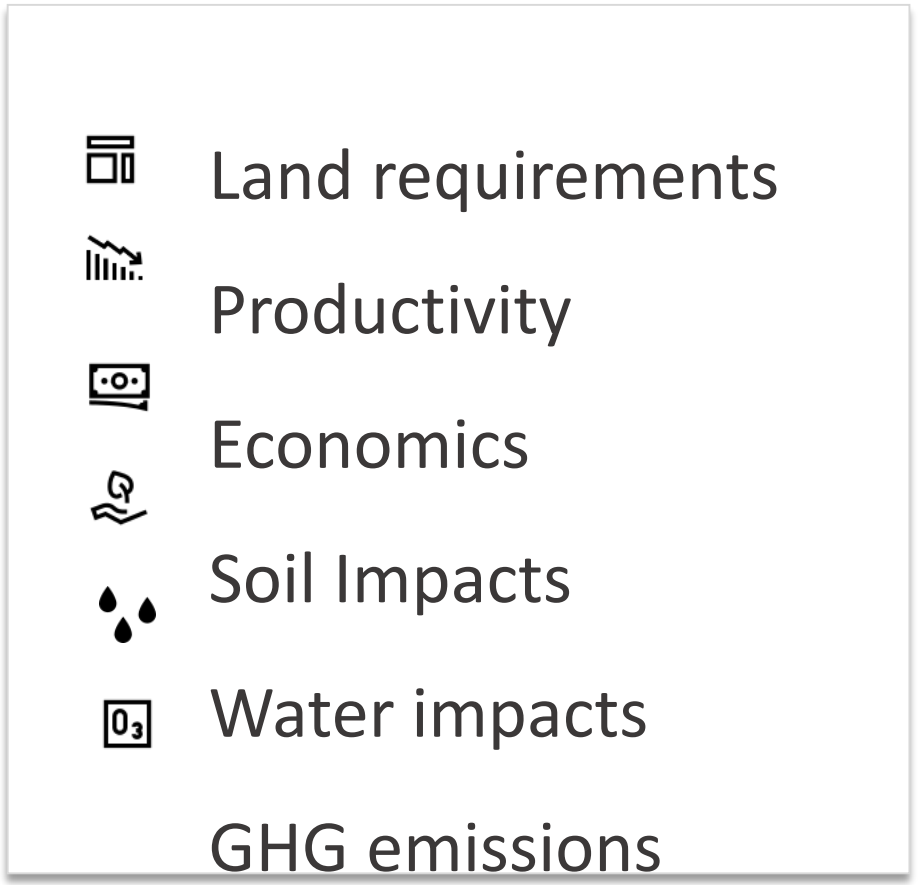
What is CLEANED?

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.

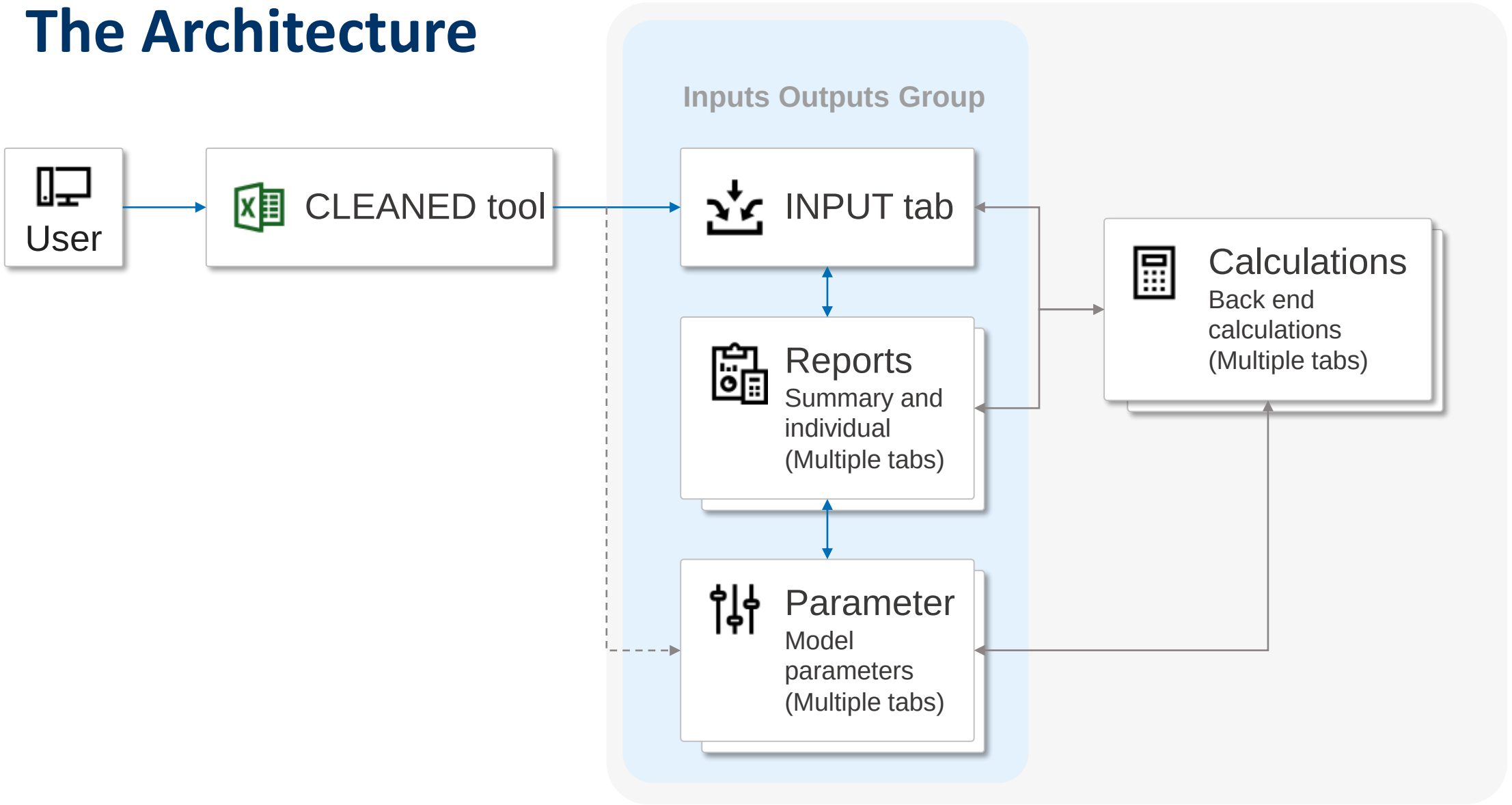
"A rapid ex-ante environmental impact assessment tool that allows users to explore multiple impacts of developing livestock value chains."

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

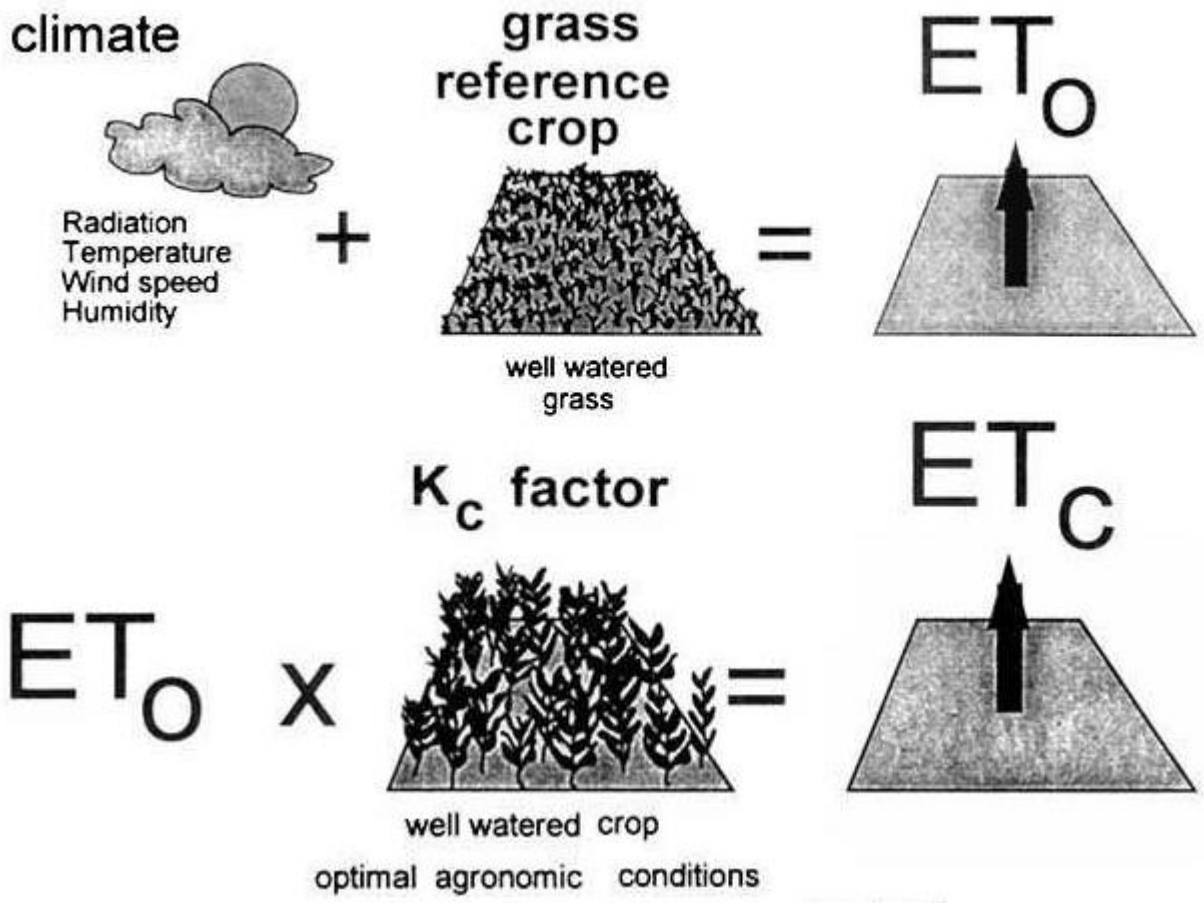
Feed amount + crop yields ==> land size

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

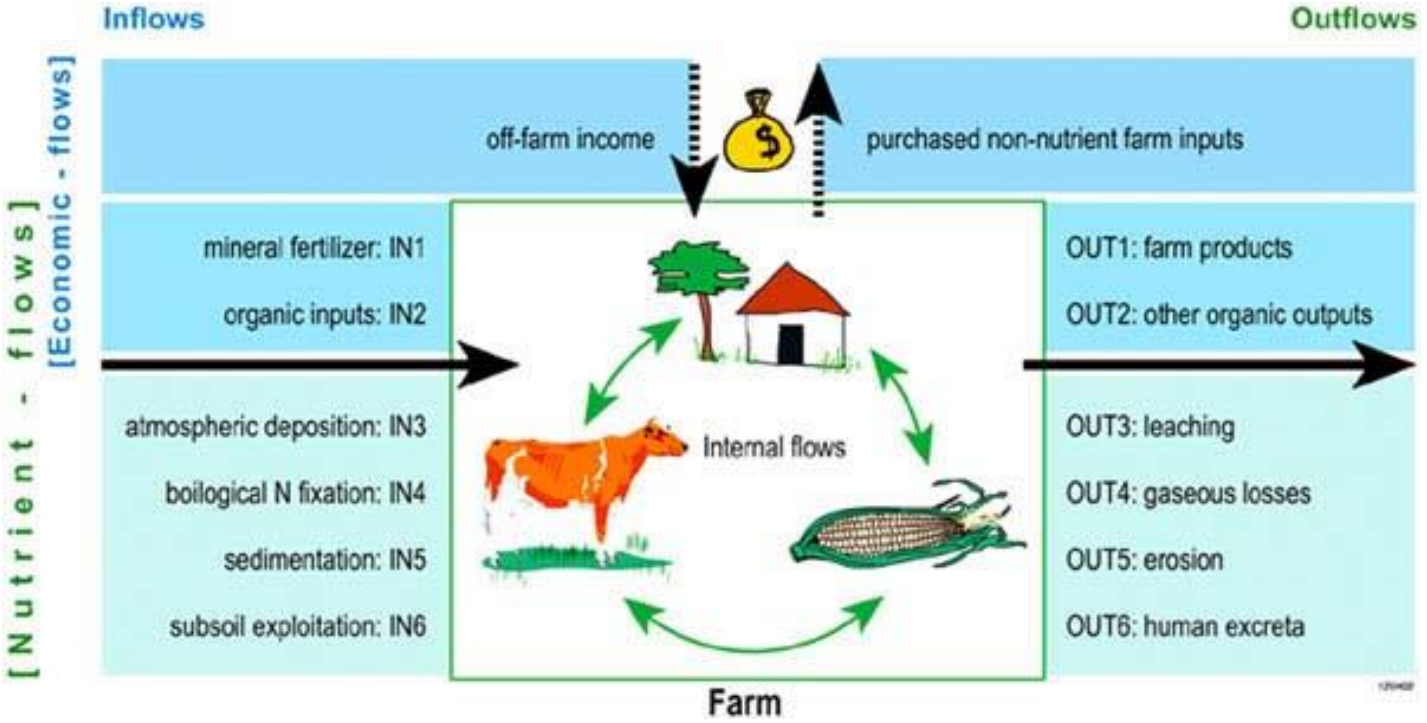
CLEANED

IN1 → OUT1

IN2 → OUT2

IN3 → OUT3

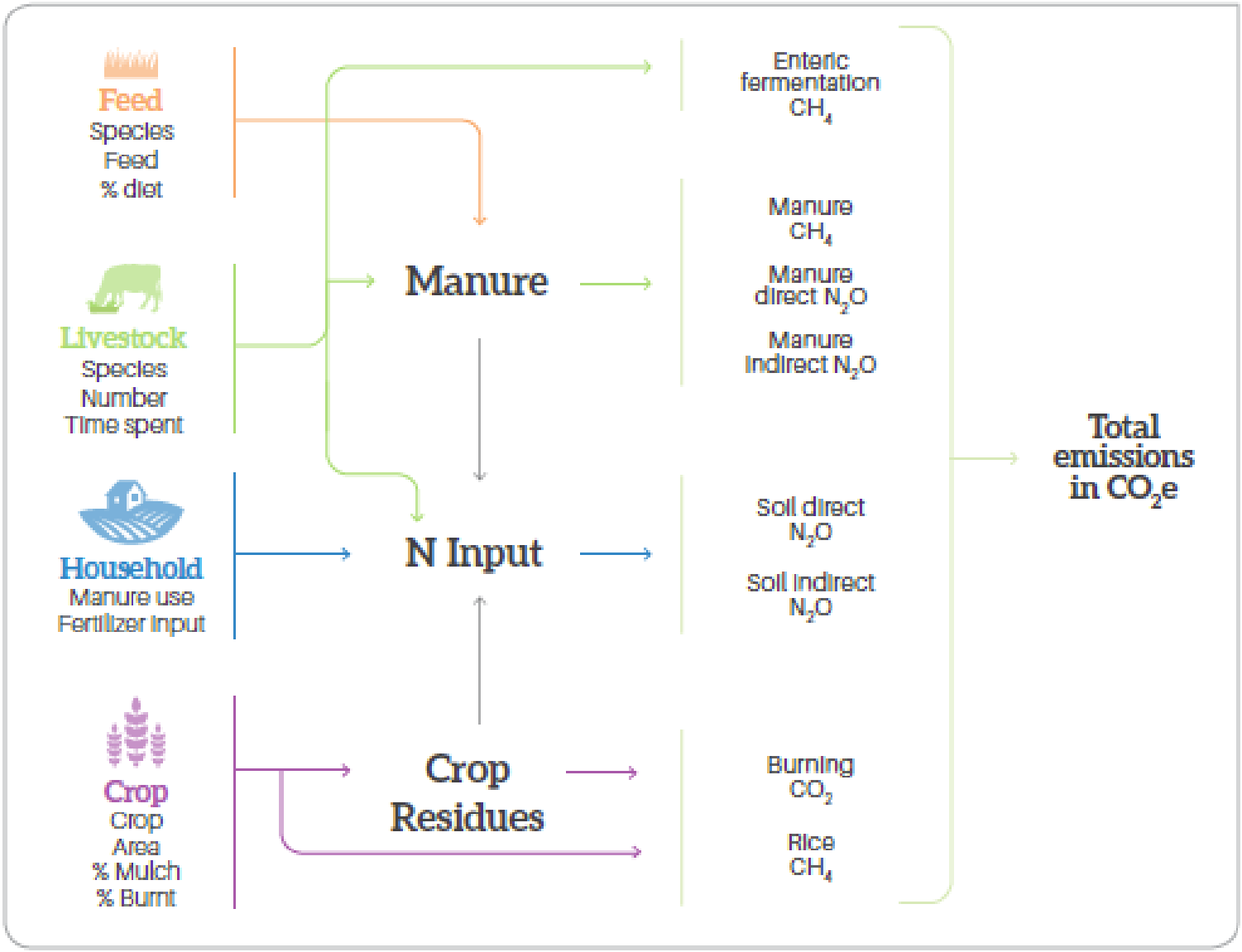
IN4 → OUT4



GHG

2006 IPPC Guidelines for National Greenhouse Gas Inventories.

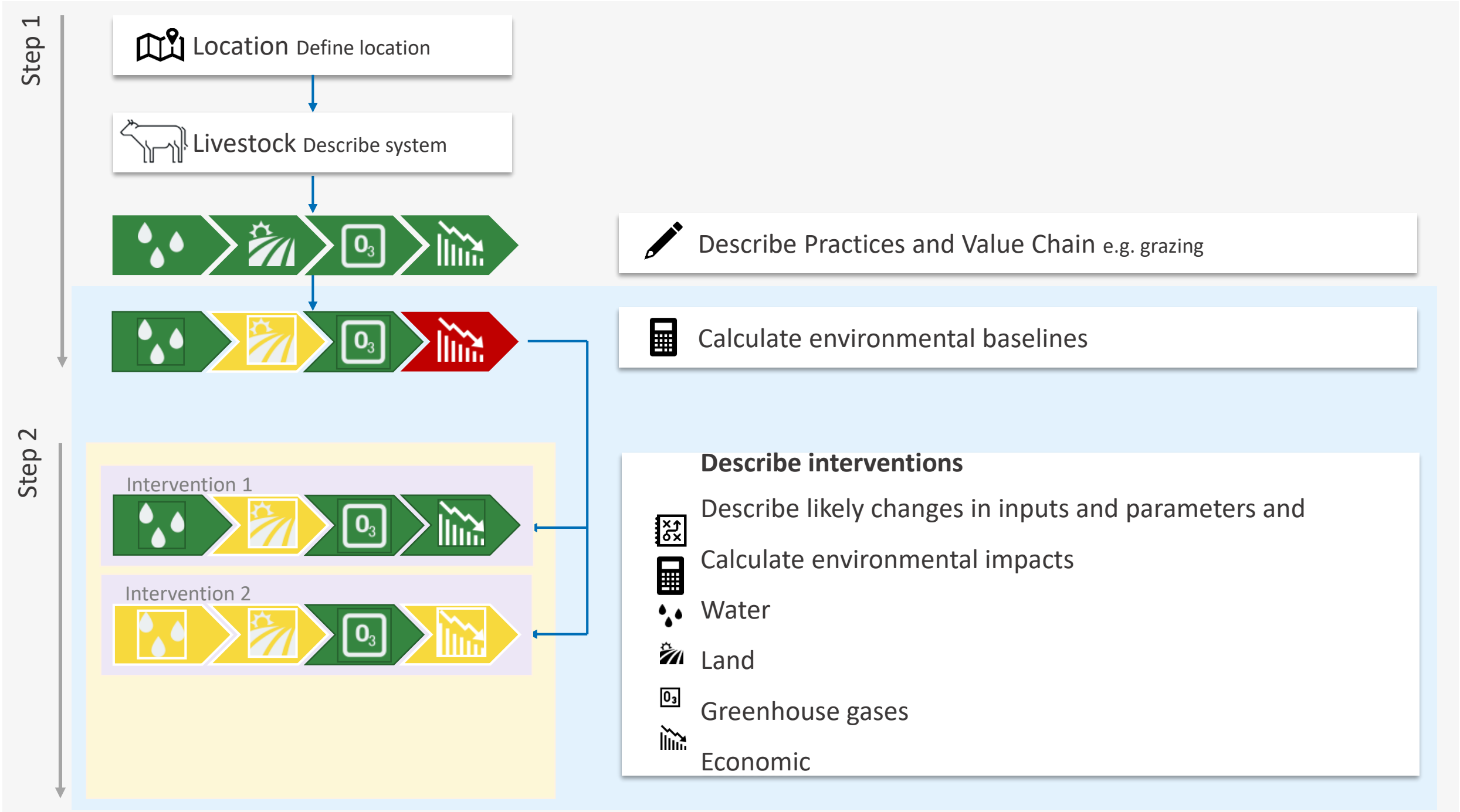
Tier 1 and 2



The process

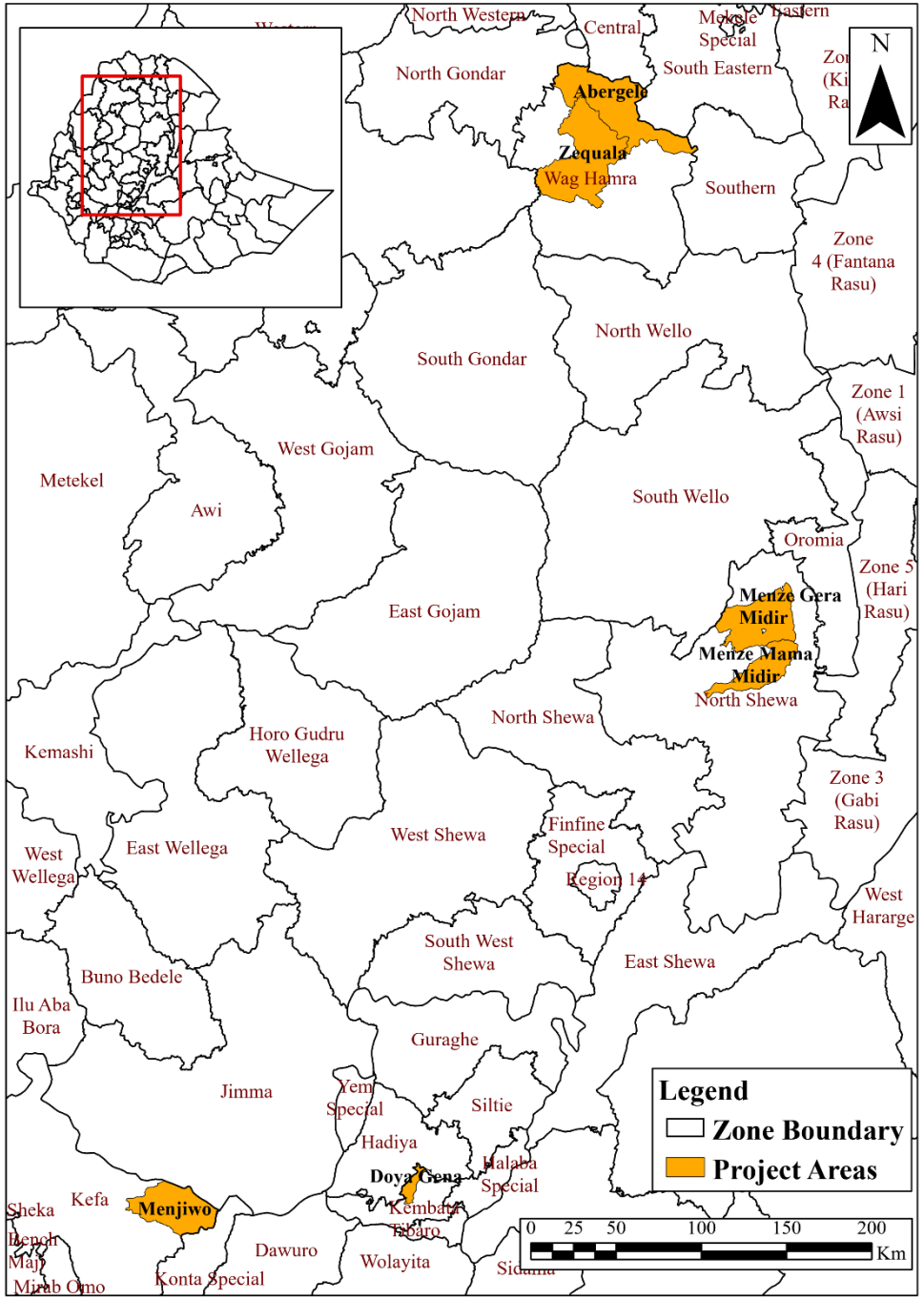
The CLEANED tool process comprises of 2 stages:

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


North Western
Central
Mekele Special
Eastern
North Gondar
South Eastern
Abergelo
Zequala
Wag Hamra
Southern
N
Zone 4 (Fantana Rasu)
North Wello
South Gondar
Zone 1 (Awsi Rasu)
West Gojam
Metekel
Awi
South Wello
Oromia
Zone 5 (Hari Rasu)
Menze Gera Midir
Menze Mama Midir
East Gojam
North Shewa
Horo Gudru Wellega
Kemashi
Zone 3 (Gabi Rasu)
West Shewa
Finfine Special
East Wellega
West Wellega
Region 14
West Hararge
South West Shewa
East Shewa
Buno Bedele
Ilu Aba Bora
Guraghe
Jimma
Yem Special
Siltie
Hadiya
Halaba Special
Doya Gena
Kefa
Menjiwo
Sheka
Kembata Tembaro
Bench Maji
Dawuro
Wolayita
Mirab Omo
Konta Special
Sidama
Legend
Zone Boundary
Project Areas
0 25 50 100 150 200
Km

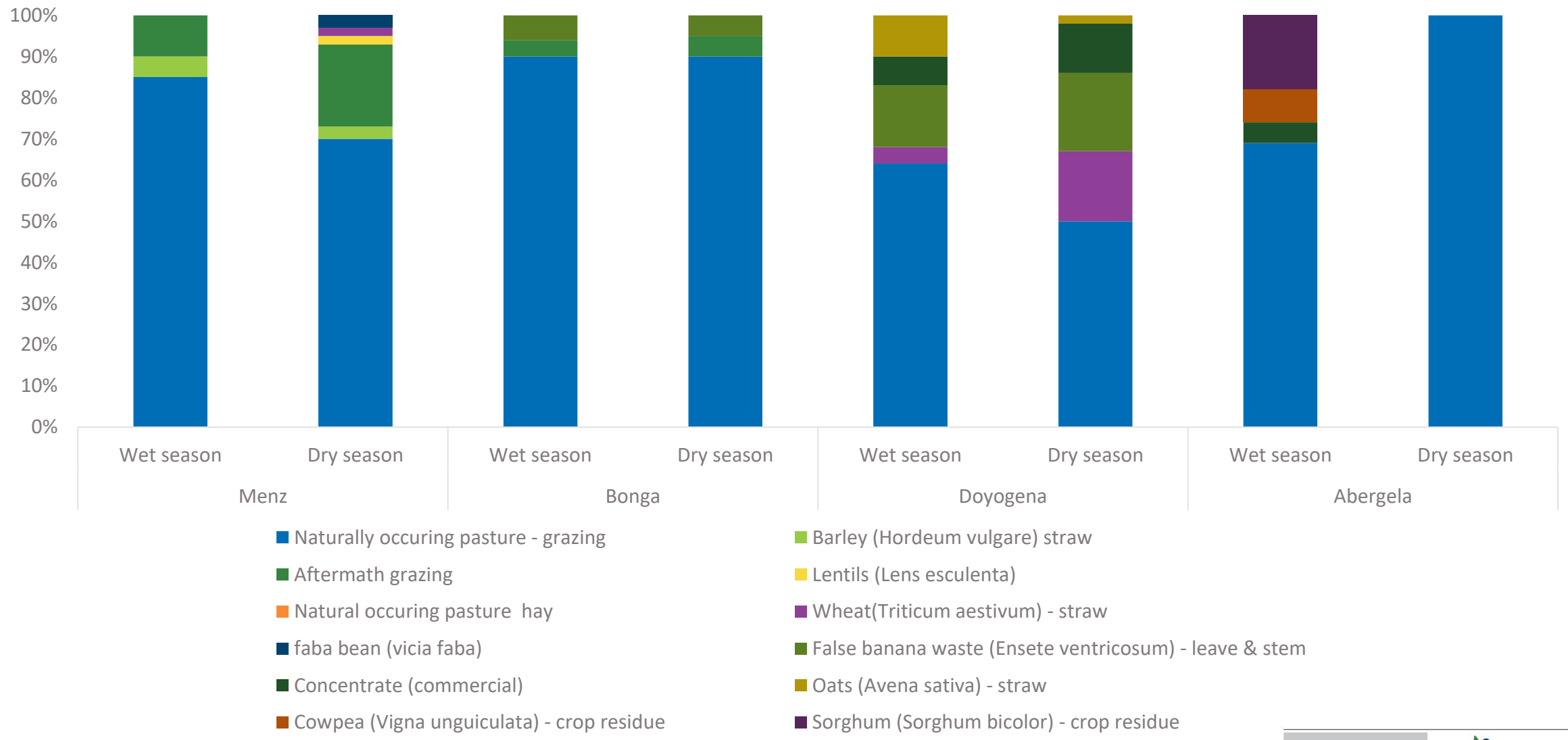
Small Ruminant Systems

Site	GPS coordinates	Mean Annual Rainfall (mm)	Mean Annual Temperature (˚C)	Land area (sq. km)	Reference
Menz	10°00´ N to 10°34´N and 39°17´E to 39°43´E	700 -1100	12.3^{O}C	1105.55	Ayele and Tahir, 2013
Bonga	7°16'N 36°14'E	2300	12-25^{O}C	10602	Tezera, 2008 Tufa et al., 2019
Doyogana	7°20' N latitude and 37°50' E	1200–1600mm	10–16°C	17,263.59 hectares	Kebede et. Al 2020
Abergele	13° 6' 0" North, 38° 57' 0" East	350-700 mm	22 °C	1,766.65 km^{2}	Samuel et.al, 2016))

Types – Livestock system

Site	Livestock systems	Season	Season Months	Management system	Breed type	Type and No. of animals	Type of feed
Abergele, Lowland	Extensive - goat	Wet	July to Sep	Grazing	Indigenous breed	Goats Does : 18 Goats Bucks: 2 Goats - Fattening Bucks: 2 Kids: 15	Grazing 100% Grazing – 70% Sorghum residues – 13% Cow pea 8%
		Dry	Dec to June				Natural pasture Hay – 5%, Concentrate 4%
Doyogena, Highland	Extensive sheep	Wet	May to Oct	Grazing	Indigenous breed	Sheep Ewes : 1.83 Sheep Fattening Rams: 0.12 Sheep Lambs: 0.80 breeding ram : 0.90	Grazing – 50% False banana supply – 17% Avena sativa– 5% Concentrate - 11% Wheat straw - 4%
		Dry	Nov to April				Grazing – 50% False banana supply – 17% Avena sativa– 6% Concentrate - 15% Wheat straw - 11% Natutak grass hay - 1%
Menz	Extensive	Dry	Nov to May	Grazing with supplementation	Indigenous breed	Sheep Ewes : 19 Sheep Breeding Rams: 3 Sheep Fattening Rams: 3 Sheep Lambs: 6	Natural pasture grazing 70%, Aftermath grazing-20%, Barley straw -3%, Lentil residue-2%, wheat straw-2% and faba bean residue- 3%
		Wet	Jun to Oct				Natural pasture grazing 85%, Aftermath grazing-10%, Barley straw -5%
Bonga	Extensive	Dry	Feb to May	Grazing with supplementation	Indigenous breed	Sheep Ewes : 4 Sheep Breeding Rams: 1 Sheep Fattening Rams: 2 Sheep Lambs: 4	Natural pasture grazing- 90%, Aftermath grazing-5%, False banana waste-4%, Banana waste-1%
		Wet	June to Jan				Natural pasture grazing-90%, Aftermath grazing- 4%, False Banana waste- 4%, Banana waste-2%

Animal Diet/ Feed basket



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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

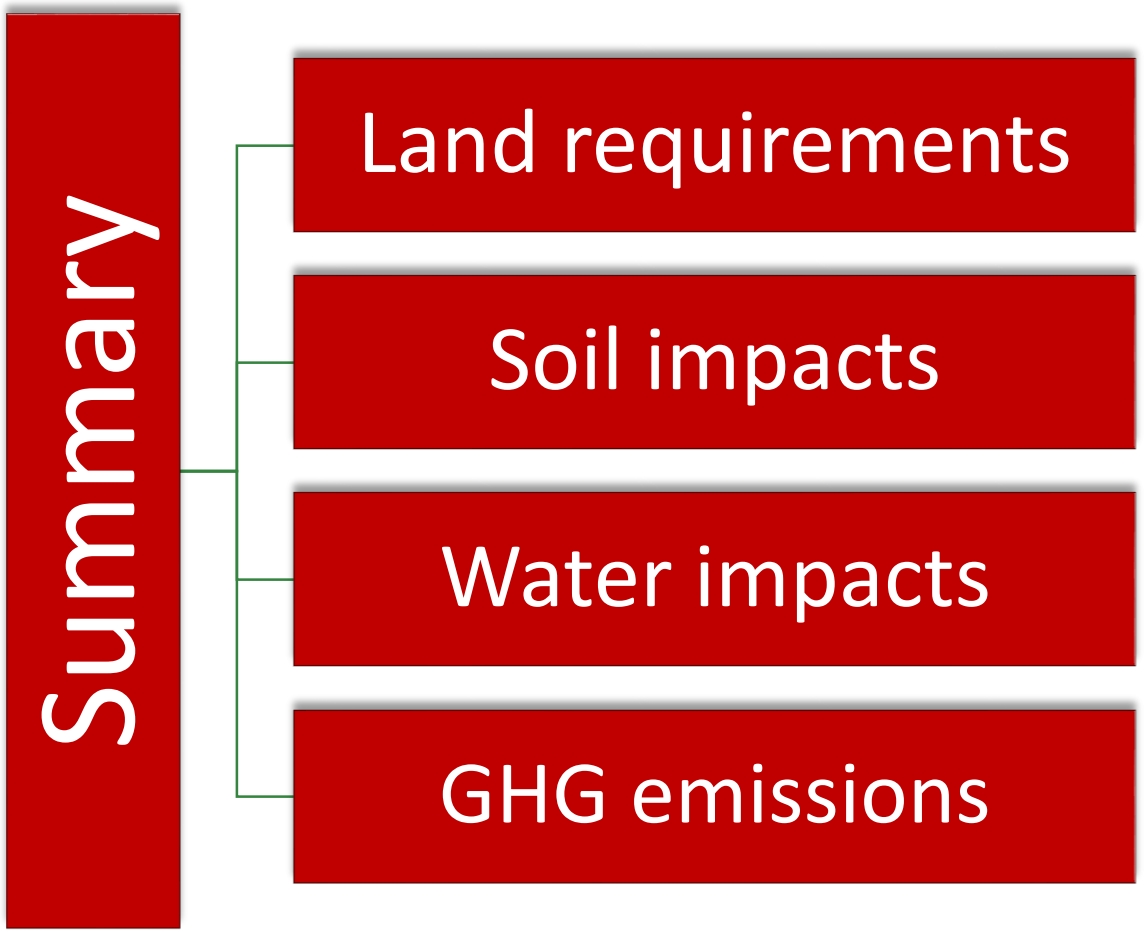
Area

Crop

Feed

CLEANED Results

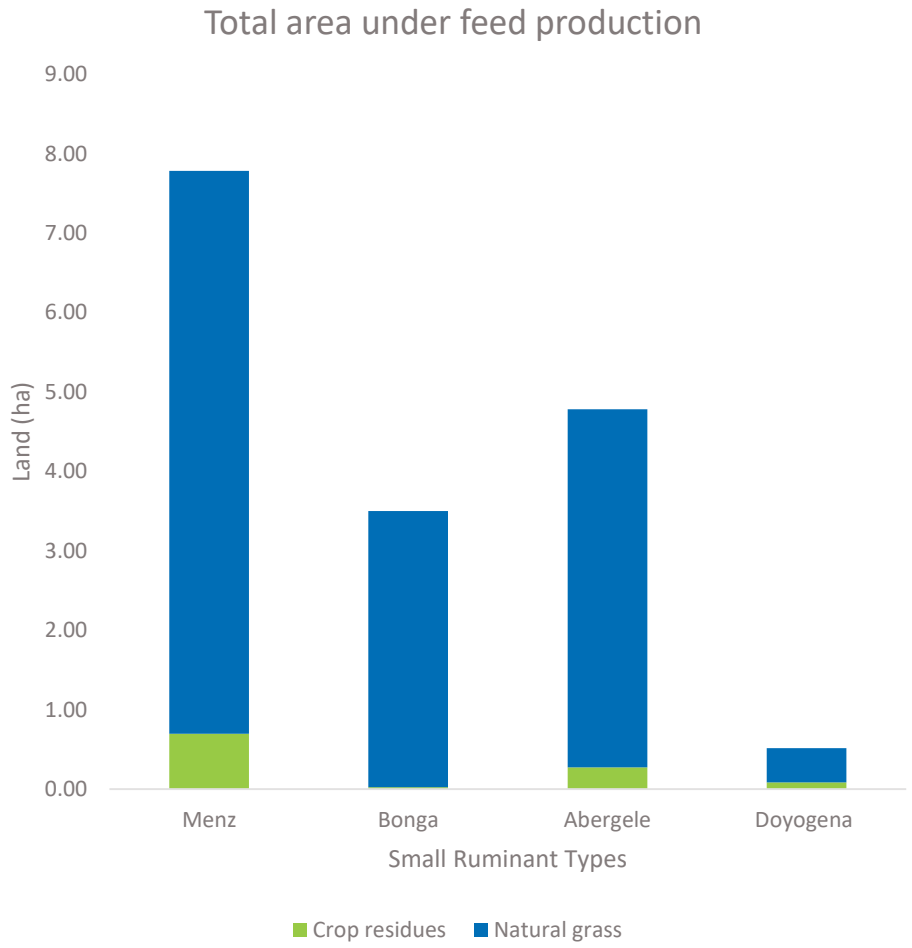
Results overview



Land

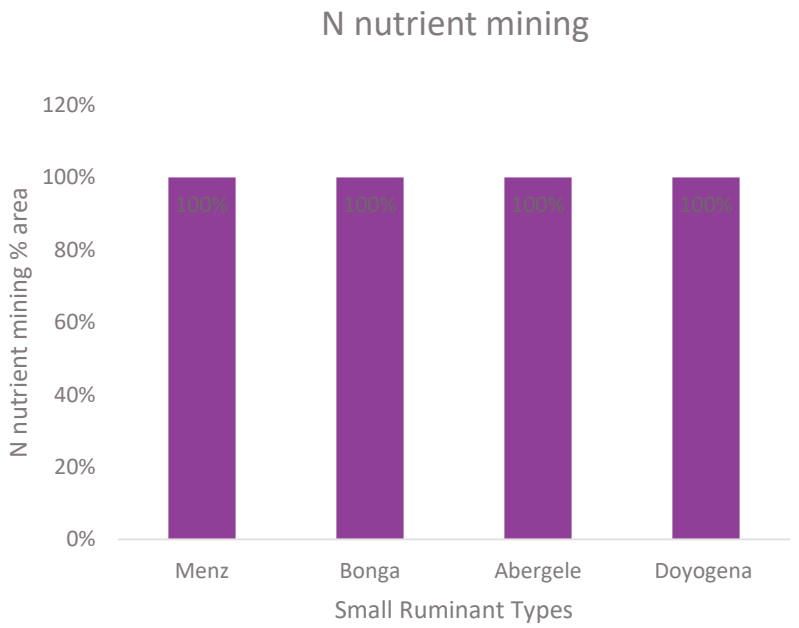
- High dependence of natural passure

- Menz and Abergela use of crop residues

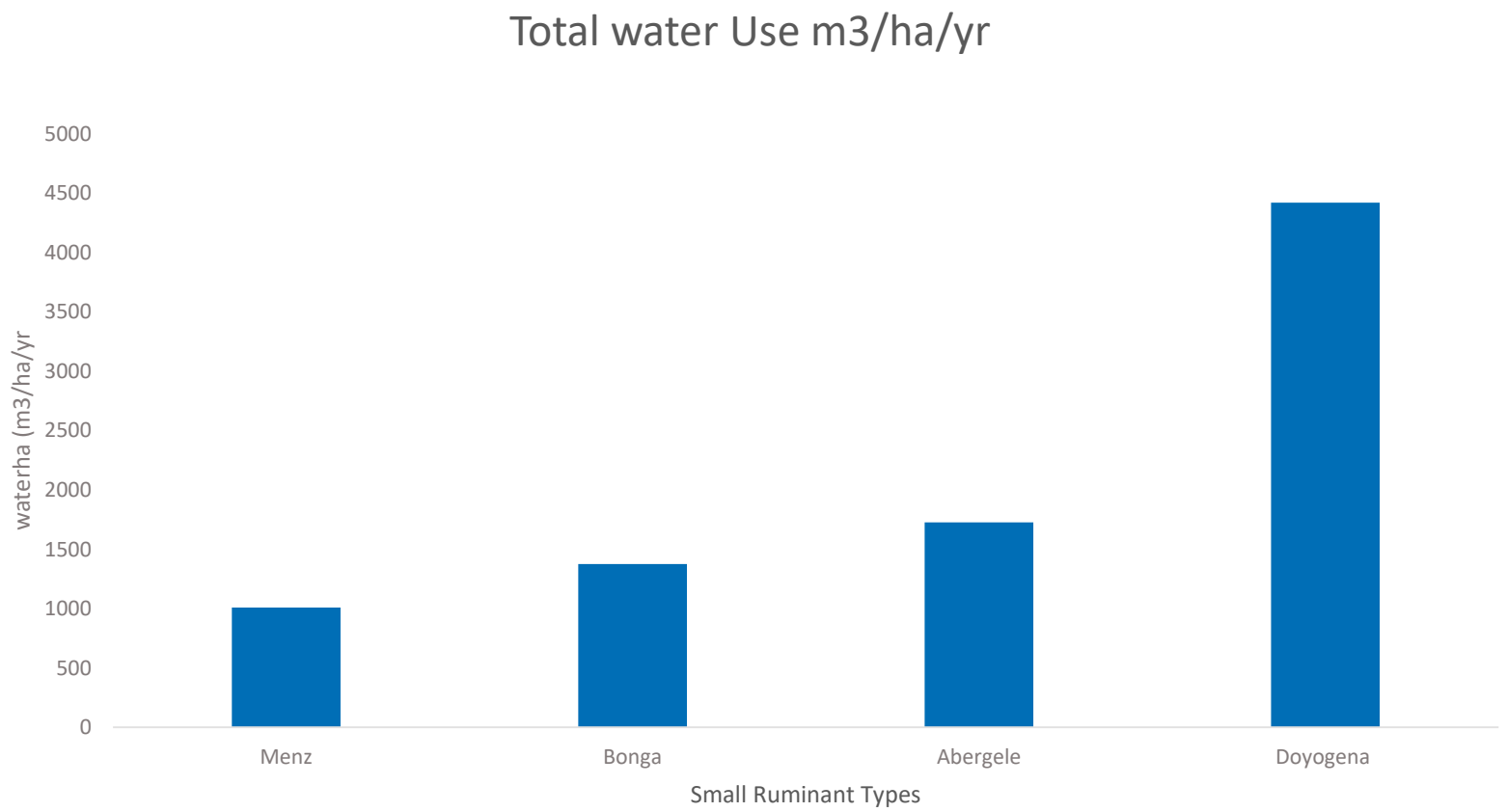


Soil Impacts

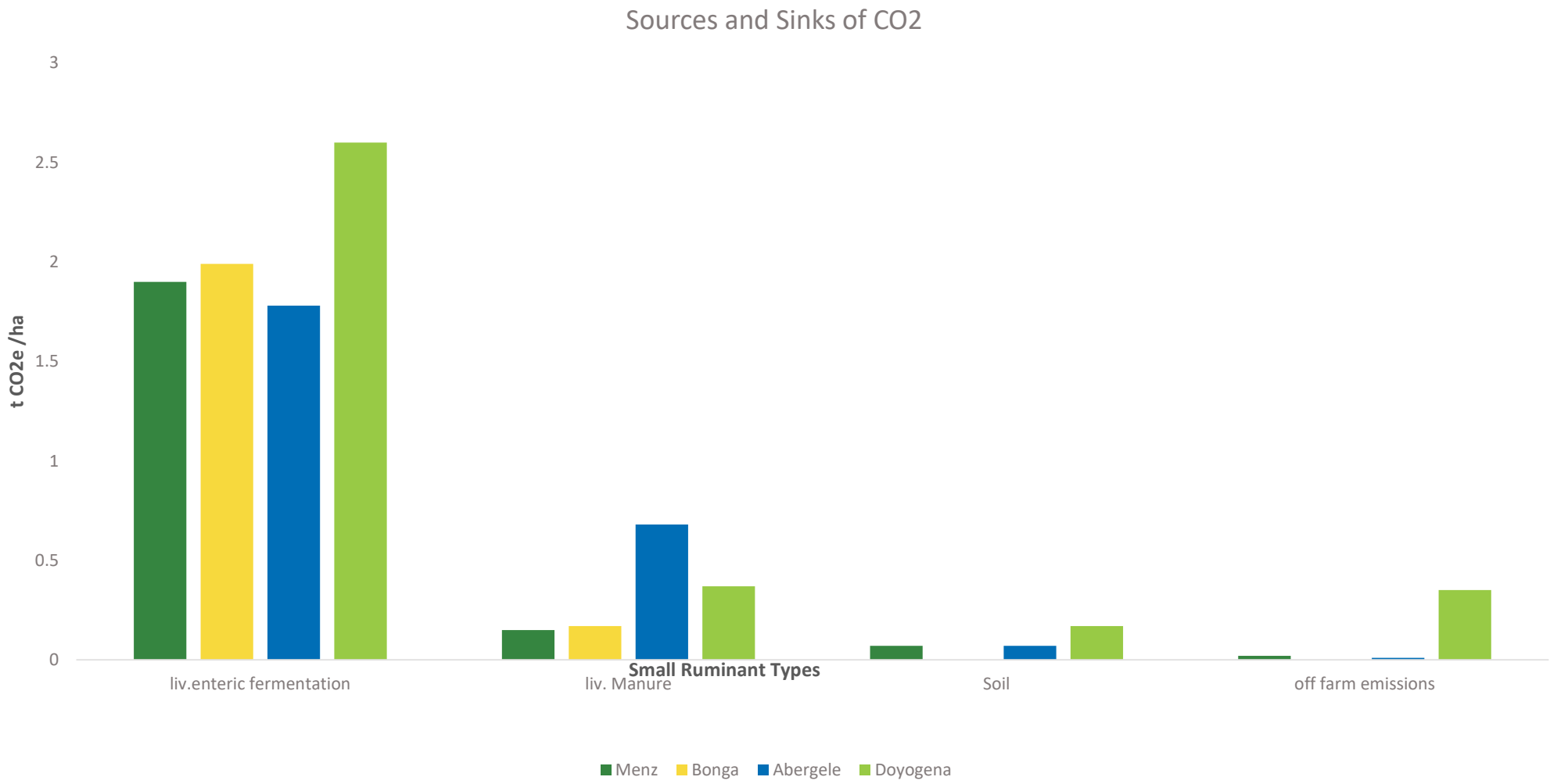
Minimum N addition to the soil coupled with grazing leads to high N nutrient mining in All sites



Water Impacts



GHG Emissions



Input and Parameters Verification

Menz		
Input/ Parameter	**Value**	**Reference**
Herd composition (nr)	31	ILRI, 2009, Expert (Tesfaye and Aemiro)
Ewe -Average annual growth per animal (kg)	0.39	Expert (Tesfaye and Aemiro)
Breeding Rams -Average annual growth per animal (kg)	5.4	Expert (Aemiro and Tesfaye)
Fattening Rams -Average annual growth per animal (kg)	7.2	Expert (Aemiro and Tesfaye)
Lambs - Average annual growth per animal (kg)	17.2	ILRI data (2009)
Sheep Ewes - Menz	22	EIAR, 2017,ILRI, 2009, Expert opinion (Aemiro, Tesfaye)
Sheep - Breeding Rams - Menz	24	EIAR, 2017,ILRI, 2009, Expert opinion (Aemiro, Tesfaye)
Sheep - Fattening Rams - Menz	25	EIAR, 2017,ILRI, 2009, Expert opinion (Aemiro, Tesfaye)
Sheep - Lambs - Menz	10	EIAR, 2017,ILRI, 2009, Expert opinion (Aemiro, Tesfaye)
Parturition interval (years)	0.6	EIAR, 2017
Feedbasket/ Diet	see pie charts	Expert opinion (Aemiro, Abiro, Tesfaye) , Tarekegn et al., 2016; Gizaw et al., 2012, Thorpe, W. R., & Duncan, A. J. (2012)
Animal Whereabouts	see pie chart	Expert Opinion (Aemiro, Tesfaye)
Barley	2.55	Seyoum et al., 2007, Holeta nutrition lab data
Natural pasture grazing/DM Yield tonne/ha	2.10	Seyoum et al., 2007, Holeta nutrition lab data
Natural pasture hay/DM Yield tonne/ha	1.98	Seyoum et al., 2007, Holeta nutrition lab data
Wheat /DM Yield tonne/ha	2.87	Seyoum et al., 2007, Holeta nutrition lab data
faba bean (vicia faba)/DM Yield tonne/ha	2.34	Seyoum et al., 2007, Holeta nutrition lab data
Lentils (Lens esculenta)/DM Yield tonne/ha	1.50	Seyoum et al., 2007, Holeta nutrition lab data
Aftermath /DM Yield tonne/ha	0.00	FAO (1987)
UREA N kg total per/ha	100	Farmers practice
DAP N total per/ ha	18	Farmers practice

Bonga		
Input/ Parameter	**Value**	**Reference**
Herd composition (nr)	11	ILRI, 2009
Average annual growth per animal (kg)	1.3	Expert (Tesfaye and Aemiro)
Breeding Rams -Average annual growth per animal (kg)	7.3	Expert (Aemiro and Tesfaye)
Fattening Rams -Average annual growth per animal (kg)	12.6	Expert (Aemiro and Tesfaye)
Lambs - Average annual growth per animal (kg)	26	ILRI data (2009)
Sheep Ewes - Menz	30	EIAR, 2017,ILRI, 2009, expert opinion (Aemiro, Tesfaye)
Sheep - Breeding Rams - Menz	31	EIAR, 2017,ILRI, 2009, expert opinion (Aemiro, Tesfaye)
Sheep - Fattening Rams - Menz	32	EIAR, 2017,ILRI, 2009, expert opinion (Aemiro, Tesfaye)
Sheep - Lambs - Menz	15	EIAR, 2017,ILRI, 2009, expert opinion (Aemiro, Tesfaye)
Parturition interval (years)	0.5	EIAR, 2017
Feedbasket/ Diet	see pie charts	Expert opinion (Aemiro, Abiro, Tesfaye) , Tarekegn et al., 2016; Gizaw et al., 2012, Thorpe, W. R., & Duncan, A. J. (2012)
Animal Whereabouts	see pie charts	Expert opinion (Aemiro, Tesfaye)
Natural pasture /DM Yield tonne/ha	2.1-3	Seyoum et al., 2007
Banana/DM Yield tonne/ha	5.7-12	Zinabu et al., 2019
Aftermath/DM Yield tonne/ha	0.5	FAO (1987)
Kocho/DM Yield tonne/ha	6-12	Pijls et al., 1995, Chiche (1995), CSA (2008-2011)

Dogoyena		
Input/ Parameter	**Value**	**Reference**
Herd composition (nr)	3.65	Taye et.al, 2016
Ewes -Average annual growth per animal (kg)	0.97	Dr. Tesfaye ICARDA Staff
Breeding Rams -Average annual growth per animal (kg)	12	Dr. Tesfaye ICARDA Staff
Fattening Rams - Average annual growth per animal (kg)	12	Dr. Tesfaye ICARDA Staff
Lambs - Average annual growth per animal (kg)	28.1	Dr. Tesfaye ICARDA Staff
Sheep Ewes - Doyogena	1.83	Taye et.al, 2016
Sheep - Breeding Rams - Doyogena	0.9	Taye et.al, 2016
Sheep - Fattening Rams - Doyogena	0.12	Taye et.al, 2016
Sheep - Lambs - Doyogena	0.8	Taye et.al, 2016
Parturition interval (years)	0.7	Taye et.al, 2016
Feedbasket/ Diet	see pie charts	
Animal Whereabouts	see pie charts	
Natural pasture/DM Yield tonne/ha	2.5	Taye et.al, 2016
Wheat /DM Yield tonne/ha	3.96	Taye et.al, 2016
Oats /DM Yield tonne/ha	2.88	Taye et.al, 2016
Enset/DM Yield tonne/ha	8.8	Taye et.al, 2016
NPK N kg per/ha	150	Farmer Practice

Abergela		
Input/ Parameter	**Value**	**Reference**
Herd composition (nr)	37	ICARDA technical reoprt by Bekahign Breeder at Abergele
Does -Average annual growth per animal (kg)	0.67	Dr. Tesfaye, ICARDA staff
Bucks -Average annual growth per animal (kg)	9	Dr. Tesfaye, ICARDA staff
Does -Average annual growth per animal (kg)	12	Dr. Tesfaye, ICARDA staff
Kids -Average annual growth per animal (kg)	10	Dr. Tesfaye, ICARDA staff
Goats Does	18	Bekahgn Wondim, Mulatu Gobeze, Baye Biresaw (2019)
Goats - Bucks	2	Bekahgn Wondim, Mulatu Gobeze, Baye Biresaw (2019)
Goats - Fattening Bucks	2	Bekahgn Wondim, Mulatu Gobeze, Baye Biresaw (2019)
Goats -Kids	15	Bekahgn Wondim, Mulatu Gobeze, Baye Biresaw (2019)
Parturition interval (years)	0.7	
Feedbasket/ Diet	see pie charts	
Animal Whereabouts	see pie charts	
Natural pasture grazing/DM Yield tonne/ha	2.5	Bekahgn Wondim, Mulatu Gobeze, Baye Biresaw (2019)
Cowpea/DM Yield tonne/ha	6	Bekahgn Wondim, Mulatu Gobeze, Baye Biresaw (2019)
Sorghum/DM Yield tonne/ha	4	Bekahgn Wondim, Mulatu Gobeze, Baye Biresaw (2019)
UREA N kg total per/ha		Bekahgn Wondim, Mulatu Gobeze, Baye Biresaw (2019)

CLEANED Scenarios

	Menz	Bonga	Sekota/Abergela	Doyogena
Package	Deworming SR for GI parasites and lungworms	Deworming SR for GI parasites and lungworms	Deworming SR for GI parasites and lungworms	Deworming SR for GI parasites and lungworms
	Deworming dogs for coenuruses	Deworming dogs for coenuruses	Vaccination for ovine pasteurellosis	Vaccination for ovine pasteurellosis
	Vaccination for ovine pasteurellosis	Vaccination for ovine pasteurellosis	Vaccination for PPR	Vaccination for PPR
	Vaccination for PPR	Vaccination for PPR	Vaccination for sheep pox	Vaccination for sheep pox
	Vaccination for sheep pox	Vaccination for sheep pox	Vaccination for Anthrax	Vaccination for Anthrax
	Vaccination for Anthrax	Vaccination for Anthrax	Vaccination for CCPP	Targeted feeding for pregnant ewes/does
	Targeted feeding for pregnant ewes/does	Targeted feeding for pregnant ewes/does	Targeted feeding for pregnant does	Smart nutritional strategies development and flushing of breeding ewes and rams
	Smart nutritional strategies development and flushing of breeding ewes and rams	Smart nutritional strategies development and flushing of breeding ewes and rams	Establish breeder cooperatives in new sites	Integration of identified cultivated forages into the feeding systems
	Integration of identified cultivated forages into the feeding systems	Integration of identified cultivated forages into the feeding systems	Breeding bucks selection and ranking	Breeding ram selection and ranking
	Establish breeder cooperatives in new sites	Breeding ram selection and ranking	Pregnancy testing, mass synchronization and artificial insemination	Pregnancy testing, mass synchronization and artificial insemination
	Breeding ram selection and ranking	Pregnancy testing, mass synchronization and artificial insemination		Breeding sire procurement and avail best rams for breeder cooperative, distribute to the new intervention site and other beneficiary
	Pregnancy testing, mass synchronization and artificial insemination	Breeding sire procurement and avail best rams for breeder cooperative, distribute to the new intervention site and other beneficiary		
	Breeding sire procurement and avail best rams for breeder cooperative, distribute to the new intervention site and other beneficiary			

Productivity increase
Meat/liveweight gain increase (%)
Input
1. Animals/herds
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?
2. Feed baskets
Does this intervention change the wet and/or dry season basket?
Which feed item will be utilized less? Which more? How much more/less?
Which feed it item will be introduced? At which proportion?
3. Manure management
Will there be any inorganic/organic fertilizer use? How much?
Will collection and use of manure change?
Parameters
What are the yields for the crops associated with the introduced feed items in the location?
What are the nutritional values for introduced feed items in the location?

Validation and New Values for Baseline and Scenario : Herd Health and Genetics intervention combination

Menz			
Input/ Parameter	**Value**	**New Value 2020/2021**	**Comments**
Sheep Ewes - Menz	**19**	18	
Sheep - Breeding Rams - Menz	**3**	0.5	
Sheep - Fattening Rams - Menz	**3**	5	
Sheep - Lambs - Menz	**6**	8	
Ewe -Average annual growth per animal (kg)	**0.39**	0.69	
Breeding Rams -Average annual growth per animal (kg)	**5.4**	6	
Fattening Rams -Average annual growth per animal (kg)	**7.2**	8	
Lambs -Average annual growth per animal (kg)	**12.7**	17.7	Yearling weight improved from 15 to 21 kg. assume 3.3 kg birth weight then gain per year is 21-3.3 = 17.7
Ewes -Average Body weight (kg)	**22**	25	average ewe post-partum weight of the base and recent years
Breeding Rams -Average Body weight (kg)	**24**	26	
Fattening Rams -Average Body weight (kg)	**25**	27	
Lambs -Average Body weight (kg)	**10**	12	
Parturition interval (years)	**0.66**	0.66	

Bonga		
Input/ Parameter	Value	New Value
Sheep Ewes - Bonga	**4**	4
Sheep - Breeding Rams - Bonga	**1**	0.26
Sheep - Fattening Rams - Bonga	**2**	4
Sheep - Lambs - Bonga	**4**	5.17
Ewe -Average annual growth per animal (kg)	**1.03**	1.07
Breeding Rams -Average annual growth per animal (kg)	**7.3**	8
Fattening Rams -Average annual growth per animal (kg)	**12.6**	13
Lambs - Average annual growth per animal (kg)	**26**	31
Ewes -Average Body weight (kg)	**30**	34.1
Breeding Rams -Average Body weight (kg)	**31**	34
Fattening Rams -Average Body weight (kg)	**32**	35
Lambs -Average Body weight (kg)	**15**	17
Parturition interval (years)	**0.5**	0.7

Doyogena		
Input/ Parameter	**Value**	**New Value**
Sheep Ewes - Doyogena	**1.83**	2
Sheep - Breeding Rams - Doyogena	**0.9**	0.16
Sheep - Fattening Rams - Doyogena	**0.12**	2.5
Sheep - Lambs - Doyogena	**0.8**	1.8
Ewes -Average annual growth per animal (kg)	**0.97**	0.7
Breeding Rams -Average annual growth per animal (kg)	**12/6**	7
Fattening Rams - Average annual growth per animal (kg)	**12**	14
Lambs - Average annual growth per animal (kg)	**28.1**	29.7
Ewes -Average Body weight (kg)	**1.83/28.75**	30.6
Breeding Rams -Average Body weight (kg)	**0.9/29**	32
Fattening Rams -Average Body weight (kg)	**0.12/30**	33
Lambs -Average Body weight (kg)	**0.8/14**	15
Parturition interval (years)	**0.77**	0.77

Abergele		
Input/ Parameter	**Value**	**New Value**
Goats Does	**18**	20
Goats - Bucks	**2**	2.1
Goats - Fattening Bucks	**2**	4
Goats -Kids	**15**	16
Does -Average annual growth per animal (kg)	**0.67**	0.45
Bucks -Average annual growth per animal (kg)	**9**	9.5
Kids -Average annual growth per animal (kg)	**10**	13
Does -Average Body weight (kg)	**18/25**	26
Bucks -Average Body weight (kg)	**2/11**	13.7
Fattening Bucks -Average Body weight (kg)	**2/13**	17
Kids -Average Body weight (kg)	**15/11.7**	13.95
Parturition interval (years)	**0.7/1**	1

Alliance

Bioversity International

CIAT
International Center for Tropical Agriculture
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Thank you!

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