CLEANED Training Nairobi 21st – 23rd November 2018

CLEANED Tool

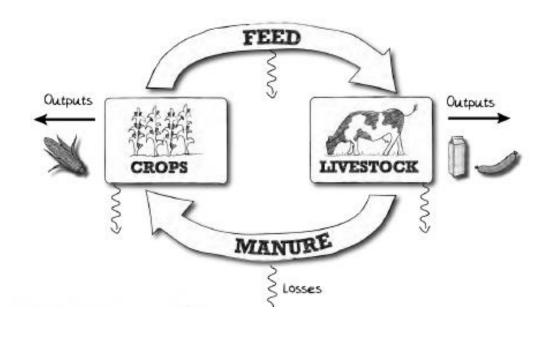
a minimum data tool for rapid ex-ante impact assessment of productivity, nitrogen balance, soil erosion, GHG emissions



Objectives

(i) Understanding CLEANED model

(ii)Model a livestock enterprise system(iii)Model a livestock enterprise system under different scenarios





Program

Day 1

- Environmental assessments
- Understanding CLEANED
- Hands on with the tool

Day 2

- Data
- Conversions
- Parameters
- Your own farming systems

Day 3

- Scenarios
- Final Presentations





Introduction

- What's your name?
- Where have you travelled from?
- What's your job?
- Describe briefly what you expect from this training



2

CLEANED Tool

a minimum data tool for rapid ex-ante impact assessment of productivity, nitrogen balance, soil erosion, GHG emissions



Environmental assessments

- Why this tool
- What is CLEANED
- Who is it CLEANED for?
- What questions can you ask CLEANED?



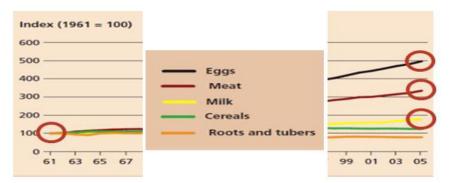
Why this tool

- Why do we need to look at the environmental impact of livestock systems?
- What problems can we encounter when trying to evaluate environmental impact of livestock systems?
- Who does this matter to?

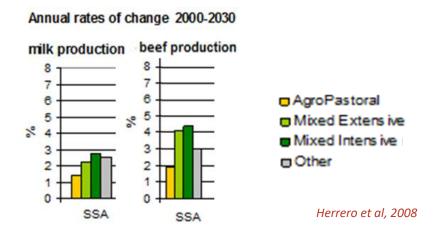


Rising demand ~ ready market

Africa's Livestock revolution



Since 1962, consumption of milk 2x, meat 3x and eggs 5x (developing countries)



By 2050 the demand for meat, milk, eggs will have doubled

Meat and milk in developing countries is predominantly produced in mixed crop-livestock systems, although productivity is still low



Opportunities & Challenges

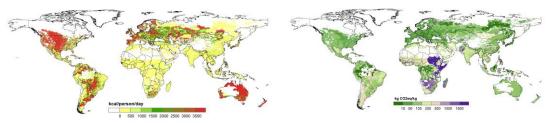
Livestock is important

For PEOPLE

- Employment, income
- Economy
- Food and nutrition
- Cultural value
- Resilience and risk management

And the PLANET

- Biggest land user
- Natural resources:
 - Manure, SOC, biodiversity, energy, ...
 - GHGe, water use and pollution, fishmeal



17 billion domestic animals 1.3 billion people employed in livestock VCs 600 million poor livestock keepers (2/3 women) 70% demand increase 2005-2030

Sector value >1.4 trillion USD; growth rate 2.5% Constitutes about 40% of agricultural GDP

Food for at least 830 million food insecure people 17% of kilocalorie and 33% of protein consumption Vitamin A, B-12, riboflavin, calcium, iron and zinc

26% = rangeland, 33% of cropland for fodder 32% of global water consumption

60% of cropping area receives manure application 14.5% of human-induced GHG emissions

FAO 2016; Gerber et al. 2007; Herrero et al. 2008; Herrero et al. 2013; LID 1999; Thornton et al. 2002; Thornton and Herrero 2008; Rosegrant et al 2009; Worldbank 2009

What is CLEANED?

Comprehensive Livestock Environmental Assessment for Improved Nutrition, a Secured Environment and Sustainable Development 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."

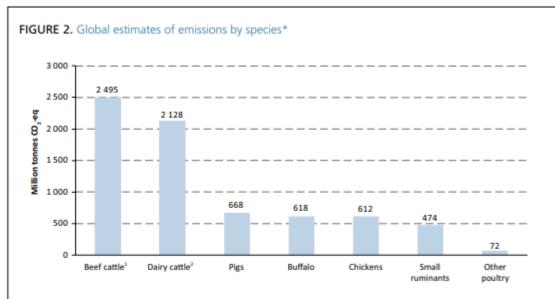


What is CLEANED

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:

Land requirements Productivity ling. **Economics** •0• Soil Impacts •• Water impacts **GHG** emissions 03

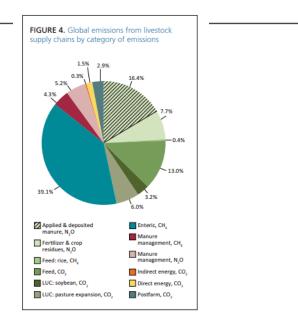


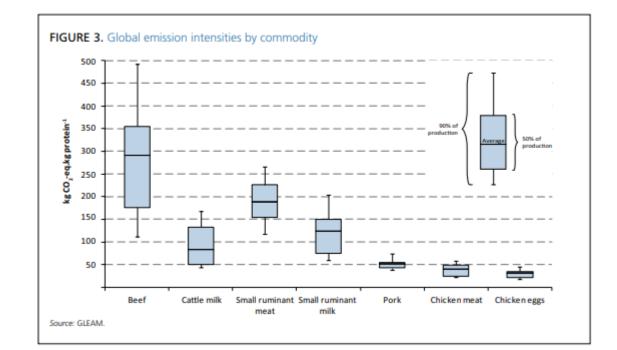


*Includes emissions attributed to edible products and to other goods and services, such as draught power and wool. ¹ Producing meat and non-edible outputs.

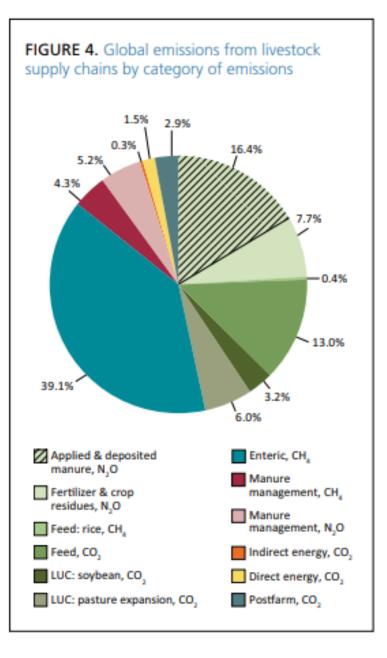
² Producing milk and meat as well as non-edible outputs.

Source: GLEAM.



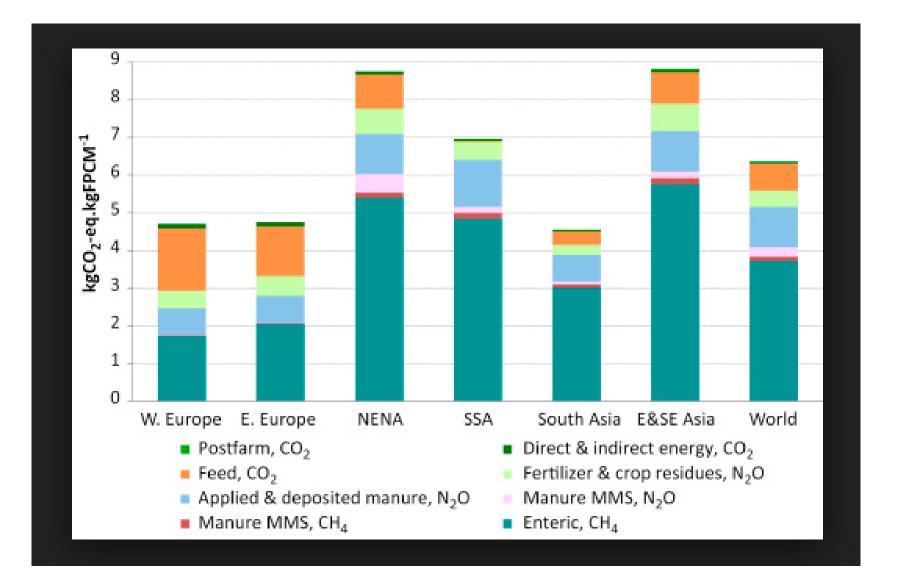














Who will be using CLEANED?

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



What is CLEANED?





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



3

CLEANED Tool

a minimum data tool for rapid ex-ante impact assessment of productivity, nitrogen balance, soil erosion, GHG emissions

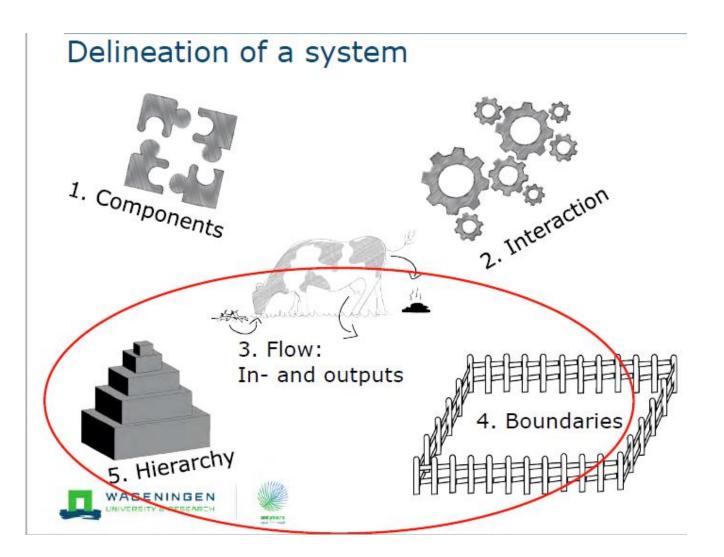


Understanding Systems

• What is a system



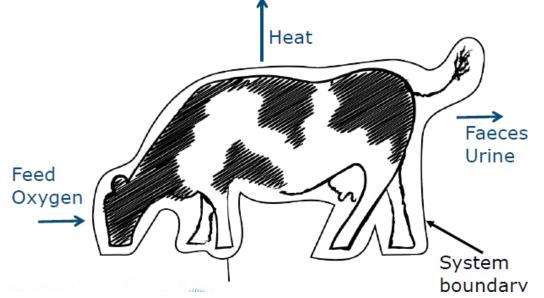
What is a system



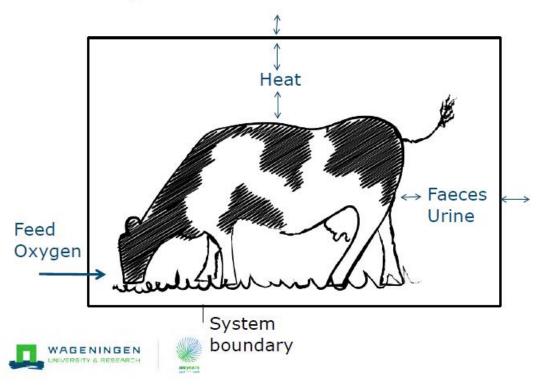




Chose in such a way that the environment influences the system, but the systems has (almost) no influence on the environment



Boundary affects results





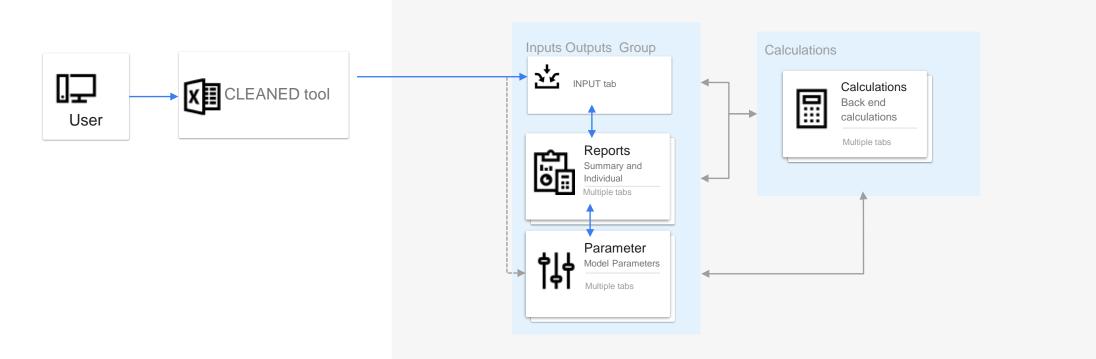
Understanding CLEANED

- The CLEANED process
- The architecture



The Architecture

Architecture: CLEANED tools



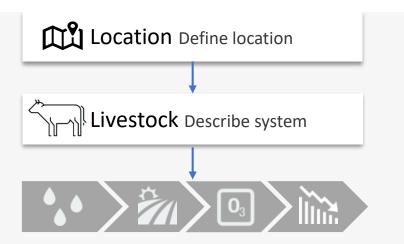


The process

The CLEANED tool process comprises of 2 stages, the first stage is to collect and input the baseline data and the next step is to generate reports for different scenarios of how the livestock production systems might change

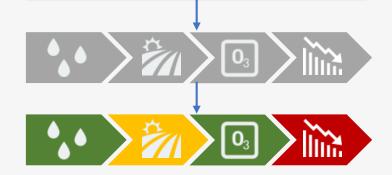


Livestock Describe system





Livestock Describe system



Describe Practices and Value Chain e.g. grazing / rural to rural market

Calculate environmental baselines along value Chain

The Calculations

N Balance

• NUTOM

Soil Erosion

• RUSSLE

Water

• Evapotranspiration (ET)

Economics

- ROI/ IRR
- Payback period

Productivity

 Productivity = ∑crop Energy * crop prod. + ∑Liv. Energyj * liv. prod

GHG

 2006 IPPC Guidelines for National Greenhouse Gas Inventories.





Livestock Describe system



Describe Practices and Value Chain e.g. grazing / rural to rural market

Calculate environmental baselines along Value Chain



Describe interventions

Est Describe likely changes in inputs and parameters and

Calculate environmental impacts along the Value Chain

- •• Water
- 🚧 Land

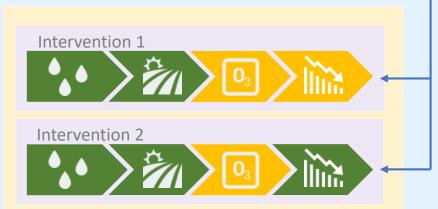
- **Greenhouse gases**
- Economic

Livestock Describe system



Describe Practices and Value Chain e.g. grazing / rural to rural market

Calculate environmental baselines along Value Chain



Describe interventions

X Describe likely changes in inputs and parameters and

Calculate environmental impacts along the Value Chain

- •• Water
- 🚧 Land

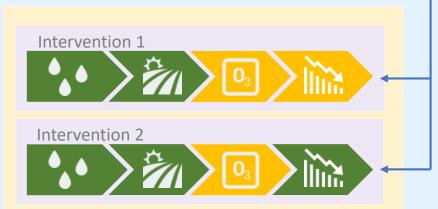
- **Greenhouse gases**
- Economic

Livestock Describe system



Describe Practices and Value Chain e.g. grazing / rural to rural market

Calculate environmental baselines along Value Chain



Describe interventions

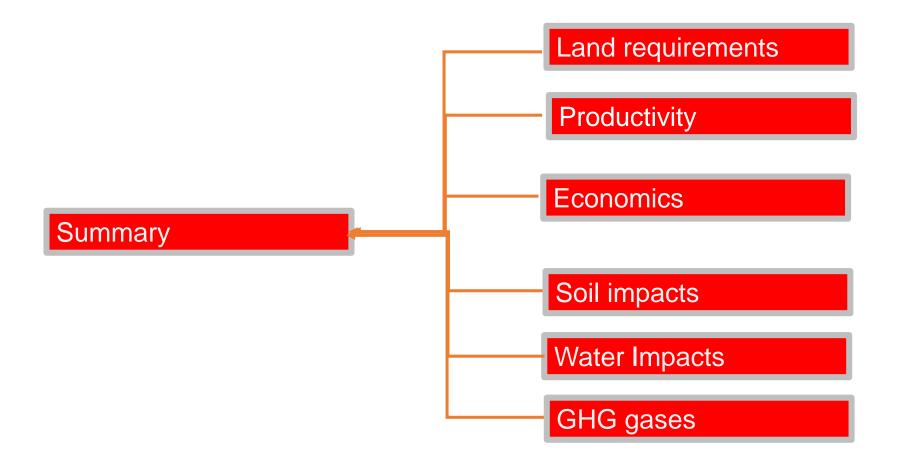
X Describe likely changes in inputs and parameters and

Calculate environmental impacts along the Value Chain

- •• Water
- 🚧 Land

- **Greenhouse gases**
- Economic

Results overview







Per livestock enterprise	
Land requirement	
Total land required (ha/year)	41.952
Productivity	
Total milk produced (kg FPCM/year)	41,072
Total milk consumed (kg FPCM/year)	35,978
Meat produced (kg/year)	-
Meat consumed (kg/year)	-
protein (kg/year)	1,355
Nbalance	
kg N/year	-794
% area mining	100
% area leaching	0
Soil Erosion	
t soil/year	-97.69
GHG emissions	
t CO2 eq. / year	134.45
Water impacts	
m3/year	37,306
Carbon stock changes	
t CO2 eq. / year	-25.46
Productivity / Energy	
kcal/year from milk	39,839,355
kcal/year from meat	-
kcal/year total	39,839,355
AME days/year from milk	15,936
AME days/year from meat	-
AME days/year total	15,936

Perhectare	
Productivity	
Total milk produced (kg FPCM/ha/yr)	979
Total milk consumed (kg FPCM/ha/year)	858
Meat produced (kg/ha/year)	-
Meat consumed (kg/ha/year)	-
protein (kg/hg/year)	32
Nbalance	
kg N/ha/yr	-18.93
Soil Erosion	
t soil/ha/yr	-2.33
t son/na/yi	-2.55
GHG emission intensity	
t CO2 eq. / ha/yr	3.20
Water impacts	
m3/ha/year	889.25
Carbon stock changes	
t CO2 eq. / ha/ year	-0.61
Productivity / Energy	
kcal/ha/yr from milk	949,642
kcal/ha/yr from meat	-
kcal/ha/yr total	949,642
	-
AME days/ha from milk	380
AME days/ha from meat	-
AME days/ha total	380
number of AME/ha that could be fed on	200
calories produced	1
	-

Per product	PRODUCED	CONSUMED	
Land requirement			
Total land required (ha/kg FPCM)	0.0010	0.0012	
Nbalance			
kg N/ kg FPCM	-0.0193	-0.0221	
Soil Erosion			
t soil/kg FPCM	-0.00238	-0.0027	
kg soil/ kg FPCM	-2.38	-2.72	
GHG emissions			
t CO2 eq. /kg FPCM	0.00327	0.0037	
kg CO2 eq. /kg FPCM	3.27	3.74	
kg CO2 eq. /kg meat	0.00	0.0	
kg CO2 eq. /kg protein	99.20		
Water impact			
m3/kg FPCM	0.91	1.04	
m3/kg meat	0.00	0.00	
m3/kg protein	27.52	31.42	
Carbon stock changes			
kg CO2 eq. /kg FPCM	-0.62	-0.71	
Total			
kg CO2 eq. /kg FPCM	3.89	4.44	
Economics	total	per ha	
production value (USD/yr)	0	c	
cost (USD/yr)	592	14	
balance (USD/yr)	-592	-14	









What do the outputs mean?

Land requirement Total land required (ha/year)	41.952	GHG emissions t CO2 eq. / year	134.45		
Productivity Total milk produced (kg FPCM/year) Total milk consumed (kg FPCM/year) Meat produced (kg/year) Meat consumed (kg/year) protein (kg/year)	41,072 35,978 - - 1,355	Carbon stock changes t CO2 eq. / year	-25.46	<i>Water impacts</i> m3/year	37,306
<i>N balance</i> kg N/year % area mining % area leaching	-794 100 0				
<i>Soil Erosion</i> t soil/year	-97.69	Productivity / Energy kcal/year from milk kcal/year from meat kcal/year total	39,839,355 - 39,839,355	AME days/year from milk AME days/year from meat AME days/year total	15,936 - 15,936





4

CLEANED Tool

a minimum data tool for rapid ex-ante impact assessment of productivity, nitrogen balance, soil erosion, GHG emissions



Hands on with the tool



Inputs data input

conversation



	Descriptors		
F			
	Planting date wet season 1	Date (MM/DD/YYY)	15-05-16
Seasons	Harvest date wet season 1	Date (MM/DD/YYY)	15-10-16
Seasons	Planting date wet season 2	Date (MM/DD/YYY)	01-12-16
	Harvest date wet season 2	Date (MM/DD/YYY)	15-02-17

Descriptors

expert opinion or observation



	Planting date wet season 1	Date (MM/DD/YYY)	15-05-16
Sapropr	Harvest date wet season 1	Date (MM/DD/YYY)	15-10-16
Seasons	Planting date wet season 2	Date (MM/DD/YYY)	01-12-16
	Harvest date wet season 2	Date (MM/DD/YYY)	15-02-17



Input

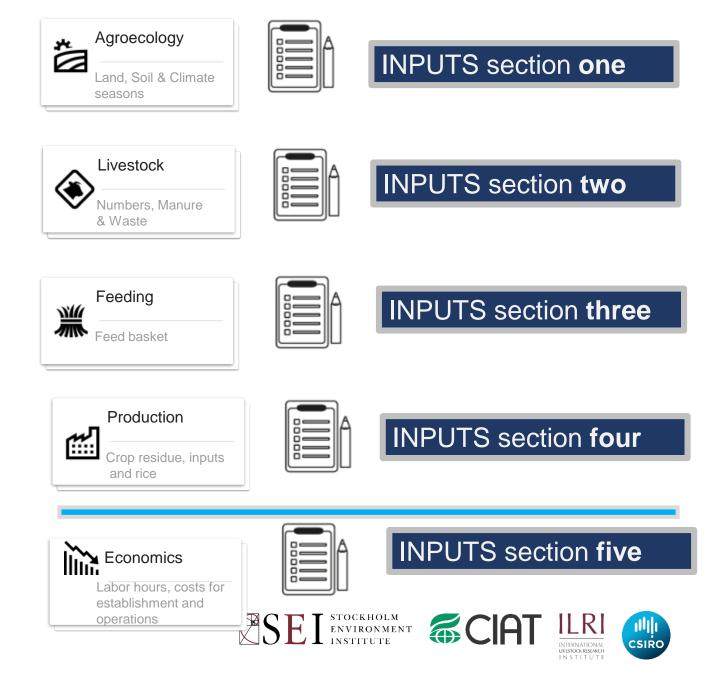
Inputs **overview**

conversation



expert opinion or observation





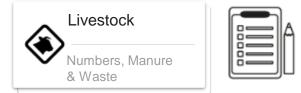
Inputs section one

*	Agroecology	ſ	
	Land, Soil & Climate seasons	Į	

- Planting date long rain: the day of the year when planting starts in the first wet season
- Harvest date long rain: the day of the year when harvesting starts in the first wet season
- Planting date short rain: the day of the year when planting starts in the first wet season
- Harvest date short rain: the day of the year when harvesting starts in the first wet season

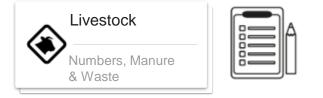
	Planting date wet season 1	Date (MM/DD/YYY)	15-05-16
Seasons	Harvest date wet season 1	Date (MM/DD/YYY)	15-10-16
Seasons	Planting date wet season 2	Date (MM/DD/YYY)	01-12-16
	Harvest date wet season 2	Date (MM/DD/YYY)	15-02-17





	¢	Herd compostion (nr)	Annual milk production per animal (I)	Livestock leaving the farm (nolyear)	Time spent in stable (fraction of day)	Time spent in yard (fraction of day)	Time spent grazing pasture/fields on- farm (fraction of day)	Time spent grazing off-farm (fraction of day)	Collection of manure in stable (fraction)	Collection of manure in yard (fraction)	collection of manure in fields/pasture (fraction)	On-farm manure used as fertilizer (fraction of total on- farm manure
Livestock numbers, whereabouts,	Dairy cows - local	4	860.00		0.50	0.25	0.25	0.00	0.80	0.50	0.00	1.00
manureuse	Dairy cows - improved	1	1500.00		0.50	0.25	0.25	0.00	0.80	0.50	0.00	1.00
	Adult cattle - male	1	0.00		0.50	0.25	0.25	0.00	0.80	0.50	0.00	1.00
	Steers/heifers	1	0.00	0	0.50	0.25	0.25	0.00	0.80	0.50	0.00	1.00
	Calves	0	0.00		0.50	0.25	0.25	0.00	0.80	0.50	0.00	1.00
	Sheep	0			0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00
	Goats	0			0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00
	Pigs	0			0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00
	Poultry	0	1		0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00
	Donkeys/horses	0	0	V/////////	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00





- Herd composition: the number of animals in this category
- Annual milk production: the total annual milk production (taking into account variances due to lactation period, etc). This information is only provided for the relevant livestock types (e.g. not for the poultry or the male cattle)
- Livestock leaving the farm: the number of livestock of this type that leave the farm, through e.g. sale or gift

INSTITI

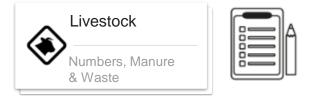
		Herd compostion (nr)	Annual milk production per animal (I)	Livestock leaving the farm (no/year)	Time spent in stable (fraction of day)	Time spent in yard (fraction of day)	Time spent grazing pasture/fields on- farm (fraction of day)	Time spent grazing off-farm (fraction of day)	Collection of manure in stable (fraction)	Collection of manure in yard (fraction)	collection of manure in fields/pasture (fraction)	On-farm manure used as fertilizer (fraction of total on- farm manure						
ivestock numbers, where abouts,	Dairy cows - local	4	860.00		0.50	0.25	0.25	0.00	0.80	0.50	0.00	1.00						
manure use	Dairy cows - improved	1	1500.00		0.50	0.25	0.25	0.00	0.80	0.50	0.00	1.00						
	Adult cattle - male	1	0.00		0.50	0.25	0.25	0.00	0.80	0.50	0.00	1.00						
	Steers/heifers	1	0.00	0	0.50	0.25	0.25	0.00	0.80	0.50	0.00	1.00						
	Calves	0	0.00		0.50	0.25	0.25	0.00	0.80	0.50	0.00	1.00						
	Sheep	0							0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	
	Goats	0										0.00	0.00	0.00	1.00	0.00	0.00	0.00
-	Pigs	0			0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00						
	Poultry				0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00						
	Donkeys/horses	0			0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	CSI					



- Time spent in the stable: the fraction of the day that an animal of this type normally spends inside a stable; a stable is any structure where there is some form of closed space, and where the manure that is produced by the livestock remains away from the outside natural elements until it is collected and displaced.
- Time spent in yard: a yard is therein defined as an enclosure or tethering area where the manure produced in that area is subject to the elements
- Time spent grazing pasture/field on-farm
- Time spent grazing off-farm: the value in this column calculated on the values you have input in the previous three columns. It is assumed that all time not spent in the stable, the yard or grazing on-farm, is spent grazing off-farm

INSTITUT

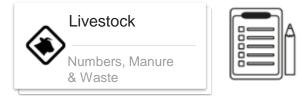
		Herd composition (nr)	Annual milk production per animal (I)	Livestock leaving the farm (nolyear)	Time spent in stable (fraction of day)	Time spent in yard (fraction of day)	farm (fraction of day)	Time spent grazing off-farm (fraction of day)	Collection of manure in stable (fraction)	Collection of manure in yard (fraction)	collection of manure in fields/pasture (fraction)	On-farm manure used as fertilizer (fraction of total on- farm manure	
Livestock numbers, whereabouts,	Dairy cows - local	4	860.00		0.50	0.25	0.25	0.00	0.80	0.50	0.00	1.00	1
manure use	Dairy cows - improved	1	1500.00		0.50	0.25	0.25	0.00	0.80	0.50	0.00	1.00	1
	Adult cattle - male	1	0.00		0.50	0.25	0.25	0.00	0.80	0.50	0.00	1.00	1
1	Steers/heifers	1	0.00	0	0.50	0.25	0.25	0.00	0.80	0.50	0.00	1.00	1
	Calves	0	0.00		0.50	0.25	0.25	0.00	0.80	0.50	0.00	1.00	1
	Sheep	0			0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	1
	Goats	0/			0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	
	Pigs	0			0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	
F	Poultry	0			0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	
	Donkeys/horses	0			0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	CSIF



- Collection of manure in stable: which fraction of the manure that is produced in the stable is collected vs. left on the floor
- Collection of manure in yard: which fraction of the manure produced in the yard is collected vs. left on the soil
- Collection of manure in fields/pasture: which fraction of the manure produced in the field or on the pasture is collected vs. left on the soil
- On-farm manure used as fertilizer: in many farms, the manure is not only collected and stored but also used for fertilizing crops. Here you are asked to indicate which fraction of the collected manure is used as fertilizer.

		Herd compositon (nr)	Annual milk production per animal (I)	Livestock leaving the farm (nolyear)	Time spent in stable (fraction of day)	Time spent in yard (fraction of day)	Time spent grazing pasture/fields on- farm (fraction of day)	Time spent grazing off-farm (fraction of day)	Collection of manure in stable (fraction)	Collection of manure in yard (fraction)	collection of manure in fields/pasture (fraction)	On-farm manure used as fertilizer (fraction of total on- farm manure	
Livestock numbers, whereabouts,	Dairy cows - local	4	860.00		0.50	0.25	0.25	0.00	0.80	0.50	0.00	1.00	
manure use	Dairy cows - improved	1	1500.00		0.50	0.25	0.25	0.00	0.80	0.50	0.00	1.00	
	Adult cattle - male	1	0.00		0.50	0.25	0.25	0.00	0.80	0.50	0.00	1.00	
[Steers/heifers	1	0.00	0	0.50	0.25	0.25	0.00	0.80	0.50	0.00	1.00	
ſ	Calves	0	0.00		0.50	0.25	0.25	0.00	0.80	0.50	0.00	1.00	
	Sheep	0			0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	
	Goats	0			0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	
	Pigs	0			0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	
	Poultry	0			0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	
E E E E E E E E E E E E E E E E E E E	Donkeys/horses	0			0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	CSI

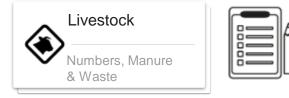
INSTITUTE



- solid storage: The storage of manure, typically for a period of several months, in unconfined piles or stacks. Manure is able to be stacked due to the presence of a sufficient amount of bedding material or loss of moisture by evaporation.
- dry lot: A paved or unpaved open confinement area without any significant vegetative cover where accumulating manure may be removed periodically.
- pasture/range/paddock: The manure from pasture and range grazing animals is allowed to lie as deposited, and is not managed.

0	Manure origins	Select
Manure management system	Stable	Solid storage
	Yard	Dry lot
	Pasture/fields	Pasture/range/padd ock

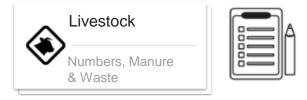




- annual purchase of animal manure: if manure is bought, indicate here how much. This is expressed in kg N/year. E.g.
- annual purchase of compost: if compost is bought, indicate here how much
- annual purchase of other organic N additions: if any other organic sources of N are bought, indicate here how much
- annual purchase of bedding materials
- annual "sales" of home-produced manure:

		kg N/year
	Annual purchase of animal manure	0.00
Additional manure inputs and	Annual purchase of compost	0.00
outputs	Annual purchase of other organic N additions	0.00
	Annual purchase of bedding materials	0.00
	Annual 'sales' of home produced manure	0.00





- waste milk and meat production
- waste milk and meat distribution
- waste milk and meat processing
- waste milk and meat consumption
- Total: the total loss is calculated based on your input in the four waste cells above.

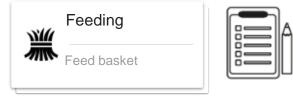
		milk	meat
	waste – prod	3	3
Waste of milk and meat at various levels in	waste – distribution	3	3
value chain (%)	waste – processing	5	5
value chair (7.)	waste - consume	2	2
	Total	12.40	12.40



Inputs section three -

黨	Feeding					=	A		Dairy cow	ws - local	Fee	ed item (select,	Maize (Zea r crop resi	nays) - uni	wpea (Vigna guiculata) - reen fodder	Maize (Zea mays) - silage	Naturally occuring pasture - grazing	Napier grass (Pennisetum purpure - green fodder	um) Rice (Oryza - strav		Sunflower (Helianthus annuus) - seed cake		Maize (Zea mays) - crop residue	Cowpea (Vigna unguiculata) - green fodder	Maize (Zea mays) - silage	Naturally occuring pasture - grazing	Napier grass (Pennisetum purpureum) - green fodder		Sunflower (Helianthus annuus) - seed cake
7////	Feed baske	et			Ľ=		U					portion in feed basket (%)	10.009	6	10.00%	25.00%	35.00%	15.00%	0.009	%	5.00%		30.00%	10.00%	25.00%	15.00%	15.00%	0.00%	5.00%
L					_														1										
	Dairg anus-Isual	Ford item (or feal)	Haine (Beamagn) - neup ernidur	Compen (Vigen enquinalala) - geren fadder	Maine (Zea mage) nilage	Haberally manering pattern- graving	Hagire graas Praaiselus gaegaeras - geres falder	Rine (Orque nation) - aleren	Saaflaare [Helizalka aanaa] - ared aake		Haire (Bramaya) - aray craidar			Rapire Vran Presidente program gree fuller															
		Proportion in feed kanket [X]	11.11X	91.11X	8.0X	5.8X	15.10X	LIIX	5.00X		31.112	10.10X	25.002 45.002	15.11X 1.11	8X 5.88X														
	Dairy arous - improved	Fred item (select)	Haine (Dea mage)- aray ceailter	Compre (Vigea angeinstata) - gerre fadder	Haiar (Sea maga) ailage	Halasalla anasia padarr gradar	Hagire grann Penniarlan gaegaeran - geren fulder	Riar (Organ antian) - alros	Saaflaure [Helisalise second] - ared aske		Haine (Reamond) - aray centitae	Compra (Vigos angainstata) - gerra fadder	Haise Rea maga) - silage generating generating	Basice Vision Presidentes geren faller	began 196-Earthoure 196-Earthoure 196-Earthoure 196-Earthoure 196-Earthoure														
		Proportion in first konket [X]	H.HX	41.00X	8.0X	35.81X	S.IIX	LIIX	5.00X		31.81X	91.01X	25.11X 15.11X	5.0X L0	8X 5.88X														
	Adull adlle - uale	Perdilen (seles)	Haine (Zea maga) - aray eraidae	Caupes (Viges angeinelsis) geren falder	Maiar (Zea maga) ailage	Halasalla anasing padarr graning	Hayire years (Praximetan preparent) - yeren falder	Rine Orqua nation - ale au	Saaflaare Refeathareanaa - aredaate		Haine (Zeamagn) - neng ernidae	Compra (Vigna magnimitata) - gerra faidee	Hater (2ra acqu) - olloge 25.00X 15.00X	Hapire gram (Presidentes proportion grow failler	brans al : au au auritation arritation					active in fast	-	-	100 100			-		san ian	
		Proportion in feed konket [X]	41.11X	9LDX	8.0X	5.0X	S.IIX	LUX	5.00X		91.11X	91.11X	25.00X 45.00X	6.0X 1.0	IX 5.IIX			·			Name One agent	Martin State	An Day and Labor Distant			menter 1	Security Parmanent	ta (Ital	
	Sheroudheidera	Ford item (artical)	Haine (Rea maga) aray craiter	Campes (Viges mysicalists) - yerra fadder	Maiar (Brawaya) ailayr	Natorally Consoliny pattern pratiny	Hagire grann Praniarlan gargarran geren falder	Rise (Vequa nativa) - utrau	Sanflawre [Refinition annau] - ared aste		Haise (Reamage) - area conidae	Compre (Vigos angeinetata) - gerre Faddre	Haine (Rea magn) - nilage geneing	Hapire yean (Presiselan pergeren) geren failer	Negas 1911 - Sanflaure 1914 Sanflau 2011 - Sanflaure 2011				1.0	and a local sector		Anno fee Anno Anno Anno Anno Anno Anno Anno An			ration rapidities p	man inter		nan ani	
	2	Proportion in feed konkel [X]	11.11X	1LDX	8.0X	35.11X	8.0X	LUX	5.00X		11.11X	11.11X	25.11X 15.11X	15.11X I.11	EX S.EEX		Goats	Pood Item (coloct) Make (2	a mayo) - sidue areen fold	gna Male i) - mays)	ce (Zea silego	pler grass tam purpungum) Rice (Oryce self/re) Sunflawer (Hi tam purpungum) - straw annuus) - se	anthus I colie	Melas (Zes mays) - crop residue	(Vigna -groon Malze (Zea moys) - silago	Naturally occuring pesture- grating folder	nos um Rice (Oryza m) sativa) -	Rower enthus uus) - f cole	-
	Calue	Perdilen (seles)	Haine (Beamaga) - aray ceailtee	Caupes (Viqes anquintists) - geren fakter	Maine (Zea mage) nilage	Haberally anneriny padore geniny	Hagire geans Penniaelun geegaeens - geeen faildee	Rise Organ aslina - alean	Sauflaure Helicallacanaal- aredade		Haiar (Bramaga) - aray craitar	Compre Vigne angainstata - geren Gaddee	Haine Rea maga) - silage 25.00X - 45.00X	Hapire gram (Presinches proportes arres failer	Segna al - en ar area al - area area al -			Propertion in feed basket (%)	green follo		- single - greding - g	een noorer		fodd					
Feedbacket	1 <u>.</u>	Proportion in feed kooket [X]	41.11X	11.11X	8.0X	5.0X	15.10 X	LIIX	5.002		91.11X	91.10X	25.00X 15.00X	6.0X 1.0	8X 5.88X				-	Class Carlotti	Man (for ease) - Couper (figure region (figure) - grant (figure) grant (figure)	Non-the Among anter Permanen anger gant gant gant gant gant gant ber	An One and before Delete	-	Danmart Course (199	man Anna Anna	111	Ani Chan Malanti Malan	
6070409990000	5k-r.a	Food ites (solve)	Haine (Reamage) aray craiter	Compra (Vigea orgainstata)- geren fakter	Haiar (Sea maga) ailage	Baharalla antoria padarer geologi	Hayire years Penaiselan yaeyseensa - yeers faddee	Rise (Vequa sating) straw	Sauffaure Helicallus comme]- ared ade		Haler (Bransse) - aray resider	Compre Vigos angeinelala -gerre faller	Haiar (Pro mage) - allage gradier gradier	Hayire Science (Presidentian gerren failder	Negas 198-15-allen an an ardaske					antine to basil									
	2	Proparlias is first kaskel [X]	1.01X	LIIX	LUX	1.IIX	LUX	LIIX	1.11X									~		Citer (whee)	Man (Income) mar with a second	Non-Tay age: obge gang gang gan labe	Ale (Inc. and Serline Subaria data antici antich	-	(harman) a settlar ballar	man inge	111	taling: Title Titl	
	Gasta	Terdiles (seles)	Haine (Des mage) - arap er sidar	Caupes (Viges angainstats)- geres fadder	Maiar (Zea maga) ailage	Halasalla anaring padaro- pratag	Hayire years (Pensiaelan yaeyaeran) - yeren faldee	Riar (Organ anlian) - alreau	Sauffaure 18eEcollice connel- ared acto		Haine (Bramage) - arag craitice	Campra (Vigas angelandata) - gerra fadder	Haiar (Zea mage) - sillage yearing yearing	Hapire gram (Presidentes (Presidentes) (Presidentes) addar	Segna Inflicture INflicture and - and - and - and -			_	1	and the local of the second								_	
		Propuelius is feed kaskel [X]												faller				-		er han (anhart)		Reservices Rescales Previous events granting gra	Man Disas saltad Spelleum Delautho disas antoni and add	-	(ha hat) sector inter a	an House Star	111	and another	
	Pipe	Predilen (selen)	Haine (Dea mage)- neuperaidhe	Campes (Viges angeinstats) geren fakter	Haise (Zea mage) ailage	Naturaliy antariy padarr yraniy	Hayire years (Proximian years) - yeren fadder	Rise Veque autics +alesa	Saaflaare [Helizallan assau] ared aske		Haire (Promope) - aray craiter	Compra (Vigos angoinstata) - gerra Fadder	Haine (Rea mapp) willoge graving	Hapire Veran Praniselan proposed geren failer	Degaa Idi aa aaraalaa aaraalaa				1	antine in faced									
		Proportion in feed kaskel [X]	1				8					8		1															
	Paulling	Food ites (soles)	Haine (Bea magn) - aray centitae	Caupes (Vique angeinstata) - gerra failte	Maine (Zea mage) nilage	Halarally americy pattern gravity	Hapire grann Pranise Inn preparan geren Salder	Riar Organ antian + ale car	Sauflaure Helizatha annal - aredaale		Maiar (Promoga) aray craiter	Compra (Viges engelisetata) - gerro Sadder	Haine (Zea Mage) village genering genering	Hapiro gram (Prasiarlas arras gree falles	Brees Helisa Helisathan annaal arrelate														
		Proportion in feed kostel [X]										-								\cap		FOCKHOLM			.				
	Daakey/Harer	Perdilen (seles)	Haine (Ze a mage) - aray ersidae	Compre (Vigee angeinstele) geren fulder	Maiar (Zea maga) ailage	Naturally converse pattern granity	Hayire yeans [Possiarlan yeeyseena] • yeers faddee	Rine Dogna nation - utrau	Sanflaure [Helfadhan anna] arad ashe		Haine (Beamage) - aray ceniilae	Compra (Vigos angoinalala) - gerra failter	Haise Rea acqu) - silage gening	Hapire Van Praniarlan Propertan Saller Faller	Negaa Isaflaure IBritailian arriaile arriaile					S	EI	FOCKHOLM NVIRONMENT NSTITUTE		CIH				IIIII SIRO	
		Proportion in Feed kankel [X]					3. S				S	3 - O		1												STOCK RESEARCE	H		

Inputs section three



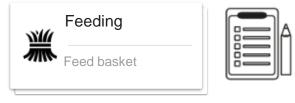
You start by selecting up to 7 different feed items. You simply pick the relevant ones from the drop-down lists that are found in the local dairy cow row (row 62). In the cell under the selected feed item, you indicate the % of the total feed basket that is made up by this feed item. This % is in terms of dry matter.

Make sure the %s add up to 100%

Dairy cows - local Feed i	d item (select)	Maize (Zea mays) - crop residue	Cowpea (Vigna unguiculata) - green fodder	Maize (Zea mays) - silage	Naturally occuring pasture - grazing	Napier grass (Pennisetum purpureum - green fodder	Rice (Oryza sativa) - straw	Sunflower (Helianthus annuus) - seed cake	Maize (Zea mays) - crop residue		Maize (Zea mays) - silage	Naturally occuring	Napier grass (Pennisetum purpureum) green fodder	Rice (Oryza	Sunflower (Helianthus annuus) - seed cake
	portion in feed basket (%)	10.00%	10.00%	25.00%	35.00%	15.00%	0.00%	5.00%	30.00%	10.00%	25.00%	15.00%	15.00%	0.00%	5.00%



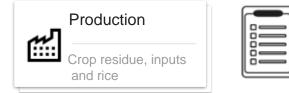
Inputs section three



You start by selecting up to 7 different feed items. You simply pick the relevant ones from the drop-down lists that are found in the local dairy cow row (row 62). In the cell under the selected feed item, you indicate the % of the total feed basket that is made up by this feed item. This % refers to the % "as fed". Make sure the %s add up to 100%

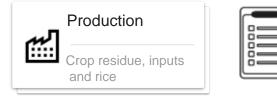
Dairy cows - local Fe	eed item (select)	Maize (Zea mays) - crop residue	Cowpea (Vigna unguiculata) - green fodder	Maize (Zea mays) - silage	Naturally occuring pasture - grazing	Napier grass (Pennisetum purpureum) - green fodder	Rice (Oryza sativa) - straw	Sunflower (Helianthus annuus) - seed cake	Maize (Zea mays crop residue	Cowpea (Vigna unguiculata) - green fodder	Maize (Zea mays) - silage	Naturally occuring pasture - grazing	Napier grass (Pennisetum purpureum) - green fodder	Rice (Oryza	Sunflower (Helianthus annuus) - seed cake
Pr	Proportion in feed basket (%)	10.00%	10.00%	25.00%	35.00%	15.00%	0.00%	5.00%	30.00%	10.00%	25.00%	15.00%	15.00%	0.00%	5.00%





Feed item	Associated Crop	Crop product	Landarea (ha)	Land cover	Slope	Length of slope (m)
Maize (Zea mays) - crop residue	Maize	Residue	1.82	Cereals	Flat (0-5%)	15
Cowpea (Vigna unguiculata) - green fodder	Cowpea	Residue	0.49	Pulses	Flat (0-5%)	15
Maize (Zea mays) - silage	Fodder maize	Main	3.41	Maize	Flat (0-5%)	5
Naturally occuring pasture - grazing	Natural pasture	Main	0.53	Degraded grass	Flat (0-5%)	5
Napier grass (Pennisetum purpureum) - green fo	Napier	Main	0.28	Dense grass	Flat (0-5%)	5
Rice (Oryza sativa) - straw	Rice	Residue	0.00	Dense grass	Flat (0-5%)	3
Sunflower (Helianthus annuus) - seed cake	Purchased	Residue	0.00	Cereals	Flat (0-5%)	1
Feed item		Crop residue removal from field (fraction)	Crop residue burnt (fraction)	-		
Teed item		from field (fraction)	(fraction)	-		
Maize (Zea mays) - crop residue	Maize	0.5	0.25			
Cowpea (Vigna unguiculata) - green fodder	Cowpea	0.5	0			
Maize (Zea mays) - silage	-	0	0.5			
Naturally occuring pasture - grazing	, 1 3	0	0.5			
Napier grass (Pennisetum purpureum) - green fo		0	0.5			
Rice (Oryza sativa) - straw	Rice	0.5	0.25			
Sunflower (Helianthus annuus) - seed cake	Purchased	0	0			

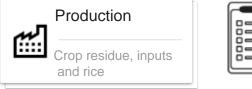




- Land cover: the crop will determine the land cover. i.e. for beans the cover crop is "pulses". In most cases, the user will select among "maize, cereals, pulses, dense or degraded grass". In the case of tuber crops, it is suggested to select either "cereals " or "pulses".
 - Slope: this in an estimation of the degree of the slope from flat to extremely steep. The steeper the more erosion there will be.
 - Length of slope:

Feed item	Associated Crop	Crop product	Land area (ha)	Land cover	Slope	Length of slope (m)
Maize (Zea mays) - crop residue	Maize	Residue	1.82	Cereals	Flat (0-5%)	15
Cowpea (Vigna unguiculata) - green fodder	Cowpea	Residue	0.49	Pulses	Flat (0-5%)	15
Maize (Zea mays) - silage	Fodder maize	Main	3.41	Maize	Flat (0-5%)	5
Naturally occuring pasture - grazing	Natural pasture	Main	0.53	Degraded grass	Flat (0-5%)	5
Napier grass (Pennisetum purpureum) - green fo	Napier	Main	0.28	Dense grass	Flat (0-5%)	5
Rice (Oryza sativa) - straw	Rice	Residue	0.00	Dense grass	Flat (0-5%)	3
Sunflower (Helianthus annuus) - seed cake	Purchased	Residue	0.00	Cereals	Flat (0-5%)	1



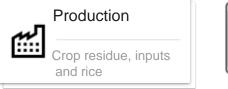




- Residue removal from field: the fraction of the totally produced crop residues that is removed from the field for feeding animals or for other purposes.
- Residue burnt: the fraction of the totally produced crop residues that is burnt

Crop areas and residue removar	Feed item		Crop residue removal from field (fraction)	Crop residue burnt (fraction)
	Maize (Zea mays) - crop residue	Maize	0.5	0.25
	Cowpea (Vigna unguiculata) - green fodder	Cowpea	0.5	0
	Maize (Zea mays) - silage	23 5 8	0	0.5
	Naturally occuring pasture - grazing	(17)	0	0.5
	Napier grass (Pennisetum purpureum) - green fo	357.3	0	0.5
	Rice (Oryza sativa) - straw	Rice	0.5	0.25
	Sunflower (Helianthus annuus) - seed cake	Purchased	0	0







For each crop associated with feed items:

• Fertilizer rate: this is expressed in kg N/ha and thus requires conversions This information is used for calculating nutrient balances and N2O emissions from each field

The purchased inorganic fertilizers:

Lime

 Per type (Urea, CAN, DAP, NPK and Lime) state the total amounts of the different fertilizers per farm and year (*not* per ha, *not* per crop).

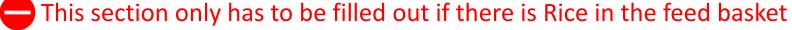
	Feed item		Fertilizer rate per crop (kg N/ ha)	Application of collected manure for fertilization (fraction)
2 11	Maize (Zea mays) - crop residue	Maize	25.00	0.00
Crop inputs	Cowpea (Vigna unguiculata) - green fodder	Cowpea	25.00	0.00
	Maize (Zea mays) - silage	Fodder maize	25.00	0.20
	Naturally occuring pasture - grazing	Natural pasture	25.00	0.50
	Napier grass (Pennisetum purpureum) - green fo	Napier	25.00	0.30
	Rice (Oryza sativa) - straw	Rice	25.00	0.00
	Sunflower (Helianthus annuus) - seed cake	Purchased	0.00	0.00
	Purchased Inorganic fertilizers	Quantity (kg fertilizer/year)		
	Urea	12		
	CAN	150]	
	DAP	200		
	NPK	450		



0



лл	Production	ſ
	Crop residue, inputs and rice	



- Harvest area: calculated from the information provided above
- Cultivation period: number of days the rice cultivation takes
- Rice ecosystem type: select from the drop-down list
- Water regime prior to rice cultivation: select from the drop-down list
- Organic amendment inputs: select from the drop-down list
- Rate of application: filled out based on information provided above

			Field 1
	Harvest area	ha	0
Rice	Cultivation period	days	75
	Rice ecosystem type	select	Intermittently flooded-single aeration
	Water regime prior to rice cultivation	select	flooded pre-season (>30 days)
	Organic amendment inputs	select	NONE
	Rate of application	t/ha	25.00







- This section only has to be filled out if looking at implementing new technologies or management systems
- Herd size: calculated from the information provided above and baseline model
- Operational cost: amount needed for implementing new technology
- Extra labor: labor hours needed for implementing new technology
- Description: short description describing what cost are being calculated

		Operational cost	Extra labour	
	herd size	USD/animal/year	(days /animal/year)	Description
Cows - local	0			
Cows - improved	15	0	0	no change
Adult cattle - male	0	0	0	no change
Steers/heifers	8			
Calves	10	0	0	no change
Steers/heifers improved	0			
Calves improved	0			
Sheep	0			
Goats	0			
Pigs	0			
Poultry	0			
Donkeys/horses	0			



Economics	
Labor hours, costs for establishment and operations	

- Herd size: calculated from the information provided above and baseline model
- Establishment cost: initial capital needed for the new technology
- Operational cost: amount needed for implementing new technology
- Establishment labor: initial capital hours needed for implementing new technology Extra labor: labor hours needed for implementing new technology
- Description: short description describing what cost are being calculated

All cost associated with new animals						
	herd size	One-off cost (USD/animal)	Operational cost USD/animal/year	Extra labour - one-off (days/animal)	Extra labour (days /animal/year)	Description
Dairy cows - local	-15	50				
Dairy cows - improved	5	90	100			
Adult cattle - male	-1	200				
Steers/heifers	7	60				
Calves	7	30				
Steers/heifers improved	0	70				
Calves improved	0	40				
Sheep	0					
Goats	0					
Pigs	0					
Poultry	0					
Donkeys/horses	0					







Economics	
Labor hours, costs for establishment and operations	

- Hectares Area/ Kg DM: calculated from the information provided above and baseline model
- Operational cost: amount needed for implementing new technology
- Extra labor: labor hours needed for implementing new technology
- Description: short description describing what cost are being calculated

Additional cost for maintaing Feed at						
	hectares	kg	Operational cost (USD/unit/year)	Extra labour (days /ha/year)	Description	
Brachiaria hybrid (forage)	0.00	0.00	180	0		
Hyparrhenia rufa (forage)	-1.72	0.00	150	11		
Maize (Zea mays)-stover	-0.33	0.00	0	0		
Napier grass (Pennisetum purpureum) -	-0.03	0.00	300	74		
Sorghum (Sorghum bicolor) – forage	-0.05	0.00	200	77		
Sugarcane (Saccharum officinarum) -	0.00	-323.47	0.3	2		
Rice (Oryza sativa) – straw	0.00	0.00	150	0		

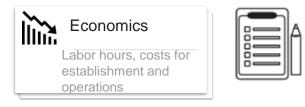


Economics	
 Labor hours, costs for establishment and operations	

- Hectares/ kg DM: calculated from the information provided above and baseline model
- Establishment cost: initial capital needed for the new technology
- Operational cost: amount needed for implementing new technology
- Establishment labor: initial capital hours needed for implementing new technology Extra labor: labor hours needed for implementing new technology
- Description: short description describing what cost are being calculated

Additional cost for new feed items	Hectares	kg	One-off / establishment cost (USD/ha)	Operational Cost (USD/ha/year)	Extra labour - one-off (days/ha)	Extra labour (days /halyear)	Description
	0.00	0.00					
	0.00	0.00					
	0.00	0.00					
	0.00	0.00					
	0.00	0.00					
	0.00	0.00					
	0.00	0.00	5	2	0		





- Other: technology not related to feed or herd size
- Establishment cost: initial capital needed for the new technology
- Operational cost: amount needed for implementing new technology
- Establishment labor: initial capital hours needed for implementing new technology Extra labor: labor hours needed for implementing new technology
- Description: short description describing what cost are being calculated

Other additional costs					
other	Extra one-off / establishment cost (USD/ha)	Operational Cost (USD/ha/year)	Extra labour - one-off (days <i>l</i> item)	Extra labour (days /item/year)	Description
extra stable	100				

