

Exploration of CLEANED input files

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Loading required package: pacman

Cleaned Data

Input data structure

The aim of this markdown document is to summarize the structure of the .json object that is required as an input for the R cleaned packages. It also explores any additional datasets that are used as inputs to create this input object, these include `cleaned/data/ghg_para.R`, `cleaned/data/stock_change_para.rda` and `qlands/cleaned-desktop/cleaned.sqlite`.

Load input json file into R Load the `qt_example.json` example input file stored in `cleaned/data`.

```
# Read in example json file #####
json_data <- fromJSON("qt_example.json")

# Summarize level 1 of the list
json_names<-data.table(field_name=names(json_data),
                        class=sapply(json_data,base::class),
                        length=sapply(json_data,length))

kable(json_names, caption = "Summary of Level 1 of the JSON Object")
```

Table 1: Summary of Level 1 of the JSON Object

field_name	class	length
annual_prec	integer	1
arable_tograssland	integer	1
climate_zone	character	1
climate_zone_2	character	1
cropland_ormatter	character	1
cropland_ormatter_ipcc	numeric	1
cropland_system	character	1
cropland_system_ipcc	numeric	1

field_name	class	length
cropland_tillage	character	1
cropland_tillage_ipcc	integer	1
database_code	character	1
et	integer	1
farm_code	character	1
farm_name	character	1
feed_basket	data.frame	2
feed_items	data.frame	65
fertilizer	data.frame	4
grassland_implevel	character	1
grassland_implevel_ipcc	integer	1
grassland_management	character	1
grassland_management_ipcc	integer	1
grassland_toarable	integer	1
livestock	data.frame	59
purchased_bedding	integer	1
purchased_compost	integer	1
purchased_manure	integer	1
purchased_organic_n	integer	1
rain_length	integer	1
region	character	1
seasons	data.frame	2
soil_bulk	integer	1
soil_c	integer	1
soil_clay	integer	1
soil_depth	integer	1
soil_description	character	1
soil_k_value	numeric	1
soil_n	numeric	1
waste_consume_meat	integer	1
waste_consume_milk	integer	1
waste_distribution_meat	integer	1
waste_distribution_milk	integer	1
waste_processing_meat	integer	1
waste_processing_milk	integer	1
waste_production_meat	integer	1
waste_production_milk	integer	1

```

simple_fields<-json_names[class!="data.frame" & length==1,field_name]
simple_fields<-json_data[json_names[class!="data.frame" & length==1,field_name]]
simple_fields<-data.table(field=names(simple_fields),
                        value=unlist(simple_fields),
                        class=json_names[class!="data.frame" & length==1,class])

```

Simple fields

Table 2: Summary of simple fields containing a single value

field	value	class
annual_prec	1500	integer
arable_tograssland	0	integer
climate_zone	Temperate	character
climate_zone_2	Warm Temperate Dry	character
cropland_orgmatter	Low, temperate/boreal, dry	character
cropland_orgmatter_ipcc	0.95	numeric
cropland_system	Long term cultivated, temperate/boreal, dry	character
cropland_system_ipcc	0.8	numeric
cropland_tillage	Full	character
cropland_tillage_ipcc	1	integer
database_code	base	character
et	1460	integer
farm_code	001	character
farm_name	test 3	character
grassland_implevel	Medium	character
grassland_implevel_ipcc	1	integer
grassland_management	Nominally managed	character
grassland_management_ipcc	1	integer
grassland_toarable	0	integer
purchased_bedding	0	integer
purchased_compost	0	integer
purchased_manure	0	integer
purchased_organic_n	0	integer
rain_length	5	integer
region	AFRICA	character
soil_bulk	6	integer
soil_c	12	integer
soil_clay	45	integer
soil_depth	2	integer
soil_description	Lixisol	character
soil_k_value	0.25	numeric
soil_n	3.5	numeric
waste_consume_meat	2	integer
waste_consume_milk	2	integer
waste_distribution_meat	3	integer
waste_distribution_milk	3	integer
waste_processing_meat	5	integer
waste_processing_milk	5	integer
waste_production_meat	3	integer
waste_production_milk	3	integer

Livestock The `json_data$livestock` of the json list is a `data.table` that contains information about livestock”]] herd structure and management, manure management and productivity.

Table 3: Transposed livestock herd data `t(json_data$livestock)`

	livetype_code_2	livetype_code_1	livetype_code_5
adult_weight	800	400	0
annual_growth	0	0	90

	livetype_code_2	livetype_code_1	livetype_code_5
annual_milk	3000	1500	0
annual_wool	0	0	0
birth_interval	1.166667	1.500000	0.000000
body_weight	600	350	200
body_weight_weaning	0	0	0
body_weight_year_one	0	0	0
carcass_fraction	0.48	0.00	0.48
cp_grazing	0	3	0
cp_growth	0.0	0.0	0.4
cp_lactation	5	2	0
cp_lactmilk	0.09	0.09	0.00
cp_maintenance	0.60	0.35	0.20
cp_pregnancy	12.21	9.64	0.00
distance_to_pasture	0.0	0.5	0.5
energy_eggcontent	0	0	0
energy_meatcontent	2200	2200	2200
energy_milkcontent	970	970	0
fat_content	4.3	5.8	0.0
grazing_displacement	0	2	0
herd_composition	2	5	0
ipcc_ef_category_t1	Dairy cattle	Other mature female	Other mature female-grazing
ipcc_ef_category_t2	Dairy cows	Dairy cows	Non-dairy
ipcc_meth_man_category	Dairy cows	Dairy cows	Other cattle
ipcc_n_exc_category	Dairy cattle	Dairy cattle	Other cattle
lactation_length	0	0	0
litter_size	0	0	0
livetype_code	2	1	5
livetype_desc	Cattle - Cows (improved)	Cattle - Cows (local)	Cattle - Steers/heifers
lw_gain	0	0	0
manure_in_field	0	0	0
manure_in_non_roofed_enclosure	0	0	0
manure_in_stable	1	0	0
manure_onfarm_fraction	1	0	0
manure_sales_fraction	0	0	0
manureman_non_roofed_enclosure	Solid storage	Solid storage	Solid storage
manureman_offfarm_grazing	Solid storage	Solid storage	Solid storage
manureman_onfarm_grazing	Solid storage	Pasture / range / paddock	Solid storage
manureman_stable	Solid storage	Solid storage	Solid storage
me_grazing	2.0	2.0	1.5
me_growth	0	0	50
me_lactation	5	2	0
me_lactmilk	5.5	5.5	0.0
me_maintenance	60.61547	40.45955	26.59148
me_pregnancy	1500	1260	0
meat_product	beef	beef	beef
milk_product	cow milk	cow milk	cow milk
n_content	0.029	0.029	0.029
piglets_relying_on_milk	0	0	0
proportion_growth	0	0	0

	livetype_code_2	livetype_code_1	livetype_code_5
protein_meatcontent	26	26	26
protein_milkcontent	3.7	3.2	0.0
time_in_non_roofed_enclosure	0	0	0
time_in_offfarm_grazing	0	0	0
time_in_onfarm_grazing	0	1	1
time_in_stable	1	0	0
water_requirement	140	120	80
work_hour	0	0	0

The livestock are linked to the `feed_basket$feeds` tables by the `livetype_code` keyfield.

```
json_data$livestock[,c("livetype_code","livetype_desc")] # Codes in the feed_items table
```

```
##   livetype_code      livetype_desc
## 1             2 Cattle - Cows (improved)
## 2             1  Cattle - Cows (local)
## 3             5  Cattle - Steers/heifers
```

```
lapply(json_data$feed_basket$feeds,"[", "livestock") # Codes in the feed_basket tables
```

```
## [[1]]
## [[1]][[1]]
##   allocation livetype_code
## 1         40             2
## 2         17             1
## 3         40             5
##
## [[1]][[2]]
##   allocation livetype_code
## 1         25             2
## 2         43             1
## 3         20             5
##
## [[1]][[3]]
##   allocation livetype_code
## 1         35             2
## 2         40             1
## 3         40             5
##
##
## [[2]]
## [[2]][[1]]
##   allocation livetype_code
## 1         40             2
## 2         17             1
## 3         40             5
##
## [[2]][[2]]
##   allocation livetype_code
## 1         25             2
```

```
## 2      43      1
## 3      20      5
##
## [[2]][[3]]
## allocation livetype_code
## 1      35      2
## 2      40      1
## 3      40      5
```

Feed items The `json_data$feed_items` level of the json list is a `data.table` that contains information about the production management and context of feed production.

Table 4: Transposed feed item data `t(json_data$feed_items)`

	feed_item_code_65	feed_item_code_99	feed_item_code_18
ammonia	0	0	0
ammonium_nitrate	0	0	0
ammonium_sulfate	0	0	0
average_dbh25	0	0	0
average_dbh2550	0	0	0
average_dbh50	0	0	0
category	cereal	cereal	legume
cp_content	13.60	3.85	18.40
cultivation_period	0	0	0
cut_carry_fraction	0	0	0
dap	0	0	0
diameter_breast	0	0	0
dm_content	89.00	91.88	90.00
dry_yield	30	15	8
ecosystem_type			
energy	0	360	336
feed_item_code	65	99	18
feed_item_name	Oats (Avena sativa) - grain IP	Rice (Oryza sativa) - straw	Cowpea (Vigna unguiculata) - crop residue
feed_type_code	2	45	9
feed_type_name	Avena sativa	Rice	Cowpea
fraction_as_fertilizer	1	1	0
fraction_as_manure	NA	NA	NA
grassman	1	1	1
grassman_change_factor		1	1
grassman_desc	Nominally managed	Nominally managed	Nominally managed
increase_dbh25	0	0	0
increase_dbh2550	0	0	0
increase_dbh50	0	0	0
intercrop	0	0	0
intercrop_fraction	0	0	0
kc_initial	0.10	1.05	0.15
kc_late	0.55	0.75	0.60
kc_midseason	1.10	1.20	1.05
land_cover	7	7	1
land_cover_desc	Cereals	Cereals	Dense forest
landcover_c_factor	0.150	0.150	0.001
main_n	0.0176	0.0090	0.0380

	feed_item_code_65	feed_item_code_99	feed_item_code_18
main_product_removal	1	1	0
me_content	12.267324	5.640000	9.880848
n_content	0.2	0.2	0.0
n_fertilizer	NA	NA	NA
n_solutions	50	300	100
npk	0	0	0
organic_amendment			
residue_burnt	0	0	0
residue_dry_yield	0	0	6
residue_n	0.0	0.2	0.0
residue_removal	0.0	0.8	0.0
slope	1	1	1
slope_desc	Flat (0-5%)	Flat (0-5%)	Flat (0-5%)
slope_length	0	0	0
slope_p_factor	0.11	0.11	0.11
source_type	Main	Residue	Main
time_horizon	0	0	0
trees_dhb	0	0	0
trees_growth	0	0	0
trees_ha	0	0	0
trees_ha_dbh25	0	0	0
trees_ha_dbh2550	0	0	0
trees_ha_dbh50	0	0	0
trees_removal	0	0	0
urea	400	700	200
usda_value	0	20450	16062
water_content	0.00	12.89	11.95
water_regime			

The `feed_items` are linked to the `feed_basket$feeds` tables by the `feed_item_code` field.

```
json_data$feed_items[,c("feed_item_code","feed_item_name")] # Codes in the feed_items table
```

```
##   feed_item_code      feed_item_name
## 1             65      Oats (Avena sativa) - grain IP
## 2             99      Rice (Oryza sativa) - straw
## 3             18 Cowpea (Vigna unguiculata) - crop residue
```

```
lapply(json_data$feed_basket$feeds, "[", "feed_item_code") # Codes in the feed_basket tables
```

```
## [[1]]
## [1] "65" "99" "18"
##
## [[2]]
## [1] "65" "99" "18"
```

Other keyfields include `feed_type_code` and `land_cover`:


```
json_data$feed_items[,c("feed_type_code", "feed_type_name", "land_cover", "land_cover_desc")]
```

```
##   feed_type_code feed_type_name land_cover land_cover_desc
## 1             2   Avena sativa          7         Cereals
## 2            45         Rice          7         Cereals
## 3             9       Cowpea          1       Dense forest
```

Fertilizer The `json_data$fertilizer` level of the json list is a data.table that contains information about the production management and context of feed production.

Table 5: Fertilizer data input table (`json_data$fertilizer`)

fertilizer_code	fertilizer_desc	fraction	percentage_n
4	Ammonium nitrate	0	12
6	N solutions	0	10

The values in `fertilizer_code` field do not appear directly correspond to any fields in the feed basket or feed item tables. However columns with similar names do appear in the field item tables

```
fertilizers<-json_data$fertilizer$fertilizer_desc
fi_cols<-colnames(json_data$feed_items)

# Reformat fertilizer names to match column names in the feed_items table
(fertilizers<-gsub(" ", "_", tolower(json_data$fertilizer$fertilizer_desc)))
```

```
## [1] "ammonium_nitrate" "n_solutions"
```

```
# Find matching columns
fi_cols[fi_cols %in% fertilizers]
```

```
## [1] "ammonium_nitrate" "n_solutions"
```

Seasons The `json_data$season` level of the input data is 2-column table that records the length of each season (adding up to 365 days max).

Table 6: Feed items data input table (`json_data$season`)

season_length	season_name
200	Wet season
165	Dry season

The `season_name` field is the key field that links to the feed basket.

```
json_data$feed_basket$season_name
```

```
## [1] "Wet season" "Dry season"
```

Feed basket The `json_data$feed_basket` level of the input data contains a further 2 list levels called `feeds` and `season_name`. These sub-levels appear to be the same length: `feeds = 2`, `season_name = 2`.

Seasons The `json_data$feed_basket$season` object is simple, being a vector containing the names of the seasons:

Table 7: Feed basket/season data input table
(`json_data$feed_basket$season`)

x
Wet season
Dry season

Feed Basket The `json_data$feed_basket$feed` object is the most structurally complex element of the input json data containing several levels of nesting.

```
str(json_data$feed_basket$feeds)
```

```
## List of 2
## $ : 'data.frame': 3 obs. of 3 variables:
## ..$ feed_item_code: chr [1:3] "65" "99" "18"
## ..$ feed_type_code: chr [1:3] "2" "45" "9"
## ..$ livestock :List of 3
## ...$ : 'data.frame': 3 obs. of 2 variables:
## ... ..$ allocation : int [1:3] 40 17 40
## ... ..$ livetype_code: chr [1:3] "2" "1" "5"
## ...$ : 'data.frame': 3 obs. of 2 variables:
## ... ..$ allocation : int [1:3] 25 43 20
## ... ..$ livetype_code: chr [1:3] "2" "1" "5"
## ...$ : 'data.frame': 3 obs. of 2 variables:
## ... ..$ allocation : int [1:3] 35 40 40
## ... ..$ livetype_code: chr [1:3] "2" "1" "5"
## $ : 'data.frame': 3 obs. of 3 variables:
## ..$ feed_item_code: chr [1:3] "65" "99" "18"
## ..$ feed_type_code: chr [1:3] "2" "45" "9"
## ..$ livestock :List of 3
## ...$ : 'data.frame': 3 obs. of 2 variables:
## ... ..$ allocation : int [1:3] 40 17 40
## ... ..$ livetype_code: chr [1:3] "2" "1" "5"
## ...$ : 'data.frame': 3 obs. of 2 variables:
## ... ..$ allocation : int [1:3] 25 43 20
## ... ..$ livetype_code: chr [1:3] "2" "1" "5"
## ...$ : 'data.frame': 3 obs. of 2 variables:
## ... ..$ allocation : int [1:3] 35 40 40
## ... ..$ livetype_code: chr [1:3] "2" "1" "5"
```

Each feed basket table (e.g., `json_data$feed_basket$feeds[[1]]`) is constructed using key fields that describe feed items found in the `json_data$feed_items` table, specifically `feed_item_code` and `feed_type_code`. The feeds are then allocated to the herd elements described in the `json_data$livestock` table.

Table 8: Feed basket/feed data input table
tablejson_datafeedbasketfeeds[[1]]

feed_item_code	feed_type_code	livestock
65	2	40, 17, 40, 2 , 1 , 5
99	45	25, 43, 20, 2 , 1 , 5
18	9	35, 40, 40, 2 , 1 , 5

The livestock field in the feed basket table contains a list with 3 elements, indicating a one-to-many relationship between the diet item and elements of the livestock herd. Each feed item represented by a row in the feed basket table is allocated to different herd elements, with the `livetype_code` field serving as the key field linking the two tables.

`\begin{table} \caption{Feed basket/feed/livestock data input table tablejson_datafeedbasketfeeds[[1]]$livestock}`

allocation	livetype_code	allocation	livetype_code	allocation	livetype_code
40	2	25	2	35	2
17	1	43	1	40	1
40	5	20	5	40	5

`\end{table}`

The first element of the livestock list contains no further nesting:

```
str(json_data$feed_basket$feeds[[1]]$livestock[[1]])
```

```
## 'data.frame':  3 obs. of  2 variables:
## $ allocation   : int  40 17 40
## $ livetype_code: chr  "2" "1" "5"
```

Explore cleaned/data .rda files

```
rda_files<-list.files(".rda")
```

GHG parameters The `ghg_para` object (`cleaned/data/ghg_para.rda`) is a list of tables that appear to refer to IPCC equations, livestock parameters and fertilizers.

```
load("ghg_para.rda")

# Summarize level 1 of the list
ghg_names<-data.table(field_name=names(ghg_para),
                      dim=sapply(ghg_para,dim))

kable(ghg_names,caption="Tables within ghg_names list")
```

Table 9: Tables within ghg_names list

field_name	dim
livestock_parameters	18, 7
Table_10.12	6, 2
table_10.17	3, 2
table_10.19	12, 3
table_10.21	3, 2
table_10.22	7, 4
table_10A_9	18, 3
table_11.1_&_table_11.3	10, 5
table_2.5	5, 2
fertilizer_table	5, 5
table_5.11	NULL
table_5.12	8, 4
table_5.13	5, 3
table_5.14	6, 2

The exception is `ghg_para$table_5.11` which is a list:

```
ghg_para$table_5.11
```

```
## $baseline_emission_factor
## [1] 1.3
##
## $soil_type_scaling_factor
## [1] 1
```

Livestock_parameters Note there is an invalid character in this table:

```
ghg_para$livestock_parameters$`IPCC Category - methane emissions enteric fermentation - Tier 2`[11]<-"0"
```

```
kable(ghg_para$livestock_parameters,caption="ghg_para$livestock_parameters")
```

Table 10: `ghg_para$livestock_parameters`

				IPCC Category - methane emissions enteric fermentation - Tier 2	IPCC Category - methane emissions enteric fermentation - Tier 2	IPCC Category - methane emissions manure - Tier 1	IPCC-Category - Default N-excretion rates Tier 1
livestock_category	primary	manure	Tier 1				
Cows (local)	0.04	0.08	Other mature female	Dairy cattle		Dairy cows	Dairy cattle
Cows (improved)	0.04	0.08	Dairy cattle	Dairy cattle		Dairy cows	Dairy cattle

livestock_category	livestock_weight	livestock_age	IPCC Category - methane emissions enteric fermentation - Tier 1	IPCC Category - methane emissions enteric fermentation - Tier 2	IPCC Category - methane emissions manure - Tier 1	IPCC-Category - Default N-excretion rates Tier 1
Cows (high productive)	0.04	0.08	Dairy cattle	Dairy cattle	Dairy cows	Dairy cattle
Adult cattle - male	0.04	0.08	Other draft bull	Other Cattle and Buffaloes that are primarily fed low quality crop residues and byproducts	Other cattle	Other cattle
Steers/heifers	0.04	0.08	Other Mature female-grazing	Other Cattle and Buffaloes that are primarily fed low quality crop residues and byproducts	Other cattle	Other cattle
Steers/heifers (improved)	0.04	0.08	Other Mature female-grazing	Other Cattle and Buffaloes that are primarily fed low quality crop residues and byproducts	Other cattle	Other cattle
Calves	0.04	0.08	Other young	Other Cattle and Buffaloes that are primarily fed low quality crop residues and byproducts	Other cattle	Other cattle
Calves (improved)	0.04	0.08	Other young	Other Cattle and Buffaloes that are primarily fed low quality crop residues and byproducts	Other cattle	Other cattle
Buffalo (dairy)	0.04	0.08	Other draft bull	Other Cattle or Buffalo - grazing	Buffalo	Other cattle
Buffalo steers/heifers	0.04	0.08	Other young	Other Cattle or Buffalo - grazing	Buffalo	Other cattle
Buffalo calves	0.04	0.08	Other young	Other Cattle or Buffalo - grazing	Buffalo	Other cattle
Sheep/Goats	0.04	0.08	Goats	Sheep	Sheep	Sheep
-						
Ewes/Does						
Sheep/Goats	0.04	0.08	Goats	Sheep	Sheep	Sheep
-						
Breeding Rams/Bucks						
Sheep/Goats	0.04	0.08	Goats	Sheep	Sheep	sheep
-						
Fattening Rams/Bucks						

livestock_category	livestock_subcategory	livestock_tier	IPCC Category - methane emissions enteric fermentation - Tier 1	IPCC Category - methane emissions enteric fermentation - Tier 2	IPCC Category - methane emissions manure - Tier 1	IPCC-Category - Default N-excretion rates Tier 1
Sheep/Goats	0.04	0.08	Goats	lambs (less 1 yr old)	Sheep	sheep
- Lambs/Kids						
Pigs - lactating/pregnant sows	0.02	0.08	Pigs	N/A	Swine	pigs
Pigs - dry sows/boars	0.02	0.08	Pigs	N/A	Swine	pigs
Pigs - growers	0.02	0.08	Pigs	N/A	Swine	pigs

```
kable(ghg_para$fertilizer_table,caption="ghg_para$fertilizer_table")
```

Fertilizer table

Table 11: ghg_para\$fertilizer_table

fertilizer_type	percent_N	emission_factor_kg_CO2eq_per_kg_N	kg_N_per_1_kg_of_fertilizer	emissions_factor_kg_CO2_eq_per_kg_fertilizer
DAP	18	2.80	0.18	0.5040
CAN	27	8.66	0.27	2.3382
Urea	NA	NA	NA	0.7850
NPK	NA	NA	NA	1.2100
Lime-application	NA	NA	NA	NA

IPCC Tables Table_10.12

```
kable(ghg_para$Table_10.12)
```

animal_category_ipcc	methane_conversion_factor
Dairy cattle	6.5
Other Cattle and Buffaloes that are primarily fed low quality crop residues and byproducts	6.5
Other Cattle or Buffalo - grazing	6.5
sheep	6.5
lambs (less 1 yr old)	4.5
N/A	0.0

table_10.17

```
kable(ghg_para$table_10.17)
```

system	mcf_by_average_annual_temperature
Pasture / range / paddock	0.015
solid storage	0.040
dry lot	0.015

table_10.19

```
kable(ghg_para$table_10.19)
```

anaimal_category	Continent	n_rate
Dairy cattle	LATIN AMERICA	0.48
Dairy cattle	AFRICA	0.60
Dairy cattle	ASIA	0.47
Other cattle	LATIN AMERICA	0.37
Other cattle	AFRICA	0.63
Other cattle	ASIA	0.34
Sheep	LATIN AMERICA	1.17
Sheep	AFRICA	1.17
Sheep	ASIA	1.17
Pigs	LATIN AMERICA	1.64
Pigs	AFRICA	1.64
Pigs	ASIA	0.50

table_10.21

```
kable(ghg_para$table_10.21)
```

system	direct_nitrous_oxide_factor
Pasture / range / paddock	0.010
solid storage	0.005
dry lot	0.020

table_10.22

```
kable(ghg_para$table_10.22)
```

anaimal_category	system	fraction_n_loss_mms	range
Dairy cows	pit storage	0.28	(10-40)
Dairy cows	dry lot	0.20	(10-35)
Dairy cows	solid storage	0.30	(10-40)
Dairy cows	daily spread	0.07	(5-60)
Other cattle	dry lot	0.30	(20-50)

animal_category	system	fraction_n_loss_mms	range
Other cattle	solid storage	0.45	(10-65)
Other cattle	deep bedding	0.30	(20-40)

table_10A_9

```
kable(ghg_para$Table_10.12)
```

animal_category_ipcc	methane_conversion_factor
Dairy cattle	6.5
Other Cattle and Buffaloes that are primarily fed low quality crop residues and byproducts	6.5
Other Cattle or Buffalo - grazing	6.5
sheep	6.5
lambs (less 1 yr old)	4.5
N/A	0.0

table_11.1_&_table_11.3

```
kable(ghg_para$`table_11.1_&_table_11.3`)
```

emission_factor	description	n2o_emissions	uncertainty	managed_soils
EF1 kg N2O-N (kg N input)-1	emission factor for N2O emissions from N inputs	0.0100	0.003-0.03	
EF2 kg N2O-N ha-1 yr-1	emission factor for N2O emissions from drained/managed organic soils	16.0000	5 TO 48	
EF3PRR kg N2O-N (kg CPP N input)-1	emission factor for N2O emissions from urine and dung N deposited on pasture, range and paddock by grazing animals	0.0200	0.007-0.06	
EF3PRR SO kg N2O-N (kg N input)-1	emission factor for N2O emissions from urine and dung N deposited on pasture, range and paddock by grazing animals	0.0100	0.003-0.03	
EF4 [kg N-N2O (kg NH3-N + NOx-N volatilised)-1]	emission factor for N2O emissions from atmospheric deposition of N on soils and water surfaces	0.0100	0.002-0.05	
EF5 kg N2O-N (kg N leached and runoff)-1	emission factor for N2O emissions from N leaching and runoff	0.0075	0.005-0.025	
EF1R kg N2O-N (kg N input)-1	emission factor for N2O emission from N inputs for flooded rice	0.0030	0.000 - 0.006	
FracGASFN volatilised (kg of N applied)-1	fraction of synthetic fertilizer N that volatilises as NH3 and NOx	0.1000	0.03-0.3	

emission_factor	description	n2o_emissions	uncertainty	managed_soils
FracGAS_N	fraction of applied organic N fertiliser materials (FON) and of urine and dung N deposited by grazing animals (FPRP) that volatilises as NH3 and NOx	0.2000	0.05-0.5	
FracLEACH_N (H)	fraction of all N added to/mineralised in managed soils in regions where leaching/runoff occurs that is lost through leaching and runoff	0.3000	if sum of rain - sum of PE > soil water holding capacity during rainy season	

table_2.5

```
kable(ghg_para$table_2.5)
```

ghg_gas	burnt_emission_factor
CO2	1515.00
CO	92.00
CH4	2.70
N2O	0.07
Nox	2.50

table_5.12

```
kable(ghg_para$table_5.12)
```

ecosystem	ecosystem_type	aggregated_scaling_factor	disaggregated_scaling_factor_w
irrigated	Irrigated-Continuously flooded	0.78	1.00
irrigated	intermittently flooded-single aeration	0.78	0.60
irrigated	Intermittently flooded-multiple aeration	0.78	0.52
Rain fed and deep water	Rainfed-regular rainfed	0.27	0.28
Rain fed and deep water	Rainfed-drought prone	0.27	0.25
Rain fed and deep water	Rainfed-deep water	0.27	0.31
Upland	Upland	0.00	0.00
None	None	0.00	0.00

table_5.13

```
kable(ghg_para$table_5.13)
```

water_regime	aggregated_scaling_factor	aggregated_scaling_factor_p
non-flooded pre-season <180 days(often in double cropping of rice)	1.22	1.00
non-flooded pre-season >180 days (single rice crop following a dry fallow period)	1.22	0.68
flooded pre-season (>30 days)	1.22	1.90
flooded pre-season (<30 days)	1.22	0.00
None	0.00	0.00

table_5.14

```
kable(ghg_para$table_5.14)
```

organic_amendment	conversion_factor
straw incorporated in soil shortly (<30 days) before cultivation	1.00
straw incorporated in soil long (>30 days) before cultivation	0.29
Compost	0.05
Farm yard manure	0.14
green manure	0.50
None	0.00

Stock change The stock change object (`cleaned/data/stock_change_para.rda`) is a series of nested lists that describe: 1) landuse, management, and input factor_variables for grassland; and 2) landuse, tillage, and input input factor_variables for cropland.

```
load("stock_change_para.rda")
str(stock_change_para)
```

```
## List of 2
## $ cropland :'data.frame':  1 obs. of  3 variables:
## ..$ landuse:List of 1
## .. ..$ :'data.frame':  1 obs. of  1 variable:
## .. .. ..$ factor_variables:List of 1
## .. .. .. ..$ :'data.frame':  1 obs. of  10 variables:
## .. .. .. .. ..$ Long term cultivated, temperate/boreal, dry : num 0.8
## .. .. .. .. ..$ Long term cultivated, temperate/boreal, moist : num 0.69
## .. .. .. .. ..$ Long term cultivated, tropical, dry : num 0.58
## .. .. .. .. ..$ Long term cultivated, tropical, moist/wet : num 0.48
## .. .. .. .. ..$ Long term cultivated, tropical montane, all : num 0.64
## .. .. .. .. ..$ Paddy rice : num 1.1
## .. .. .. .. ..$ Perennial/tree crop : int 1
## .. .. .. .. ..$ Set aside (< 20 years), temperate/boreal and tropical, dry : num 0.93
## .. .. .. .. ..$ Set aside (< 20 years), temperate/boreal and tropical, moist/wet: num 0.82
## .. .. .. .. ..$ Set aside (< 20 years),tropical montane, all : num 0.88
## ..$ tillage:List of 1
## .. ..$ :'data.frame':  1 obs. of  1 variable:
## .. .. ..$ factor_variables:List of 1
## .. .. .. ..$ :'data.frame':  1 obs. of  11 variables:
## .. .. .. .. ..$ Full : int 1
```

```

## ..$ Reduced, temperate/boreal, dry : num 1.02
## ..$ Reduced, temperate/boreal, moist: num 1.08
## ..$ Reduced, tropical, dry : num 1.09
## ..$ Reduced, tropical, moist : num 1.15
## ..$ Reduced, tropical montane, all : num 1.09
## ..$ No-till, temperate/boreal, dry : num 1.1
## ..$ No-till, temperate/boreal, moist: num 1.15
## ..$ No-till, tropical, dry : num 1.17
## ..$ No-till, tropical, moist/wet : num 1.22
## ..$ No-till, tropical montane, all : num 1.16
## ..$ input :List of 1
## ..$ :'data.frame': 1 obs. of 1 variable:
## ..$ factor_variables:List of 1
## ..$ :'data.frame': 1 obs. of 12 variables:
## ..$ Low, temperate/boreal, dry : num 0.95
## ..$ Low, temperate/boreal, moist : num 0.92
## ..$ Low, tropical, dry : num 0.95
## ..$ Low, tropical, moist : num 0.92
## ..$ Low, tropical montane, all : num 0.94
## ..$ Medium, all : int 1
## ..$ High w/OUT manure, temperate/boral and tropical, dry : num 1.04
## ..$ High w/OUT manure, temperate/boral and tropical, moist/wet: num 1.11
## ..$ High w/OUT manure, tropical montane : num 1.08
## ..$ High with manure, temperate/boral and tropical, dry : num 1.37
## ..$ High with manure, temperate/boral and tropical, moist/wet : num 1.44
## ..$ High with manure, tropical montane : num 1.41
## $ grassland:'data.frame': 1 obs. of 3 variables:
## ..$ landuse :List of 1
## ..$ :'data.frame': 1 obs. of 1 variable:
## ..$ factor_variables:List of 1
## ..$ :'data.frame': 1 obs. of 1 variable:
## ..$ All: int 1
## ..$ management:List of 1
## ..$ :'data.frame': 1 obs. of 1 variable:
## ..$ factor_variables:List of 1
## ..$ :'data.frame': 1 obs. of 8 variables:
## ..$ Nominally managed : num 1
## ..$ Moderately degraded grassland, temperate/boreal: num 0.95
## ..$ Moderately degraded grassland, tropical : num 0.97
## ..$ Moderately degraded grassland, tropical montane: num 0.96
## ..$ Severely degraded : num 0.7
## ..$ Improved grassland, temperate/boreal : num 1.14
## ..$ Improved grassland, tropical : num 1.17
## ..$ Improved grassland, tropical montane : num 1.16
## ..$ input :List of 1
## ..$ :'data.frame': 1 obs. of 1 variable:
## ..$ factor_variables:List of 1
## ..$ :'data.frame': 1 obs. of 3 variables:
## ..$ Medium: int 1
## ..$ High : num 1.11
## ..$ none : int 1

```

Grass factor variables Grassland: landuse

```
x<-unlist(stock_change_para$grassland$landuse[[1]]$factor_variables)
kable(data.frame(variable=names(x),value=as.numeric(x)))
```

variable	value
All	1

Grassland: management

```
x<-unlist(stock_change_para$grassland$management[[1]]$factor_variables)
kable(data.frame(variable=names(x),value=as.numeric(x)))
```

variable	value
Nominally managed	1.00
Moderately degraded grassland, temperate/boreal	0.95
Moderately degraded grassland, tropical	0.97
Moderately degraded grassland, tropical montane	0.96
Severely degraded	0.70
Improved grassland, temperate/boreal	1.14
Improved grassland, tropical	1.17
Improved grassland, tropical montane	1.16

Grassland: input

```
x<-unlist(stock_change_para$grassland$input[[1]]$factor_variables)
kable(data.frame(variable=names(x),value=as.numeric(x)))
```

variable	value
Medium	1.00
High	1.11
none	1.00

Cropland factor variables Cropland: landuse

```
x<-unlist(stock_change_para$cropland$landuse[[1]]$factor_variables)
kable(data.frame(variable=names(x),value=as.numeric(x)))
```

variable	value
Long term cultivated, temperate/boreal, dry	0.80
Long term cultivated, temperate/boreal, moist	0.69
Long term cultivated, tropical, dry	0.58
Long term cultivated, tropical, moist/wet	0.48
Long term cultivated, tropical montane, all	0.64
Paddy rice	1.10
Perennial/tree crop	1.00
Set aside (< 20 years), temperate/boreal and tropical, dry	0.93

variable	value
Set aside (< 20 years), temperate/boreal and tropical, moist/wet	0.82
Set aside (< 20 years),tropical montane, all	0.88

Cropland: tillage

```
x<-unlist(stock_change_para$cropland$tillage[[1]]$factor_variables)
kable(data.frame(variable=names(x),value=as.numeric(x)))
```

variable	value
Full	1.00
Reduced, temperate/boreal, dry	1.02
Reduced, temperate/boreal, moist	1.08
Reduced, tropical, dry	1.09
Reduced, tropical, moist	1.15
Reduced, tropical montane, all	1.09
No-till, temperate/boreal, dry	1.10
No-till, temperate/boreal, moist	1.15
No-till, tropical, dry	1.17
No-till, tropical, moist/wet	1.22
No-till, tropical montane, all	1.16

Cropland: input

```
x<-unlist(stock_change_para$cropland$input[[1]]$factor_variables)
kable(data.frame(variable=names(x),value=as.numeric(x)))
```

variable	value
Low, temperate/boreal, dry	0.95
Low, temperate/boreal, moist	0.92
Low, tropical, dry	0.95
Low, tropical, moist	0.92
Low, tropical montane, all	0.94
Medium, all	1.00
High w/OUT manure, temperate/boral and tropical, dry	1.04
High w/OUT manure, temperate/boral and tropical, moist/wet	1.11
High w/OUT manure, tropical montane	1.08
High with manure, temperate/boral and tropical, dry	1.37
High with manure, temperate/boral and tropical, moist/wet	1.44
High with manure, tropical montane	1.41

mufindi The mufindi object (`cleaned/data/mufindi.rda`) appears to be an input dataset similar to the `qt_example.json` file.

```
load("mufindi.rda")
str(mufindi)
```

```

## List of 48
## $ cba_discount_rate      : int 0
## $ cba_years              : int 0
## $ cropland_orgmatter     : chr "High w/OUT manure, temperate/boral and tropical, moist/wet"
## $ cropland_system       : chr "Long term cultivated, temperate/boreal, moist"
## $ cropland_tillage       : chr "Reduced, tropical, moist"
## $ farm_code              : chr "ddd"
## $ farm_name              : chr "ooo"
## $ feed_basket            : 'data.frame':  2 obs. of  2 variables:
##   ..$ feeds              :List of 2
##   .. ..$ : 'data.frame':  4 obs. of  3 variables:
##   .. .. ..$ feed_item_code: chr [1:4] "16" "31" "51" "82"
##   .. .. ..$ feed_type_code: chr [1:4] "8" "17" "29" "40"
##   .. .. ..$ livestock     :List of 4
##   .. .. .. ..$ : 'data.frame':  2 obs. of  2 variables:
##   .. .. .. .. ..$ allocation : int [1:2] 2 10
##   .. .. .. .. ..$ livetype_code: chr [1:2] "3" "6"
##   .. .. .. .. ..$ : 'data.frame':  2 obs. of  2 variables:
##   .. .. .. .. ..$ allocation : int [1:2] 20 10
##   .. .. .. .. ..$ livetype_code: chr [1:2] "3" "6"
##   .. .. .. .. ..$ : 'data.frame':  2 obs. of  2 variables:
##   .. .. .. .. ..$ allocation : int [1:2] 30 10
##   .. .. .. .. ..$ livetype_code: chr [1:2] "3" "6"
##   .. .. .. .. ..$ : 'data.frame':  2 obs. of  2 variables:
##   .. .. .. .. ..$ allocation : int [1:2] 48 70
##   .. .. .. .. ..$ livetype_code: chr [1:2] "3" "6"
##   .. .. .. .. ..$ : 'data.frame':  4 obs. of  3 variables:
##   .. .. .. .. ..$ feed_item_code: chr [1:4] "16" "31" "51" "82"
##   .. .. .. .. ..$ feed_type_code: chr [1:4] "8" "17" "29" "40"
##   .. .. .. .. ..$ livestock     :List of 4
##   .. .. .. .. ..$ : 'data.frame':  2 obs. of  2 variables:
##   .. .. .. .. ..$ allocation : int [1:2] 70 50
##   .. .. .. .. ..$ livetype_code: chr [1:2] "3" "6"
##   .. .. .. .. ..$ : 'data.frame':  2 obs. of  2 variables:
##   .. .. .. .. ..$ allocation : int [1:2] 20 5
##   .. .. .. .. ..$ livetype_code: chr [1:2] "3" "6"
##   .. .. .. .. ..$ : 'data.frame':  2 obs. of  2 variables:
##   .. .. .. .. ..$ allocation : int [1:2] 5 5
##   .. .. .. .. ..$ livetype_code: chr [1:2] "3" "6"
##   .. .. .. .. ..$ : 'data.frame':  2 obs. of  2 variables:
##   .. .. .. .. ..$ allocation : int [1:2] 5 40
##   .. .. .. .. ..$ livetype_code: chr [1:2] "3" "6"
##   ..$ season_name: chr [1:2] "Dry season" "Wet season"
## $ feed_items      : 'data.frame':  4 obs. of  64 variables:
##   ..$ ammonia      : int [1:4] 14 0 0 8
##   ..$ ammonium_nitrate : int [1:4] 11 0 5 0
##   ..$ ammonium_sulfate : int [1:4] 12 6 0 0
##   ..$ c_factor      : num [1:4] 0.05 0.117 0.05 0.027
##   ..$ category      : chr [1:4] "" "legume" "cereal" "grass"
##   ..$ cp_content     : num [1:4] 1.81 16.29 8.9 11
##   ..$ cp_fresh       : num [1:4] 1.61 15.17 7.3 1.65
##   ..$ crop_coefficient : num [1:4] 0 0.633 0.533 0.917
##   ..$ cut_carry_fraction : int [1:4] 2 0 0 0
##   ..$ dap            : int [1:4] 10 0 0 4

```

```

## ..$ de : num [1:4] 0.71 0.433 0.674 0.652
## ..$ dm_content : num [1:4] 88.8 93.1 82 15
## ..$ dry_yield : num [1:4] 5.04 1.16 8.6 6
## ..$ emission_factor : int [1:4] 0 0 0 0
## ..$ energy : int [1:4] 160 567 365 0
## ..$ energy_dm : num [1:4] 397 606 407 0
## ..$ establishment_cost : int [1:4] 0 0 0 20
## ..$ establishment_labour : int [1:4] 0 0 0 6
## ..$ feed_item_code : chr [1:4] "16" "31" "51" "82"
## ..$ feed_item_name : chr [1:4] "Cassava (Manihot esculenta) - tubers" "Groundnut (Arachis h
## ..$ feed_type_code : chr [1:4] "8" "17" "29" "40"
## ..$ feed_type_name : chr [1:4] "Cassava" "Groundnut" "Maize" "Pennisetum purpureum"
## ..$ fraction_as_fertilizer: int [1:4] 7 1 0 0
## ..$ fresh_yield : num [1:4] 12.5 1.22 10 20
## ..$ grassman : chr [1:4] "1" "1" "1" "1"
## ..$ grassman_change_factor: int [1:4] 1 1 1 1
## ..$ harvest_index : num [1:4] 0.5 0.29 0.47 0.9
## ..$ intercrop : int [1:4] 1 0 0 1
## ..$ intercrop_fraction : int [1:4] 1 0 0 2
## ..$ kc_initial : num [1:4] 0 0.15 0.15 0.6
## ..$ kc_late : num [1:4] 0 0.6 0.3 1.05
## ..$ kc_midseason : num [1:4] 0 1.15 1.15 1.1
## ..$ land_cover : chr [1:4] "1" "1" "1" "1"
## ..$ landcover_c_factor : num [1:4] 0.001 0.001 0.001 0.001
## ..$ main_n : num [1:4] 0.004 0.037 0.017 0.023
## ..$ main_product_removal : int [1:4] 4 0 0 0
## ..$ me_content : num [1:4] 10.76 6.56 10.22 9.88
## ..$ me_fresh : num [1:4] 9.56 6.11 8.38 1.48
## ..$ n_fertilizer : int [1:4] 15 0 9 0
## ..$ n_fixation : num [1:4] 0 38.2 0 0
## ..$ n_solutions : int [1:4] 13 0 7 0
## ..$ npk : int [1:4] 9 0 3 0
## ..$ operational_cost : int [1:4] 0 0 0 18
## ..$ operational_labour : num [1:4] 0 0 0.203 0.5
## ..$ residue_burnt : int [1:4] 6 0 0 0
## ..$ residue_dm_content : num [1:4] 0.403 0.935 0.896 0.85
## ..$ residue_dry_yield : num [1:4] 5.04 2.79 3 0
## ..$ residue_fresh_yield : num [1:4] 12.5 2.99 3.5 2.22
## ..$ residue_n : int [1:4] 0 0 0 0
## ..$ residue_n_dm : num [1:4] 0.003 0.012 0.007 0.023
## ..$ residue_removal : int [1:4] 5 0 0 0
## ..$ slope : chr [1:4] "1" "1" "1" "1"
## ..$ slope_length : int [1:4] 3 0 0 0
## ..$ slope_p_factor : num [1:4] 0.11 0.11 0.11 0.11
## ..$ trees_dhb : int [1:4] 0 0 0 0
## ..$ trees_growth : int [1:4] 0 0 0 0
## ..$ trees_ha : int [1:4] 0 0 0 0
## ..$ trees_removal : int [1:4] 0 0 0 0
## ..$ urea : int [1:4] 8 2 0 0
## ..$ usda_value : int [1:4] 11134 16067 20314 0
## ..$ water_content : num [1:4] 59.7 6.5 10.4 0
## ..$ wfp_blue : num [1:4] 0 0 0.002 0
## ..$ wfp_green : num [1:4] 0 0 0.199 0
## ..$ wfp_grey : num [1:4] 0 0 0.002 0

```

```

## $ ferlitizer          : 'data.frame':  1 obs. of  5 variables:
##   ..$ cost            : int 2
##   ..$ fertilizer_code: chr "4"
##   ..$ fertilizer_desc: chr "Ammonium nitrate"
##   ..$ fraction        : int 3
##   ..$ quantity       : int 1
## $ grassland_implevel  : chr "High"
## $ grassland_management : chr "Moderately degraded grassland, tropical montane"
## $ land_oppcost        : int 0
## $ livestock          : 'data.frame':  2 obs. of  53 variables:
##   ..$ annual_growth    : int [1:2] 3 9
##   ..$ annual_milk      : int [1:2] 2 10
##   ..$ birth_interval   : num [1:2] 1.17 0
##   ..$ body_weight      : int [1:2] 600 300
##   ..$ carcass_fraction : num [1:2] 0.45 0.49
##   ..$ cp_grazing       : int [1:2] 0 0
##   ..$ cp_growth        : num [1:2] 0 0.4
##   ..$ cp_lactation     : int [1:2] 0 0
##   ..$ cp_lactmilk      : num [1:2] 0.09 0
##   ..$ cp_maintenance   : num [1:2] 0.6 0.3
##   ..$ cp_pregnancy     : int [1:2] 15 0
##   ..$ distance_to_pasture : int [1:2] 8 4
##   ..$ energy_eggcontent : int [1:2] 0 0
##   ..$ energy_meatcontent : int [1:2] 2200 2200
##   ..$ energy_milkcontent : int [1:2] 970 0
##   ..$ er_grazing       : num [1:2] 2 1.5
##   ..$ er_growth        : int [1:2] 0 50
##   ..$ er_lactation     : int [1:2] 0 0
##   ..$ er_lactmilk      : num [1:2] 5.5 0
##   ..$ er_maintenance   : num [1:2] 60.6 36
##   ..$ er_pregnancy     : int [1:2] 2000 0
##   ..$ fat_content      : int [1:2] 4 0
##   ..$ grazing_displacement : int [1:2] 2 2
##   ..$ herd_composition : int [1:2] 1 11
##   ..$ ipcc_meth_ef_t1   : int [1:2] 68 46
##   ..$ ipcc_meth_ef_t2   : num [1:2] 6.5 6.5
##   ..$ ipcc_meth_exc     : num [1:2] 0.47 0.34
##   ..$ ipcc_meth_man     : int [1:2] 19 1
##   ..$ lactation_length  : int [1:2] 0 0
##   ..$ litter_size      : int [1:2] 0 0
##   ..$ livetype_code     : chr [1:2] "3" "6"
##   ..$ livetype_desc     : chr [1:2] "Cows (high productive)" "Steers/heifers (improved)"
##   ..$ lw_gain          : int [1:2] 0 0
##   ..$ manure_in_field   : int [1:2] 11 1
##   ..$ manure_in_non_roofed_enclosure: int [1:2] 10 2
##   ..$ manure_in_stable  : int [1:2] 9 3
##   ..$ meat_price        : int [1:2] 23 23
##   ..$ meat_product      : chr [1:2] "beef" "beef"
##   ..$ milk_price        : num [1:2] 1.04 1.04
##   ..$ milk_product      : chr [1:2] "cow milk" "cow milk"
##   ..$ n_content         : num [1:2] 0.029 0.029
##   ..$ oneoff_cost       : int [1:2] 6400 3450
##   ..$ oneoff_labour     : int [1:2] 0 0
##   ..$ operational_cost  : int [1:2] 4000 1650

```



```

## ..$ operational_labour      : num [1:2] 50.7 7.6
## ..$ proportion_growth      : int [1:2] 0 0
## ..$ protein_meatcontent     : int [1:2] 26 26
## ..$ protein_milkcontent     : num [1:2] 3.7 0
## ..$ time_in_non_roofed_enclosure : int [1:2] 5 7
## ..$ time_in_offfarm_grazing  : int [1:2] 7 5
## ..$ time_in_onfarm_grazing   : int [1:2] 6 6
## ..$ time_in_stable          : int [1:2] 4 8
## ..$ water_requirement       : int [1:2] 160 100
## $ manure_onfarm_fraction    : int 1
## $ manure_sales_fraction     : int 2
## $ manureman_pasture         : chr "Pasture / range / paddock"
## $ manureman_stable          : chr "Solid storage"
## $ manureman_yard            : chr "Dry slot"
## $ purchased_bedding         : int 6
## $ purchased_compost         : int 4
## $ purchased_manure          : int 3
## $ purchased_organic_n       : int 5
## $ region                    : chr "ASIA"
## $ seasons                   : 'data.frame': 2 obs. of 2 variables:
## ..$ season_length: int [1:2] 200 165
## ..$ season_name : chr [1:2] "Dry season" "Wet season"
## $ txt_annual_prec          : int 1
## $ txt_arable_tograssland   : int 16
## $ txt_cropland_ormatter_ipcc : num 1.11
## $ txt_cropland_system_ipcc : num 0.69
## $ txt_cropland_tillage_ipcc : num 1.15
## $ txt_et                   : int 9
## $ txt_grassland_implevel_ipcc : num 1.11
## $ txt_grassland_management_ipcc: num 0.96
## $ txt_grassland_toarable   : int 15
## $ txt_rain_length          : int 2
## $ txt_soil_bulk            : int 7
## $ txt_soil_c                : int 5
## $ txt_soil_clay            : int 6
## $ txt_soil_depth           : int 8
## $ txt_soil_k_value         : num 0.25
## $ txt_soil_n                : int 4
## $ waste_consume_milk        : int 0
## $ waste_distribution_meat   : int 0
## $ waste_distribution_milk   : int 0
## $ waste_processing_meat     : int 0
## $ waste_processing_milk     : int 0
## $ waste_production_meat     : int 0
## $ waste_production_milk     : int 0

```

Explore cleaned.sqlite file

This sqlite database object is found in the `qlands/cleaned-desktop` github it contains several tables of look-up values.

```
conn <- dbConnect(RSQLite::SQLite(), "cleaned.sqlite")
tables <- dbListTables(conn)
print(tables)
```

Load input json file into R

```
## [1] "lkp_climate"          "lkp_climate2"         "lkp_croplandsystem"
## [4] "lkp_feeditem"         "lkp_feedtype"         "lkp_grassinputlevel"
## [7] "lkp_grasslandman"     "lkp_landcover"        "lkp_livetype"
## [10] "lkp_manureman"        "lkp_organicmatter"    "lkp_orgfertilizer"
## [13] "lkp_region"          "lkp_slope"            "lkp_soil"
## [16] "lkp_tillageregime"
```

```
sq_tables<-lapply(tables,FUN=function(TAB){
  query<-paste0("SELECT * FROM ",TAB)
  data <- dbGetQuery(conn,query)
  data
})
names(sq_tables)<-tables
```

Climate

climate_code	climate_desc
Temperate	Temperate
Warm	Warm

Climate2

climate_code	climate2_code	climate2_desc
Temperate	Warm Temperate Moist	Warm Temperate Moist
Temperate	Warm Temperate Dry	Warm Temperate Dry
Warm	Tropical Montane	Tropical Montane
Warm	Tropical Wet	Tropical Wet
Warm	Tropical Moist	Tropical Moist
Warm	Tropical Dry	Tropical Dry

Region

region_code	region_desc
AFRICA	AFRICA
LATIN	LATIN AMERICA
ASIA	ASIA

Cropland system

sys_code	sys_desc	change_factor
1	Long term cultivated, temperate/boreal, dry	0.80
2	Long term cultivated, temperate/boreal, moist	0.69
3	Long term cultivated, tropical, dry	0.58
4	Long term cultivated, tropical, moist/wet	0.48
5	Long term cultivated, tropical montane, all	0.64
6	Paddy rice	1.10
7	Perennial/tree crop	1.00
8	Set aside (< 20 years), temperate/boreal and tropical, dry	0.93
9	Set aside (< 20 years), temperate/boreal and tropical, moist/wet	0.82
10	Set aside (< 20 years),tropical montane, all	0.88

Feeds Item

##	feed_type_code	feed_item_code
## 1	1	1
## 2	34	2
## 3	34	3
## 4	21	4
## 5	23	5
## 6	22	6
## 7	22	7
## 8	11	8
## 9	11	9
## 10	50	10
## 11	5	11
## 12	6	12
## 13	7	13
## 14	8	14
## 15	8	15
## 16	8	16
## 17	43	17
## 18	9	18
## 19	9	19
## 20	9	20
## 21	9	21
## 22	10	22
## 23	11	23
## 24	12	24
## 25	49	25
## 26	54	26
## 27	54	27
## 28	15	28
## 29	17	29
## 30	17	30
## 31	17	31
## 32	19	32
## 33	24	33
## 34	25	34
## 35	28	35
## 36	28	36
## 37	28	37

## 38	26	38
## 39	26	39
## 40	26	40
## 41	27	41
## 42	32	42
## 43	32	43
## 44	32	44
## 45	<NA>	45
## 46	<NA>	46
## 47	<NA>	47
## 48	43	48
## 49	29	49
## 50	30	50
## 51	29	51
## 52	31	52
## 53	29	53
## 54	29	54
## 55	33	55
## 56	<NA>	56
## 57	<NA>	57
## 58	<NA>	58
## 59	<NA>	59
## 60	<NA>	60
## 61	35	61
## 62	36	62
## 63	36	63
## 64	36	64
## 65	2	65
## 66	3	66
## 67	3	67
## 68	3	68
## 69	2	69
## 70	43	70
## 71	3	71
## 72	2	72
## 73	<NA>	73
## 74	<NA>	74
## 75	<NA>	75
## 76	38	76
## 77	38	77
## 78	39	78
## 79	<NA>	79
## 80	<NA>	80
## 81	<NA>	81
## 82	40	82
## 83	41	83
## 84	42	84
## 85	42	85
## 86	42	86
## 87	<NA>	87
## 88	<NA>	88
## 89	<NA>	89
## 90	<NA>	90
## 91	43	91

## 92	<NA>	92
## 93	<NA>	93
## 94	<NA>	94
## 95	<NA>	95
## 96	<NA>	96
## 97	43	97
## 98	45	98
## 99	45	99
## 100	<NA>	100
## 101	<NA>	101
## 102	<NA>	102
## 103	46	103
## 104	47	104
## 105	46	105
## 106	47	106
## 107	16	107
## 108	16	108
## 109	16	109
## 110	16	110
## 111	<NA>	111
## 112	<NA>	112
## 113	4	113
## 114	43	114
## 115	48	115
## 116	48	116
## 117	43	117
## 118	48	118
## 119	48	119
## 120	20	120
## 121	43	121
## 122	<NA>	122
## 123	<NA>	123
## 124	<NA>	124
## 125	<NA>	125
## 126	14	126
## 127	<NA>	127
## 128	53	128
## 129	52	129
## 130	51	130
## 131	51	131
## 132	<NA>	132
##		
	feed_item_name	dm_content me_content
## 1	Andropogon gayanus (forage)	27.800 7.100000
## 2	Banana (fruit)	22.000 12.300000
## 3	Banana leaves	16.000 10.000000
## 4	Barley (forage)	34.000 8.690000
## 5	Barley (grains) IP	87.100 12.400000
## 6	Barley (grains) OFC	87.100 12.400000
## 7	Barley (straw)	87.000 5.880000
## 8	Bermuda grass (Cynodon dactylon) - forage	30.300 9.671508
## 9	Bermuda grass (Cynodon dactylon) - hay	93.000 7.410636
## 10	Berseem clover	11.000 12.390000
## 11	Brachiaria brizantha (forage)	26.000 7.254795
## 12	Brachiaria hybrid (forage)	26.000 7.254795

## 13	Canavalia brasiliensis (forage)	30.000	12.100000
## 14	Cassava (Manihot esculenta) - crop residue	16.100	10.006452
## 15	Cassava (Manihot esculenta) - fresh peelings	27.900	4.312400
## 16	Cassava (Manihot esculenta) - tubers	88.840	10.760000
## 17	Concentrate (commercial)	90.000	12.100000
## 18	Cowpea (Vigna unguiculata) - crop residue	90.000	9.880848
## 19	Cowpea (Vigna unguiculata) - forage	12.280	10.450000
## 20	Cowpea (Vigna unguiculata) - grain	89.830	13.210000
## 21	Cowpea (Vigna unguiculata) - meal	90.170	14.000000
## 22	Cratylia argentea (forage)	30.000	9.400000
## 23	Cynodon nlemfuensis (forage)	30.300	9.671508
## 24	Dichanthium aristatum (forage)	33.000	7.250000
## 25	Digitaria swazilandensis (forage)	24.000	9.700000
## 26	Fava bean (grain)	86.600	13.300000
## 27	Fava bean (straw)	89.700	6.400000
## 28	Gliricidia sepium (forage)	30.000	11.500000
## 29	Groundnut (Arachis hypogaea) - crop residue	89.530	7.990000
## 30	Groundnut (Arachis hypogaea) - Kernel	92.700	21.185200
## 31	Groundnut (Arachis hypogaea) - seed hulls	93.120	6.560000
## 32	Guazuma ulmifolia (forage)	30.000	11.000000
## 33	Hyparrhenia rufa (forage)	26.000	6.129315
## 34	Ischaemum ciliare (forage)	24.000	6.003836
## 35	Italian ryegrass (forage)	19.000	8.700000
## 36	Italian ryegrass (hay)	85.000	8.360000
## 37	Italian ryegrass (silage)	33.500	9.070000
## 38	Lablab (Lablab purpureus) - forage	18.300	11.430000
## 39	Lablab (Lablab purpureus) - hay	90.000	9.290000
## 40	Lablab (Lablab purpureus) - silage	27.830	7.440000
## 41	Leucaena (Leucaena leucocephala) - forage	26.200	9.500000
## 42	Lucerne (Medicago sativa) - forage	21.000	10.080000
## 43	Lucerne (Medicago sativa) - hay	85.000	8.360000
## 44	Lucerne (Medicago sativa) - silage	44.100	9.545904
## 45	Lupins (Lupinus angustifolius) - crop residue	93.850	5.570000
## 46	Lupins (Lupinus angustifolius) - grain	90.000	19.000000
## 47	Lupins (Lupinus angustifolius) - pods	91.890	7.360000
## 48	Maize (Zea mays) - bought stover	87.000	9.127224
## 49	Maize (Zea mays) - cobs ground	90.100	7.578108
## 50	Maize (Zea mays) - cracked grains IP	89.000	13.020948
## 51	Maize (Zea mays) - forage	82.000	10.215792
## 52	Maize (Zea mays) - silage	30.000	10.790000
## 53	Maize (Zea mays) - stover	87.000	9.127224
## 54	Maize (Zea mays) - whole grain	90.000	15.000000
## 55	Moringa oleifera (forage)	26.200	10.600000
## 56	Mucuna (Mucuna pruriens) - forage	20.967	10.800000
## 57	Mucuna (Mucuna pruriens) - green fodder	20.967	10.800000
## 58	Mucuna (Mucuna pruriens) - hay	90.600	10.890000
## 59	Mucuna (Mucuna pruriens) - seed	92.370	14.193000
## 60	Mulberry (Morus alba)	28.400	10.000000
## 61	N/A	0.000	0.000000
## 62	Naturally occurring pasture - grazing	60.000	5.000000
## 63	Naturally occurring pasture - grazing OFR	60.000	5.000000
## 64	Naturally occurring pasture - green fodder	60.000	5.000000
## 65	Oats (Avena sativa) - grain IP	89.000	12.267324
## 66	Oats (Avena sativa) - green fodder	31.000	8.360000

## 67	Oats (<i>Avena sativa</i>) - hay	85.000	7.480000
## 68	Oats (<i>Avena sativa</i>) - hay OFR	85.000	7.480000
## 69	Oats (<i>Avena sativa</i>) - hulls	92.400	5.317236
## 70	Oats (<i>Avena sativa</i>) - meal/cereal by-product	91.000	15.281820
## 71	Oats (<i>Avena sativa</i>) - silage	36.400	8.917884
## 72	Oats (<i>Avena sativa</i>) - straw	88.000	6.470000
## 73	Orchard grass (<i>Dactylis glomerata</i>) - green fodder	27.400	8.624808
## 74	Orchard grass (<i>Dactylis glomerata</i>) - hay	90.600	8.164260
## 75	Orchard tree (<i>Bauhinia variegata</i>) - green leaves	42.850	7.494370
## 76	Panicum maximum (forage)	26.000	7.543014
## 77	Panicum maximum (green fodder)	26.000	7.580000
## 78	Paspalum notatum (forage)	28.000	7.543014
## 79	Pearl Millet (<i>Pennisetum glaucum</i>) - crop residue	86.000	9.462168
## 80	Pearl Millet (<i>Pennisetum glaucum</i>) - grain	90.340	12.430000
## 81	Pearl Millet (<i>Pennisetum glaucum</i>) - green fodder	25.000	8.550000
## 82	Pennisetum purpureum - forage	15.000	9.880848
## 83	Pennisetum purpureum - silage	19.500	7.500000
## 84	Pigeon Pea (<i>Cajanus cajan</i>) - crop residue	91.690	7.996788
## 85	Pigeon Pea (<i>Cajanus cajan</i>) - meal	89.400	11.080000
## 86	Pigeon Pea (<i>Cajanus cajan</i>) - seed	68.700	11.500000
## 87	Pineapple (<i>Ananas comosus</i>) - crop residue	20.600	11.513700
## 88	Pineapple (<i>Ananas comosus</i>) - leaf silage	35.120	8.220000
## 89	Potato (<i>Solanum tuberosum</i>) - peelings	15.440	10.250000
## 90	Potato (<i>Solanum tuberosum</i>) - tuber	16.340	12.990000
## 91	Poultry litter	78.700	8.164260
## 92	Pumpkin (<i>Cucurbita maxima</i>) - fruit	22.730	9.910000
## 93	Red clover (<i>Trifolium pratense</i>) - green fodder	19.600	10.425132
## 94	Red clover (<i>Trifolium pratense</i>) - hay	88.400	8.331732
## 95	Rhodes grass (<i>Chloris gayana</i>) - forage	28.060	7.540000
## 96	Rhodes grass (<i>Chloris gayana</i>) - hay	92.400	9.100000
## 97	Rice (<i>Oryza sativa</i>) - bran (with germs)	91.000	10.425132
## 98	Rice (<i>Oryza sativa</i>) - hulls	92.000	1.423512
## 99	Rice (<i>Oryza sativa</i>) - straw	91.880	5.640000
## 100	Sesbania (<i>Sesbania sesban</i>) - green fodder	28.900	8.540000
## 101	Smooth Broome (<i>Bromus inermis</i>) - green fodder	26.100	11.220624
## 102	Smooth Broome (<i>Bromus inermis</i>) - hay	92.600	8.038656
## 103	Sorghum (<i>Sorghum bicolor</i>) - crop residue	85.000	7.033824
## 104	Sorghum (<i>Sorghum bicolor</i>) - forage	27.000	8.570000
## 105	Sorghum (<i>Sorghum bicolor</i>) - grain	90.000	12.392928
## 106	Sorghum (<i>Sorghum bicolor</i>) - silage	30.000	8.570000
## 107	Soybean (<i>Glycine max</i>) - crop residue	88.000	6.322068
## 108	Soybean (<i>Glycine max</i>) - meal	89.000	13.188420
## 109	Soybean (<i>Glycine max</i>) - seed coats	90.300	12.476664
## 110	Soybean (<i>Glycine max</i>) - whole seed IP	86.400	14.235120
## 111	Stipa (grazing) OF	72.000	5.600000
## 112	Stylo (<i>Stylosanthes guianensis</i>) - forage	19.420	9.545904
## 113	Sugar beet (pulp) OFR	89.000	11.400000
## 114	Sugarcane (<i>Saccharum officinarum</i>) - BOUGHT	29.000	6.900000
## 115	Sugarcane (<i>Saccharum officinarum</i>) - crop residue	96.270	7.440000
## 116	Sugarcane (<i>Saccharum officinarum</i>) - forage	23.200	9.000000
## 117	Sugarcane (<i>Saccharum officinarum</i>) - molasses	74.300	10.885680
## 118	Sugarcane (<i>Saccharum officinarum</i>) - tops (forage)	29.000	6.900000
## 119	Sugarcane (<i>Saccharum officinarum</i>) - tops (hay)	85.000	7.000000
## 120	Sulla	12.300	9.700000

## 121	Sunflower (<i>Helianthus annuus</i>) - seed cake	94.900	9.127224
## 122	Sweet potato (<i>Ipomoea batatas</i>) - leaves	10.800	10.010000
## 123	Sweet potato (<i>Ipomoea batatas</i>) - tubers (fresh)	59.000	13.580000
## 124	Sweet potato (<i>Ipomoea batatas</i>) - tubers meal (dried)	87.100	11.350000
## 125	Sweet potato (<i>Ipomoea batatas</i>) - vines	10.800	10.010000
## 126	Tall fescue	21.000	9.110000
## 127	Tomato (<i>Lycopersicon esculentum</i>) - waste fruits	44.080	7.430000
## 128	Wheat (bran) IP	87.000	11.000000
## 129	Wheat (bran) OFC	87.000	11.000000
## 130	Wheat (straw)	88.000	5.630000
## 131	Wheat (straw) OFR	88.000	5.630000
## 132	White sweet clover (<i>Melilotus alba</i>) - green fodder	15.000	9.100000
##	cp_content establishment_cost operational_cost establishment_labour		
## 1	6.254795	0.0	18
## 2	5.200000	0.0	0
## 3	9.500000	0.0	0
## 4	4.500000	0.0	0
## 5	11.800000	0.0	0
## 6	11.800000	0.0	0
## 7	0.300000	0.0	0
## 8	12.600000	0.0	18
## 9	7.600000	0.0	18
## 10	26.000000	0.0	0
## 11	7.254795	20.0	31
## 12	8.254795	20.0	31
## 13	22.000000	100.0	6
## 14	19.940000	0.0	0
## 15	5.450000	0.0	0
## 16	1.810000	0.0	0
## 17	16.000000	0.3	0
## 18	18.400000	0.0	0
## 19	20.560000	100.0	6
## 20	23.880000	0.0	0
## 21	22.530000	0.0	0
## 22	24.000000	0.0	18
## 23	12.600000	100.0	6
## 24	8.000000	0.0	18
## 25	9.900000	20.0	31
## 26	29.000000	0.0	0
## 27	7.400000	0.0	0
## 28	22.300000	100.0	6
## 29	6.520000	0.0	0
## 30	33.200000	0.0	0
## 31	16.290000	0.0	0
## 32	15.000000	0.0	0
## 33	6.000000	0.0	18
## 34	6.000000	0.0	18
## 35	7.000000	0.0	0
## 36	6.010000	0.0	0
## 37	5.300000	0.0	0
## 38	22.940000	100.0	6
## 39	16.600000	50.0	10
## 40	17.510000	50.0	10
## 41	19.930000	100.0	6

## 42	19.700000	0.0	0	0
## 43	12.500000	0.0	0	0
## 44	19.500000	0.0	0	0
## 45	6.440000	0.0	0	0
## 46	30.000000	0.0	0	0
## 47	5.540000	0.0	0	0
## 48	5.900000	0.0	0	0
## 49	2.800000	0.0	0	0
## 50	10.000000	0.0	0	0
## 51	8.900000	0.0	0	0
## 52	4.400000	1680.0	0	0
## 53	5.900000	0.0	0	0
## 54	9.000000	0.0	0	0
## 55	24.300000	0.0	0	0
## 56	15.770000	0.0	0	0
## 57	15.770000	0.0	0	0
## 58	14.800000	0.0	0	0
## 59	27.300000	0.0	0	0
## 60	19.400000	0.0	0	0
## 61	0.000000	0.0	0	0
## 62	6.000000	20.0	18	6
## 63	6.000000	20.0	18	6
## 64	6.000000	840.0	18	100
## 65	13.600000	0.0	0	0
## 66	4.000000	0.0	0	0
## 67	3.500000	0.0	0	0
## 68	3.500000	0.0	0	0
## 69	4.100000	0.0	0	0
## 70	16.200000	0.0	0	0
## 71	12.700000	0.0	0	0
## 72	0.000000	0.0	0	0
## 73	10.100000	0.0	0	0
## 74	8.400000	0.0	0	0
## 75	16.150000	0.0	0	0
## 76	9.882192	20.0	31	8
## 77	10.000000	20.0	31	8
## 78	8.254795	20.0	31	8
## 79	6.400000	0.0	0	0
## 80	13.880000	0.0	0	0
## 81	13.810000	0.0	0	0
## 82	11.000000	20.0	18	6
## 83	6.500000	20.0	18	6
## 84	16.300000	0.0	0	0
## 85	19.390000	0.0	0	0
## 86	21.600000	0.0	0	0
## 87	9.100000	0.0	0	0
## 88	7.940000	0.0	0	0
## 89	6.960000	0.0	0	0
## 90	14.130000	0.0	0	0
## 91	17.780000	0.0	0	0
## 92	15.440000	0.0	0	0
## 93	20.800000	0.0	0	0
## 94	15.000000	0.0	0	0
## 95	14.100000	0.0	0	0

## 96	7.700000	0.0	0	0
## 97	14.000000	0.0	0	0
## 98	3.100000	0.0	0	0
## 99	3.850000	0.0	0	0
## 100	21.300000	0.0	0	0
## 101	21.300000	0.0	0	0
## 102	6.000000	0.0	0	0
## 103	4.900000	0.0	0	0
## 104	3.700000	200.0	0	10
## 105	12.600000	0.0	0	0
## 106	3.700000	0.0	0	0
## 107	5.200000	0.0	0	0
## 108	49.600000	0.0	0	0
## 109	12.200000	0.0	0	0
## 110	40.300000	0.0	0	0
## 111	5.000000	0.0	0	0
## 112	18.690000	0.0	0	0
## 113	8.900000	0.0	0	0
## 114	5.900000	0.0	0	0
## 115	3.690000	0.0	0	0
## 116	4.300000	200.0	18	200
## 117	5.800000	0.3	0	0
## 118	5.900000	100.0	0	100
## 119	5.500000	100.0	0	100
## 120	20.200000	0.0	0	0
## 121	17.900000	0.0	0	0
## 122	19.400000	0.0	0	0
## 123	5.100000	0.0	0	0
## 124	4.600000	0.0	0	0
## 125	19.400000	0.0	0	0
## 126	8.900000	0.0	0	0
## 127	21.000000	0.0	0	0
## 128	17.300000	0.0	0	0
## 129	17.300000	0.0	0	0
## 130	4.200000	0.0	0	0
## 131	4.200000	0.0	0	0
## 132	22.500000	0.0	0	0
##	operational_labour	me_fresh	cp_fresh	de wfp_green wfp_blue
## 1	0.203	2.528124	1.738833	0.46860000 0.1990 0.0020
## 2	0.970	2.706000	1.144000	0.81180000 0.6600 0.0970
## 3	0.970	1.600000	1.520000	0.66000000 0.6600 0.0970
## 4	0.203	2.954600	1.530000	0.57354000 0.1990 0.0020
## 5	1.423	10.800400	10.277800	0.81840000 1.2130 0.0790
## 6	1.423	10.800400	10.277800	0.81840000 1.2130 0.0790
## 7	1.423	5.115600	0.261000	0.38808000 1.2130 0.0790
## 8	0.203	2.930467	3.817800	0.63831953 0.1990 0.0020
## 9	0.203	6.891891	7.068000	0.48910198 0.1990 0.0020
## 10	0.203	1.362900	2.860000	0.81774000 0.1990 0.0020
## 11	0.203	1.886247	1.886247	0.47881644 0.1990 0.0020
## 12	0.203	1.886247	2.146247	0.47881644 0.1990 0.0020
## 13	0.203	3.630000	6.600000	0.79860000 0.1990 0.0020
## 14	0.000	1.611039	3.210340	0.66042583 0.0000 0.0000
## 15	0.000	1.203160	1.520550	0.28461840 0.0000 0.0000
## 16	0.000	9.559184	1.608004	0.71016000 0.0000 0.0000

## 17	0.000	10.890000	14.400000	0.79860000	0.0000	0.0000
## 18	0.000	8.892763	16.560000	0.65213597	0.0000	0.0000
## 19	0.203	1.283260	2.524768	0.68970000	0.1990	0.0020
## 20	0.000	11.866543	21.451404	0.87186000	0.0000	0.0000
## 21	0.000	12.623800	20.315301	0.92400000	0.0000	0.0000
## 22	0.000	2.820000	7.200000	0.62040000	0.0000	0.0000
## 23	0.203	2.930467	3.817800	0.63831953	0.1990	0.0020
## 24	0.203	2.392500	2.640000	0.47850000	0.1990	0.0020
## 25	0.203	2.328000	2.376000	0.64020000	0.1990	0.0020
## 26	0.203	11.517800	25.114000	0.87780000	0.1990	0.0020
## 27	0.203	5.740800	6.637800	0.42240000	0.1990	0.0020
## 28	0.000	3.450000	6.690000	0.75900000	0.0000	0.0000
## 29	0.203	7.153447	5.837356	0.52734000	0.1990	0.0020
## 30	0.000	19.638680	30.776400	1.39822320	0.0000	0.0000
## 31	0.000	6.108672	15.169248	0.43296000	0.0000	0.0000
## 32	0.000	3.300000	4.500000	0.72600000	0.0000	0.0000
## 33	0.203	1.593622	1.560000	0.40453479	0.1990	0.0020
## 34	0.203	1.440921	1.440000	0.39625315	0.1990	0.0020
## 35	0.203	1.653000	1.330000	0.57420000	0.1990	0.0020
## 36	0.203	7.106000	5.108500	0.55176000	0.1990	0.0020
## 37	0.203	3.038450	1.775500	0.59862000	0.1990	0.0020
## 38	0.203	2.091690	4.198020	0.75438000	0.1990	0.0020
## 39	0.203	8.361000	14.940000	0.61314000	0.1990	0.0020
## 40	0.203	2.070552	4.873033	0.49104000	0.1990	0.0020
## 41	0.000	2.489000	5.221660	0.62700000	0.0000	0.0000
## 42	0.378	2.116800	4.137000	0.66528000	0.2070	0.1710
## 43	0.378	7.106000	10.625000	0.55176000	0.2070	0.1710
## 44	0.378	4.209744	8.599500	0.63002966	0.2070	0.1710
## 45	0.000	5.227445	6.043940	0.36762000	0.0000	0.0000
## 46	0.000	17.100000	27.000000	1.25400000	0.0000	0.0000
## 47	0.000	6.763104	5.090706	0.48576000	0.0000	0.0000
## 48	1.222	7.940685	5.133000	0.60239678	0.9470	0.0810
## 49	1.222	6.827875	2.522800	0.50015513	0.9470	0.0810
## 50	1.222	11.588644	8.900000	0.85938257	0.9470	0.0810
## 51	0.203	8.376949	7.298000	0.67424227	0.1990	0.0020
## 52	0.203	3.237000	1.320000	0.71214000	0.1990	0.0020
## 53	1.222	7.940685	5.133000	0.60239678	0.9470	0.0810
## 54	1.222	13.500000	8.100000	0.99000000	0.9470	0.0810
## 55	0.000	2.777200	6.366600	0.69960000	0.0000	0.0000
## 56	0.203	2.264436	3.306496	0.71280000	0.1990	0.0020
## 57	0.203	2.264436	3.306496	0.71280000	0.1990	0.0020
## 58	0.203	9.866340	13.408800	0.71874000	0.1990	0.0020
## 59	0.000	13.110074	25.217010	0.93673800	0.0000	0.0000
## 60	0.203	2.840000	5.509600	0.66000000	0.1990	0.0020
## 61	0.000	0.000000	0.000000	0.00000000	0.0000	0.0000
## 62	0.203	3.000000	3.600000	0.33000000	0.1990	0.0020
## 63	0.203	3.000000	3.600000	0.33000000	0.1990	0.0020
## 64	0.203	3.000000	3.600000	0.33000000	0.1990	0.0020
## 65	1.788	10.917918	12.104000	0.80964338	1.4790	0.1810
## 66	0.400	2.591600	1.240000	0.55176000	0.3920	0.0040
## 67	0.400	6.358000	2.975000	0.49368000	0.3920	0.0040
## 68	0.400	6.358000	2.975000	0.49368000	0.3920	0.0040
## 69	0.000	4.913126	3.788400	0.35093758	0.0000	0.0000
## 70	0.000	13.906456	14.742000	1.00860012	0.0000	0.0000

## 71	0.203	3.246110	4.622800	0.58858034	0.1990	0.0020
## 72	1.788	5.693600	0.000000	0.42702000	1.4790	0.1810
## 73	0.000	2.363197	2.767400	0.56923733	0.0000	0.0000
## 74	0.000	7.396820	7.610400	0.53884116	0.0000	0.0000
## 75	0.000	3.211338	6.920275	0.49462842	0.0000	0.0000
## 76	0.203	1.961184	2.569370	0.49783890	0.1990	0.0020
## 77	0.203	1.970800	2.600000	0.50028000	0.1990	0.0020
## 78	0.203	2.112044	2.311342	0.49783890	0.1990	0.0020
## 79	1.644	8.137464	5.504000	0.62450309	0.0000	0.0000
## 80	0.000	11.229262	12.539192	0.82038000	0.0000	0.0000
## 81	0.203	2.137500	3.452500	0.56430000	0.1990	0.0020
## 82	0.500	1.482127	1.650000	0.65213597	0.0000	0.0000
## 83	0.500	1.462500	1.267500	0.49500000	0.0000	0.0000
## 84	0.000	7.332255	14.945470	0.52778801	0.0000	0.0000
## 85	0.000	9.905520	17.334660	0.73128000	0.0000	0.0000
## 86	0.000	7.900500	14.839200	0.75900000	0.0000	0.0000
## 87	0.000	2.371822	1.874600	0.75990420	0.0000	0.0000
## 88	0.000	2.886864	2.788528	0.54252000	0.0000	0.0000
## 89	0.000	1.582600	1.074624	0.67650000	0.0000	0.0000
## 90	0.000	2.122566	2.308842	0.85734000	0.0000	0.0000
## 91	0.000	6.425273	13.992860	0.53884116	0.0000	0.0000
## 92	0.000	2.252543	3.509512	0.65406000	0.0000	0.0000
## 93	0.203	2.043326	4.076800	0.68805871	0.1990	0.0020
## 94	0.203	7.365251	13.260000	0.54989431	0.1990	0.0020
## 95	0.203	2.115724	3.956460	0.49764000	0.1990	0.0020
## 96	0.203	8.408400	7.114800	0.60060000	0.1990	0.0020
## 97	0.000	9.486870	12.740000	0.68805871	0.0000	0.0000
## 98	0.000	1.309631	2.852000	0.09395179	0.0000	0.0000
## 99	1.644	5.182032	3.537380	0.37224000	0.0000	0.0000
## 100	0.000	2.468060	6.155700	0.56364000	0.0000	0.0000
## 101	0.000	2.928583	5.559300	0.74056118	0.0000	0.0000
## 102	0.000	7.443795	5.556000	0.53055130	0.0000	0.0000
## 103	3.048	5.978750	4.165000	0.46423238	2.8570	0.1030
## 104	0.203	3.626526	0.999000	0.56562000	0.1990	0.0020
## 105	0.000	11.153635	11.340000	0.81793325	0.0000	0.0000
## 106	0.203	2.571000	1.110000	0.56562000	0.1990	0.0020
## 107	0.000	5.563420	4.576000	0.41725649	0.0000	0.0000
## 108	0.000	11.737694	44.144000	0.87043572	0.0000	0.0000
## 109	0.000	11.266428	11.016600	0.82345982	0.0000	0.0000
## 110	2.145	12.299144	34.819200	0.93951792	2.0370	0.0700
## 111	0.000	4.032000	3.600000	0.36960000	0.0000	0.0000
## 112	0.203	1.853815	3.629598	0.63002966	0.1990	0.0020
## 113	0.033	10.146000	7.921000	0.75240000	0.0205	0.0065
## 114	0.000	2.001000	1.711000	0.45540000	0.0000	0.0000
## 115	0.210	7.162488	3.552363	0.49104000	0.1390	0.0570
## 116	0.197	2.088000	0.997600	0.59400000	0.0000	0.0000
## 117	0.000	8.088060	4.309400	0.71845488	0.0000	0.0000
## 118	0.210	2.001000	1.711000	0.45540000	0.1390	0.0570
## 119	0.210	5.950000	4.675000	0.46200000	0.1390	0.0570
## 120	0.203	1.193100	2.484600	0.64020000	0.1990	0.0020
## 121	0.000	8.661736	16.987100	0.60239678	0.0000	0.0000
## 122	0.000	1.081080	2.095200	0.66066000	0.0000	0.0000
## 123	0.000	8.012200	3.009000	0.89628000	0.0000	0.0000
## 124	0.000	9.885850	4.006600	0.74910000	0.0000	0.0000

## 125	0.000	1.081080	2.095200	0.66066000	0.0000	0.0000
## 126	0.203	1.913100	1.869000	0.60126000	0.1990	0.0020
## 127	0.000	3.275144	9.256800	0.49038000	0.0000	0.0000
## 128	1.828	9.570000	15.051000	0.72600000	1.2780	0.3420
## 129	1.828	9.570000	15.051000	0.72600000	1.2780	0.3420
## 130	1.828	4.954400	3.696000	0.37158000	1.2780	0.3420
## 131	1.828	4.954400	3.696000	0.37158000	1.2780	0.3420
## 132	0.203	1.365000	3.375000	0.60060000	0.1990	0.0020
##	wfp_grey	emission_factor		associated_crop		
## 1	0.00200	0.00		Andropogon gayanus		
## 2	0.03300	0.00		Musa spp.		
## 3	0.03300	0.00		Musa spp.		
## 4	0.00200	0.00		Hordeum vulgare (forage)		
## 5	0.13100	0.50		Hordeum vulgare (IP)		
## 6	0.13100	0.50		Hordeum vulgare (grain)		
## 7	0.13100	0.00		Hordeum vulgare (grain)		
## 8	0.00200	0.00		Cynodon nlemfuensis		
## 9	0.00200	0.00		Cynodon nlemfuensis		
## 10	0.00200	0.00		Trifolium alexandrinum		
## 11	0.00200	0.00		Brachiaria brizantha		
## 12	0.00200	0.00		Brachiaria hybrid		
## 13	0.00200	0.00		Canavalia brasiliensis		
## 14	0.00000	0.00		Cassava		
## 15	0.00000	0.00		Cassava		
## 16	0.00000	0.00		Cassava		
## 17	0.00000	0.00		Purchased		
## 18	0.00000	0.00		Cowpea		
## 19	0.00200	0.00		Cowpea		
## 20	0.00000	0.00		Cowpea		
## 21	0.00000	0.00		Cowpea		
## 22	0.00000	0.00		Cratylia		
## 23	0.00200	0.00		Cynodon nlemfuensis		
## 24	0.00200	0.00		Dichanthium aristatum		
## 25	0.00200	0.00		Swazi		
## 26	0.00200	0.00		Vicia faba (grain)		
## 27	0.00200	0.00		Vicia faba (grain)		
## 28	0.00000	0.00		Gliricidia		
## 29	0.00200	0.00		Groundnut		
## 30	0.00000	0.00		Groundnut		
## 31	0.00000	0.00		Groundnut		
## 32	0.00000	0.00		Guazuma ulmifolia		
## 33	0.00200	0.00		Hyparrhenia rufa		
## 34	0.00200	0.00		Ischaemum ciliare		
## 35	0.00200	0.00		Lolium multiflorum		
## 36	0.00200	0.00		Lolium multiflorum		
## 37	0.00200	0.00		Lolium multiflorum		
## 38	0.00200	0.00		Lablab		
## 39	0.00200	0.00		Lablab		
## 40	0.00200	0.00		Lablab		
## 41	0.00000	0.00		Leucaena		
## 42	0.00000	0.00		Medicago sativa		
## 43	0.00000	0.00		Medicago sativa		
## 44	0.00000	0.00		Medicago sativa		
## 45	0.00000	0.00		Lupins		

## 46	0.00000	0.00	Lupins
## 47	0.00000	0.00	Lupins
## 48	0.19400	0.00	Purchased
## 49	0.19400	0.00	Maize
## 50	0.19400	0.50	Maize IP
## 51	0.00200	0.00	Maize
## 52	0.00200	0.00	Maize-silage
## 53	0.19400	0.00	Maize
## 54	0.19400	0.50	Maize
## 55	0.00000	0.00	Moringa oleifera
## 56	0.00200	0.00	Mucuna
## 57	0.00200	0.00	Mucuna
## 58	0.00200	0.00	Mucuna
## 59	0.00000	0.00	Mucuna
## 60	0.00200	0.00	Mulberry
## 61	0.00000	0.00	N/A
## 62	0.00200	0.00	Natural pasture
## 63	0.00200	0.00	Natural pasture
## 64	0.00200	0.00	Natural pasture
## 65	0.12800	0.50	Avena sativa
## 66	0.00400	0.00	Avena sativa-forage
## 67	0.00400	0.00	Avena sativa-forage
## 68	0.00400	0.00	Avena sativa-forage
## 69	0.00000	0.00	Avena sativa
## 70	0.00000	0.00	Purchased
## 71	0.00200	0.00	Avena sativa-forage
## 72	0.12800	0.50	Avena sativa
## 73	0.00000	0.00	Orchard grass
## 74	0.00000	0.00	Orchard grass
## 75	0.00000	0.00	Orchard grass
## 76	0.00200	0.00	Panicum maximum
## 77	0.00200	0.00	Panicum maximum
## 78	0.00200	0.00	Paspalum notatum
## 79	0.00000	0.00	Pearl Millet
## 80	0.00000	0.00	Pearl Millet
## 81	0.00200	0.00	Pearl Millet
## 82	0.00000	0.00	Pennisetum purpureum
## 83	0.00000	0.00	Pennisetum purpureum-silage
## 84	0.00000	0.00	Pigeon pea
## 85	0.00000	0.00	Pigeon pea
## 86	0.00000	0.00	Pigeon pea
## 87	0.00000	0.00	Pineapple
## 88	0.00000	0.00	Pineapple
## 89	0.00000	0.00	Potato
## 90	0.00000	0.00	Potato
## 91	0.00000	0.00	Purchased
## 92	0.00000	0.00	Pumpkin
## 93	0.00200	0.00	Red clover
## 94	0.00200	0.00	Red clover
## 95	0.00200	0.00	Rhodes
## 96	0.00200	0.00	Rhodes
## 97	0.00000	0.05	Purchased
## 98	0.00000	0.00	Rice
## 99	0.00000	0.00	Rice

## 100	0.00000	0.00	Sesbania
## 101	0.00000	0.00	Smooth Broome
## 102	0.00000	0.00	Smooth Broome
## 103	0.08700	0.00	Sorghum bicolor (grain)
## 104	0.00200	0.00	Sorghum bicolor (forage/silage)
## 105	0.00000	0.50	Sorghum bicolor (grain)
## 106	0.00200	0.00	Sorghum bicolor (forage/silage)
## 107	0.00000	0.00	Glycine max
## 108	0.00000	0.00	Glycine max
## 109	0.00000	0.00	Glycine max
## 110	0.03700	0.40	Glycine max
## 111	0.00000	0.00	Stipa tenacissima
## 112	0.00200	0.00	Stylo
## 113	0.00625	0.00	Beta vulgaris
## 114	0.00000	0.00	Purchased
## 115	0.01300	0.00	Sugarcane
## 116	0.00000	0.00	Sugarcane
## 117	0.00000	0.00	Purchased
## 118	0.01300	0.00	Sugarcane
## 119	0.01300	0.00	Sugarcane
## 120	0.00200	0.00	Hedysarum coronarium
## 121	0.00000	0.00	Purchased
## 122	0.00000	0.00	Sweet potato
## 123	0.00000	0.00	Sweet potato
## 124	0.00000	0.00	Sweet potato
## 125	0.00000	0.00	Sweet potato
## 126	0.00200	0.00	Fustuca arundinacea
## 127	0.00000	0.00	Tomato
## 128	0.20800	0.05	Triticum IP
## 129	0.20800	0.05	Triticum OF
## 130	0.20800	0.00	Triticum
## 131	0.20800	0.00	Triticum
## 132	0.00200	0.00	White sweet clover

Type

##	feed_type_code	feed_type_name	feedtype_concentrate
## 1	1	Andropogon gayanus	0
## 2	2	Avena sativa	0
## 3	3	Avena sativa-forage	0
## 4	4	Beta vulgaris	0
## 5	5	Brachiaria brizantha	0
## 6	6	Brachiaria hybrid	0
## 7	7	Canavalia brasiliensis	0
## 8	8	Cassava	0
## 9	9	Cowpea	0
## 10	10	Cratylia	0
## 11	11	Cynodon nlemfuensis	0
## 12	12	Dichanthium aristatum	0
## 13	13	Fodder maize	0
## 14	14	Fustuca arundinacea	0
## 15	15	Gliricidia	0
## 16	16	Glycine max	0
## 17	17	Groundnut	0

## 18	18	Guava	0		
## 19	19	Guazuma ulmifolia	0		
## 20	20	Hedysarum coronarium	0		
## 21	21	Hordeum vulgare (forage)	0		
## 22	22	Hordeum vulgare (grain)	0		
## 23	23	Hordeum vulgare (IP)	0		
## 24	24	Hyparrhenia rufa	0		
## 25	25	Ischaemum ciliare	0		
## 26	26	Lablab	0		
## 27	27	Leucaena	0		
## 28	28	Lolium multiflorum	0		
## 29	29	Maize	0		
## 30	30	Maize IP	0		
## 31	31	Maize-silage	0		
## 32	32	Medicago sativa	0		
## 33	33	Moringa oleifera	0		
## 34	34	Musa spp.	0		
## 35	35	N/A	0		
## 36	36	Natural pasture	0		
## 37	37	Natural trees	0		
## 38	38	Panicum maximum	0		
## 39	39	Paspalum notatum	0		
## 40	40	Pennisetum purpureum	0		
## 41	41	Pennisetum purpureum-silage	0		
## 42	42	Pigeon pea	0		
## 43	43	Purchased	0		
## 44	44	Red pepper	0		
## 45	45	Rice	0		
## 46	46	Sorghum bicolor (grain)	0		
## 47	47	Sorghum bicolor (forage/silage)	0		
## 48	48	Sugarcane	0		
## 49	49	Swazi	0		
## 50	50	Trifolium alexandrinum	0		
## 51	51	Triticum	0		
## 52	52	Triticum OF	0		
## 53	53	Triticum IP	0		
## 54	54	Vicia faba (grain)	0		
##	fresh_yield	dm_fraction	dry_yield	harvest_index	residue_fresh_yield
## 1	0.000	0.0000	8.882192	0.0000	0.0000000
## 2	0.400	0.8800	0.352000	0.0000	3.0000000
## 3	35.000	0.2600	9.100000	0.0000	0.0000000
## 4	55.000	0.1900	10.450000	0.0000	2.7500000
## 5	0.000	0.2600	15.646575	0.0000	0.0000000
## 6	0.000	0.2600	13.764384	0.0000	0.0000000
## 7	0.000	0.0000	4.000000	0.0000	0.0000000
## 8	12.500	0.4032	5.040000	0.5000	12.5000000
## 9	0.950	0.8990	0.854050	0.2199	3.3701455
## 10	0.000	0.0000	12.000000	0.0000	0.0000000
## 11	0.000	0.0000	10.000000	0.0000	0.0000000
## 12	0.000	0.0000	10.000000	0.0000	0.0000000
## 13	1.330	0.8000	1.064000	0.4700	1.4997872
## 14	60.000	0.2100	12.600000	0.0000	0.0000000
## 15	0.000	0.0000	5.000000	0.0000	0.0000000
## 16	3.500	0.8870	3.104500	0.0000	0.0000000

## 17	1.220	0.9500	1.159000	0.2900	2.9868966	
## 18	0.000	0.0000	0.000000	0.0000	0.0000000	
## 19	0.000	0.0000	17.000000	0.0000	0.0000000	
## 20	0.000	0.8700	5.000000	0.0000	0.0000000	
## 21	20.000	0.3400	6.800000	0.0000	0.0000000	
## 22	0.700	0.8700	0.609000	0.0000	1.8000000	
## 23	5.000	0.8700	4.350000	0.0000	1.8000000	
## 24	0.000	0.0000	10.136986	0.0000	0.0000000	
## 25	0.000	0.0000	8.000000	0.0000	0.0000000	
## 26	1.843	0.8800	1.621840	0.5000	1.8430000	
## 27	0.000	0.0000	14.000000	0.0000	0.0000000	
## 28	60.000	0.1900	11.400000	0.0000	0.0000000	
## 29	10.000	0.8600	8.600000	0.4700	3.5000000	
## 30	10.000	0.8600	8.600000	0.4700	3.5000000	
## 31	60.000	0.3000	18.000000	1.0000	1.0000000	
## 32	40.000	0.0000	12.000000	0.0000	40.0000000	
## 33	0.000	0.0000	20.000000	0.0000	0.0000000	
## 34	10.000	0.0000	5.000000	0.0000	10.0000000	
## 35	0.000	0.0000	0.000000	0.0000	0.0000000	
## 36	2.000	0.0000	10.000000	0.9500	0.1052632	
## 37	0.000	0.0000	0.000000	0.0000	0.0000000	
## 38	0.000	0.0000	17.019178	0.0000	0.0000000	
## 39	0.000	0.0000	6.882192	0.0000	0.0000000	
## 40	20.000	0.3000	6.000000	0.9000	2.2222222	
## 41	20.000	0.3000	6.000000	0.0000	0.0000000	
## 42	0.950	0.9030	0.857850	0.2600	2.7038462	
## 43	0.000	0.0000	0.000000	0.0000	0.0000000	
## 44	7.800	0.0800	0.624000	0.9000	0.8666667	
## 45	2.000	0.8000	1.600000	0.4200	2.7619048	
## 46	4.300	0.9300	3.999000	0.3000	10.0333333	
## 47	50.000	0.2700	13.500000	0.0000	0.0000000	
## 48	55.000	0.2000	11.000000	0.0000	0.0000000	
## 49	0.000	0.2400	15.000000	0.0000	0.0000000	
## 50	45.000	0.1100	4.950000	0.0000	0.0000000	
## 51	1.800	0.8700	1.566000	0.4500	2.2000000	
## 52	1.800	0.8700	1.566000	0.0000	0.1800000	
## 53	5.000	0.8700	4.350000	0.4500	6.1111111	
## 54	2.000	0.8700	1.740000	0.0000	2.0000000	
##	residue_dm_content	residue_dry_yield	main_n	residue_n	c_factor	energy
## 1	0.0000	0.00000000	0.01040	0	0.000	0
## 2	0.8800	2.64000000	0.01760	0	0.000	0
## 3	0.0000	0.00000000	0.01600	0	0.000	0
## 4	0.0000	2.75000000	0.01250	0	0.000	0
## 5	0.0000	0.00000000	0.01760	0	0.000	0
## 6	0.0000	0.00000000	0.02240	0	0.000	0
## 7	0.0000	0.00000000	0.03520	0	0.000	0
## 8	0.4032	5.04000000	0.00400	0	0.050	160
## 9	0.8805	2.96741313	0.03800	0	0.117	336
## 10	0.0000	0.00000000	0.03840	0	0.000	0
## 11	0.0000	0.00000000	0.02000	0	0.000	0
## 12	0.0000	0.00000000	0.01280	0	0.000	0
## 13	0.8963	1.34425930	0.01700	0	0.050	365
## 14	0.0000	0.00000000	0.01400	0	0.000	0
## 15	0.0000	0.00000000	0.03560	0	0.000	0

## 16	0.0000	0.00000000	0.06400	0	0.000	0
## 17	0.9350	2.79274828	0.03700	0	0.117	567
## 18	0.1920	0.00000000	0.00200	0	0.146	68
## 19	0.0000	0.00000000	0.02400	0	0.000	0
## 20	0.8800	0.00000000	0.03200	0	0.000	0
## 21	0.0000	0.00000000	0.00720	0	0.000	0
## 22	0.8800	1.58400000	0.01888	0	0.000	0
## 23	0.8800	1.58400000	0.01888	0	0.000	0
## 24	0.0000	0.00000000	0.01000	0	0.000	0
## 25	0.0000	0.00000000	0.01000	0	0.000	0
## 26	0.8941	1.64782630	0.00400	0	0.000	343
## 27	1.0000	0.00000000	0.03400	0	0.000	0
## 28	0.0000	0.00000000	0.01200	0	0.000	0
## 29	0.8963	3.00000000	0.01700	0	0.050	365
## 30	0.8963	3.00000000	0.01700	0	0.050	365
## 31	0.2500	0.00000000	0.00700	0	0.050	0
## 32	0.0000	0.00000000	0.03200	0	0.000	0
## 33	0.0000	0.00000000	0.03800	0	0.000	0
## 34	0.1600	1.60000000	0.00800	0	0.000	0
## 35	0.0000	0.00000000	0.00000	0	0.000	0
## 36	1.0000	0.00000000	0.01000	0	0.027	0
## 37	1.0000	0.00000000	0.00500	0	0.730	0
## 38	0.0000	0.00000000	0.01920	0	0.000	0
## 39	0.0000	0.00000000	0.01600	0	0.000	0
## 40	0.8500	0.00000000	0.02300	0	0.027	0
## 41	0.0000	0.00000000	0.01000	0	0.000	0
## 42	0.8941	2.41750885	0.03500	0	0.116	343
## 43	0.0000	0.00000000	0.00000	0	0.000	0
## 44	0.0779	0.06751333	0.00900	0	0.100	31
## 45	0.8711	2.40589524	0.00900	0	0.000	360
## 46	0.8760	8.78920000	0.02000	0	0.050	329
## 47	0.0000	0.00000000	0.00600	0	0.000	0
## 48	0.0000	1.38433613	0.00100	0	0.171	0
## 49	0.0000	0.00000000	0.01600	0	0.000	0
## 50	0.0000	0.00000000	0.04160	0	0.000	0
## 51	0.9100	2.00200000	0.02020	0	0.000	0
## 52	0.8800	0.15840000	0.02020	0	0.000	0
## 53	0.8800	5.37777778	0.02020	0	0.000	0
## 54	0.9000	1.80000000	0.04600	0	0.000	0
##	water_content	usda_value	kc_initial	kc_midseason	kc_late	residue_n_dm
## 1	0.00	0	0.30	0.75	0.75	0.0104
## 2	0.00	0	0.10	1.10	0.55	0.0000
## 3	0.00	0	0.10	1.10	0.55	0.0000
## 4	0.00	0	0.72	1.04	0.70	0.0125
## 5	0.00	0	0.60	1.10	1.05	0.0176
## 6	0.00	0	0.60	1.10	1.05	0.0224
## 7	0.00	0	0.15	1.10	0.25	0.0352
## 8	59.68	11134	0.00	0.00	0.00	0.0030
## 9	11.95	16062	0.15	1.05	0.60	0.0230
## 10	0.00	0	1.05	1.10	1.10	0.0384
## 11	0.00	0	0.30	0.75	0.75	0.0200
## 12	0.00	0	0.30	0.75	0.75	0.0000
## 13	10.37	20314	0.15	1.15	0.30	0.0070
## 14	0.00	0	0.30	0.75	0.75	0.0000

## 15	0.00	0	1.05	1.10	1.10	0.0000
## 16	0.00	0	0.15	1.15	0.60	0.0000
## 17	6.50	16067	0.15	1.15	0.60	0.0120
## 18	80.80	9139	1.05	1.10	1.10	0.0280
## 19	0.00	0	1.05	1.10	1.10	0.0000
## 20	0.00	0	0.15	1.10	0.25	0.0000
## 21	0.00	0	0.10	1.10	0.55	0.0000
## 22	0.00	0	0.10	1.10	0.55	0.0005
## 23	0.00	0	0.10	1.10	0.55	0.0005
## 24	0.00	0	0.30	0.75	0.75	0.0100
## 25	0.00	0	0.30	0.75	0.75	0.0100
## 26	10.59	16101	0.15	1.10	0.25	0.0400
## 27	0.00	0	1.05	1.10	1.10	0.0340
## 28	0.00	0	0.30	0.75	0.75	0.0000
## 29	10.37	20314	0.15	1.15	0.30	0.0070
## 30	10.37	20314	0.15	1.15	0.30	0.0070
## 31	0.00	0	0.15	1.15	0.30	0.0120
## 32	0.00	0	0.15	1.10	0.25	0.0320
## 33	0.00	0	1.05	1.10	1.10	0.0380
## 34	0.00	0	0.15	1.20	0.70	0.0152
## 35	0.00	0	0.00	0.00	0.00	0.0000
## 36	0.00	0	0.30	0.75	0.75	0.0100
## 37	0.00	0	1.05	1.10	1.10	0.0050
## 38	0.00	0	0.60	1.10	1.05	0.0192
## 39	0.00	0	0.30	0.75	0.75	0.0160
## 40	0.00	0	0.60	1.10	1.05	0.0230
## 41	0.00	0	1.00	1.00	1.00	0.0100
## 42	10.59	16101	0.00	0.00	0.00	0.0180
## 43	0.00	0	0.00	0.00	0.00	0.0000
## 44	92.21	11821	0.00	0.00	0.00	0.0030
## 45	12.89	20450	1.05	1.20	0.75	0.0060
## 46	12.40	20067	0.10	1.10	0.55	0.0060
## 47	0.00	0	0.10	1.10	0.55	0.0000
## 48	68.00	0	0.15	1.20	0.70	0.0010
## 49	0.00	0	0.30	0.75	0.75	0.0160
## 50	0.00	0	0.15	1.10	0.25	0.0000
## 51	0.00	0	0.10	1.10	0.55	0.0060
## 52	0.00	0	0.10	1.10	0.55	0.0280
## 53	0.00	0	0.10	1.10	0.55	0.0280
## 54	0.00	0	0.15	1.10	0.25	0.0120
##	n_fixation	crop_coefficient	category	trees_ha	trees_dhb	trees_growth
## 1	0.00000	0.6000000	grass	0	0	0
## 2	0.00000	0.5833333	cereal	0	0	0
## 3	0.00000	0.5833333	cereal	0	0	0
## 4	0.00000	0.8200000		0	0	0
## 5	0.00000	0.9166667	grass	0	0	0
## 6	0.00000	0.9166667	grass	0	0	0
## 7	70.40000	0.5000000	legume	0	0	0
## 8	0.00000	0.0000000		0	0	0
## 9	50.35220	0.6000000	legume	0	0	0
## 10	230.40000	1.0833333	tree legume	400	18	2
## 11	0.00000	0.6000000	grass	0	0	0
## 12	0.00000	0.6000000	grass	0	0	0
## 13	0.00000	0.5333333	cereal	0	0	0

## 14	0.00000	0.6000000		0	0	0
## 15	89.00000	1.0833333	tree legume	3000	18	2
## 16	99.34400	0.6333333	legume	0	0	0
## 17	38.19799	0.6333333	legume	0	0	0
## 18	0.00000	1.0833333		25	20	0
## 19	204.00000	1.0833333	tree legume	10000	0	0
## 20	80.00000	0.5000000	legume	0	0	0
## 21	0.00000	0.5833333	cereal	0	0	0
## 22	0.00000	0.5833333	cereal	0	0	0
## 23	0.00000	0.5833333	cereal	0	0	0
## 24	0.00000	0.6000000	grass	0	0	0
## 25	0.00000	0.6000000	grass	0	0	0
## 26	36.20021	0.5000000	legume	0	0	0
## 27	238.00000	1.0833333	tree legume	400	18	3
## 28	0.00000	0.6000000	grass	0	0	0
## 29	0.00000	0.5333333	cereal	0	0	0
## 30	0.00000	0.5333333	cereal	0	0	0
## 31	0.00000	0.5333333	cereal	0	0	0
## 32	192.00000	0.5000000	legume	0	0	0
## 33	380.00000	1.0833333	tree legume	80000	0	0
## 34	0.00000	0.6833333		0	0	0
## 35	0.00000	0.0000000		0	0	0
## 36	0.00000	0.6000000	grass	0	0	0
## 37	0.00000	1.0833333		0	0	0
## 38	0.00000	0.9166667	grass	0	0	0
## 39	0.00000	0.6000000	grass	0	0	0
## 40	0.00000	0.9166667	grass	0	0	0
## 41	0.00000	0.0000000	grass	0	0	0
## 42	36.76995	0.0000000	tree legume	5000	10	25
## 43	0.00000	0.0000000		0	0	0
## 44	0.00000	0.0000000		0	0	0
## 45	0.00000	1.0000000	cereal	0	0	0
## 46	0.00000	0.5833333	cereal	0	0	0
## 47	0.00000	0.5833333	cereal	0	0	0
## 48	0.00000	0.6833333	grass	0	0	0
## 49	0.00000	0.6000000	grass	0	0	0
## 50	102.96000	0.5000000	legume	0	0	0
## 51	0.00000	0.5833333	cereal	0	0	0
## 52	0.00000	0.5833333	cereal	0	0	0
## 53	0.00000	0.5833333	cereal	0	0	0
## 54	50.82000	0.5000000	legume	0	0	0
##	trees_removal	energy_dm	trees_ha_dbh25	average_dbh25	increase_dbh25	
## 1	0	0.0000	0	0	0	
## 2	0	0.0000	0	0	0	
## 3	0	0.0000	0	0	0	
## 4	0	0.0000	0	0	0	
## 5	0	0.0000	0	0	0	
## 6	0	0.0000	0	0	0	
## 7	0	0.0000	0	0	0	
## 8	0	396.8254	0	0	0	
## 9	0	381.6014	0	0	0	
## 10	0	0.0000	0	0	0	
## 11	0	0.0000	0	0	0	
## 12	0	0.0000	0	0	0	

## 13	0	407.2297	0	0	0
## 14	0	0.0000	0	0	0
## 15	0	0.0000	0	0	0
## 16	0	0.0000	0	0	0
## 17	0	606.4171	0	0	0
## 18	0	354.1667	0	0	0
## 19	0	0.0000	0	0	0
## 20	0	0.0000	0	0	0
## 21	0	0.0000	0	0	0
## 22	0	0.0000	0	0	0
## 23	0	0.0000	0	0	0
## 24	0	0.0000	0	0	0
## 25	0	0.0000	0	0	0
## 26	0	383.6260	0	0	0
## 27	0	0.0000	0	0	0
## 28	0	0.0000	0	0	0
## 29	0	407.2297	0	0	0
## 30	0	407.2297	0	0	0
## 31	0	0.0000	0	0	0
## 32	0	0.0000	0	0	0
## 33	0	0.0000	0	0	0
## 34	0	0.0000	0	0	0
## 35	0	0.0000	0	0	0
## 36	0	0.0000	0	0	0
## 37	0	0.0000	0	0	0
## 38	0	0.0000	0	0	0
## 39	0	0.0000	0	0	0
## 40	0	0.0000	0	0	0
## 41	0	0.0000	0	0	0
## 42	0	383.6260	0	0	0
## 43	0	0.0000	0	0	0
## 44	0	397.9461	0	0	0
## 45	0	413.2706	0	0	0
## 46	0	375.5708	0	0	0
## 47	0	0.0000	0	0	0
## 48	0	0.0000	0	0	0
## 49	0	0.0000	0	0	0
## 50	0	0.0000	0	0	0
## 51	0	0.0000	0	0	0
## 52	0	0.0000	0	0	0
## 53	0	0.0000	0	0	0
## 54	0	0.0000	0	0	0
##	trees_ha_dbh2550	average_dbh2550	increase_dbh2550	trees_ha_dbh50	
## 1	0	0	0	0	
## 2	0	0	0	0	
## 3	0	0	0	0	
## 4	0	0	0	0	
## 5	0	0	0	0	
## 6	0	0	0	0	
## 7	0	0	0	0	
## 8	0	0	0	0	
## 9	0	0	0	0	
## 10	0	0	0	0	
## 11	0	0	0	0	

## 12	0	0	0	0
## 13	0	0	0	0
## 14	0	0	0	0
## 15	0	0	0	0
## 16	0	0	0	0
## 17	0	0	0	0
## 18	0	0	0	0
## 19	0	0	0	0
## 20	0	0	0	0
## 21	0	0	0	0
## 22	0	0	0	0
## 23	0	0	0	0
## 24	0	0	0	0
## 25	0	0	0	0
## 26	0	0	0	0
## 27	0	0	0	0
## 28	0	0	0	0
## 29	0	0	0	0
## 30	0	0	0	0
## 31	0	0	0	0
## 32	0	0	0	0
## 33	0	0	0	0
## 34	0	0	0	0
## 35	0	0	0	0
## 36	0	0	0	0
## 37	0	0	0	0
## 38	0	0	0	0
## 39	0	0	0	0
## 40	0	0	0	0
## 41	0	0	0	0
## 42	0	0	0	0
## 43	0	0	0	0
## 44	0	0	0	0
## 45	0	0	0	0
## 46	0	0	0	0
## 47	0	0	0	0
## 48	0	0	0	0
## 49	0	0	0	0
## 50	0	0	0	0
## 51	0	0	0	0
## 52	0	0	0	0
## 53	0	0	0	0
## 54	0	0	0	0
##	average_dbh50	increase_dbh50	time_horizon	diameter_breast
## 1	0	0	0	0
## 2	0	0	0	0
## 3	0	0	0	0
## 4	0	0	0	0
## 5	0	0	0	0
## 6	0	0	0	0
## 7	0	0	0	0
## 8	0	0	0	0
## 9	0	0	0	0
## 10	0	0	0	0

## 11	0	0	0	0
## 12	0	0	0	0
## 13	0	0	0	0
## 14	0	0	0	0
## 15	0	0	0	0
## 16	0	0	0	0
## 17	0	0	0	0
## 18	0	0	0	0
## 19	0	0	0	0
## 20	0	0	0	0
## 21	0	0	0	0
## 22	0	0	0	0
## 23	0	0	0	0
## 24	0	0	0	0
## 25	0	0	0	0
## 26	0	0	0	0
## 27	0	0	0	0
## 28	0	0	0	0
## 29	0	0	0	0
## 30	0	0	0	0
## 31	0	0	0	0
## 32	0	0	0	0
## 33	0	0	0	0
## 34	0	0	0	0
## 35	0	0	0	0
## 36	0	0	0	0
## 37	0	0	0	0
## 38	0	0	0	0
## 39	0	0	0	0
## 40	0	0	0	0
## 41	0	0	0	0
## 42	0	0	0	0
## 43	0	0	0	0
## 44	0	0	0	0
## 45	0	0	0	0
## 46	0	0	0	0
## 47	0	0	0	0
## 48	0	0	0	0
## 49	0	0	0	0
## 50	0	0	0	0
## 51	0	0	0	0
## 52	0	0	0	0
## 53	0	0	0	0
## 54	0	0	0	0

Grass input level

grassinputlevel_code	grassinputlevel_desc	change_factor
1	Medium	1.00
2	High	1.11
3	None	1.00

```
kable(sq_tables$lkp_grasslandman)
```

Grassland management

management_code	management_desc	change_factor
1	Nominally managed	1.00
2	Moderately degraded grassland, temperate/boreal	0.95
3	Moderately degraded grassland, tropical	0.97
4	Moderately degraded grassland, tropical montane	0.96
5	Severely degraded	0.70
6	Improved grassland, temperate/boreal	1.14
7	Improved grassland, tropical	1.17
8	Improved grassland, tropical montane	1.16

Landcover

landcover_code	landcover_desc	c_factor
1	Dense forest	0.001
2	Other forest	0.050
3	Badlands hard	0.050
4	Badlands soft	0.400
5	Sorghum	0.100
6	Maize	0.100
7	Cereals	0.150
8	Pulses	0.150
9	Dense grass	0.010
10	Degraded grass	0.050
11	Fallow hard	0.050
12	Fallow ploughed	0.600
13	Ethiopian teff	0.250
14	Continuous fallow	1.000

Livestock type

##	livetype_code	livetype_desc	body_weight	litter_size
## 1	1	Cattle - Cows (local)	350	0
## 2	2	Cattle - Cows (improved)	600	0
## 3	3	Cattle - Cows (high productive)	600	0
## 4	4	Cattle - Adult male	580	0
## 5	5	Cattle - Steers/heifers	200	0
## 6	6	Cattle - Steers/heifers (improved)	300	0
## 7	7	Cattle - Calves	90	0
## 8	8	Cattle - Calves (improved)	90	0
## 9	9	Buffalo - Cows	450	0
## 10	10	Buffalo - Steers/heifers	270	0
## 11	11	Buffalo - Calves	110	0
## 12	12	Sheep - Ewes	53	0
## 13	13	Sheep - Breeding Rams	30	0

## 14	14	Sheep - Fattening Rams	20	0		
## 15	15	Sheep - Lambs	15	0		
## 16	16	Goats - Does	53	0		
## 17	17	Goats - Breeding Bucks	30	0		
## 18	18	Goats - Fattening Bucks	20	0		
## 19	19	Goats - Kids	15	0		
## 20	20	Pigs - lactating/pregnant sows	200	10		
## 21	21	Pigs - dry sows/boars	200	0		
## 22	22	Pigs - growers	80	0		
##	lactation_length	proportion_growth	lw_gain	grazing_displacement		
## 1	0	0	0.0	0		
## 2	0	0	0.0	0		
## 3	0	0	0.0	2		
## 4	0	0	0.0	0		
## 5	0	0	0.0	0		
## 6	0	0	0.0	2		
## 7	0	0	0.0	0		
## 8	0	0	0.0	2		
## 9	0	0	0.0	0		
## 10	0	0	0.0	0		
## 11	0	0	0.0	0		
## 12	60	0	0.0	0		
## 13	0	0	0.0	0		
## 14	0	0	0.0	0		
## 15	0	0	0.0	0		
## 16	60	0	0.0	0		
## 17	0	0	0.0	0		
## 18	0	0	0.0	0		
## 19	0	0	0.0	0		
## 20	21	60	0.2	0		
## 21	0	0	0.0	0		
## 22	0	0	0.0	0		
##	me_maintenance	me_grazing	me_pregnancy	me_lactation	me_lactmilk	me_growth
## 1	40.459549	2.0	1260.0000	0.0000	5.5	0
## 2	60.615465	2.0	1500.0000	0.0000	5.5	0
## 3	60.615465	2.0	2000.0000	0.0000	5.5	0
## 4	59.093675	2.0	0.0000	0.0000	0.0	0
## 5	26.591479	1.5	0.0000	0.0000	0.0	50
## 6	36.042171	1.5	0.0000	0.0000	0.0	50
## 7	14.610056	1.0	0.0000	0.0000	0.0	50
## 8	14.610056	1.0	0.0000	0.0000	0.0	50
## 9	48.851667	2.0	1260.0000	0.0000	5.5	0
## 10	33.303726	1.5	0.0000	0.0000	0.0	50
## 11	16.983004	0.0	0.0000	0.0000	0.0	50
## 12	8.642902	0.0	518.5741	1296.4353	5.5	0
## 13	5.640188	0.0	0.0000	0.0000	0.0	46
## 14	4.161263	0.0	0.0000	0.0000	0.0	46
## 15	3.353676	0.0	0.0000	0.0000	0.0	46
## 16	8.642902	0.0	518.5741	1296.4353	5.5	0
## 17	5.640188	0.0	0.0000	0.0000	0.0	46
## 18	4.161263	0.0	0.0000	0.0000	0.0	46
## 19	3.353676	0.0	0.0000	0.0000	0.0	46
## 20	23.400502	0.0	170.0000	656.7372	0.0	0
## 21	23.400502	0.0	0.0000	0.0000	0.0	0

## 22	11.769829	0.0	0.0000	0.0000	0.0	45
##	cp_maintenance	cp_grazing	cp_pregnancy	cp_lactation	cp_lactmilk	cp_growth
## 1	0.35000000	0	9.64000	0.0000	0.09	0.00
## 2	0.60000000	0	12.21000	0.0000	0.09	0.00
## 3	0.60000000	0	15.00000	0.0000	0.09	0.00
## 4	0.58000000	0	0.00000	0.0000	0.00	0.00
## 5	0.20000000	0	0.00000	0.0000	0.00	0.40
## 6	0.30000000	0	0.00000	0.0000	0.00	0.40
## 7	0.09000000	0	0.00000	0.0000	0.00	0.40
## 8	0.09000000	0	0.00000	0.0000	0.00	0.40
## 9	0.45000000	0	9.64000	0.0000	0.09	0.00
## 10	0.27000000	0	0.00000	0.0000	0.00	0.40
## 11	0.11000000	0	0.00000	0.0000	0.00	0.40
## 12	0.10600000	0	8.37400	12.7200	0.09	0.00
## 13	0.06000000	0	0.00000	0.0000	0.00	0.45
## 14	0.04000000	0	0.00000	0.0000	0.00	0.45
## 15	0.03000000	0	0.00000	0.0000	0.00	0.45
## 16	0.10600000	0	8.37400	12.7200	0.09	0.00
## 17	0.06000000	0	0.00000	0.0000	0.00	0.45
## 18	0.04000000	0	0.00000	0.0000	0.00	0.45
## 19	0.03000000	0	0.00000	0.0000	0.00	0.45
## 20	0.02978246	0	0.33396	1.2348	0.00	0.00
## 21	0.02978246	0	0.00000	0.0000	0.00	0.00
## 22	0.01497978	0	0.00000	0.0000	0.00	0.05
##	milk_production	live_weight_gain	birth_interval	protein_milkcontent		
## 1	0	0	1.500000		3.2	
## 2	0	0	1.166667		3.7	
## 3	0	0	1.166667		3.7	
## 4	0	0	0.000000		0.0	
## 5	0	0	0.000000		0.0	
## 6	0	0	0.000000		0.0	
## 7	0	0	0.000000		0.0	
## 8	0	0	0.000000		0.0	
## 9	0	0	1.200000		3.7	
## 10	0	0	0.000000		0.0	
## 11	0	0	0.000000		0.0	
## 12	0	0	1.000000		3.2	
## 13	0	0	0.000000		0.0	
## 14	0	0	0.000000		0.0	
## 15	0	0	0.000000		3.2	
## 16	0	0	1.000000		3.2	
## 17	0	0	0.000000		0.0	
## 18	0	0	0.000000		0.0	
## 19	0	0	0.000000		3.2	
## 20	0	0	0.500000		0.0	
## 21	0	0	0.000000		0.0	
## 22	0	0	0.000000		0.0	
##	fat_content	energy_milkcontent	energy_meatcontent	protein_meatcontent		
## 1	5.8	970	2200		26	
## 2	4.3	970	2200		26	
## 3	4.0	970	2200		26	
## 4	0.0	0	2200		26	
## 5	0.0	0	2200		26	
## 6	0.0	0	2200		26	

## 7	0.0	0	2200	26	
## 8	0.0	0	2200	26	
## 9	4.3	970	2200	26	
## 10	0.0	0	2200	26	
## 11	0.0	0	2200	26	
## 12	5.8	970	2200	25	
## 13	0.0	0	0	0	
## 14	0.0	0	0	0	
## 15	5.8	970	2200	25	
## 16	5.8	970	2200	25	
## 17	0.0	0	0	0	
## 18	0.0	0	0	0	
## 19	5.8	970	2200	25	
## 20	0.0	0	2580	21	
## 21	0.0	0	2580	21	
## 22	0.0	0	2580	21	
##	carcass_fraction	energy_eggcontent	n_content	water_requirement	meat_product
## 1	0.00	0	0.029	120	beef
## 2	0.48	0	0.029	140	beef
## 3	0.45	0	0.029	160	beef
## 4	0.48	0	0.029	100	beef
## 5	0.48	0	0.029	80	beef
## 6	0.49	0	0.029	100	beef
## 7	0.49	0	0.029	50	beef
## 8	0.52	0	0.029	50	beef
## 9	0.00	0	0.029	140	buffalo
## 10	0.58	0	0.029	100	buffalo
## 11	0.58	0	0.029	50	buffalo
## 12	0.50	0	0.027	14	mutton
## 13	0.00	0	0.000	14	mutton
## 14	0.00	0	0.000	10	mutton
## 15	0.50	0	0.029	5	mutton
## 16	0.50	0	0.027	14	goat
## 17	0.00	0	0.000	14	goat
## 18	0.00	0	0.000	10	goat
## 19	0.50	0	0.029	5	goat
## 20	0.00	0	0.040	40	pork
## 21	0.00	0	0.040	15	pork
## 22	0.60	0	0.040	10	pork
##	milk_product	oneoff_cost	operational_cost	oneoff_labour	operational_labour
## 1	cow milk	6200	4200	0	46.0
## 2	cow milk	1300	1200	0	5.0
## 3	cow milk	6400	4000	0	50.7
## 4	cow milk	5800	3400	0	5.0
## 5	cow milk	200	40	0	5.0
## 6	cow milk	3450	1650	0	7.6
## 7	cow milk	100	30	0	5.0
## 8	cow milk	1100	1500	0	15.2
## 9	buffalo milk	1500	20	0	8.0
## 10	buffalo milk	1000	10	0	2.0
## 11	buffalo milk	400	10	0	2.0
## 12	sheep milk	460	210	0	15.2
## 13	sheep milk	0	0	0	0.0
## 14	sheep milk	0	0	0	0.0

## 15	sheep milk	180	150	0	3.0
## 16	goat milk	460	210	0	15.2
## 17	goat milk	0	0	0	0.0
## 18	goat milk	0	0	0	0.0
## 19	goat milk	180	150	0	3.0
## 20	N/A	0	0	0	0.0
## 21	N/A	0	0	0	0.0
## 22	N/A	0	0	0	0.0
##	meat_price	milk_price	ipcc_meth_ef_t1	ipcc_meth_ef_t2	
## 1	0	1.045	Other mature female	Dairy cows	
## 2	0	1.045	Dairy cattle	Dairy cows	
## 3	0	1.045	Dairy cattle	Dairy cows	
## 4	0	1.045	Other draft bull	Non-dairy	
## 5	0	1.045	Other mature female-grazing	Non-dairy	
## 6	0	1.045	Other mature female-grazing	Non-dairy	
## 7	0	1.045	Other young	Non-dairy	
## 8	0	1.045	Other young	Non-dairy	
## 9	21	1.045	Other mature female-grazing	Dairy cows	
## 10	21	1.045	Other young	Non-dairy	
## 11	21	1.045	Other young	Non-dairy	
## 12	25	0.000	Goats	Sheep	
## 13	25	0.000	Goats	Sheep	
## 14	25	0.000	Goats	Sheep	
## 15	25	0.000	Goats	Sheep	
## 16	25	0.000	Goats	Goats	
## 17	25	0.000	Goats	Goats	
## 18	25	0.000	Goats	Goats	
## 19	25	0.000	Goats	Goats	
## 20	0	0.000	Pigs	N/A	
## 21	0	0.000	Pigs	N/A	
## 22	0	0.000	Pigs	N/A	
##	ipcc_meth_man	ipcc_meth_exc			
## 1	Dairy cows	Dairy cattle			
## 2	Dairy cows	Dairy cattle			
## 3	Dairy cows	Dairy cattle			
## 4	Other cattle	Other cattle			
## 5	Other cattle	Other cattle			
## 6	Other cattle	Other cattle			
## 7	Other cattle	Other cattle			
## 8	Other cattle	Other cattle			
## 9	Dairy cows	Dairy cattle			
## 10	Other cattle	Other cattle			
## 11	Other cattle	Other cattle			
## 12	Sheep	Sheep			
## 13	Sheep	Sheep			
## 14	Sheep	Sheep			
## 15	Sheep	Sheep			
## 16	Sheep	Sheep			
## 17	Sheep	Sheep			
## 18	Sheep	Sheep			
## 19	Sheep	Sheep			
## 20	Swine	Pigs			
## 21	Swine	Pigs			
## 22	Swine	Pigs			

Manure management

manureman_code	manureman_desc	emission_factor
pasture	Pasture / range / paddock	0.010
storage	Solid storage	0.005
drylot	Dry lot	0.020
Uncovered anaerobic lagoon	Uncovered anaerobic lagoon	0.000
Liquid/Slurry Pit below animals 1 Month	Liquid/Slurry Pit below animals 1 Month	0.000
Liquid/Slurry Pit below animals 3 Month	Liquid/Slurry Pit below animals 3 Month	0.000
Liquid/Slurry Pit below animals 4 Month	Liquid/Slurry Pit below animals 4 Month	0.000
Liquid/Slurry Pit below animals 6 Month	Liquid/Slurry Pit below animals 6 Month	0.000
Liquid/Slurry Pit below animals 12 Month	Liquid/Slurry Pit below animals 12 Month	0.000
Cattle and swine deep bedding < 1 month	Cattle and swine deep bedding < 1 month	0.000
Cattle and swine deep bedding > 1 month	Cattle and swine deep bedding > 1 month	0.000
Solid storage	Solid storage	0.000
Solid storage - Covered/compacted	Solid storage - Covered/compacted	0.000
Solid storage - Bulking agent addition	Solid storage - Bulking agent addition	0.000
Solid storage - Additives	Solid storage - Additives	0.000
Daily spread	Daily spread	0.000
Composting - In-vessel	Composting - In-vessel	0.000
Composting - Static pile (forced aeration)	Composting - Static pile (forced aeration)	0.000
Composting - Intensive windrow	Composting - Intensive windrow	0.000
Composting - Unfrequent turning	Composting - Unfrequent turning	0.000
Pasture/Range/Paddock	Pasture/Range/Paddock	0.000
Poultry manure with and without litter	Poultry manure with and without litter	0.000
Aerobic treatment	Aerobic treatment	0.000
Burned for fuel	Burned for fuel	0.000
Anaer digester, Low leak, HQ stor, HQ tec.	Anaer digester, Low leak, HQ stor, HQ tec.	0.000
Anaer digester, Low leak, HQ stor, LQ tec	Anaer digester, Low leak, HQ stor, LQ tec	0.000
Anaer digester, Low leak, open stor, HQ tec	Anaer digester, Low leak, open stor, HQ tec	0.000
Anaer digester, High leak, open stor, HQ tec	Anaer digester, High leak, open stor, HQ tec	0.000
Anaer digester, High leak, LQ stor, LQ tec	Anaer digester, High leak, LQ stor, LQ tec	0.000
Anaer digester, High leak, open stor, LQ tec	Anaer digester, High leak, open stor, LQ tec	0.000

Organic matter

orgmatter_code	orgmatter_desc	change_factor
1	Low, temperate/boreal, dry	0.95
2	Low, temperate/boreal, moist	0.92
3	Low, tropical, dry	0.95
4	Low, tropical, moist	0.92
5	Low, tropical montane, all	0.94
6	Medium, all	1.00
7	High w/OUT manure, temperate/boral and tropical, dry	1.04
8	High w/OUT manure, temperate/boral and tropical, moist/wet	1.11
9	High w/OUT manure, tropical montane	1.08
10	High with manure, temperate/boral and tropical, dry	1.37
11	High with manure, temperate/boral and tropical, moist/wet	1.44

orgmatter_code	orgmatter_desc	change_factor
12	High with manure, tropical montane	1.41

Organic fertilizer

fertilizer_code	fertilizer_desc
1	Urea
3	DAP
2	NPK
4	Ammonium nitrate
5	Ammonium sulfate
6	N solutions
7	Ammonia
8	Manure
9	Compost
10	Other organic N additions
11	Bedding material

Slope

slope_code	slope_desc	p_factor
1	Flat (0-5%)	0.11
2	Hilly (5-20%)	0.13
3	Steep (20-30%)	0.22
4	Extremely steep (30%+)	0.37
5	Non-agricultural (all slope categories)	1.00

Soil

soil_code	soil_desc	k_value
andosol	Andosol	0.15
cambisol	Cambisol	0.20
lixisol	Lixisol	0.25
fluvisol	Fluvisol	0.30
vertisol	Vertisol	0.15
phaeozem	Phaeozem	0.20
nitosol	Nitosol	0.25
xerosol	Xerosol	0.30

Tillage regime

tillage_code	tillage_desc	change_factor
1	Full	1.00
2	Reduced, temperate/boreal, dry	1.02
3	Reduced, temperate/boreal, moist	1.08
4	Reduced, tropical, dry	1.09

tillage_code	tillage_desc	change_factor
5	Reduced, tropical, moist	1.15
6	Reduced, tropical montane, all	1.09
7	No-till, temperate/boreal, dry	1.10
8	No-till, temperate/boreal, moist	1.15
9	No-till, tropical, dry	1.17
10	No-till, tropical, moist/wet	1.22
11	No-till, tropical montane, all	1.16