Exploration of CLEANED QT json file

Peter Steward

2024-07-01

Contents


```
## Loading required package: pacman
```

Cleaned Data

Input data structure

The aim of this markdown document is to summarize the structure of the .json object provided from the QT UI.

```r
# 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")
```

Load the json file into R

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_orgmatter	character	1
cropland_orgmatter_ipcc	numeric	1
cropland_system	character	1
cropland_system_ipcc	numeric	1
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

field_name	class	length
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

field	value	class
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
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_code_2	livetype_code_1	livetype_code_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
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

	feed_item_code_65	feed_item_code_99	feed_item_code_18
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	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
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 futher 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_data$feed_basket$feeds[[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_data$feed_basket$feeds[[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"
```

R-project datasets

```
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]<-"O
```

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

Table 10: ghg_para$livestock_parameters

livestock_category	Urinary energy	Methane conversion factor	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 (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
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 - Ewes/Does	0.04	0.08	Goats	Sheep	Sheep	Sheep

livestock_category	Urinary_energy_frac	ash_content	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 - Breeding Rams/Bucks	0.04	0.08	Goats	Sheep	Sheep	Sheep
Sheep/Goats - Fattening Rams/Bucks	0.04	0.08	Goats	Sheep	Sheep	sheep
Sheep/Goats - Lambs/Kids	0.04	0.08	Goats	lambs (less 1 yr old)	Sheep	sheep
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_fertilize
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)
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_factors	unit	description	n2o_emissions_from_managed_soils	uncertainty_range
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
EF3PRPCPP	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	0.0200	0.007-0.06
EF3PRPSO	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

emission_factors	unit	description	n2o_emissions_from_managed_soils	uncertainty_range
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
FracGASF	kg N volatilised (kg of N applied)-1	fraction of synthetic fertilzer N that volatilises as NH3 and NOx	0.1000	0.03-0.3
FracGASM	kg N volatilised (kg of N applied or deposited)-1	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-(H)	kg N (kg of N additions)-1	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_cf	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	disaggregated_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

variable	value
Perennial/tree crop	1.00
Set aside (< 20 years), temperate/boreal and tropical, dry	0.93
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 hy
##   ..$ 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_orgmatter_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
```