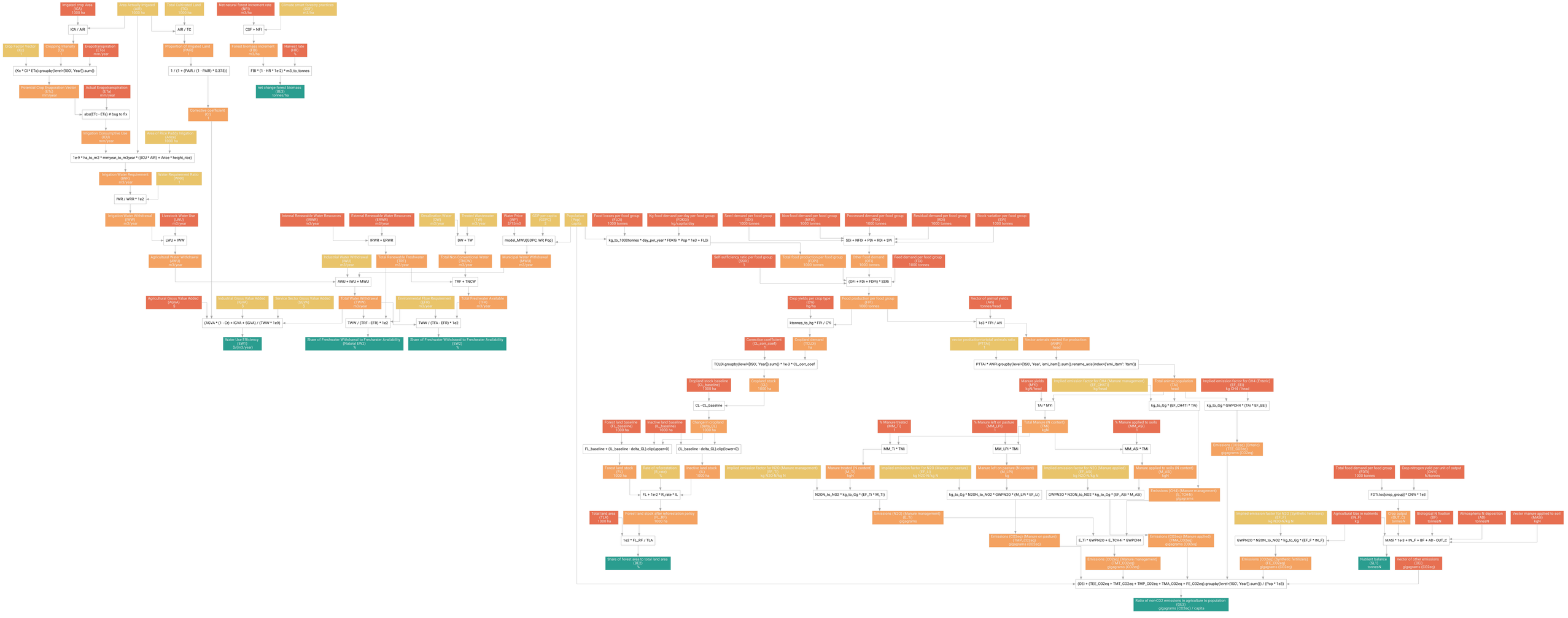
Irrigated crop Area (ICA) 1000 ha
Area Actually Irrigated (AIR) 1000 ha
Total Cultivated Land (TC) 1000 ha
Net natural forest increment rate (NFI) m3/ha
Climate smart forestry practices (CSF) m3/ha
ICA / AIR
AIR / TC
CSF + NFI
Crop Factor Vector (Kc) 1
Cropping Intensity (CI) 1
Evapotranspiration (ETo) mm/year
Proportion of Irrigated Land (PAIR) 1
Forest biomass increment (FBI) m3/ha
Harvest rate (HR) %
(Kc * CI * ETo).groupby(level=['ISO', 'Year']).sum()
1 / (1 + (PAIR / (1 - PAIR) * 0.375))
FBI * (1 - HR * 1e-2) * m3_to_tonnes
Potential Crop Evaporation Vector (ETc) mm/year
Actual Evapotranspiration (ETa) mm/year
net change forest biomass (BE3) tonnes/ha
abs(ETc - ETa) # bug to fix
Corrective coefficient (CC) 1
Irrigation Consumptive Use (ICU) mm/year
Area of Rice Paddy Irrigation (Arice) 1000 ha
1e-9 * ha_to_m2 * mmyear_to_m3year * ((ICU * AIR) + Arice * height_rice)
Irrigation Water Requirement (IWR) m3/year
Water Requirement Ratio (WRR) 1
IWR / WRR * 1e2
Irrigation Water Withdrawal (IWW) m3/year
Livestock Water Use (LWU) m3/year
LWU + IWW
Agricultural Water Withdrawal (AWU) m3/year
Internal Renewable Water Resources (IRWR) m3/year
External Renewable Water Resources (ERWR) m3/year
Desalination Water (DW) m3/year
Treated Wastewater (TW) m3/year
Water Price (WP) $/1e3m3
GDP per capita (GDPC) $
Population (Pop) capita
IRWR + ERWR
DW + TW
model_MWU(GDPC, WP, Pop)
Industrial Water Withdrawal (IWU) m3/year
Total Renewable Freshwater (TRF) m3/year
Total Non-Conventional Water (TNCW) m3/year
Municipal Water Withdrawal (MWU) m3/year
AWU + IWU + MWU
TRF + TNCW
Agricultural Gross Value Added (AGVA) $
Industrial Gross Value Added (IGVA) $
Service Sector Gross Value Added (SGVA) $
Total Water Withdrawal (TWW) m3/year
Environmental Flow Requirement (EFR) m3/year
Total Freshwater Available (TFA) m3/year
(AGVA * (1 - Cr) + IGVA + SGVA) / (TWW * 1e9)
TWW / (TRF - EFR) * 1e2
TWW / (TFA - EFR) * 1e2
Water Use Efficiency (EW1) $/(m3/year)
Share of Freshwater Withdrawal to Freshwater Availability (Natural EW2) %
Share of Freshwater Withdrawal to Freshwater Availability (EW2) %
Food losses per food group (FL) 1000 tonnes
Kg food demand per day per food group (FDKG) kg/capita/day
Seed demand per food group (SD) 1000 tonnes
Non food demand per food group (ND) 1000 tonnes
Processed demand per food group (PDI) 1000 tonnes
Residual demand per food group (RDI) 1000 tonnes
Stock variation per food group (SVI) 1000 tonnes
kg_to_1000tonnes * day_per_year * FDKGI * Pop * 1e3 + FLOI
SDI + NFDI + PDI + RDI + SVI
Self sufficiency ratio per food group (SSR) 1
Total food production per food group (FDPI) 1000 tonnes
Other food demand (OFI) 1000 tonnes
Feed demand per food group (FDI) 1000 tonnes
(OFI + FDI + FDPI) * SSRI
Crop yields per crop type (CYI) hg/ha
Food production per food group (FPI) 1000 tonnes
Vector of animal yields (AYI) tonnes/head
ktonnes_to_hg * FPI / CYI
1e3 * FPI / AYI
Correction coefficient (CL_corr_coef) 1
Cropland demand (TCLDI) ha
Vector production to total animals ratio (PTTAI) 1
Vector animals needed for production (ANN) head
TCLDI.groupby(level=['ISO', 'Year']).sum() * 1e-3 * CL_corr_coef
PTTAI * ANPI.groupby(level=['ISO', 'Year', 'emi_item']).sum().rename_axis(index={'emi_item': 'Item'})
Cropland stock baseline (CL_baseline) 1000 ha
Cropland stock (CL) 1000 ha
Manure yields (MYI) kgN/head
Implied emission factor for CH4 (Manure management) (EF_CH4TI) kg/head
Total animal population (TAI) head
Implied emission factor for CH4 (Enteric) (EF_EEI) kg CH4 / head
CL - CL_baseline
TAI * MYI
kg_to_Gg * (EF_CH4TI * TAI)
kg_to_Gg * GWPCH4 * (TAI * EF_EEI)
Forest land baseline (FL_baseline) 1000 ha
Inactive land baseline (IL_baseline) 1000 ha
Change in cropland (delta_CL) 1000 ha
% Manure treated (MM_Ti)
% Manure left on pasture (MM_LPI) %
Total Manure (N content) (TMI) kgN
% Manure applied to soils (MM_ASI) %
Emissions (CO2eq) (Enteric) (TEE_CO2eq) gigagrams (CO2eq)
FL_baseline + (IL_baseline - delta_CL).clip(upper=0)
(IL_baseline - delta_CL).clip(lower=0)
MM_Ti * TMI
MM_LPI * TMI
MM_ASI * TMI
Forest land stock 1000 ha
Rate of reforestation (R_rate) %
Inactive land stock (IL) 1000 ha
Implied emission factor for N2O (Manure management) (EF_Ti) kg N2O-N/kg N
Manure treated (N content) (M_Ti) kgN
Implied emission factor for N2O (Manure on pasture) (EF_Li) kg N2O-N/kg N
Manure left on pasture (N content) (M_LPI) kg
Implied emission factor for N2O (Manure applied) (EF_ASI) kg N2O-N/kg N
Manure applied to soils (N content) (M_ASI) kgN
Emissions (CH4) (Manure management) (E_TCH4) gigagrams
Total food demand per food group (FDTI) 1000 tonnes
Crop nitrogen yield per unit of output (CNYI) N/tonnes
FL + 1e2 * R_rate * IL
N2ON_to_NO2 * kg_to_Gg * (EF_Ti * M_Ti)
kg_to_Gg * N2ON_to_NO2 * GWPN2O * (M_LPI * EF_Li)
GWPN2O * N2ON_to_NO2 * kg_to_Gg * (EF_ASI * M_ASI)
FDTI.loc[crop_group] * CNYI * 1e3
Total land area (TLA) 1000 ha
Forest land stock after reforestation policy (FL_RF) 1000 ha
Emissions (N2O) (Manure management) (E_Ti) gigagrams
Implied emission factor for N2O (Synthetic fertilizers) (EF_F) kg N2O-N/kg N
Agricultural Use in nutrients (IN_F) kg
Crop output (OUT_C) tonnesN
Biological N fixation (BF) tonnesN
Atmospheric N deposition (AD) tonnesN
Vector manure applied to soil (MASI) kgN
1e2 * FL_RF / TLA
Emissions (CO2eq) (Manure on pasture) (TMP_CO2eq) gigagrams (CO2eq)
E_Ti * GWPN2O + E_TCH4i * GWPCH4
Emissions (CO2eq) (Manure applied) (TMA_CO2eq) gigagrams (CO2eq)
GWPN2O * N2ON_to_NO2 * kg_to_Gg * (EF_F * IN_F)
MASI * 1e-3 + IN_F + BF + AD - OUT_C
Share of forest area to total land area (SE2) %
Emissions (CO2eq) (Manure management) (TMT_CO2eq) gigagrams (CO2eq)
Emissions (CO2eq) (Synthetic fertilizers) (FE_CO2eq) gigagrams (CO2eq)
Nutrient balance (SL1) tonnesN
Vector of other emissions (OEI) gigagrams (CO2eq)
(OEI + (TEE_CO2eq + TMT_CO2eq + TMP_CO2eq + TMA_CO2eq + FE_CO2eq).groupby(level=['ISO', 'Year']).sum()) / (Pop * 1e3)
Ratio of non-CO2 emissions in agriculture to population (GE3) gigagrams (CO2eq) / capita