种养殖业温室气体核算平台

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Agro-GHG Platform (web site：agro-ghg.lapc.ac.cn)

The Agro-GHG Platform is a comprehensive accounting platform for quantifying the greenhouse gas emissions from agricultural enterprise / organization. The Platform can provide a quantification assessment for the GHG reduction technology or project implementation and provide technical support for agricultural emission reduction strategy.

Agro-GHG Platform has adopted the most advanced compiling methods of agricultural greenhouse gas inventory in China, which are including CH4MOD model for paddy methane emission (IPCC Tier3 recommended), regional nitrogen cycle model IAP-N (farmland part) for cropland nitrous oxide emission (IPCC Tier2) and soil carbon model Agro - C for farmland soil carbon change (IPCC Tier3), IPCC Tier2 method for methane emission from enteric, and IPCC method for methane and nitrous oxide emissions from manure management system.

The Agro-GHG Platform has been tried by 20 planting examples in North China, and 105 pig enterprises (about 582 thousand pigs) and 94 dairy enterprises (about 155.7 thousand dairies) covering 11 provinces and cities.

Under the same standards:
-- data quality control and evaluation
-- determinations of key parameters and emission factors
Unified calculation tools for Agro-GHG estimation

→ The method is comparable
The result is comparable

→ For Managers:
Emission：directly visible
Mitigation：clear goal

Data quality control and evaluation

Data Base:
- A：Meteorological data
- B：Soil data
- C：Planting management info.
  area, production, crop regime, fertilizers, residues returning, irrigation, date of planting and harvest, key crop parameters et al.
- D：Livestock management info.
  for different growth stage: amount, feed info. excrement collection method, et. al.
  key parameters: percent of each MMS coefficients of excrement N, et. al.
- E：Emission factors
- F：other data
- G：GHG emission

Calculation tools:
- CH_4 from enteric fermentation: IPCC Tier2
- CH_4 & N_2O from MMS: IPCC Tier2, Tier1
- CH_4 from paddy field: CH4MOD
- N_2O from farmlands: IAP-N
- ΔSOC of cropland soils: Agro-C

CO_2 from soils: IPCC 2006 guidelines
GHG from residues burning: IPCC
CO_2 from fuel consumption: GHG guidelines for province level of China

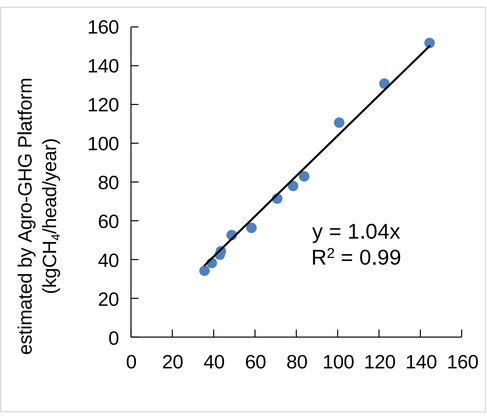
Dairy：4 stages
calf, growing heifer, heifer, lactating cow
犊牛，育成牛，　青年牛，泌乳牛

Swine/Pig：4 stages
piglet, fattening pig, sow, boars
仔猪，　育肥猪，　母猪，公猪

Paddy/rice field：4 types
single rice
double rice -early rice
Double rice - late rice
no-rice planting with winter-flooded r

Cropland type：6 types
Paddy field,
Upland (wheat, maize)
Rotation of rice with wheat

Validation of CH_4 from enteric fermentation of different growing stage of dairy cow



Key parameters and emission factors

 # livestock:
- ***Nex:*** annual N excrement under the standard weight of the different growth stage of dairy or pig in sub-region
  --- from Data Set of the First National Pollution Source Survey
- Y_m : the CH_4 conversion factor of cattle
- $MCF_{s,k}$: methane conversion factors for MMS *s* by climate region *k*
- B_0: maximum CH_4 producing capacity for manure produced by dairy or pig
- N_2O_MMS: N_2O direct emission factors of each MMS
- $NH_3/NO_x\_VOLA\ MMS$: N loss due to NH_3 & NO_x volatilization from each MMS
  --- from IPCC, 2006 or observation data

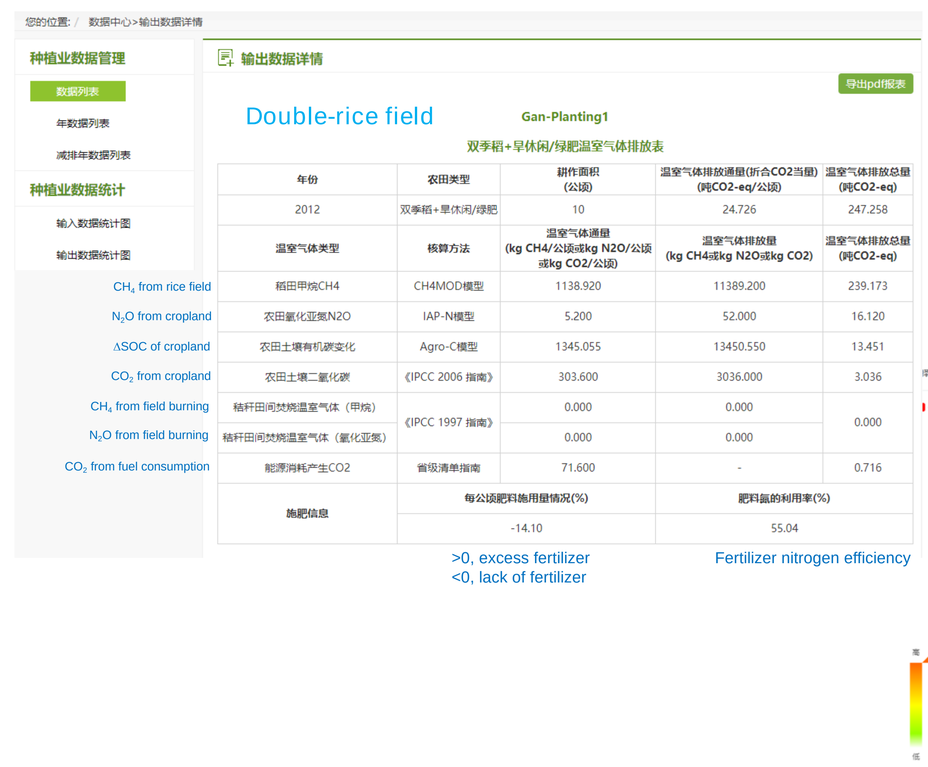
 # cropland soils:
- field data：fraction of organic matter in each of easy/difficult to decompose
  direct emission factors (N_2O, NH_3 and NO_x) of different croplands
  N loss rate by leaching / runoff from different croplands
  main crop parameters
- IPCC, 2006：indirect N_2O emission factors, some crop parameters

Output of GHG emission : Table, Figure or Map

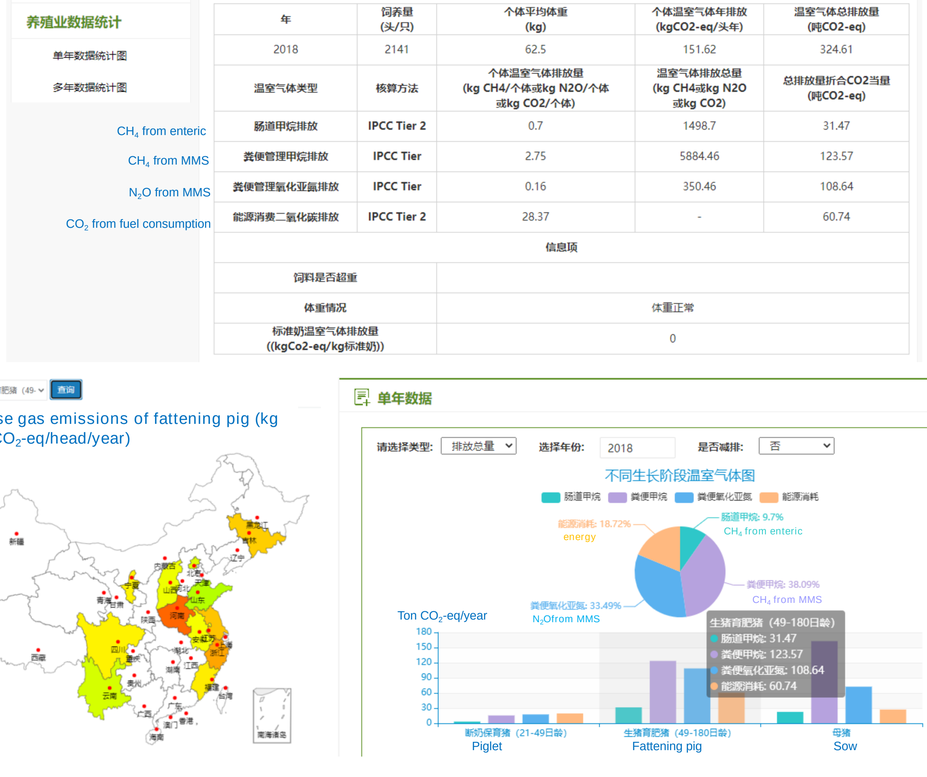
年	饲养量 (头/只)	个体平均体重 (kg)	个体温室气体年排放 (kgCO2-eq/头年)	温室气体总排放量 (吨CO2-eq)
2018	714	600	2474.87	1767.06
温室气体类型	核算方法	个体温室气体排放量 (kg CH4/个体或kg N2O/个体或kg CO2/个体)	温室气体排放总量 (kg CH4或kg N2O或kg CO2)	总排放量折合CO2当量 (吨CO2-eq)
肠道甲烷排放	IPCC Tier 2	66.66	47595.24	999.50
粪便管理甲烷排放	IPCC Tier	11.7	8350.17	175.35
粪便管理氧化亚氮排放	IPCC Tier	1.16	826.75	256.29
能源消费二氧化碳排放	IPCC Tier 2	470.43	-	335.89
信息项				
饲料是否超重	If feed is lack or excess, the platform will show the relevant message			
体重情况	体重正常	If a animal herd average weight is underweight or overweight, the platform will show the message		
标准奶温室气体排放量 ((kgCo2-eq/kg标准奶))	GHG of standard milk （$kgCO_2$-eq/kg standard milk）	0.330		

A Dairy farm company in Jiangsu province （MMS: daily spread, Solid storage）	growing stage	production (head)	CH_4 from enteric ($kgCH_4$/head/year)	MMS-CH_4 ($kgCH_4$/head/year)	MMS-N_2O (direct+indirect) (kgN_2O/head/year)	CO_2 from fuel consumption ($kgCO_2$/head/year)
	calf	217	31.35	1.78	0.35	327.7
	growing heifer	121	45.02	6.56	0.54	437.5
	heifer	147	92.54	11.36	0.91	437.4
	lactating cow	714	66.66	11.7	1.16	470.4
	company	1199	61.26	9.34	0.92	437.2

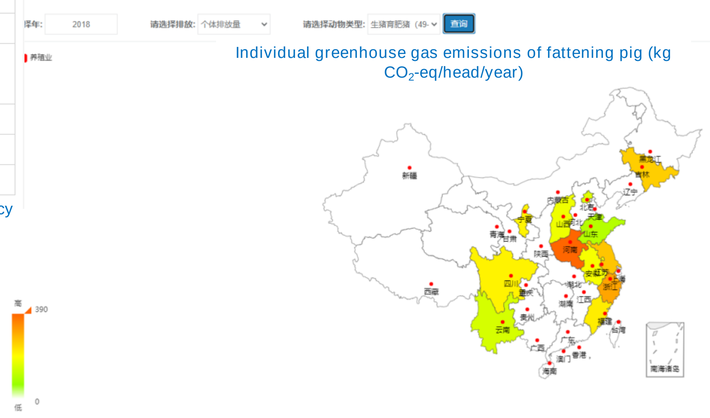
年份	农田类型	耕作面积 (公顷)	温室气体排放通量(折合CO2当量) (吨CO2-eq/公顷)	温室气体排放总量 (吨CO2-eq)
2011	非蔬菜四季旱作地	200	0.405	81.067
温室气体类型	核算方法	温室气体通量 (kg CH4/公顷或kg N2O/公顷或kg CO2/公顷)	温室气体排放量 (kg CH4或kg N2O或kg CO2)	温室气体排放总量 (吨CO2-eq)
稻田甲烷CH4	CH4MOD模型	-	-	-
农田氧化亚氮N2O	IAP-N模型	3.565	713.000	221.030
农田土壤有机碳变化	Agro-C模型	-939.887	-187977.400	-187.977
农田土壤二氧化碳	《IPCC 2006 指南》	50.000	10000.000	10.000
秸秆田间焚烧温室气体（甲烷）	《IPCC 1997 指南》	3.390	678.000	17.028
秸秆田间焚烧温室气体（氧化亚氮）		0.045	9.000	
能源消耗产生CO2	省级清单指南	104.930	-	20.986
施肥信息	每公顷肥料施用量情况(%)		肥料氮的利用率(%)	
	-8.78		75.22	



年份	农田类型	耕作面积 (公顷)	温室气体排放通量(折合CO2当量) (吨CO2-eq/公顷)	温室气体排放总量 (吨CO2-eq)
2012	双季稻+旱休闲/绿肥	10	24.726	247.258
温室气体类型	核算方法	温室气体通量 (kg CH4/公顷或kg N2O/公顷或kg CO2/公顷)	温室气体排放量 (kg CH4或kg N2O或kg CO2)	温室气体排放总量 (吨CO2-eq)
稻田甲烷CH4	CH4MOD模型	1138.920	11389.200	239.173
农田氧化亚氮N2O	IAP-N模型	5.200	52.000	16.120
农田土壤有机碳变化	Agro-C模型	1345.055	13450.550	13.451
农田土壤二氧化碳	《IPCC 2006 指南》	303.600	3036.000	3.036
秸秆田间焚烧温室气体（甲烷）	《IPCC 1997 指南》	0.000	0.000	0.000
秸秆田间焚烧温室气体（氧化亚氮）		0.000	0.000	
能源消耗产生CO2	省级清单指南	71.600	-	0.716
施肥信息	每公顷肥料施用量情况(%)		肥料氮的利用率(%)	
	-14.10		55.04	



年	饲养量 (头/只)	个体平均体重 (kg)	个体温室气体年排放 (kgCO2-eq/头年)	温室气体总排放量 (吨CO2-eq)
2018	2141	62.5	151.62	324.61
温室气体类型	核算方法	个体温室气体排放量 (kg CH4/个体或kg N2O/个体或kg CO2/个体)	温室气体排放总量 (kg CH4或kg N2O或kg CO2)	总排放量折合CO2当量 (吨CO2-eq)
肠道甲烷排放	IPCC Tier 2	0.7	1498.7	31.47
粪便管理甲烷排放	IPCC Tier	2.75	5884.46	123.57
粪便管理氧化亚氮排放	IPCC Tier	0.16	350.46	108.64
能源消费二氧化碳排放	IPCC Tier 2	28.37	-	60.74
信息项				
饲料是否超重				
体重情况	体重正常			
标准奶温室气体排放量 ((kgCo2-eq/kg标准奶))	0			



Individual greenhouse gas emissions of fattening pig (kg CO_2-eq/head/year)