GHG Mitigation in China's Agriculture Sector

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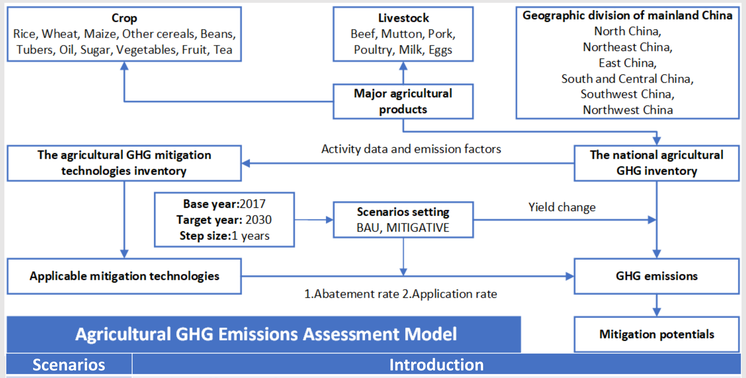
Introduction

- Greenhouse gas (GHG) emissions from the agricultural sector are responsible for a significant fraction of anthropogenic emissions. In this study, we model the decarbonization of the agricultural sector in China from 2017 to 2030.
- We develop a national agricultural GHG inventory and an agricultural GHG mitigation technology inventory, then make some projections of the future GHG emissions by an agricultural GHG emissions assessment model.
- In addition, we construct a partial equilibrium model of agricultural supply and demand and a multi-regional CGE model to study more systematically the interactions between agricultural GHG emissions, technological progress and economic development.

Methodology

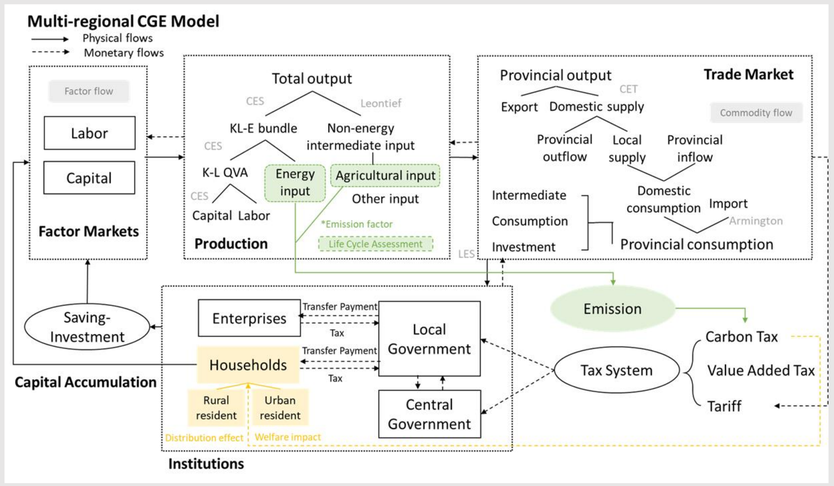
- To facilitate the study, mainland China is divided into six geographic regions and major agricultural products in China are grouped into 17 categories.
- The national agricultural GHG inventory, based on activity data and emission factors collected from the literature, lists GHG emissions in the production process of the agricultural products. It is used to calculate GHG emissions from China's agriculture sector in 2017 regardless of the application of mitigation measures.
- The agricultural GHG mitigation technology inventory specially focus on non-CO2 GHG mitigation. The applicable mitigation technologies are screened by technical potential, future application prospect and impact on agricultural production. The abatement rate is quantified based on relevant meta-analysis results or experimental results.
- The agricultural GHG emissions assessment model uses the above two inventories and other available agricultural data to evaluate GHG emissions and mitigation potentials in China's agriculture sector in 2030 under two different scenarios.



Agricultural GHG Emissions Assessment Model

Scenarios	Introduction
BAU	The diffusion of GHG mitigation technologies application is **not** considered
MITIGATIVE	The diffusion of GHG mitigation technologies application is considered

- The multi-regional CGE model is based on the national agricultural GHG inventory to study the impact of carbon tax on the agri-food sector in China.
- For this purpose, we divide the agri-food sector in the CGE model into 12 primary agricultural sectors and 15 processed food sectors. The emission factors in the GHG inventory provide the basis for the GHG emissions calculation. By taxing those carbon emissions from production side, we are able to know how a carbon tax may affect the consumption and welfare of heterogeneous households.

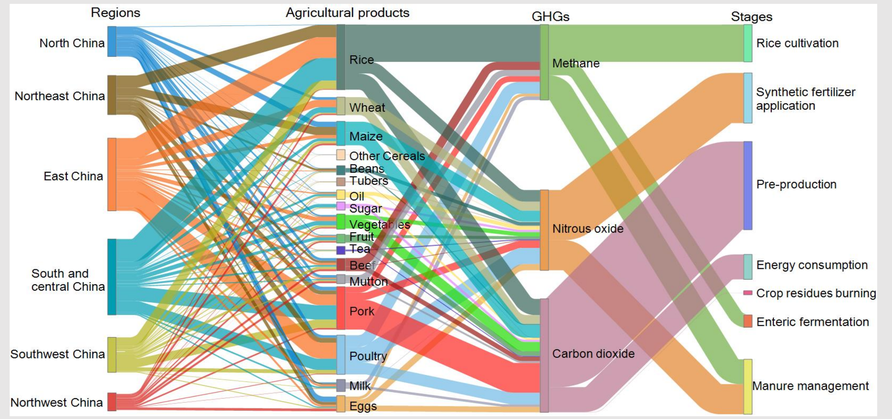


Results

- Details of applicable mitigation technologies

Code	Applicable Mitigation technology	Target	GHG(s)	Introduction
C1	Advanced Irrigation Management	Rice	CH4	Replacing continuous flooding with medium season drainage and intermittent irrigation
C2	Enhanced-efficiency Synthetic Fertilizer	Rice, wheat, maize	N2O	Promoting stabilized fertilizers and controlled fertilizers
C3	Better Synthetic N Fertilizer Management	Rice, wheat, maize	N2O	Using soil N test to determine the optimal N application rate Increasing the frequency of fertilization by stages and fertilizer deep placement
C4	Crop Straw or Residue Returning to Field	Wheat, Maize	N2O, SOC	Returning crop straw or residue back to field
C5	Biochar Addition	Rice, wheat, maize	N2O,SOC	Adding biochar to cropland
C6	Efficient Recycling of Composed Manure	Rice, wheat, maize	N2O, SOC	Replacing certain proportion of N fertilizers with composed livestock manure
L1	Anaerobic Digestion of Manure	Cattle, pig, poultry	CH4, N2O	Reducing direct emissions in storage and treatment of livestock manure
L2	Dietary Additives	Cattle, sheep	CH4	Adding lipid and tea saponins to diet
L3	Silage Feed Promotion	Cattle, sheep	CH4	Promoting silage feed
L4	Grazed Grassland Restoration	Grassland	SOC	Optimizing grassland grazing intensity, grazing prohibition, and grass planting

- GHG emissions from China's agriculture sector in 2017



- GHG emissions estimation 2017-2030

Year:2030	BAU	MITIGATIVE
GHG emissions/MtCO2e	1026.32	667.78
GHG reduction/MtCO2e	377.85	775.74
Reduction rate	26.91%	55.25%
CH4 reduction/MtCO2e	11.36	35.18
N2O reduction/MtCO2e	25.60	31.06
SOC reduction/MtCO2e	340.89	709.50

Conclusions & discussion

- GHG emissions in agriculture sector in China regardless of the application of mitigation measures are 1304.46MtCO2e in 2017 and 1404.17MtCO2e in 2030. Apart from pre-production, the largest source of emissions from crop and livestock are respectively synthetic fertilizer application and manure management. As a result of the huge amounts of methane produced by rice cultivation, rice is the agricultural product that emits the most GHGs.
- Under the BAU scenario, the GHG mitigation potential of China's agricultural sector in 2030 is 377.85 MtCO2e, 70% of which is due to the carbon sequestration effect from grazed grassland. Under the MITIGATIVE scenario, the GHG mitigation potential of China's agricultural sector in 2030 is 775.74 MtCO2e, and the reduction rate exceeds 55%.
- The impact of carbon tax on agricultural GHG emissions needs further research.

Data Source

- Basic agricultural data are mainly obtained from the National Bureau of Statistics, all kinds of provincial statistical yearbooks and FAOSTAT.
- The structural parameters are mainly collected from related literatures.
- Emission factors are obtained from the IPCC, and scenarios are designed with reference to the IPCC AR6 scenarios.