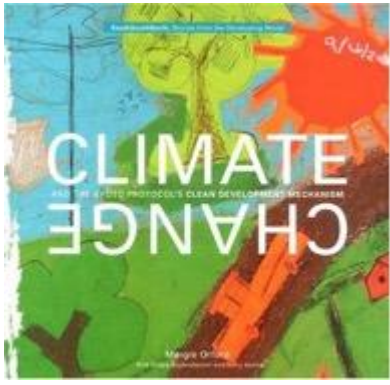
Institute of Environment and Sustainable Development in Agriculture, Chinese Academy of Agricultural Sciences

IEDA, CAAS

GLOBAL RESEARCH ALLIANCE ON AGRICULTURAL GREENHOUSE GASES



Research updates of China

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Oct 12, 2019

In this talk

- National policies & background information
- Research updates

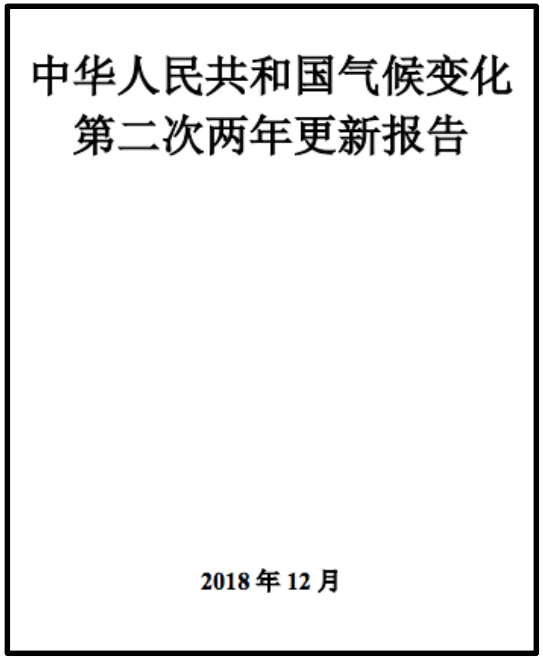
China's policies and actions to address climate change——2018 Annual Report

- **Control GHG from agricultural sector**
  - **Promote soil testing and formula fertilization and fertilizer and pesticide reduction and synergy**
  - **In 2017, the utilization rate of chemical fertilizers for rice, corn and wheat in the country was 37.8%, an increase of 2.6 percentage points over 2015; the use of chemical fertilizers and pesticides achieved zero growth ahead of schedule**

Source: Ministry of Ecology & Environment 2019

Second update report on climate change in the People's Republic of China

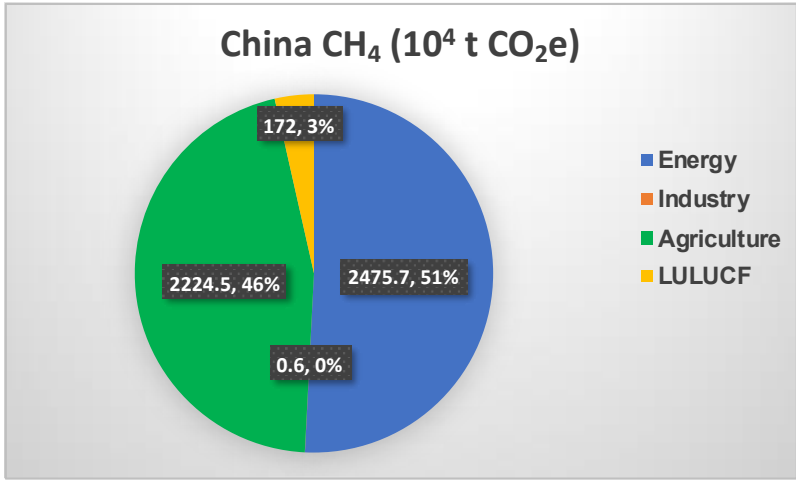
Greenhouse gas emission in China 2014 (Mt CO_2e)

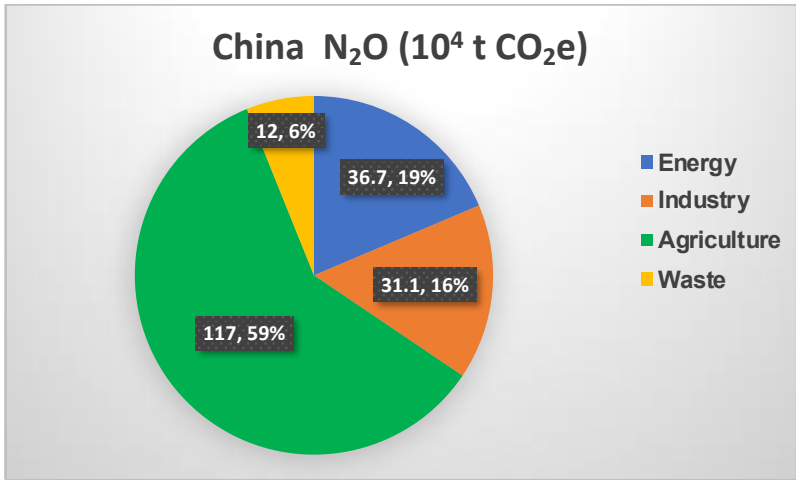


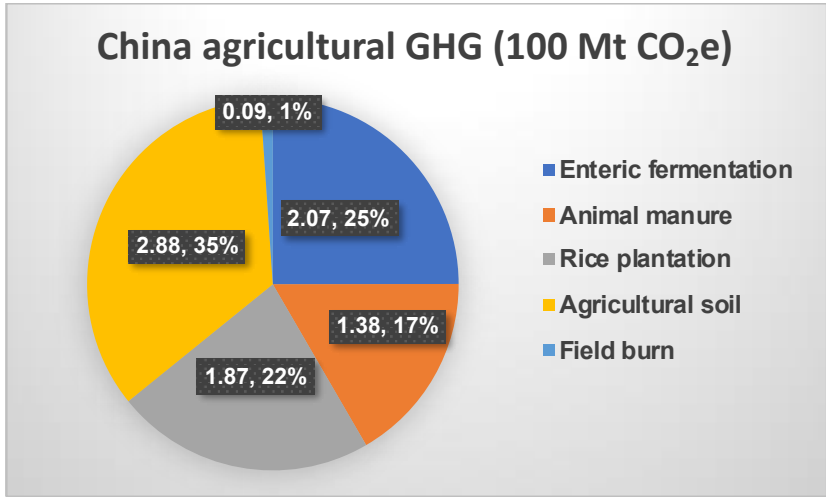
	CO_2	CH_4	N_2O
Energy	8925	520	114
Industry	13.3		96
Agriculture		467	363
Waste	20	138	037
LULUCF & Forestry	-1151	36	
All	9124	1161	610

Source: Ministry of Ecology & Environment 2018

GHG emission from China agriculture







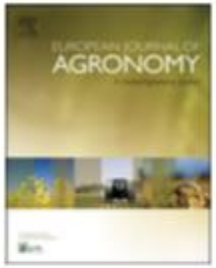
Source: Ministry of Ecology & Environment 2018

Climate change

Contents lists available at ScienceDirect

European Journal of Agronomy

journal homepage: www.elsevier.com/locate/eja



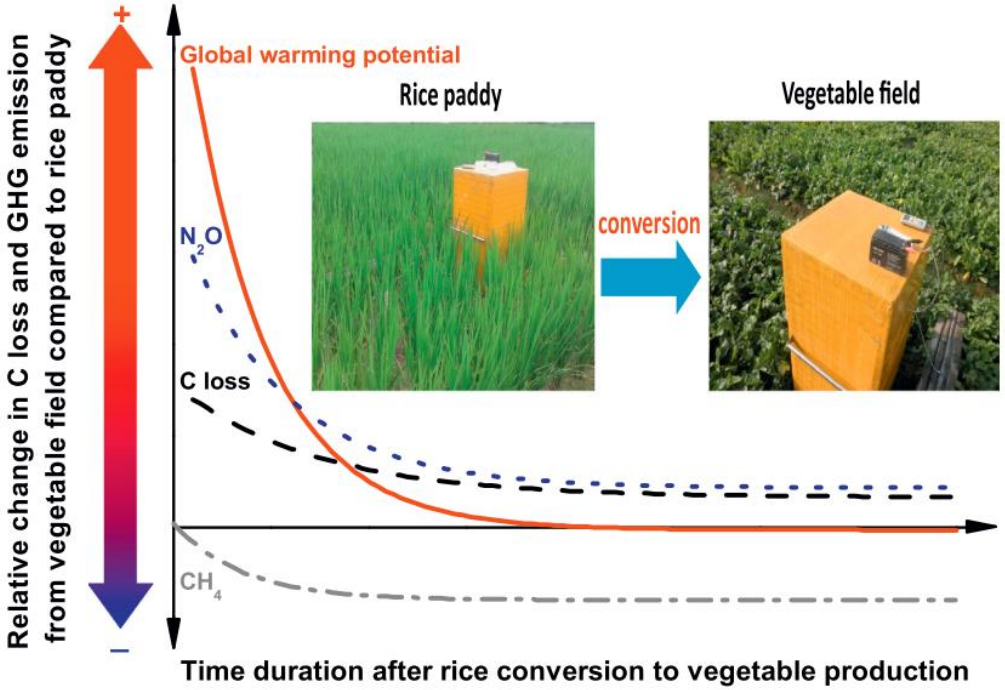
Responses of yield, CH_4 and N_2O emissions to elevated atmospheric temperature and CO_2 concentration in a double rice cropping system

Bin Wang[a,1], Jianling Li[a,1], Yunfan Wan[a,*], Yu'e Li[a], Xiaobo Qin[a], Qinzhu Gao[a], Muhammad Ahmed Waqas[a], Andreas Wilkes[a], Weiwei Cai[b], Songcai You[a], Shouhua Zhou[c]

- **Elevated [CO2] (60 ppm above ambient) increased yield, CH4 and N2O emissions in the double rice cropping system**
- **Elevated temperature (2 ℃ above ambient) enhanced CH4 emissions, whereas it tended to decrease N2O emissions**
- **The combined effect between temperature and [CO2] was positive on CH4 emissions and yield of late rice, but showed an offsetting effect on N2O emissions and yield of early rice**

(Wang et al. 2018 European journal of agronomy)

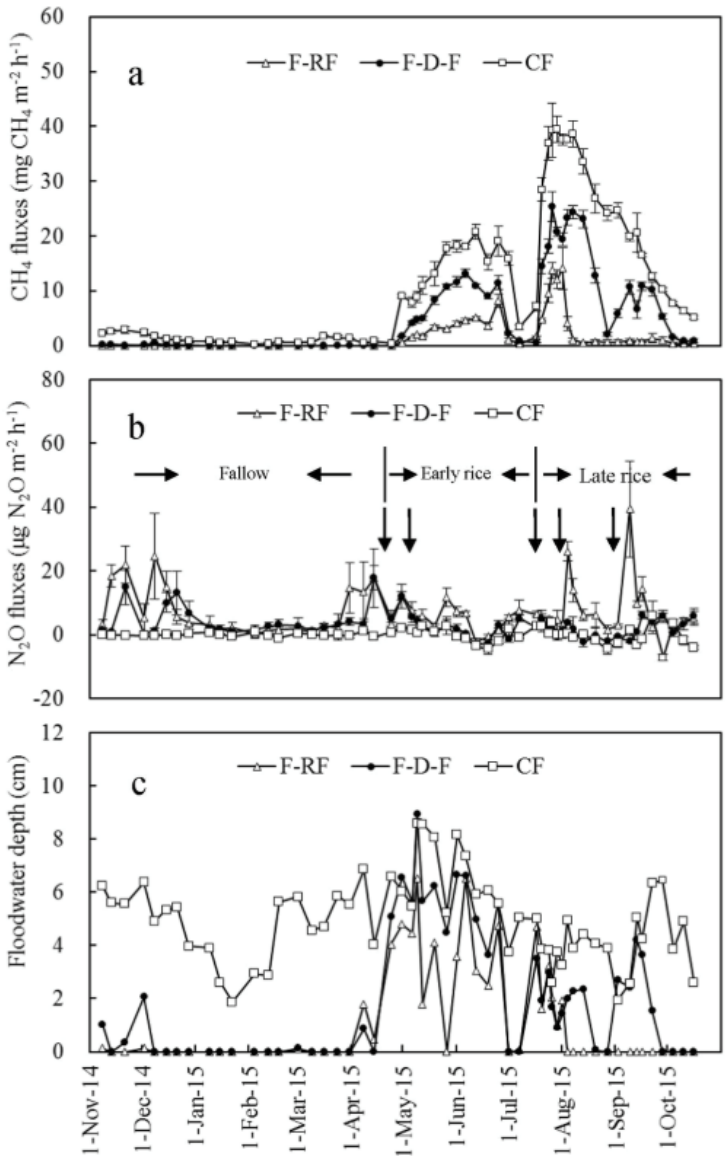
Land use conversion



- Land-use conversion from rice to vegetable cultivation led to substantial C losses (2.6 to 4.5 Mg C ha−1 yr−1), resulting from strongly reduced C input by 44–52% and increased soil organic matter mineralization by 46–59% relative to Rice
- Land-use conversion greatly increased the global warming potential (GWP) from Veg by 116–395% relative to Rice in the first year, primarily due to increased C losses and N2O emission outweighing the decreased CH4 emission.

(Wu et al. 2018, Science of the total environment)

Water regime



SCIENTIFIC REPORTS

OPEN

ed: 19 July 2017
ed: 13 December 2017
ed online: 15 January 2018

Net global warming potential and greenhouse gas intensity as affected by different water management strategies in Chinese double rice-cropping systems

Xiaohong Wu[1,2], Wei Wang[1], Xiaoli Xie[1], Chunmei Yin[1], Haijun Hou[1], Wende Yan[2] & Guangjun Wang[2]

- **The GHGIs were 2.07, 0.87 and 0.18 kg CO2-equivalent kg−1 grain yr−1 for the CF, F-D-F, and F-RF, respectively**
  - **CF: continuous (year-round) flooding (CF)**
  - **F-D-F: flooding during the rice season but with drainage during the midseason and harvest time (F-D-F)**
  - **F-RF: irrigation only for flooding during transplanting and the tillering stage (F-RF).**

(Wu et al. 2018 Scientific report)

Additives

Environmental Science and Pollution Research (2018) 25:15896–15908
https://doi.org/10.1007/s11356-018-1808-6

RESEARCH ARTICLE

Nitrogen fertilizer in combination with an ameliorant mitigated yield-scaled greenhouse gas emissions from a coastal saline rice field in southeastern China

Liying Sun[1,2] · Yuchun Ma[1,3] · Bo Li[4] · Cheng Xiao[1] · Lixin Fan[1] · Zhengqin Xiong[2]

- Three N fertilizers significantly increased the CH4 emissions, N2O emissions, GWP, and grain yield by 42.2% ($p < 0.001$), 57.1% ($p < 0.001$), 49.8% ($p < 0.001$), and 58.9% ($p < 0.001$), respectively
- NuA1, NmA1, and NwA1 treatments obviously reduced the yield-scaled GHG by 21.3%, 16.3%, and 12.4%, respectively
- N fertilizers would increase the GWP, combining an ameliorant amendment with N fertilizer can effectively reduce the yield-scaled GHGI and meanwhile increase the grain yield, particularly the NmA1 strategy

Biochar

Contents lists available at ScienceDirect

Agriculture, Ecosystems and Environment

journal homepage: www.elsevier.com/locate/agee

Effects of biochar amendment on net greenhouse gas emissions and soil fertility in a double rice cropping system: A 4-year field experiment

Cong Wang[a,b,c], Jieyun Liu[d], Jianlin Shen[a,*], Dan Chen[a,c], Yong Li[a,*], Bingshen Jiang[a,c], Jinshui Wu[a]

- On a 4-year average, biochar addition significantly reduced annual NGHGE and GHGI by 156 to 264% and 159 to 278%, respectively
- Biochar amendment also significantly and persistently increased soil pH, total organic carbon (TOC), total nitrogen (TSN), and total phosphorus (TSP)

(Wang et al. 2018)

Biochar

Environmental Science and Pollution Research (2019) 26:749–758
https://doi.org/10.1007/s11356-018-3636-0

RESEARCH ARTICLE

Greenhouse gas emissions vary in response to different biochar amendments: an assessment based on two consecutive rice growth cycles

Haijun Sun [1,3] · Haiying Lu [2] · Yanfang Feng [2]

- Biochar applications did not alter GHG emission flux patterns in either rice cycle
- The response of GWP and GHGI varied mainly with application rate and pyrolysis temperature
- High temperature and high rate caused higher GWP & GHGI mitigation efficiencies

Biochar + water-saving

sustainability

MDPI

Article

Effect of Biochar Amendment on Methane Emissions from Paddy Field under Water-Saving Irrigation

Yanan Xiao [1], Shihong Yang [1,2,*], Junzeng Xu [1,2], Jie Ding [1], Xiao Sun [1] and Zewei Jiang [1]

- Rice-straw biochar amendment and water-saving irrigation technology can inhibit CH4 emissions while increasing rice yield and irrigation water productivity
- The effects of increasing rice yield and irrigation water productivity were more remarkable for C40, but C20 was more effective in mitigating CH4 emission

Sustainability **2018**, *10*, 1371; doi:10.3390/su10051371

Organic management

Contents lists available at ScienceDirect

Soil & Tillage Research

journal homepage: www.elsevier.com/locate/still

Winter tillage with the incorporation of stubble reduces the net global warming potential and greenhouse gas intensity of double-cropping rice fields

Yuting Yang[a,b], Qiong Huang[a,b], Haiyang Yu[a,b], Kaifu Song[a,b], Jing Ma[a], Hua Xu[a], Guangbin Zhang[a,*]

- **Significant decreases in the net GWP (46-82%) and GHGI (49-84%) were observed when changing the tillage practices with the incorporation of stubble from spring to winter**
- **Tillage with the incorporation of stubble in the winter fallow season, particularly with 3.5 t ha−1 stubble, is an effective strategy to mitigate the net GWP and GHGI while maintaining a high grain yield in the double-cropping rice system**

(Yang et al. 2018)

Biodiversity

Environmental Science and Pollution Research (2018) 25:22744–22753
https://doi.org/10.1007/s11356-018-2380-9

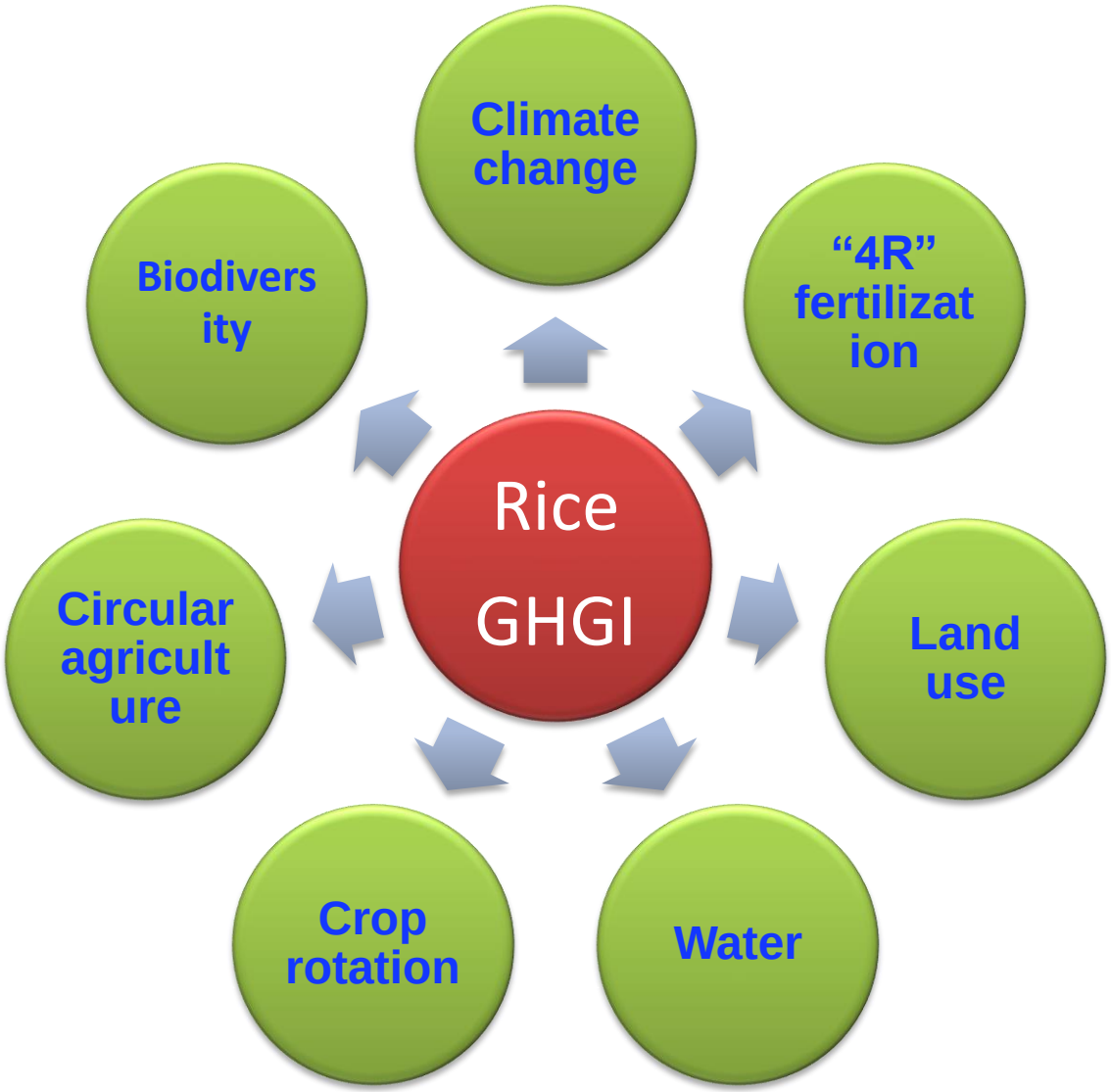
RESEARCH ARTICLE

Integrated rice-duck farming decreases global warming potential and increases net ecosystem economic budget in central China

Feng Sheng [1,2] · Cou-gui Cao [1,3] · Cheng-fang Li [1,3]

- RD treatment significantly elevated the N2O emissions ($p < 0.05$) but decreased CH4 emissions ($p < 0.05$) during rice growing seasons compared with R treatment
- RD treatment significantly decreased the GWP by 28.1 and 28.0% and reduced the greenhouse gas intensity by 30.6 and 29.8%
- Integrated rice-duck farming system is an effective strategy to optimize the economic and environmental benefits of paddy fields in central China

Multiple solutions




Thank you for your attention!
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