

Climate Smart Agriculture for Food Security

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1. Background

2. Work Progress

3. Proposal



Climate Smart Agriculture

- Climate-smart agriculture (CSA) is an approach for developing agricultural strategies to secure sustainable food security under climate change.
- **CSA** aims to tackle three objectives:
 - Increasing agricultural productivity and incomes;
 - Adapting and building resilience to <u>climate change</u>;
 - Reducing and/or removing GHG emissions.

Why CSA is important for Climate change and Food Production?

http://www.fao.org/climate-smart-agriculture/en/



Food Production is One of Major Objective of Addressing Climate Change

□ 《 UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE)》 (UNFCCC), Article 2

The ultimate objective of this Convention is to achieve, stabilization of greenhouse gas concentrations in the atmosphere at a level Such a level should be achieved to ensure that food production is not threaten.

□ 《 Paris Agreement》, Article 2.1 (b)

Increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production;





Agriculture Is A Major GHGs Emission Source – 13%



Note: Figures may not equal 100% due to rounding.

100% = 6.4 Gt CO_e

* LULUCF = Land Use, Land Use Change, and Forestry.

** Includes emissions from on-farm energy consumption as well as from manufacturing of farm tractors, irrigation pumps, other machinery, and key inputs such as fertilizer. It excludes emissions from the transport of food.

*** Excludes emissions from agricultural energy sources described above.

Source: WRI analysis based on UNEP(2012), FAO(2012e), EIA(2012), IEA(2012), and Houghton(2008) with adjustments.



Agriculture GHG Emissions in China





GHG Emissions in China

	1994	2005	2012
温室气体排放总量(考虑LUCF) Total GHG emission with LUCF (Pg CO₂e)	3.65	7.05	11.32
年温室气体排放增加速率 Increase rate of total GHG emissions (Pg CO₂e/year)	0.28	0.47	
农业源温室气体排放 Emission from agriculture sector (Pg CO2e)	0.61	0.82	0.92
农业源年温室气体排放增加速率 GHG Increase rate in agri. sector (Tg CO ₂ e/year)	17.5	11.1	
农业源对全国温室气体贡献 Contribution of Agriculture (%)	16.7	11.6	8.1



Climate Change Impact on Yield in China

By 2030, plant production may reduce 5%-10%, due to high temperature, frequent drought and flood, and water shortage





Extreme Weather Impact in China



Annual Variation of GGP in China(1949~2010)



Drought



Flooding



Hail

11

Caused by extreme climatic event in 2009

- grain losses reached 55 million tones
- 10% of total grain production



The 13th five-year plan for economic and social development

China Responded to Global Climate Change

While working hard to both adapt to and slow down climate change, we will take active steps to control carbon emissions, fulfill our commitments for emission reduction

Greenhouse gas emissions control

- ✓ Effectively control carbon emissions in key industries,
- ✓ Control the emissions of non- CO_2 greenhouse gases.
- ✓ Establish national carbon trading scheme
- ✓ Implement MRV and quota management for major carbon emitters
- / Improve statistic, accounting and performance evaluation

During the 13th five-year period, carbon dioxide per unit GDP will decrease by 18% as a binding indicator



China's Nationally Determined Contributions

China NDC are as follows

- ✓ To achieve the peaking of carbon dioxide emissions around 2030 and making best efforts to peak early
- ✓ To lower carbon dioxide emissions per unit of GDP by 60% to 65% from the 2005 level

Agricultural related content in NDC

- ✓ To promote the low-carbon development in agriculture, making efforts to achieve zero growth of fertilizer and pesticide utilization by 2020
- To control methane emissions from rice fields and nitrous oxide emissions from farmland
- ✓ To construct a recycle agriculture system, promoting comprehensive utilization of straw, agricultural wastes and animal manure



Work Progress



I. GHG emissions and mitigation



Climate change related work in CAAS





1. Site Level















Monitoring Network-livestock





Monitoring Network-Grass Land





Monitoring Network-Cropland





1. Site level Identification of mitigation options

4-year continuously monitoring CH₄ and N₂O emissions from double rice paddies
▶ Different fertilizers (Urea, Capsuled urea, urea plus nitrification inhibiter)
▶ Different water regime (traditional water irrigation, water saving irrigation)





GHG Emission Reduction by Formula Fertilization





The area of formula fertilization in China from 2006 to 2013

The weighted average of fertilizer saving for three crops is 27.23 ± 7.42 kg·ha⁻¹.



Project/Enterprise level----MRV of Mitigation

- Meta-analysis to obtain emission factors and carbon sequestration factors under different condition
- Development of carbon trading methodologies for CDM, VCS and CCER projects
- Guidelines for GHG accounting and reporting for planting enterprises and livestock enterprises



2. Project/Enterprise level Meta-analysis Carbon Sequestration Factor









2. Project/Enterprise Level Mitigation Carbon Trading Methodologies

Development of methodologies for carbon trading systems (CDM, VCS, CCER)

- Methane recovery in agricultural activities at household/small farm level (CDM: AMS-III.R)
- Sustainable Grassland Management (SGM) (VCS: VM0026)
- Carbon sequestration and GHG mitigation of conservation tillage(CCER: CMS-083-V01)
- CH4 mitigation from ruminant animals (CCER: CMS-081-V01)
- GHG mitigation through animal manure compost (CCER: CMS-082-V01)
- GHG mitigation through fertilizer management
- Carbon sequestration and GHG mitigation of biochar application



2. Project/Enterprise Level Mitigation National Standards on Accounting & Reporting for Enterprises

- Guidelines of GHG emission accounting & reporting---Planting Enterprise
- Guidelines of GHG emission accounting & reporting---Livestock Enterprise
 - Accounting boundary
 - Accounting methods
 - Monitoring requirements
 - Reporting requirements

The standards can support MRV of mitigation actions at enterprise level



Subnational / National Level Compilation of GHG Inventory, Tracking Mitigation Progress

- Compilation of GHG emission inventory
- Evaluation of low carbon agricultural development P&Ms effects on GHG emissions
- Development of MRV system for mitigation actions at national or subnational levels



3. National Level Inventory and Mitigation Compilation of GHG Emission Inventories

- CH₄ emissions from livestock
- CH_4 and N_2O emissions from manure management systems
- Carbon sequestration in grassland

中华人民共和国 气候変化初始国家信息通报 The People's Republic of China Infrag National Communication on Climate Change	Second National Communication on Climate Change of The People's Republic of China	The People's Republic of China First Biennial Update Report on Climate Change	Third National Communication On Climate Change of The people's Republic of China The people's Republic of China Second Biennial Update Report on Climate Change	
A.0. 2005		December 2016	available at the end of 2018	



II. Climate Change Impact Assessment



1960

1970 1980 1990 2000 2010 2020

2030 2040 2050 2060 2070 2080 2090 2100

Year



1.0



FACE System

Exploring the impact of elevated CO₂ and temperature on crop yields and nutrient cycling
 Identifying crop varieties adapting to Climate Change







National Basic Research Program

Impact and Adaptation Mechanism of Climate Change on Food Production in China

1. Depicted the change trends of climate indicators, including water and temperature, of major crops

2. Analyzed regional prevailing mechanism of plant diseases and its impact on productivity

3. Illustrated the Climate Change impact on crop planting system and regional distribution

4. Discovered the impact and adaptation mechanism of Climate Change on the yields of major crops

5. Assessed the Climate Change impact on food security in long term in China





National-Scale Crop Spatial Distribution Data Uploaded to "Spatial Production Allocation Model(SPAM)"

http://www.mapspam.info/









Climate Smart Agriculture

- Improve *productivity for* food supply
 - Genetic exploring and climate change ready varieties
 - Technical Integration and intensification
- Enhance *climatic resilience* for ecosystem health
 - Multi- and/or Inter-cropping system to improve profit and reduce environmental and natural disaster risks
 - Crop-based livestock (dry subhumid)
 - Grassland-based livestock (arid and semiarid)
- Intensify *carbon management* for C sequestration & GHGs reduction
 - Enhance soil organic carbon and fertility
 - GHGs emission Reduction



Targeted Regions (Countries): China, Central and Western Asia, North Africa, and South Asia



Theory and Methodology of CSA

Fully understanding of the dynamics of climate change and how will climate change affect the agro-ecosystems and agricultural sector

- Study the dynamics of climate change, responses and adaptation mechanisms of crops and agro-ecosystems to climate change;
- Develop the climate change impact assessment model to identify impact pattern and trends of climate change, and assess impacts for different regions



Improving Agricultural Productivity

- Study on key technologies related to water harvesting, water-saving irrigation and water-fertilizer integration
- Develop climate ready crop varieties, and optimize cropping system
- Develop the integrated technology system for intensive oasis production system and dryland agricultural production system to enhance productivity and resilience to climate change



Impact Assessment & Adaptation

- Achieve precise mapping of crop distribution and of farming conditions, disasters monitoring, production estimation, and information services for decision-making.
- Develop adaptation strategies and early warning mechanism for targeted countries.







EQA-CANS

GHGs Mitigation & C Sequestration

- Improve estimation and monitoring of emissions in typical systems
- Develop and identify of Mitigation technology or systems to reduce emissions, increase carbon sequestration, through improving productivity and efficiency
- **Demonstration and extension** of the integrated technology system of carbon sequestration and mitigation technologies







Thanks for your attention !

