Impacts of Climate Change on Water and Agricultural Production in the Huang-Huai-Hai Plain in China

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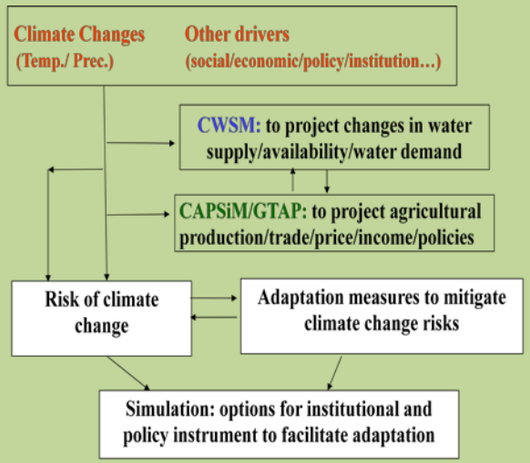
Research Objectives

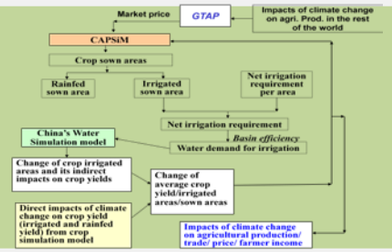
- Develop one integrated conceptual framework and analysis tool that can be used to analyze the relationship among climate change, water and agricultural production.
- Explore the impacts of climate change on water availability and irrigation water demand.
- Explore the impacts of climate change on agricultural production and cropping pattern.
- Provide several policy recommendations in water and agricultural development.

Study Areas

Conceptual Framework



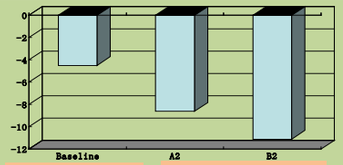
Linkage among Models



Alternative Scenarios Analyzed in the Study

	A2		B2		Worse scenario	
	W/O CO2	With CO2	W/O CO2	With CO2	A2- W/O CO2	B2- W/O CO2
Reducing water supply in all						
Only climate change in China	S1	S3	S5	S6		
Climate change in all countries	S2	S4				
Reducing water use only in agricultural						
Only climate change in China						S8
Climate change in all countries					S7	

Water Shortage under various scenarios(2030)



No climate change | Climate change

Percentage change of crop irrigated areas relative to reference scenario in 2030

	Haihe RB	Huaihe RB	Yellow RB (down)
Reducing water use in all sectors			
A2	-4.37	-5.45	-2.18
B2	-8.99	-8.05	-2.77
Reducing water use only in agricultural sector			
A2	-7.4	-10.42	-3.77
B2	-15.05	-15.01	-4.74

The impacts of climate change on productions in China (relative to reference scenario in 2030, A2 scenario)

	Without fertilization effect		With fertilization effect	
	Only climate change in China	Climate change in both China and the rest of the world	Only climate change in China	Climate change in both China and the rest of the world
	S1	S2	S3	S4
Impacts on production				
In thousand tons				
Rice	-6158	-4889	-115	-382
Wheat	-4620	-3667	5436	5963
Maize	-12669	-8802	5135	6664
In percentage (%)				
Rice	-5.6	-4.5	-0.1	-0.3
Wheat	-5	-4	5.9	6.5
Maize	-5.1	-3.6	2.1	2.7

The impacts of climate change on prices of three major crops in China (relative to reference scenario in 2030, A2 scenario)

	S1	S2	S3	S4
Impacts on prices (%)				
Rice	14.4	17.6	-1.6	-2
Wheat	12.5	15.9	-11.7	-11.4
Maize	6.9	10.9	-3.6	-3.4

Source: simulation results from GTAP and CAPSiM models.

The impacts of climate change on exports and imports of three major grains in China (relative to reference scenario in 2030, A2 scenario)

	Without fertilization effect		With fertilization effect	
	Only climate change in China	Climate change in both China and the rest of the world	Only climate change in China	Climate change in both China and the rest of the world
	S1	S2	S3	S4
Export in 2030				
Rice	-1949	-116	301	-127
Wheat	-847	-111	826	1363
Maize	-394	-174	227	339
Import in 2030				
Rice	185	59	-13	0
Wheat	959	101	-601	-794
Maize	9742	4811	-3725	-5298

The impacts of climate change on self-efficiency of three major grain crops in China (relative to reference scenario in 2030, A2 scenario)

	Without fertilization effect		With fertilization effect	
	Only climate change in China	Climate change in both China and the rest of the world	Only climate change in China	Climate change in both China and the rest of the world
	S1	S2	S3	S4
Rice	-2	0	0.3	-0.1
Wheat	-2	-0.2	1.5	2.2
Maize	-3.9	-2	1.6	2.2

Policy Suggestions (I): Related with Water Scarcity

- Significant increases in investment in water infrastructure, including irrigation, drainage and water storage capacity;
- Substantially increase its water use efficiency in all sectors
  - Institutional and management changes
  - Water pricing reform
  - Water rights reform
  - Water saving technology

Policy Suggestions (II): Related with Agricultural Productivity enhance

- Develop a national long term plan for agricultural research development strategy that incorporate climate change into China's agricultural research priority setting
- Enhance research and development on crops that will likely be negatively affected by climate change (e.g., maize and rice).
- Enhance research and development in areas that will likely be much more negatively affected by climate change (e.g., Haihe RB and Huaihe RB).
- Enhance research and development on technologies, particular biotechnology, that will facilitate crops to fix nitrogen, improve disease and pest control, and improve efficiency of water uses (e.g., water saving technology, draught resistant crop varieties, etc.)

Policy Suggestions (III): Related to Market Infrastructure and Trade

- Continue to increase investment in rural infrastructure, particular road system so that domestic market can be better integrated.
- Increase investment in marketing facilities (e.g., national and regional wholesale markets) and marketing information and communication system.
- Facilitate global trade liberalization, particular the efforts to push the conclusions of Doha Round negations.