

GREENPEACE 绿色和平

Climate Change and Food Security in China



Executive Summary

Climate change has become one of the greatest challenges faced by the human race. It affects almost all aspects of our society, including food supply. Agriculture has long been the foundation of China's social and economic development. With a large agricultural population and a huge pressure placed on resources, as well as a large production area that features complex topography and distinct patterns of climate, China's farming industry is very vulnerable to climate change. Against this background, ecological agriculture therefore has its obvious advantages. It is of great importance for the sustainable development of agricultural and national security to determine the impact of climate change on agriculture and food security in the country, and to devise and implement appropriate measures to avoid these problems.

Climate Change threatens China's Food Security

Climate change affects agricultural production through changes in temperature, water

resources, soil condition, as well as causing extreme weather events, disease and pest outbreaks. Its influence varies between different regions and seasons. Generally speaking, its impact on China's agriculture has both a positive and a negative aspect, with the latter being dominant. Climate change will lead to increasing fluctuations in the country's food production, and threaten the country's food security.

Rising temperature is the most prominent feature of climate change. It directly affects the growth of crops from a physiological perspective, and therefore affects food production capability. It is estimated that because of climate change, over the next 20 to 50 years, China's rice, corn and wheat production will drop significantly, while the overall agricultural productivity will also be hit hard. If no effective measures are taken, a national average temperature increase of 2.5-3°C will lead to decreases in the yield of these three major crops. The primary result of a new study shows that, with the combined effects of the increase in temperature and the decrease in agricultural water resources and arable land,



China's overall food production will fall by 14%-23% by 2050 from 2000 (when the total food production was 500 million tons).

In northern China, rising temperatures will worsen water shortages, especially in arid and semi-arid regions where desertification is accelerating. On the other hand, strong precipitations in the middle and lower reaches of the Yangtze River are happening at an increased rate and will cause more catastrophic flooding. These droughts and precipitations have a direct impact on agricultural production. Crop yields may be reduced, with some being completely wiped out.

China's agriculture is relatively vulnerable to climatic disasters. Currently, as much as 50 million hectares of crops in China are threatened by various climatic disasters every year. With increased frequency and intensity of extreme weather events, including heat waves, rainstorms, droughts, floods and typhoons, China may suffer even larger losses in agricultural production in the future.

Climate change will also lead to increased activity of soil microorganisms. That will cause a loss of organic matter and nitrogen in the soil, accelerated soil degradation, erosion and alkalinizing, as well as weakening in the capability of the agricultural ecosystem to resist natural disasters.

Environmental changes due to climate change can aggravate the spread of plant diseases, pests and weed growth. Plant diseases and pests are currently causing a 20%-25% average annual loss to China's agriculture output value.

Rising winter temperatures have helped many pests and pathogens to survive more easily, increasing the number of generations in a single year and therefore the probability of harming crops.

Climate change also poses a challenge to China's agricultural production pattern and planting system established over hundreds of years because of the changes it makes to water and temperature conditions, especially in low-latitude areas. However, these changes have also made it possible to introduce the multiple-crop planting systems in mid and high latitude areas as well as in plateau areas, such as rice planting in Heilongjiang and the northward expansion of winter wheat planting operations.

We have seen an increasing use of pesticides and chemical fertilizers in an effort to adapt to the negative climate impact. In addition, climate change can also increase irrigation costs and costs for soil improvement and conservation, thus increasing total agricultural investment.

The increasing demand for food and bio-fuel and the decrease in both crop yield and storage around the globe due to natural disasters, has caused global food prices to shoot up. Climate change may further deteriorate the situation. For China, this means serious consequences for food production. Taking into consideration increased demands for food in the future, climate change will affect the country's ability to balance food supply and demand. Under a high greenhouse gas emission scenario, basic food supplies will become insufficient around 2030. Under a mid to low emission scenario, this problem may not occur but it may not be possible to meet the



food requirements for sustainable social development.

Therefore, it becomes especially important to devise suitable policies to adapt to these scenarios, which include better irrigation, more appropriately selected seeding times, and alternating among different crops. Meanwhile, more emphasis should be placed on ecological agriculture, which is a way to reduce greenhouse gas emissions from agriculture while ensuring production yield.

The Advantages of Ecological Agriculture

This report has pointed out that compared to the

current production mode which depends heavily on agro-chemical input, the more comprehensive ecological approach to agriculture can effectively reduce greenhouse gas emissions. Also, due to its characteristics, ecological agriculture can more easily adapt to climate change, and its associated problems such as rising temperatures, water shortages, extreme weather, soil degradation and increasing frequency of disease and pest outbreaks. Eco-agriculture can help to ensure the country's food production and food security.

The main features of ecological agriculture include maintaining soil fertility through organic measures and reducing dependence on synthesized materials such as fertilizers, pesticides and other agro-chemicals. It works with nature by following the way nature functions, protecting and rationally using natural resources, promoting animal breeding methods that better cater to the animals' needs, adapting to the local environment and providing highly diversified operation modes.

Ecological agriculture can reduce greenhouse gas emissions and can increase carbon sequestration.

On greenhouse gas emissions: According to the report, the rice-fish system is shown to be able to improve the oxidation-reduction condition of soil and significantly decrease methane emissions. The rice-duck system is also capable of improving the microclimate in the field and reducing methane emissions. The construction of biogas generators in rural areas can control methane emissions during the processing of organic fertiliser. The utilising of biogas in

stead of coal is expected to cut carbon dioxide emissions by 3,077,700-45,928,000 tons and sulphur dioxide emissions by 130,000-988,700 tons annually between 2010 and 2050. The use of organic fertiliser can also reduce dependence on nitrogenous fertilisers. Nitrous oxide emissions can also be reduced.

On carbon sequestration: The report points out that conservation farming methods in ecological agriculture, including the restoration of farmland to forest and grassland, no-till or less-till farming and returning straw and stalk to the field, can greatly increase the carbon storage capacity of China's soil and improve the overall ecological environment, therefore mitigating the impact of climate change.

As a comprehensive and systematic agricultural production method that suits local circumstances, ecological agriculture can better adapt to climate change. The report has illustrated the high adaptability of ecological agriculture to climate change examples including the northward relocation of winter wheat planting in Liaoning and conservation farming operations in Inner Mongolia.

Ecological agriculture can also control the threat from disease, pests and weeds, and reduce the use of agro-chemicals. By increasing biodiversity in the field, plant disease can be effectively controlled through the natural competition among different species, therefore significantly reducing the need for agro-chemicals





and resulting in less pollution. Experiments carried out in Yunnan have shown that by planting only the disease vulnerable glutinous rice, an average incidence of 20% for rice blast is observed. After intercropping glutinous rice with other rice varieties, however, the incidence rate was reduced to only 1%. Intercropping of glutinous rice and other rice varieties reduces the production loss caused by rice blast and rice falling over and increases production yield by 6.5%-8%.

By integrating physical, agricultural and biological measures, disease, pests and weeds that affect crops can be better controlled. According

to the report, measures including planting lettuce with cucumbers and the rice-duck, rice-fish systems can effectively control disease, pests and weeds, while the income of farmers is also boosted. These methods also help to decrease human intervention to the natural ecological system in the forms of herbicides and pesticides. Studies show that the rice-duck system is 65.5% effective in controlling the rice planthopper pest. A four-year consecutive adoption of rice-duck mode will control 99% of the rice field weeds, cut the infection rate of rice roots to rice sheath blight by 56.0% and the infection rate of rice stripe by 57.7%. Climate change may cause increased incidence

of disease, pests and weeds, while the eco-agricultural mode presents an effective means to solve the country's agricultural pollution and food security problems.

The report presents two cases in Liaoning and Inner Mongolia, in which the effectiveness of ecological agriculture in adapting to climate change is clearly demonstrated. The northward relocation of winter wheat planting fully utilises land and climate resources, improves the alternating planting mode, and increases the cropping index. It is a good example showing the development of ecological agriculture and its adaptability to climate change. Through measures including no-till, less-till and surface covering, conservation farming increases the permeation of natural precipitation and reduces ground flow and evaporation, therefore improving the operation's endurance against drought and its water conservation, thus mitigating the negative effects of climate change. Conservation farming can adjust to changes in temperature and moisture in the field, reduce the respiration of crops while increasing the retention of carbon. It can also prevent erosion by wind or water, while providing protection from sandstorms. It improves the quality of life and increases the income of farmers.

These methods have shown good potential in increasing the region's adaptability to climate change. Also, an integrated agricultural system called farmland shelterbelt network has been developed based on these methods. It combines farmland with forest, and can serve to stop sandstorms and drought, adjust local climate, improve agricultural production conditions,

ensure a high and stable agricultural yield, while also increasing the region's adaptability to climate change and mitigate its impact.

Policy Recommendations

It has become very important to devise suitable counter-measures to deal with the increasing threat from climate change. This is essential to ensure the country's food security and sustainable development.

The report believes that promoting ecological agriculture to improve the environment and ensure the agricultural stability is an effective method to combat the impact of climate change. Specific policy suggestions include:

1. Develop ecological agriculture under climate change conditions;
2. Promote low-cost adaptation technology based on ecological agriculture;
3. Enhance the public's awareness on ecological agriculture's adaptability for climate change;
4. Provide financial support to protect the interests of farmers and increase their active participation;
5. Improve the development of new technologies in the agricultural sector, while devising relevant adaptive measures.

Aside from developing adaptive measures, mitigation measures aiming at reducing greenhouse gases emissions are equally important. China has to decarbonize its energy structure through increasing energy efficiency and developing renewable energy.

Lead Author

The Chinese Academy of Agricultural Sciences Lin Erda

Authors

The Chinese Academy of Agricultural Sciences Ju Hui Xiong Wei Ma Shiming Yang Xiu
Ma Chunsen Ma Zhanyun Wang Heran
Li Yingchun Han Xue Hao Yingyu
Shenyang Agricultural University Xie Liyong
Inner Mongolia Agricultural University Li Lijun

Greenpeace Coordinators

Pan Wenjing Li Yan Luo Yuannan Zheng Mingqing

Photographers

©Greenpeace / John Novis Du Jiang Kuang Yin Li Minfu

Greenpeace China

Floor 19, Unit 2, Block E Lanchou Famous Building, Jiqingli
Chaowai Street, Chaoyang District, Beijing, 100020, P.R. China

T: +86 10 6554 6931

F: +86 10 6554 6932

www.greenpeace.cn