China
Food Security Issues and Solutions

Research on Ecological Security for Food Security in China's Main Grain Production Areas

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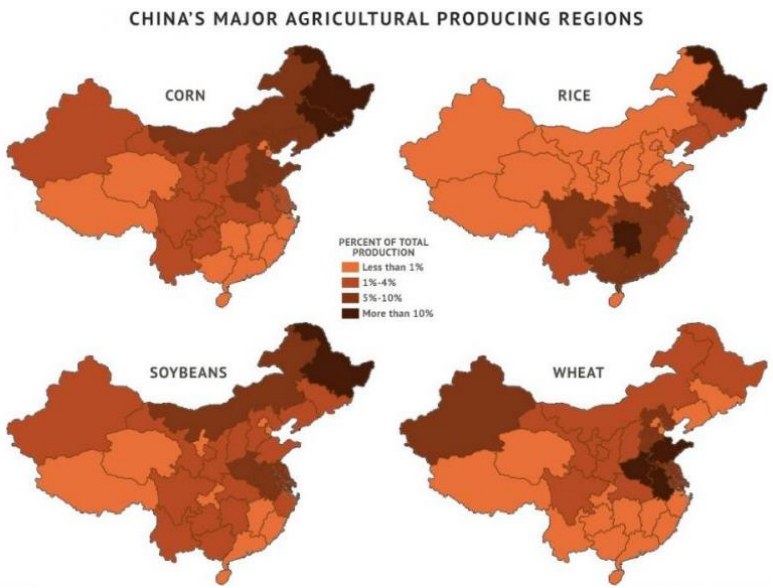
General food security situation in China:

Past and Current Policies



- Nowadays, whatever the effects of the COVID and the war in Ukraine, China must feed its population of 1.4 billion - roughly 20% of the world population - on 7% of the world arable land and ¼ of the world per capita water endowment.

- Historically, China experienced numerous food shortages and famines, which were remedied by implementing:
  - *A policy of quota* system (1953);
  - *A policy of land contract reform (*1981):
  - The *Household Responsibility System policy (*1982);
  - The creation of *13 core grain growing (CGG) areas* (2008); and
  - *An eco-civilization strategy* (2014) emphasizing green development in line with Agenda 2030 objectives.

- Nowadays, those 13 CGGs are provided the bulk of China's grain production (wheat, corn, rice, potato, etc.). As such, they are at the core of China's food security.

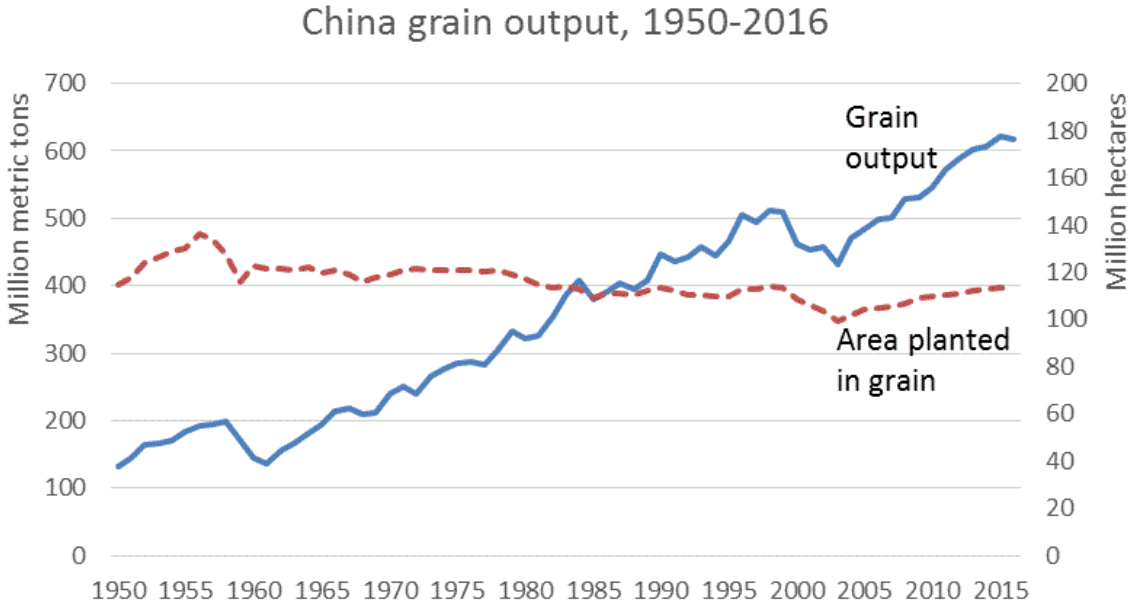
Current general food security situation in China: Facts and issues

- Due to the success of past successive policies, China has, nowadays, basically resolved the problem of insufficient grain supply - with self-sufficiency of about 95%.

  - Sinnce the early 2000, China's national agriculture production vastly increase to reach *617 million tons of grain in 2017*, surpassing the growth of its population by 34 %.
  - However, China remains the world's largest importer of soybeans and meat, dairy, wine, other food products and beverages.

  - Yet, during that period, due to the excessive pursuit of GDP growth and irrational development, China has heavily exploited its natural resources and damaged environmental conditions.

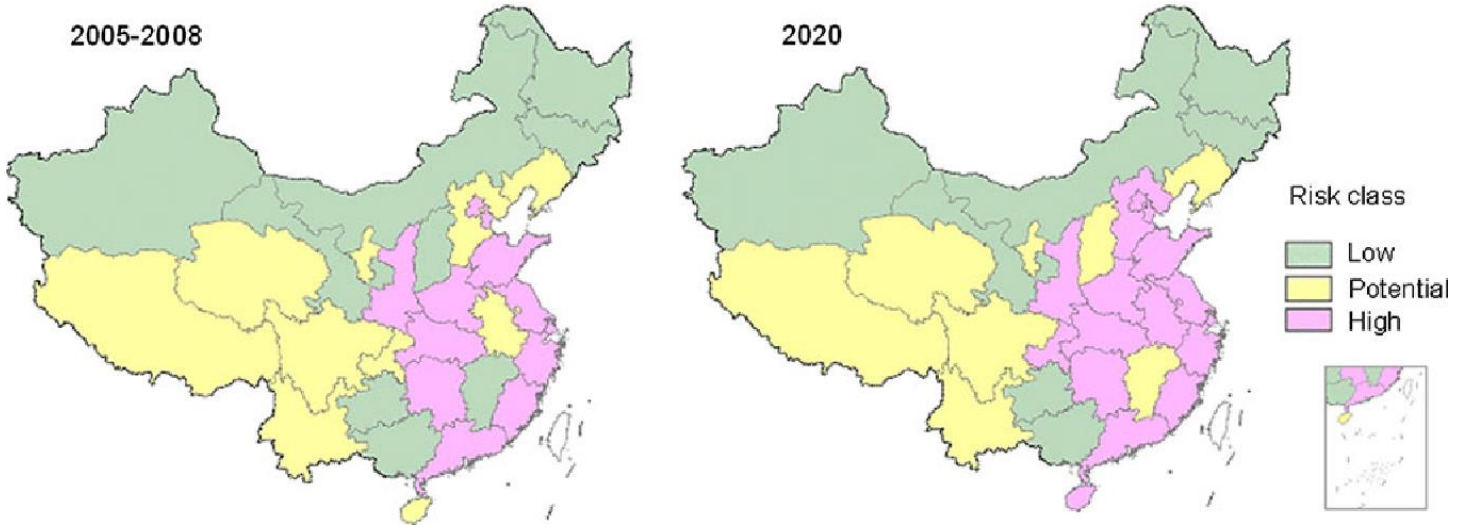
  - This a resulted in a series of serious and critical ecological and environmental issues, which may affect its food security such as soil and water pollution, groundwater scarcity, soil erosion, forest ecosystem degradation and loss of biodiversity.



Issues affecting food security in CGG areas:

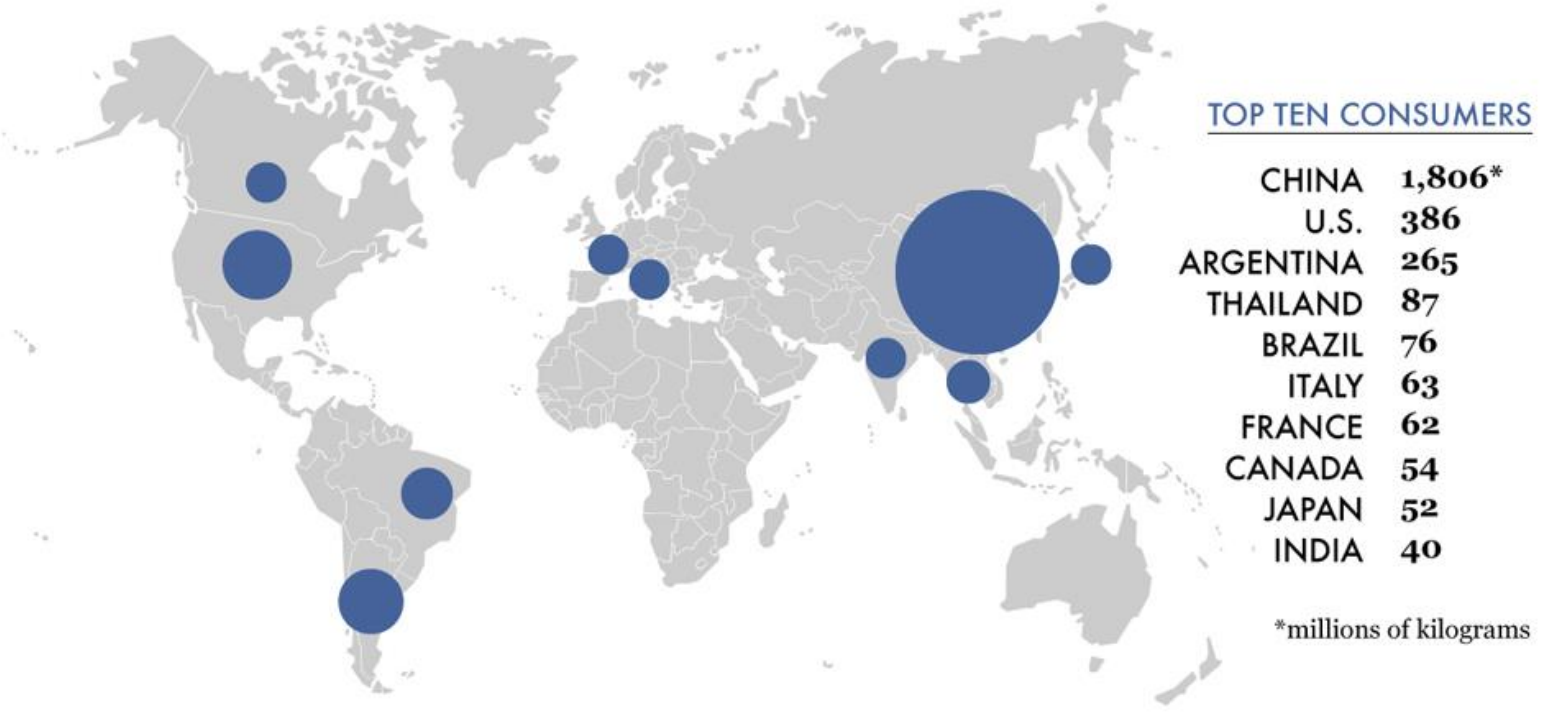
NPS Pollution

- During the past 40 years, the fertilizer application rate increase 3.7 fold since the founding of the PRC– given an average application of about 427 kg/ha with efficiencies averaging 55 % compared to 70-80 % in developing countries.
- In 2017, about 318,000 tons of pesticides were used in China, given an average application rate of 11,6 kg/ha for grain - an application rate of about 50 % higher than in other developed countries (7-8 kg/ha).
- Both, the excessive use of chemical fertilizers and pesticides is nowadays the main source of diffuse (non-point) source pollution of agricultural soils and water (NPS), which is currently affecting about 16 % of China's arable land.



Issues affecting food security in CGG areas:

Over consumtion of pesticides



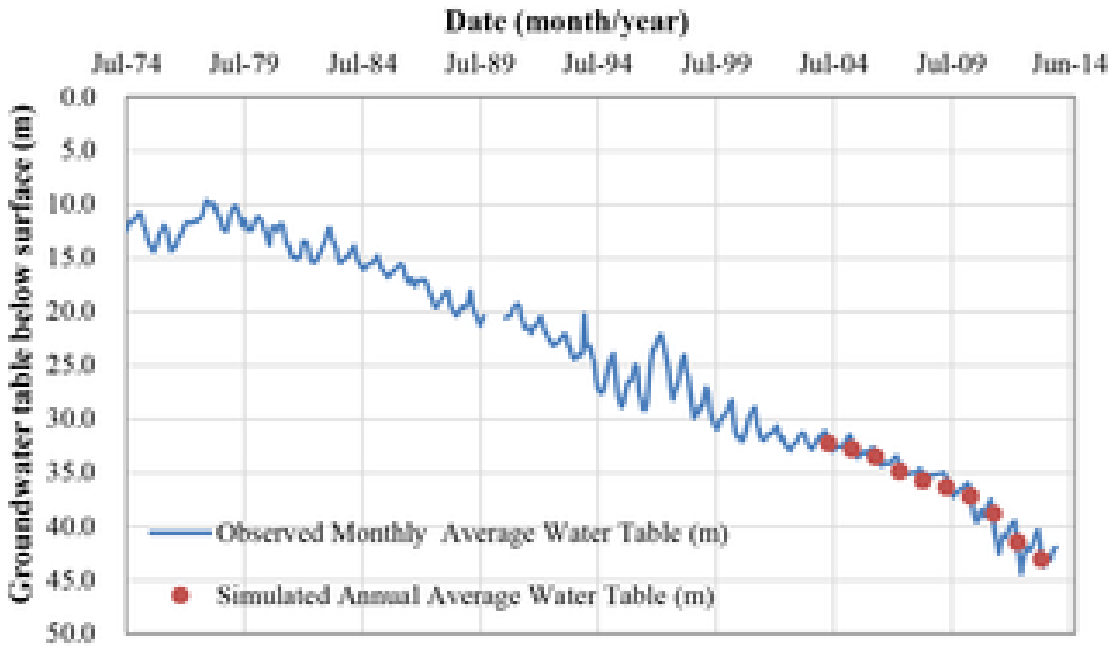
Soucce; FAO/OECD 2015

Issues affecting food security in CGG areas:

Declining availability of water for irrigation

- Irrigated areas increased in China from 15.9 million ha in 1949 to 67.1 million ha in 2016 – an increase of 52.2 million ha since the founding of the PRC.
- Due to the undiscriminate use of groundwater for irrigation, in 5 among the 13 core grain growing areas, the decline of groundwater levels has become one the most prominent environmental problem, which is worsening water competition with other sectors.

Groundwater use and recharge in the North China Plain 1974-2014

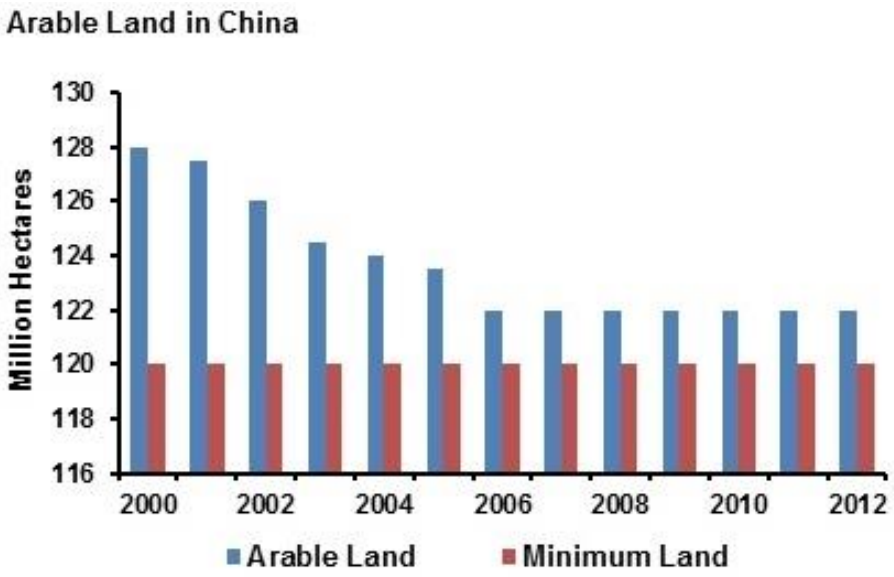


Issues affecting food security in CGG areas:

Loss of agriculture land

- The Chinese government estimates that 120 million ha must be maintained to be self-sufficient in grain production for food security reason.
- However, according to available statistics, China's total arable land declined between 2013 and 2017 to 134.9 million ha, as a result of urban extension and industrial development, soil erosion and desertification, natural disasters and environmental protection (reforestation).
- Furthermore, as many as 10 million ha are contaminated by heavy metals (mainly cadmium, nickel and mercury).

Decreasing availability of arable land and heavy metal polluted land (2000-2012)

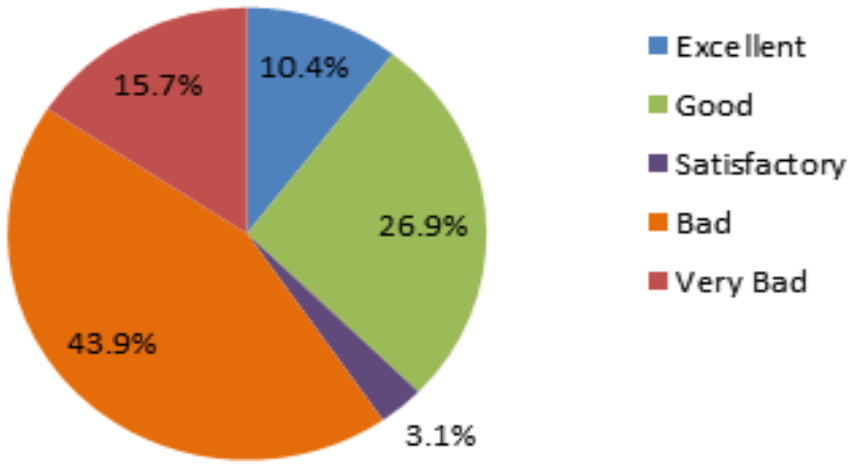


Issues affecting food security in CGG areas:

Water pollution

- Yet, the rapid industrial development and NPS pollution have left large swathes of groundwater unfit for human use and deemed too polluted for growing crops.
- As of today, it is estimated that over 95 % of China rivers and 90 % of groundwater are polluted at various degrees.

Water pollution level of China's groundwater sources



Issues affecting food security in CGG areas:

Climate change

- Over the past decades, climate change has led to serious consequences for agricultural production in China.
- According to IPCC AR5 estimates, climate change will lead to both negative and positive impacts on crop yields:
  - Negative: increasing temperatures and evapotranspiration are leading to harvest losses due runoff, erosion, salinization, increasing risks of traditional and new pests, and, more importantly, to an increased occurrence of extreme weather, especially natural disasters such as heat waves, torrential rains, floods, sandstorms, and droughts – already experienced in 13 CGGs.
  - Positive: increasing temperature associated with increased rainfall may extend the length of growing seasons, which would provide more opportunities for rainfed crops.

Issues affecting food security in CGG areas:

Decrease benefits from farmland protection forests

- Besides forests, tree-crop intercropping, riparian tree lines, windbreaks, shelterbelts, hedges, have traditionally plaid a critical farmland protection role, notably under form of networks of farmland protection forests (*called four sides*) under the commune system.
- Yet, despite the inherent ecological benefits of four sides' structures, a series of problems, constraints, and barriers have gradually emerged, leading to their degradation or even eradication.

Issues affecting food security in CGG areas:

Conclusions

- To sum up, climate change, NPS diffuse pollution, decreasing water availability and pollution, artificialization of arable land and environmental degradation of 4 sides will not only have large negative impacts on future crop production, but also on the overall resistance of farmlands putting an increased stress on food security.

- The above issues affecting China's food security are not confined to China only, since, according to FAO (2014), the quarter of the world's arable land is already degraded, a degradation compounded with biodiversity loss.

- Consequently, adapting agriculture to the above issues will require the GoC as well as other governments from developed and developing countries to adopt new food security strategies that would enhance the ecological security conditions of farms and agricultural landscapes.

The 6 pillars of the proposed Ecological Security Strategy

The adoption of:

1. An agricultural NPS pollution control system;
2. A water resources conservation system;
3. Ecological farming field practices to improve farmland productivity while adapting to climate change;
4. An ecological protection system at farm and agricultural landscapes;
5. An enabling governance system enhancing farm and landscape ecological security;
6. Measures to advance the knowledge of ecological security requirements and extending the know-how to armers and policymakers.

Ecological security strategy

Establishment of an NPS pollution control system

- Issuance of quotas for synthetic fertilizers and pesticide;
- Promotion of organic fertilization - Creation of industrial Eco-industrial park to produce easy to use organic fertilizers.
- improving the use of slow and controlled release fertilizers and fertigation.
- Use of low toxicity eco-friendly pesticides.
- Promoting mechanized pesticides spreading technologies.
- Improving mulch film standards to decrease white pollution and mulch film recovery technologies.
- Establishment of biological crop deseases and insect pests control systems.

Ecological security strategy

Establishment of water resources conservation system

- Modernizing irrigation infrastrure
- Issuance of water coupons and development of water-right trading markets (*one well - one meter - one household – one card*).
- Adjustment of planting patterns to soil moisture and availability of surface water.
- Adopting *one-season fallow - one season rainfed technology* instead of two harvest a year.
- Adoption of soil water conservation cropping practices such as no tillage farming, cover crops, mulching, dry farming, …

Ecological security strategy

Adopting ecological farming practices

- Moving from monoculture to ecological farming principles and transforming high-input agriculture towards more sustainable ecological farming practices:
  - Encouraging crop rotation and fallow systems.
  - Routinely keeping soil covered with living or crop residues.
  - Encouraging the use of organic matter.
  - Adopting reduced tillage or no tillage.
  - Improving the use of organic fertilizers.
- Using physical, chemical or biological agronomic measures to restore farmland fertility.
- Adopting holistic farmland management practices to mitigate the effects of changing climate:
  - Tree-crop intercropping.
  - Windbreaks.
  - Shelterbelts.
  - Insect strips.
  - Living fences.

Ecological security strategy

Adopting ecological farmland protection system

- Conserve, manage and expand existing farmland forest protection systems (4 sides):
  - Adopting adequate financial compensation to further enhance farmers' participation.
  - Revising management and harvesting prescriptions related to farmland protection forests.
  - Revise existing design to minimize trees' impacts on production.
- Update existing incentive (eco-compensation) systems to enhance farmers' participation in the mangement, conservation and expansion of farmland protection forests and other agroforestry measures.
- Creation of tree lines along infrastructure, ecological corridors, buffer strips, natural habitats and biodiversity niches.
- Clarifying tree and land tenure rights on basic and regular farmland for the management of farmland protection forests.
- Adopting nature-based forest management systems to improve the stabiity and protective effects of afforestation, economic forests and natural forests surrounding CGGs.

Ecological security strategy

Building an enabling governance environment

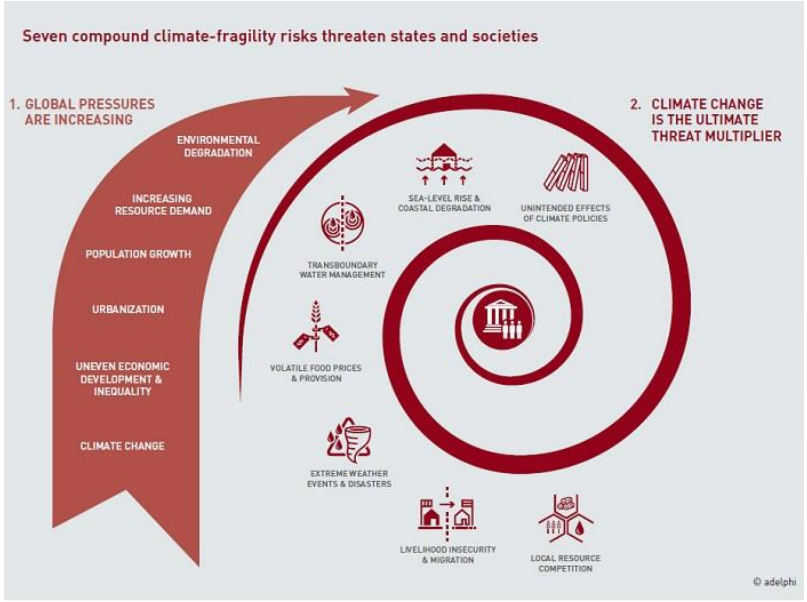
- Compulsory policies
  - Reforming current system of input subsidies.
  - Formulation of new laws and standards for stricktly controlling NPS pollution, conserving soil fertility, improving irrigation efficiency and protecting farmlands.
- Coordination policies
  - Development of platforms for cross-agency policy and institutional coordination among and between departments,with farmers and related prganizations.
  - Adopting third-party cross-sector, independant and participatory M&E system.
- Incentive policies
  - Revise incentive policies and transfer payments (eco-compensation) to reward farmers adopting proposed ecological security measures.

Ecological security strategy

Advancing the knowledge and extending the know-how

- Raising farmers' awareness while advancing their kmowledge of ecological security requirements through
  - Increasing the scope and the scale of adaptive R&D targeted to decreasing soil and water pollution and increasing farmland productivity and resilience to climate change.

- Communicating the know-how
  - Development of a cross-sector ecological security-related extension , focussing on the knowledge, information, and technlogy that farmers need to acquire to improve farm and landscape ecological security; and
  - Enhancing agricultural services efficiency through capacity building and training to enable extension professionals and farmers to efficiently use modern ICT tools that will provide technical, educational, financial and marketing assistance to farmers and farmers' communities.



The food security, climate change and ecological security nexus

In short, the research is advocating a “farmers-centered” and “knowledge-based” integrated ecological security strategy.

Such strategy should be leading to the development of locally adapted climate-resilient agriculture and environmentally-sound agricultural landscapes practices.

To be successful and efficiently support farmers, this strategy should include mainstreaming cross-sector policies, incentives, and technical assistance from extension services, and adaptive R&D.

Thank you for your attention

Origin, context and objectives of the research

- In September 2018, the State Council of China released the **Strategy Plan for Rural Revitalization** (2018-2022).
- This strategy stressed that resolving issues relating to agriculture and rural development (*San Nong in Chinese*) are fundamental to China as they directly concern the stability of the country, its food security and people's well being.
- It is in this context that this research on China's food security issues in China National Core Grain Growing Areas was conducted by Prof. Li Zhou (CAAS) in collaboration with Claude R. Heimo (CSEND) and a group of Chinese sector experts between 2016 and 2019 under financing from the Asian Development Bank (ADB – TA-8430 and TA 8960 REG).
- The conclusions of this research has now been published in Chinese and English.
- This publication is not only aimed at all those involved in making and implementing food security policies in China, but at all their counterparts operating in other developed and developing countries