



The Economics of Ecosystem and Biodiversity (TEEB):
Promoting a Sustainable Agriculture and Food Sector

**Policy Mapping of China's Agriculture and Food Systems
from the Ecosystems and Biodiversity Perspective**
(Draft)

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Summary

China has the largest amount of population in the world today, and it is expected to continue growing among the first three decades of the century. This will certainly pose significant implications to food demand of the country—720million tons of annual grain production will need to be met by 2030, approximate 10% increase from 2018. At the same time, China's ongoing economic development has sparked the largest urban migration in the history of the world. From 2016 to 2030, 200 million people will be transferred from rural areas to cities.

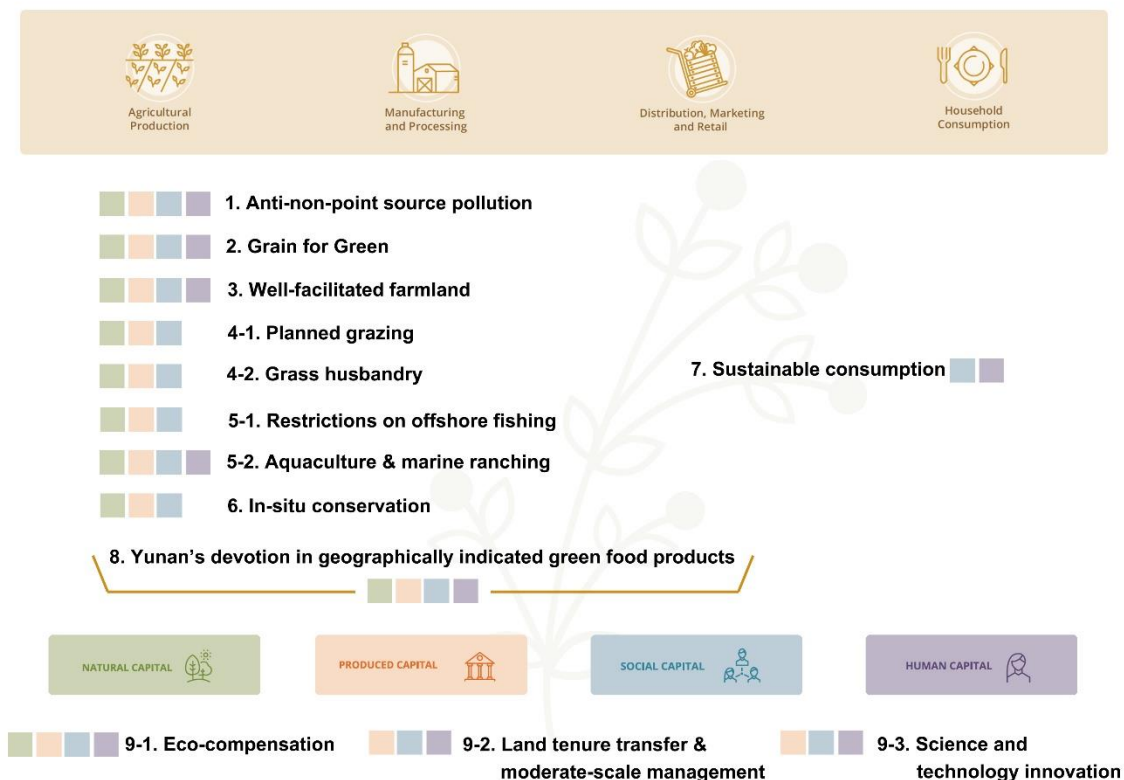
In the pursuit to meet its food demand, unsustainable agricultural practices have become widespread in China, and they exerted significant pressures on the natural environment, leading to the change of environmental state. Here are some numbers bringing you to the fact:

- Water
 - ✓ Per capita water resources (2000m³) is one third of the world level
 - ✓ Agricultural water consumption accounts for 63.5% of the total, while irrigation water accounts for 90% of the agricultural use
 - ✓ Irrigation coefficient is 15% to 20% lower than developed countries
- Pollution
 - ✓ 60.22 million tons of chemical fertilizer used in crop farming annually, with the effective use rate at only 35.2%
 - ✓ Chemical fertilizer use per mu much higher than the world average, and is 2.5 times to the EU's
 - ✓ 300,000 tons of pesticide effective constituent applied in crop farming annually, with the effective use rate at 36.6%
 - ✓ More than one third agricultural plastic mulch discarded randomly
 - ✓ Less than half of the livestock and poultry manure being effectively treated
- Land
 - ✓ One fifth of the cultivated land is polluted
 - ✓ Basic soil fertility 20-30% lower than developed countries
 - ✓ Desertification land area in China exceeded 2.616 million km² – 27.2% of the total
 - ✓ More than one third of grassland had been either moderately or severely degraded

How China's policies on eco-agri-food systems respond to the issue?

China has embraced sustainable development through a variety of national level strategies. This report looks at national-level policies targeting the alleviation of pressures that unsustainable agricultural practices exert on the environment, which deprive ecosystems of the services biodiversity provides. Meanwhile, a few policies at provincial or municipal level are explained, as supplements to national-level policies, for better understanding of how lower-level policy can enhance its operability.

The figure below shows how the policy streams in scope are positioned in the TEEB AgriFood framework. Some of them function in a direct way by focusing on the agricultural production phase (#1-6) while others function indirectly by targeting the lower reaches of the value chain (#7-8). In addition, three policy streams focusing on cross-cutting or enabling conditions (#9.1-9.3) are also elaborated as they mainly function by looking at non-natural capitals, i.e. produced, social and human capitals.



Through a thorough desk review of these policy streams, we found some commonalities exist.

- Problem-driven and highly planned nature

For each policy stream, clear policy targets are set for a specific interval of time (e.g., five years), and pathways to achieve them are proposed.

- A certain level of flexibility for adapting to the latest situation

An excellent example of this is the phased suspension of the Grain for Green Program to slow down the trend of rapid reduction in grain production – a policy response to ensure the country's food security. During the suspending period, policy focus had been shifted to the improvement of farmland productivity. Currently, these two policy streams are implemented coordinately.

- A phased and regionally-differentiated approach

It usually begins with establishing demonstration pilots to test out the best practical model for the further up-scaling, and at the same time taking into full account of the diversities among regions so that the models are customized to local circumstances and thus differ from each other.

- Punitive versus incentive

Incentive approaches, such as reductions in taxes or provision of subsidies, have been used more and more frequently to guide the practices in recent years. The eco-compensation mechanism has been regarded as an important approach to motivate different stakeholders for ecosystem conservation.

- Multi-source financing

Although government finance is still the leading source for policy implementation, China is now exploring the use of multi-source financing, for example, credit funds and business funds.

Below are some highlights of the 10 policy streams under review.

1) Anti-agricultural non-point source pollution

2020 policy target: the aggravating trend of agricultural non-point source pollution being effectively curbed, through the “control of the one, reduction of the two, and recycling of the three” initiative.

- Control of the one – strictly control the total amount of agricultural water use and vigorously develop water-saving agriculture

- Reduction of the two – reducing the use of chemical fertilizer and pesticides to achieve zero growth
- Recycling of the three – resource-oriented utilization of livestock and poultry manure, crop straw and agricultural plastic mulch

2) Grain for Green Program

The Program is the largest ecological restoration initiative in terms of policy implications, investment amount, scope and level of public participation that China has ever proposed. It was first carried out in pilots in 1999, and then being formally implemented nationwide in 2002. After a 8-year suspending period starting from 2007, the government resumed the Program in 2014.

The promulgation of *A New Round of Overall Scheme of Grain for Green Program* marked as the resume of the work. Slope cropland, farmland with serious desertification or salinization, or those plays an important role in providing ecological functions are stopped from cultivation. Replantation or natural enclosure are adopted for restoring degraded ecosystems. Farmers and households are provided with subsidies in forms of food, cash and seedlings. The criteria of subsidy for returning farmland to forestry is 1500 yuan per mu and 800 yuan per mu for returning farmland to grassland. Provincial governments can determine specific subsidy standard as long as it is not below the state criteria.

Targets by 2020: a total area of 42.4 million mu of slop farmland and those suffered from serious desertification will be returned to forest or grassland.

3) The establishment of well-facilitated farmland program

The establishment of well-facilitated farmland program – to improve the quality of low and medium-yield farmland, transforming them into well-facilitated farmland—was proposed in 2008 to ensure food security. It covers eight aspects including land, soil, water, road, forest, electricity, technology and management. By 2020, a target of 800 million mu of well-facilitated farmland will be built, with the production capacity of grain per mu increased to 100 kg or above.

Additionally, the farmland rotation and fallow farming mechanism was proposed in 2016. Through which, the average quality of cultivated land is expected to be improved by 0.5 grade by 2020 as compared with that in 2015, while 1.0 grade of improvement by 2030.

4) Grassland restoration

Prohibiting grazing, resting grazing, and the grass-livestock balance mechanism in grassland areas of serious degradation, desertification and salinization as well as ecologically fragile areas have been applied in China. Prohibition of grazing is an approach not allowing for utilization of grassland for a more-than-one-year period, while resting grazing refers to not allowed to graze in a specific period within a year. The grass-livestock balance mechanism is to determine the amount of livestock by the quantity and quality of forage available (including those obtained from natural grassland, cultivated grassland or forage production base).

During the 13th Five-Year-Plan period, the government has realized that the key to solve insufficiency in forage grass provision lies in the development of cultivated grassland, and the concept of grass husbandry was proposed. It covers several dimensions including natural grassland conservation, grass forage production, and processing of livestock products.

Targets by 2020: i) to ensure 1.05 billion tons of total amount of fresh grass from natural grasslands, ii) 56% of vegetation coverage of natural grassland; 3) less than 10% of the rate of overloaded key natural grassland, iv) 350 million mu of area reserved for cultivated grassland, v) over 13 million tons of total output of beef and mutton, and vi) over 41 million tons of total output of milk.

5) Anti-overfishing

Although a series of policies (refer to the below) were proposed for the purpose of reduction in offshore fishing, the situation of overexploitation of offshore fishery resources has been getting worse due to the large number of fishery practitioners, the rapid growth of the capacity of fishing vessels, and an unsustainable way of the catching practice.

- ✓ Set entry requirements for entities of catching marine fishery resources
- ✓ Limit the total number of fishing vessels
- ✓ Total power capacity management
- ✓ Summer fishing moratorium
- ✓ Establishment of a special fund for marine fishermen's transfer to other business
- ✓ Guarantee that the Special Fund for Stock Enhancement of Aquatic Organisms to be channeled from the Fishery Resource Fee
- ✓ Stipulate the minimum mesh size for major marine fishing tool

In parallel with the endeavor of putting restrictions on the offshore fishery, China has been developing its freshwater aquaculture and marine ranching. It is expected that by 2020, the total amount of marine fishing will be controlled at 10 million tons; more than 2500 freshwater aquaculture demo-farms and 80 state-level marine ranching demo-zones will be newly established.

6) In-situ conservation

Biodiversity for agriculture. 1) In situ conservation of germplasm resources of crops is to protect the centralized distribution area of wild crop relatives as well as wild germplasm resources with important economic value, and to monitor their vitality and generic integrity regularly. 2) In order to conserve forage and livestock genetic resources, grassland nature reserve, conservation livestock farms and protected areas are established. Activities such as felling, hunting, collecting medicine, reclamation, and burning grass are prohibited in the nature reserve. Grasslands that have been reclaimed in the nature reserve must be rehabilitated and managed with the grass-livestock balance principle. 3) For fishery germplasm resources conservation, aquatic flora and fauna nature reserves and aquatic germplasm resources reserves are established.

Negative validation rule for industries accessing the key ecological-function zones. The key ecological-function zone is the area of great importance to ecological security but undergoing certain extent of ecosystem degradation. It is restricted from large-scale and intensive development activities for the recovery of its ability in providing ecosystem products and services. The negative validation rule for industries accessing the key ecological-function zones, proposed in 2015, stipulates the people's government at county or municipal level to sort out the situation of industrial development in their respective administrative regions, assess the status of the ecological environment, and propose a negative list of industries to be involved in the local development. This negative list shall include industries restricted or prohibited. For the restricted, the scale of production, its location or scope, and the process of production should be clearly identified, while the prohibited industries should be totally banned.

7) Sustainable consumption

China's consumption structure is undergoing profound changes, leading to the upgrade of related industries which expands new space for future development. In 2016, National Development and Reform Commission, Ministry of Finance and together with other 8 line ministries released the *Guidance on Promoting Sustainable Consumption*, aiming to speed

up the transformation toward a sustainable direction. Promoting sustainable consumption of agricultural products is within the landscape.

8) Yunnan's devotion in geographically indicated green food products

Relying on its climate, water and biological resources, as well as the advantages in crop variety innovation, Yunnan province plans to vigorously develop its green food industry, promoting geographically indicated green food products (*the Green Food Programme*). The Programme aims to integrate green concept into all links of the whole value chain, including biological variety breeding/selection, planting, processing, manufacturing, as well as enterprise and brand building. The Programme puts the development of agricultural processing and manufacturing at the core of its success, and eight industries were proposed as the focal industries, they are tea, flowers, fruits, vegetables, nuts, coffee, Chinese herbs, and beef cattle. By 2020, Yunnan government will strive to achieve the national average ratio of agricultural product processing output value to agricultural total output value, while by 2025, to achieve the ratio to more than 3:1.

In terms of approaches for implementation, Yunnan plans to establish 20 demo-counties – each county cultivate one leading industry. Smallholder farmers are considered as an important force in the landscape. For a duration of three years, 30 million yuan of subsidies annually will be allocated by the provincial finance to each demo-county. The subsidy funds are planned to be used in public infrastructure construction, promotion of green or organic certification, Internet of Things (IoTs) demo-base construction, product quality traceability system construction, technical upgrading, brand building, R&D, and loan discount.

9-1) Eco-compensation mechanism

The eco-compensation mechanism has been put into implementation since the beginning of this century, as an important approach to motivate different stakeholders for ecosystem conservation. However, the scope is still relatively small, and mainly adopts the form of vertical transfer payment, while the use of horizontal transfer payment mainly focuses on the trans-river basins practice

In order to establish a diversified eco-compensation mechanism and to expand its scope, the government set a target of achieving a full coverage of eco-compensation in key ecosystems (including forest, grassland, wetland, desert, ocean, river and arable land) and key areas (i.e., prohibited development area and key ecological-function zone) by 2020. Horizontal eco-compensation relationships are encouraged to be established between beneficiary areas and eco-protected areas, through means of financial compensation, talent training, industrial transfer and so on.

9-2) Land tenure transfer and moderate-scale management

Back in the 1980s, the right of land contracting and management was separated from the collective-owned land ownership. At the present stage, it is further divided into the right of land contracting and the right of land management, which accelerated the transfer of the right of land management to large professional households, family farms, farmers' cooperatives as well as leading enterprises. Nowadays, these new types of agricultural management entity have become a driving force for the development of moderate-scale management—an initiative highly advocated by the government to optimize the allocation of land resources and increasing land productivity.

9-3) Science and technology innovation

Since *the 12th Five-Year-Plan* period, science and technology innovation has been greatly valued by the government in their efforts addressing the challenges of food security, food safety and ecological security. The contribution rate of agricultural science and technology to the Gross Agricultural Output Value was increased to 56% in 2015 from 52% in 2010, while the target of this rate set for *the 13th Five-Year-Plan* period is 60%.

Agriculture green development, effective agricultural supply and modern marine agricultural are three of the several thematic areas proposed by the government to exert efforts on. By 2020, the number of high-tech agricultural enterprises is expected to be increased to more than 10000, while the target number for national agricultural high-tech industry demonstration zones is 30.

Gaps and implications for TEEB AgriFood

The table below shows the result from a preliminary estimate of the level of linkage of the target policies to the respective capital and its ecosystem services flows.

	Policies	Level of linkage			
		Natural capital	Produced capital	Social capital	Human capital
1	Anti-agricultural non-point source pollution	Strong (freshwater, nutrient cycling...)	Strong (infrastructure, R&D fertilizers & pesticides)	Strong (land tenure, social networks)	Moderate (labor & knowledge)
2	Grain for Green Program	Strong (biomass growth, soil and water)	Moderate (finance)	Strong (land tenure, social networks)	Strong (labor & knowledge)
3	Well-facilitated farmland	Strong	Strong	Strong	Moderate

		(biomass growth, freshwater...)	(machinery and infrastructure, R&D...)	(land tenure, social networks)	(labor & knowledge)
4-1	Planned grazing	Strong (biomass growth)	Moderate (finance)	Moderate (land access)	Weak
4-2	Development of grass husbandry	Strong (biomass growth)	Moderate (R&D, finance)	Moderate (land access)	Weak
5-1	Restriction on offshore fishing	Strong (biomass growth)	Strong (machinery, energy)	Moderate (land access)	Weak
5-2	Aquaculture industry & marine ranching	Strong (biomass growth)	Strong (infrastructure, energy, R&D, finance)	Moderate (land access)	Moderate (labor & knowledge)
6	In situ conservation	Strong (biomass growth)	Strong (infrastructure, R&D, finance)	Moderate (land access)	Weak
7	Sustainable consumption	Weak	Weak	Strong (networks, cultural knowledge)	Strong (knowledge)
8	Yunnan's green food programme	Moderate (green production)	Strong (machinery & infrastructure, finance, R&D)	Strong (networks, land access)	Strong (labor, knowledge)
9-1	Eco-compensation	Strong (ecosystem services)	Strong (finance)	Strong (institution)	Strong (knowledge)
9-2	Land tenure transfer & moderate-scale management	Weak	Strong (infrastructure)	Strong (networks, land access)	Strong (labor)
9-3	Science & technology innovation	Weak	Strong (infrastructure, R&D, finance)	Moderate (networks)	Strong (knowledge, labor)

Generally speaking, the current eco-agri-food policy system has the strongest linkage with natural capital and its respective ecosystem service flows, as policies usually start with tackling the immediate and direct cause of the problem, for example, to prohibit grazing for grassland restoration (i.e., to ensure biomass growth). Finance, as one flow from the produced capital, appears in most of policy streams and is a prerequisite for policies to

tackle on. Other aspects related to the produced capital are also accounted. The most representative one is the well-facilitated farmland construction, in which the construction of irrigation and drainage system as well as field roads are highly valued. Furthermore, with a strong willingness from the government to advance its science and technology innovation, research and development penetrate across several policy streams.

When it comes to the social capital, the linkages have become less intense. Current policy entry points in this regard are mainly attributed to the transfer of the land management right, as well as the advocacy of developing new types of the agricultural management entity, in which social ties play a vital role. Human capital is the weakest dimension that policies have paid attention to. Actually, it is only until recent years and with the proposal of developing the “modern agriculture” that educating farmers and households has being mentioned by some policies.

In addition, from the information gained, China’s eco-agri-food policy systems still lack a value chain perspective. Policies are mainly tapping on the agricultural production, while their implications to other value chain aspects (manufacturing and processing, distribution, marketing and retail, and household consumption) are rarely reflected.

By reviewing China’s policies on eco-agri-food systems, people could find how complicated the reality might be – this highlights the need to have the issues assessed by a comprehensive and systematic framework so that policymakers could be better informed. And we believe this is where TEEB AgriFood could provide assistance.

Background

A number of global trends are influencing the overall sustainability of our agricultural and food systems. The world's population, at 7 billion today, is expected to reach 9 billion by 2050. The vast majority of this growth will occur in developing countries where meeting the food needs is already a challenge, and it will also happen in urban areas where most people buy food, not grow it.

The agricultural and food systems are struggling with several challenges – the challenge of meeting future demand of food; the challenge of conserving and enhancing water, soil and habitat; the challenge of improving nutrition and public health. What adds atop these challenges is the complexity of the systems—where causalities and effects are intertwined, and where solutions from one single discipline would mostly fail.

TEEBAgriFood framework provides us with a tool to deal with this complexity. It tries to achieve a comprehensive understanding of reality by framing the eco-agri-food systems as a vast and interacting complex of elements that are variously involved in growing, processing, distributing and consuming food. It encourages policy makers to assess their decisions by a systematic approach and to explore room for improvement.

This policy mapping report of China's eco-agri-food systems is formulated under the project "The Economics of Ecosystems and Biodiversity: Promoting a Sustainable Agriculture and Food Sector" in which China is one of the seven partner countries in scope. This project aims to protect biodiversity and contribute to a more sustainable agriculture and food sector in the seven EU partner countries, with a view to moving towards a level playing field by avoiding unfair competition through low environmental standards. This report is one of the background documents to the inception workshop, which will focus on identifying policy interventions to be studied through the life of the project.

Define the issue

a) What trends are driving China's eco-agri-food systems

China, as a developing country, has the largest amount of population in the world today. It is expected to continue growing among the first three decades of the century: by 2020, China's population will reach 1.4 billion, and the population peak will occur around 2030. This will certainly pose significant implications to food demand of the country—720million tons of annual grain production will need to be met by 2030 (presuming at medium consuming level), approximate 10% increase from 2018.

At the same time, China's ongoing economic development has sparked the largest urban migration in the history of the world. From 2016 to 2030, 200 million people will be transferred from rural areas to cities, and 70% of China's total population will permanently reside in cities by 2030.

The challenge is having fewer people to grow more food for China.

b) Unsustainable agricultural practices and environment at stake

In the pursuit to meet its food demand, unsustainable agricultural practices have become widespread in China, such as overuse of chemical fertilizer and pesticides, inefficient irrigation, groundwater overexploitation, overgrazing and overfishing. As Figure 1 shows, these practices exerted significant pressures on the natural environment, leading to the change of environmental state.

China is a country with extremely scarce water resources, with per capita water resources of 2000m³ (year 2014), only one quarter of the world level. Agricultural water consumption accounts for 63.5% of the total (year 2016), while irrigation water accounts for 90% of the agricultural use. Irrigation coefficient is only 0.542 (year 2016), that is 15% to 20% lower than developed countries. The northern part of China owns only 19% of the country's water resources, but is responsible for 60% of the country's grain production—this leads to serious overexploitation of groundwater.

China is facing critical agricultural non-point source pollution. In 2015, 60.22 million tons of chemical fertilizer were used in crop farming, with effective use rate at only 35.2%; chemical fertilizer use per mu (approx. 667m²) was 21.9kg, much higher than the 8kg of the world average, and 2.5 times to the EU's. The same year, around 300 thousand tons of pesticide effective constituent were applied in crop farming, with the effective using rate at 36.6%.

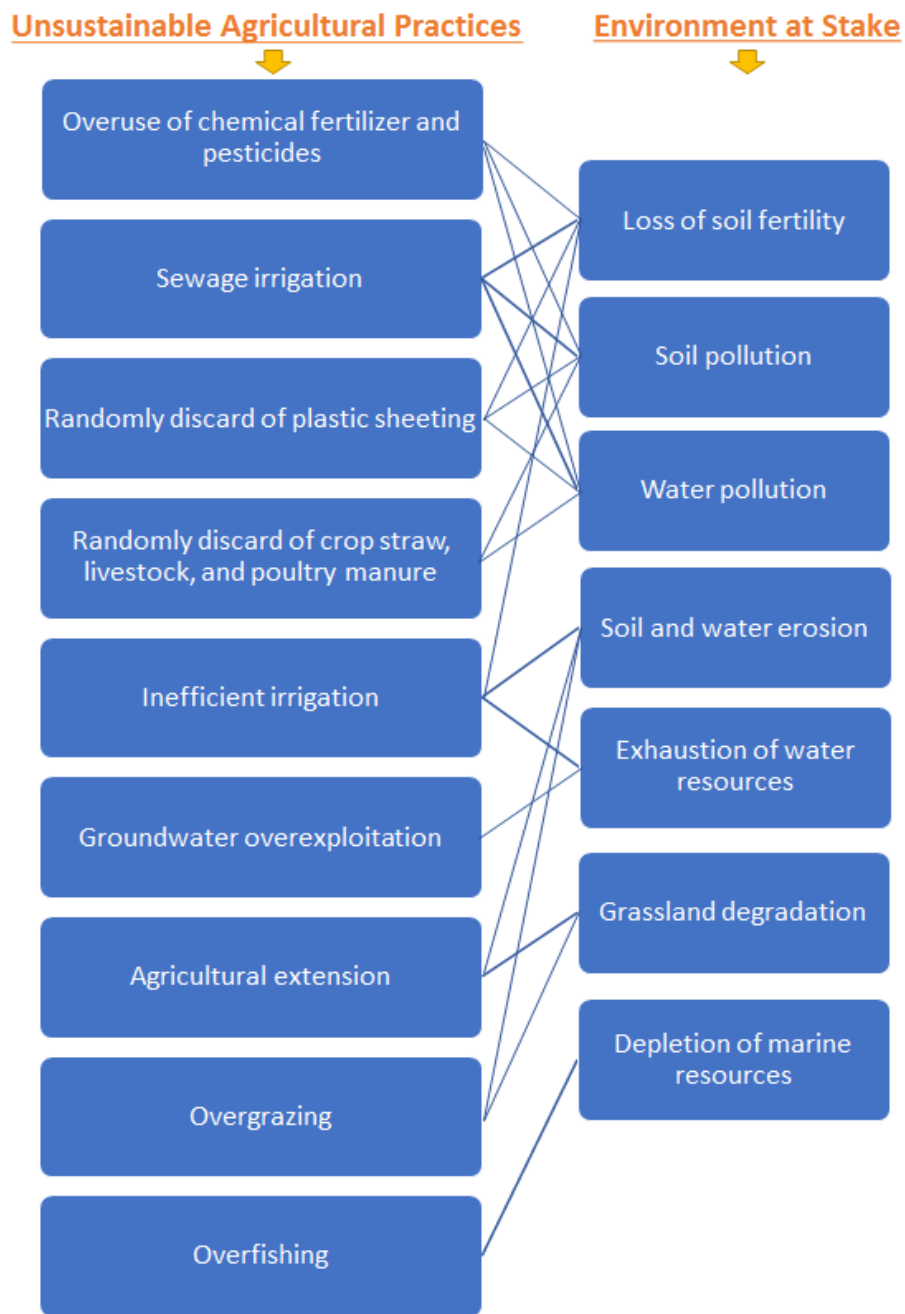


Figure 1. Agricultural Practices and Environmental Implications

Agricultural pollution also comes from randomly discarded agricultural plastic mulch, crop straw, and livestock and poultry manure. In 2015, among the use of 1.45 million tons of plastic mulch for agriculture, less than two thirds were recycled, while more than one third were discarded carelessly. As for crop straw, among the 1 billion tons of crop straw produced, one fifth was discarded randomly. And less than half of the livestock and poultry manure was effectively treated.

The quality of cultivated land is declining. One fifth of the monitoring sites on cultivated land is polluted. Basic soil fertility is 20-30% lower than that of the developed countries. By 2014, desertification land area in China had exceeded 2.616 million km², accounting for 27.2% of the country's total land area. Vegetation coverage of grassland is 54%, more than one third of grassland had been either moderately or severely degraded, and ecosystem of the restored grassland remains fragile.

On fishery, China had reached its total allowable catch of 9 million tons in 1994. And since then, fishing volume continued to increase, reaching a historical peak of 14.97 million tons in 1999. Although it declined gradually to 13.28 million tons in 2016, it was still higher than the optimal exploitation level of marine fishery resources.

c) Some impacts

The impacts of agricultural practices permeate all aspects of people's lives. Food safety is one. According to the results of a national test for rice safety in 2002, lead was the most serious heavy metal contamination detected, with 28.4% of the samples exceeding the safety limit, followed by cadmium of 10.3%.

Another channel for health implications from agriculture to happen is to through the water people drink. A study estimating health risk from agricultural water contamination in Haihe River basin (covering Henan, Anhui, Jiangsu and Shandong provinces) shows that, 82.26% of the cities in the basin have a high level of non-carcinogenic risk.

Degraded ecosystems are less capable of buffering the negative effect of extreme weather events. In this regard, China learnt a lot from the 1998 massive flood of Yangtze River, which led to a loss of 4150 lives. Direct economic loss estimated to be 255.1 billion CNY (30.8 billion USD). One major cause for the flood was unsustainable agricultural activities—deforestation in the upper reaches, and withdraw of wetlands and lakes in the middle and lower reaches, both caused by farmland reclamation.

How China's policy system responds to the issue

Environmental protection is encoded in China's Constitution. The current Constitution, since its adoption and promulgation in 1982 and through five times amendments in 1988, 1993, 1999, 2004 and 2018, has always maintained the provisions of Article 26, Paragraph 1 of Chapter 1—"the state protects and improves the living surroundings and ecological environment, and prevents and controls pollution and other public hazards".

China's legal and policy framework is led by *the Constitution*, composed of department laws and administrative regulations, and supported by top-level policy designs such as *the Five-Year Plan for National Economic and Social Development*, *the Report of the National Congress of the Communist Party of China (CPC)*, *the No.1 Central Document*¹, and *the State Council's Government Work Report*.

China has embraced sustainable development through a variety of national level strategies. The most significant one is the adoption of "ecological civilization", which emphasizes harmony between human and nature, and in this regard, it represents the sum of material, spiritual and institutional achievements in the process of protecting and building a better ecological environment. In 2012, at the 18th National Congress of the CPC, a strategic decision of promoting ecological civilization had been made. The vision for eco-civilization is required to be integrated into all aspects of economic, political, cultural and social developments. In 2015, *Opinions on Accelerating the Formation of Ecological Civilization* was released, emphasizing the importance of 1) optimization of the territorial spatial-layout, 2) efficient utilization of natural resources, 3) improvement the quality of eco-environment, and 4) institution development. The same year, *Overall Scheme of Eco-civilization Institutional System Reform* came out, in which eco-compensation mechanism played a role. Later on, promoting eco-civilization was written in *the 2018 Constitutional Amendment*.

Agriculture has been on top priority in China's policy agenda. From 2004 to 2019, *the No.1 Central Document* have been consecutively focusing on issues of "agriculture, rural areas and farmers". Several concepts have been put forward, for example, construction of "new countryside" in 2006, development of "modern agriculture" in 2012, as well as the most recent "rural vitalization strategy" proposed at the 19th National Congress of the CPC in 2017.

At the implementation level, environmental and agricultural planning and relevant action plan play a crucial leading and coordinating role. 2015 released *National Sustainable Development Plan for Agriculture (2015-2030)* has become a programmatic document to guide the sustainable development of agriculture in the coming period. The Plan divides the whole country into three regions: optimal development zone, moderate development zone and protective development zone, and takes step-by-step measures according to local conditions; it puts forward five key tasks including optimized zoning of production,

¹ No.1 Central Document is the first policy document released by the CPC Central Committee and the State Council at the beginning of the year

conservation of cultivated land, increased water efficiency, controlled pollution, and restoration of agricultural ecosystem functions.

This report mainly targets national level policies, as China has a vast territory with great spatial heterogeneity, and is administratively divided into 24 provinces, 5 autonomous regions, 4 direct-controlled municipalities and 2 special administrative regions, leading to variations across sub-national policies. Generally speaking, national-level policy sets overall goals against the problem in scope, and provides a holistic framework of tasks and paths to achieve them. It is usually characterized as being directive and less operative, leaving room for interpretation for policy adaptation at lower levels. This report recognizes the usefulness of showing how lower level policies are designed to deal with their respective problems. A few policies at provincial or municipal level are explained, as supplements to national-level policies, for better understanding of how lower-level policy can enhance its operability.

In the following parts of this report, eight policy streams are chosen (see 3.1-3.8 below) as they target the alleviation of pressures that unsustainable agricultural practices exert on the environment, which deprive ecosystems of the services biodiversity provides. Some of them function in a direct way by focusing on the agricultural production phase (3.1-3.6) while others function indirectly by targeting the lower reaches of the value chain (3.7-3.8). The figure below shows how the policy streams in scope are positioned in the TEEB AgriFood framework. In addition, three policy streams focusing on cross-cutting or enabling conditions (see 3.9 below) are also elaborated as they mainly function by looking at non-natural capitals, i.e. produced, social and human capitals.

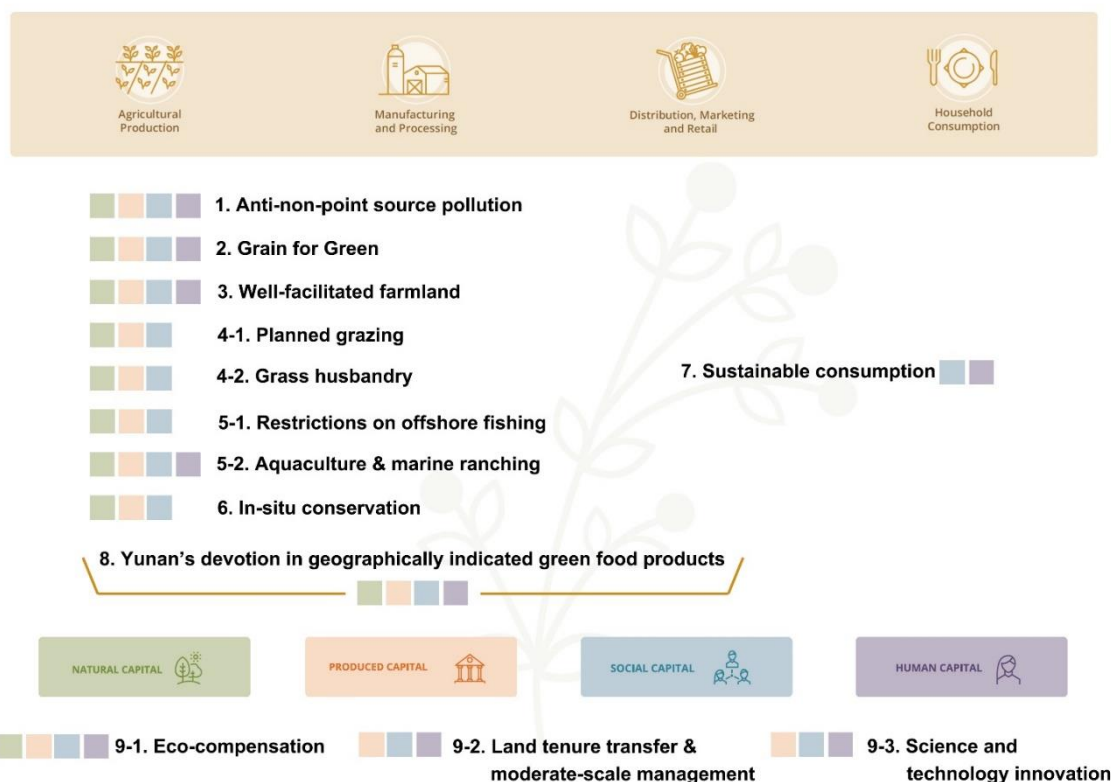


Figure 2 How policy streams in scope positioned in the TEEBAgriFood framework

1. Anti-agricultural non-point source pollution

Agricultural non-point source pollution includes contaminants from crop production, livestock and poultry, as well as aquaculture. Before the term “agricultural non-point source pollution” formally appeared in the policy system, China carried out relevant work by controlling “farmland pollution” and “water pollution”. It was until the 11th Five-Year Plan when the “new countryside construction” was proposed that “agricultural non-point source pollution” became one of the focuses for solving agriculture-related environmental issues. After that, top-level policy documents continued to pay attention to the prevention and control of it, and relevant work revolves around agricultural drainage, chemical fertilizer, pesticides, livestock and poultry manure, crop straw, plastic mulch and so on.

Year 2015 was a year of action with a series of policies successively promulgated, as follows:

1. *Opinions on Implementing the Battle of Agricultural Non-point source Pollution Prevention and Control*

2. *Action Plan for Water Pollution Prevention and Control*
3. *Action Plan for Soil Pollution Prevention and Control*
4. *Action Plan for Cultivated Land Quality Protection and Improvement*
5. *Action Plan for Zero Increase in Chemical Fertilizer Use by 2020*
6. *Action Plan for Zero Increase in Pesticides Use by 2020*
7. *Demonstration Project Planning for Comprehensive Control of Agricultural Non-point Pollution in Key Watersheds (2016-2020)*

In the *Opinions on Implementing the Fight of Agricultural Non-point source Pollution Prevention and Control*, the then Ministry of Agriculture has set up a target that by 2020 the aggravating trend of agricultural non-point source pollution being effectively curbed through “control of the one, reduction of the two, and recycling of the three” initiative. “Control of the one” refers to strictly control the total amount of agricultural water use and vigorously develop water-saving agriculture, “reduction of the two” means reducing the use of chemical fertilizer and pesticides to achieve zero growth of them, while “recycling of the three” stands for resource-oriented utilization of livestock and poultry manure, crop straw and agricultural plastic mulch. According to this, actions are designed to be implemented around the following six aspects.

1.1 Develop water-saving agriculture

Targets:

- By 2020, total amount of water used for agricultural irrigation maintained at 372 billion m³
- By 2020, effective utilization coefficient of irrigation water in farmland increased to 0.55
- Irrigation water quality conforms to the Water Quality Standard for Farmland Irrigation
- By the end of 2018, 33 million mu of irrigated farmland being comprehensively harnessed with at least 3.7 billion m³ reduction of irrigation water use
- By 2020, water-saving renovation program for large and medium-sized irrigated farmland being completed, achieving a total renovation area of 700 million mu

Pathways:

- Set up several caution lines for water use control, including total amount limit, use efficiency and receiving capacity for pollutants
- Strictly prohibit irrigation with untreated industrial and municipal wastewater, strengthen monitoring of irrigation water quality, and impose strict control of total amount of pollutants discharged into rivers and lakes

- Promote the use of technologies such as conservation tillage, fertigation, sprinkler irrigation and drip irrigation
- Promote large-scale water-saving irrigation and popularize drought-resilient techniques in Northeast, Northwest, and Huanghuaihai regions
- Adjust the planting structure and choose drought-tolerant species in areas short of water resources
- Advance pilot work on agricultural water price reform, subsidies and incentives for water-saving, and awareness raising

1.2 Cut the use of chemical fertilizer

Targets:

- By 2020, coverage rate of soil testing and formula fertilization increased to 90% or above
- By 2020, managing and technical system for fertilization preliminarily established
- Since 2015, fertilizer use efficiency increased by more than 1% annually, and by 2020, the use efficiency reaches 40% or above
- By 2019, annual growth rate of chemical fertilizer use controlled under 1%, while by 2020, zero increase achieved for major crops
- By 2020, the rate returning nutrients from livestock and poultry manure to farmland reached 60% from 50%
- By 2020, the rate of returning nutrients from crop straw reached 60% from 35%
- By 2020, mechanical fertilization accounts for more than 40% the planting area, and area for fertigation application reaches 150 million mu

Pathways:

- Develop and promote highly efficient fertilizers
- Develop advanced fertilization techniques and equipment, changing surface fertilization and spray fertilization into deep fertilization, fertigation, seed and fertilizer co-sowing, etc.
- Explore effective use model for organic resources utilization, and encourage farmers to apply it
- In sensitive areas and large and medium-sized irrigation areas, construct eco-ditches, sewage purification ponds and surface runoff storage ponds to purify farmland drainage and surface runoff

1.3 Cut the use of pesticide

Targets:

- By 2020, pesticide use per area controlled below the average level in the past three years, and try to achieve zero growth in the total amount of pesticide use
- Coverage rate of using green approach for pest prevention and control increased to 30% or above, while 100% of coverage for major vegetable bases
- Coverage rate of the specialized large-scale pest control system being over 40%, while 100% of coverage for high yield demonstration areas of grain, cotton, oil and sugar
- Pesticides use efficiency reaches 40% or above
- Proportion of high-efficiency, low-toxicity and low-residue pesticides increased significantly

Pathways:

- Establish automated and intelligent pest and disease monitoring network and early warning system
- Apply green prevention and control technologies such as agricultural control, biological control, and physical control to create environmental conditions unconducive to the occurrence of pests and diseases
- Expand the implementation scope for subsidies for low-toxic bio-pesticides
- Accelerate the popularization of application of bio-pesticides, high-efficiency and low-residue pesticides, and phase out high toxicity pesticides
- Develop and use modern plant protection machinery to reduce pesticide loss and waste
- Select formula pesticide on the basis of accurately diagnosing pests and diseases and understanding their resistance level
- Support specialized pest and disease control service organizations to carry out large-scale specialized unified control activities

1.4 Recycling of plastic mulch

Targets:

- Recovery rate for agricultural plastic mulch achieves 80% or above
- By 2020, Provinces with high plastic mulch use (Hebei, Liaoning, Shandong, Henan, Gansu, Xinjiang, etc.) achieve comprehensive recycling and utilization of the mulch

Pathways:

- Speed up the revision of standard for plastic mulch production, strictly stipulate its thickness and tensile strength, and strict prohibit production and use of the mulch with thickness less than 0.01mm

- Increase funding support for dry farming techniques subsidy, and subsidize the use, recycling, processing and utilization of thick plastic mulch
- Carry out regional demonstration of plastic mulch recycling, develop capacity of the recycling network and waste mulch processing
- Accelerate research and development of eco-friendly degradable plastic mulch
- Accelerate research and development of plastic mulch residue collection and processing machinery

1.5 Resource-oriented utilization of livestock and poultry manure

Targets:

- By 2020, proportion of large-scale livestock and poultry farms with waste treatment facilities installed reaches 75% or more

Pathways:

- To plan the layout of livestock and poultry farming reasonably, taking into account the environmental carrying capacity and pollution control requirements
- Implement standardized and scaled rearing, and establish facilities for storage, treatment and utilization of fecal sewage
- Encourage and support household collection and centralized processing in areas with intensively distributed livestock and poultry farms
- Construct large-scale biogas project in areas with intensively distributed livestock and poultry farms, and at the same time, support to develop large-scale natural gas projects
- Promote techniques of comprehensive utilization of livestock and poultry manure, and guide farms conducting resources-oriented utilization
- Strengthen the development of aquaculture demonstration farms, and promote aquaculture techniques such as industrial recirculating, pond eco-recirculating, and bottom sewage discharge from large-scale cage aquaculture
- By end of 2017, close down or relocate farms in areas not allowed to develop livestock and poultry farming by law
- Since 2016, newly built, re-built, and renovated large-scale livestock and poultry farms should implement rainwater and sewage diversion project as well as resource-oriented use of fecal wastewater

1.6 Resource-oriented utilization of crop straw

Targets:

- Comprehensive utilization rate of crop straw reaches 85% or above

Pathways:

- Carry out crop straw returning to the field, and fertilizer, raw material, energy-oriented utilization
- Establish government-promoted and market-driven crop straw collection and storage system, and accelerate the industrialization of its comprehensive utilization
- Research and promulgate policies and measures such as preferential tariff for straw preliminary processing, incorporation of land for straw storage into agricultural land management, and expansion of the scope of tax incentives and credit loan
- Initiate demonstration projects of comprehensive utilization of crop straw in key areas for anti-air pollution such as Beijing, Tianjin and Hebei, taking the lead in realizing its full resource-oriented utilization

1.7 Demonstration

During the 13th Five-Year Plan period, China has been promoting, at different scales, the establishment of demonstrations on circulating agriculture and anti-nonpoint-source pollution. The aim is to explore a bunch of replicable technologies and practical models for its full-scale implementation.

Zhejiang is the selected pilot province of modern eco-recycling agriculture. A number of demo-bases are planned to be established focusing on chemical fertilizer and pesticides reduction, recycling of livestock and poultry wastes, high-value utilization of crop straw, pollution reduction of aquaculture, resource-oriented utilization of residual plastic mulch and treatment of rural domestic pollution, paying attention to develop market-oriented operation.

At river basin level, China has started several anti-agricultural non-point resource pollution programs. According to the *Demonstration Project Planning for Comprehensive Control of Agricultural Non-point Pollution in Key Watersheds (2016-2020)*, in key water source protected areas and environmental sensitive areas – including Dongtinghu Lake, Poyanghu Lake, Taihu Lake, Haihe River basin, Songhuajiang River basin, Huaihe River basin, Three Gorges Reservior area, Danjiangkou Reservior area, Chaohu Lake, and Erhai Lake—government selects a series of typical agricultural small watersheds to carry out the comprehensive control of agricultural non-point source pollution.

While in provinces suffered heavily from the agricultural “white pollution”— including Xinjiang, Gansu, Inner Mongolia, Shaanxi, Ningxia, Shanxi, Shandong, Hebei, Henan,

Heilongjiang, Jilin, and Liaoning – a number of counties are selected for pilot demonstration of farmland plastic mulch recycling and utilization.

1.8 Governance arrangements

In terms of financing, government promotes to use a combination of government financial funds, financial loans as well as private sector funds. Financial investments needed for the planned demo bases or projects are supposed to be channeled through multiple sources by means such as policy guides, using the rewards instead of subsidies approach, as well as public and private sector cooperation, with the aim of giving full play to the market mechanism. Government also encourage financial institutions to increase the availability of credit funds.

In order to foster new types of governance entity, government encourages the development of service organizations on a variety of aspects, for example, agricultural machinery, plant protection, agricultural technology and information, plastic mulch recycling, crop straw recycling and processing, organic fertilizer production and so on. Government also encourages to explore the mechanism of government purchasing services as well as the PPP (public-private-partnership) model. The aim is to form a operation system where public welfare services and business services coexist and being well coordinated.

At provincial level, the identification of demo-sites is led by provincial development and reform department in consultation with provincial agricultural department. The two departments also guide the compilation of Feasibility Study Report and Preliminary Design Report which are supposed to be conducted by people's government of the pilot county, and followed by project bidding.

1.9 Example at municipal level:

Governments at provincial or lower levels formulate the implementation rules in their respective administrative areas, in accordance with the guidelines and policies set by the state. This report uses an example of Jingmen City, Hubei Province to elaborate at local level, how policies are set in addressing agricultural non-point source pollution.

In December 2018, at the 16th meeting of the Standing Committee of the 9th People's Congress of Jingmen City, *Regulations on the Prevention and Control of Agricultural Non-point Source Pollution of Jingmen City (Draft)* was adopted. The promulgation of this regulation is based on the cognition that there are many relevant strategic guidelines and

policy orientations at national level, but relevant legislation is fragmented and scattered. Jingmen government considers that a comprehensive legislation is needed.

The regulation stipulates that agricultural non-point source control in Jingmen city adopts a capped approach. The department of eco-environment sets the total amount control target, and implements strict discharge standards and technical specifications. It also, together with other relevant department of agriculture, forestry, water affairs and land and resources, establish a monitoring network and organize monitoring. Entities or individuals who caused the pollution shall be responsible for its control and remediation; if the main body of responsibility cannot be determined, the government at county level shall bear the responsibility.

Examples of measures:

- Prohibiting the production, sale and use of agricultural inputs that are prohibited by the state or do not meet the quality and safety standards
- Guiding the agricultural producers to reasonably use agricultural inputs such as pesticides, veterinary drugs, fertilizers, and plastic mulch
- Implementing pesticide sales prescription system, and establishing electronic monitoring and regulating platform. Pesticides' purchase, sale and use records shall be kept for at least two years
- Establishing recycling stations for pesticides, fertilizers and plastic mulch, and implementing centralized and harmless treatment. Randomly discard, burying or burning of wastes from agricultural inputs shall be imposed a fine of 200-1000 Yuan.
- Promoting standardized aquaculture technology and ecological breeding models, prohibiting enclosure breeding in rivers, lakes and reservoirs. Water treatment facilities and water quality testing instruments shall be equipped.
- The practice of resource-oriented utilization of livestock and poultry shall be recorded and reported to the department of eco-environment. Taking and keeping livestock and poultry breeding records is mandatory, and a fine of 200-1000 yuan will be imposed to those who fail to establish the records.
- Constructing pollution prevention and control facilities appropriate to the scale of livestock and poultry farming, and ensuring their normal operation; or entrusting a third part entity for the treatment and utilization. Livestock and poultry farms shall not be put into operation if not following the requirements.
- Encouraging practices such as returning manure to the field, producing biogas, and organic fertilizer. Livestock and poultry wastes discarded shall meet the

discharge standards stipulated by the State, and any discharge of wastes that do not meet the standard shall be fined for 1000-5000 yuan.

- Establishing eco-compensation mechanism for agricultural non-point source pollution prevention and control, and incorporating the development of eco-agriculture into the scope of financial subsidies.

2. Grain for green program

2.1 Eco-restoration against desertification

Grain for green program is the largest ecological restoration initiative in terms of policy implications, investment amount, scope and level of public participation that China has ever proposed. And it is also regarded as the most significant program in terms of enabling and benefiting farmers. It was proposed by the Central Committee of CPC and the State Council, after the massive flood in the Yangtze River in 1998, as a strategic decision to exchange grain for good eco-environment, i.e. to retrieve forestry/grassland from farmland to control soil and water erosion and desertification.

Since 1999, the pilots has been carried out in Sichuan, Shanxi and Gansu provinces. Sloping cropland and other farmland with serious desertification/salinization or those plays an important role in providing ecological functions have been stopped from cultivation. Replantation or natural enclosure have been adopted for restoring degraded ecosystems. Farmers and households were provided with subsidies in forms of food, cash and seedlings for free. In 2000, the pilots was extended to the upper reaches of the Yangtze River and middle and upper reaches of the Yellow River.

Planning of Grain for Green Program (2001-2010) came out in 2001. It proposed that the total area of the program should reach 14.67 million hectares by 2010. At the same time, it is very important to increase farmers' income and pay attention to the adjustment and optimization of agricultural structure, i.e. to gradually shift farmers from traditional crop farming to forestry, eco-farming and animal husbandry, as well as non-agricultural industries. In 2002, Grain for Green Program has been formally implemented nationwide with a coverage of 25 provinces, direct-controlled municipalities and autonomous region. In the same year, *Regulations on Grain for Green Program* was promulgated, marking that the work has stepped into the era of legalized management.

The Regulation regulates activities under the program through a top-down, highly planned approach. The State Forestry and Grassland Administration complies the general plan for the programme which gets approved by the State Council later. Then forestry

department at provincial level to be in charge of compiling the implementation plan for their respective administrative region, and county level government to be responsible for implementation. At the same time, government at all levels shall strengthen the establishment of seedling production and harvesting bases, and organize technicians to provide technical guidance and services. Local governments at all levels are in charge of examining the achievements of the project, as well as issuing certificates upon being qualified.

The cash subsidy arranged by the central government is mainly used for the compensation of necessary expenditures such as medical treatment, education and daily life. The standard is set as 20 yuan per mu annually with a duration of 8 years for the transformed non-commercial forests, 5 years for commercial forests, and 2 years for grasslands. In 2007, on the basis of maintaining the original allowance, there is an extra amount of subsidy added: 105 yuan per mu annually in the Yangtze River basin and the southern region, while 70 yuan for that of the Yellow River basin. Local governments may appropriately raise the standard according to local conditions.

Government protects the legitimate rights of returnees by, for example, ensuring their ownership of woods planted on the rehabilitated land. Those who engaged in activities of destroying vegetation, such as reclamation without authorization and mining, should bear respective legal liability.

The program achieved its historical peak in 2003 when more than 2 million hectares of agricultural land were transformed for eco-restoration. However, it was the same year that the country's grain production fell to its lowest level within the recent decade. This situation made the policymakers to have a second thought over its land use policy, and finally decided to gradually reduce the intensity of the program. By the end of 2006, a total of 139 million mu of farmland has been reforested throughout the country. In 2007, the State Council decided not to stick to the original plan of returning 20 million mu of farmland in order to ensure an adequate amount of area for grain production. And since then, the Grain for Green Program has entered a stage of achievements' consolidation.

In 2014, the promulgation of *A New Round of Overall Scheme of Grain for Green Program* marked as the resume of the work. according to *the Scheme*, by 2020, a total area of 42.4 million mu of slopping farmland and those suffered from serious desertification will be returned to forest or grassland; this includes 21.73 million mu of farmland with 25 degree in slope, 17 million mu of heavily desertificated cultivated land, and 3.7 million mu cropland in Danjiangkou Reservoir area and Three Gorges Reservoir area with 15-25

degree in slope. In terms of subsidy criteria, the subsidy for returning farmland to forestry is 1500 yuan per mu and 800 yuan per mu for returning farmland to grassland. Provincial governments can determine specific subsidy standard as long as it is not below the state criteria.

In terms of other supporting policies, the transformed forests, as long as it can meet the criteria of public non-commercial forest, should be compensated for their ecological benefits. While for those not classified as public non-commercial forest, they may be harvested once getting authorized. The returned grassland with clear ownerships shall be included in the grassland eco-compensation mechanism. Under the premise of not destroying vegetation and causing more soil and water loss, farmers are allowed to develop under-forestry economy and conduct diversifying operation.

2.2 Governance arrangements

Subsidy funds all come from the government. The central government allocates the subsidy fund to the provincial level government according to the area of farmland being transformed. The provincial government can independently determine specific subsidy standard according to local circumstances as long as it is higher than the central standard, where the increased part is borne by local government finance.

For the vegetated forests which meet the criteria of public welfare forest, they shall be included in either national or local forest eco-compensation mechanism, while for those not conform to the standard, they can be harvested upon approval. For restored grassland with clearly defined ownership, they shall be included in the grassland eco-compensation mechanism.

On the premise of not destroying vegetation and causing soil and water erosion, farmers are allowed to develop agroforestry. Family forestry farms are encouraged as a way of promoting a diversified economy. Special funds of central finance are arranged and coordinated to support a smooth transition after farmland being transformed, for example, for developing characteristic industries, helping the adjustment of agricultural industry structure, and income increasing.

3. Well-facilitated farmland

3.1 Improvement of farmland productivity

Cultivated land protection has always played an important role in China's agricultural and land policy. From 1997 to 2008, China lost a total area of 125 million mu of cultivated land, due to the Grain for Green Program, occupation by non-agricultural use, disaster damage

and adjustment of agricultural structure. The most significant factor was the Grain for Green Program. In order to curb the trend of rapid reduction of cultivated land in China, the central government has put forward a policy of setting up a “caution line of 1.8 billion mu” for the total area of cultivated land in China, which should be strictly implemented. According to requirements from the *National Land Use Plan (2016-2030)*, the total area of China’s cultivated land should be maintained at 1.865 billion mu or above by 2020, and this number for 2030 is 1.825 billion mu or above.

There are great differences in land quality of China’s cultivated land – two thirds of them are qualified as low and medium-yield farmland. In order to ensure food security, improving the quality of cultivated land has become an inevitable choice. *The 2008 State Council Report* proposed to improve the quality of low and medium-yield farmland, transforming them into well-facilitated farmland. The importance of this work can be understood from the promulgation of a series of central policy documents, including *the No.1 Central Document* from 2009-2013 and *the 12th Five-Year Plan*. It is noteworthy that *the 13th Five-Year Plan* calls for the implementation of the strategy for food security – store grain in the ground, and store grain in technology.

The establishment of well-facilitated farmland covers eight aspects including land, soil, water, road, forest, electricity, technology and management. *The National Master Plan for Promotion of Well-facilitated Farmland (2011-2020)* proposes a target of 800 million mu of well-facilitated farmland to be built by 2020, with the production capacity of grain per mu increased to 100 kg or above.

Targets:

- Forming a number of centralized well-facilitated farmlands with more than 50,000 mu of area for each
- Thickness of effective soil layer more than 50cm, thickness of plough layer more than 20cm, less than 8% of the land occupied by infrastructure, and no less than 90% of terrace coverage rate in hilly areas
- Content of soil organic matter over 12g/kg, nutrient content reaches the “medium” or “high” level referring to local standard, soil PH value maintained at 5.5-7.5, and heavy metal content conforms to national standard
- Irrigation and drainage system well equipped, with guaranteed irrigation rate of 50% or above
- Proportion of field directly accessible by field road – 100% in plain areas while 90% or more in hilly areas

- Power supply for farm machinery such as wells and pumping stations improved, and installation and operation of power systems meet relevant standards
- Coverage of soil testing and formula fertilization technique more than 95%, coverage of field monitoring spots more than 50%, coverage of integrated control of crop diseases and pests more than 50%, comprehensive mechanization level reaches 50% or above, and coverage of advanced seeds over 96%
- Monitoring and supervision system improved

Pathways:

- Land consolidation
 - ✓ Divide and consolidate plots, level the ground and reduce the surface slope
 - ✓ Plough and loose soil deeply
 - ✓ Build terraces according to local condition
- Improvement of soil
 - ✓ Use farm manure, and return crop straw to the field
 - ✓ Implement soil testing and formula fertilization
 - ✓ Promote conservation tillage, treat saline-alkali soil, pacified soil and heavy metal-polluted soil, and improve the physical and chemical properties in tillage layer
- Construction of irrigation and drainage facilities
 - ✓ Implement water source project
 - ✓ Support the construction of distribution channels, drainage ditches and pumping stations
 - ✓ Popularize water-saving irrigation techniques such as canal seepage control, pipeline water conveyance, sprinkler irrigation and micro-irrigation
- Renovation of field roads
 - ✓ Optimizing the layout of roads for machine-ploughing, and reasonably determine the density of road network
 - ✓ Renovate and construct farm roads and other ancillary facilities to improve the convenience of agricultural machinery operation
- Improvement of farmland protection and ecosystem conservation system
 - ✓ Construct and restore farmland shelter forest networks in areas severely affected by strong winds and sandstorms
 - ✓ Construct facilities for slope protection and gully control in areas prone to soil erosion

- Power transmission and distribution systems
 - ✓ For farmland suitable for electric power irrigation and drainage, as well as informatization management, lay high and low-voltage transmission lines, build transformer and distribution facilities to guarantee a well-functioning of pumping stations, wells and the information project
- Strengthening of agricultural science and technology services
 - ✓ Deploy positioning monitoring equipment, establish monitoring stations for soil quality, and pest situation
 - ✓ Strengthen the irrigation test station network
 - ✓ Develop demonstration for agricultural science and technology, promote its application
 - ✓ Speed up the demonstration and popularization of new agricultural machinery
- Follow-up care
 - ✓ Identify the main body for management and its responsibilities
 - ✓ Establish reward and compensation mechanism
 - ✓ Guide and encourage the participation of large professional households, family farms, farmers' cooperatives, farmers' water cooperatives, agricultural enterprises and village collectives in the operation and management of facilities
 - ✓ Secure funds for management and supervise its usage

Later on in 2016, the central government upgraded its targets of establishing well-facilitated farmland to 1 billion mu from the original 800 million mu. At the same time, the farmland rotation and fallow farming mechanism was proposed. *Recuperation plan for cultivated land, grassland, rivers and lakes (2016-2030)* comes up with a target that, by 2020 the average quality of cultivated land to be improved by 0.5 grade as compared with that in 2015, while to achieve 1.0 grade of improvement by 2030, by establishing a reasonable rotation and fallow farming system. The implementation scale for farmland fallow in 2017 is 2 million mu.

The farmland rotation and fallow farming mechanism aims to be operational on the premise of guaranteeing national food security and not affecting farmers' income. It requires that regular fallow cultivation should be carried out on farmland suffering from soil pollution, degradation of ecosystem functions, and insufficient water resources. The role of the market mechanism is emphasized. For example, the Plan suggests guiding the

practitioner to reduce the intensity of arable land use by adjusting agricultural product's price and support their storage.

3.2 Demonstration and governance arrangements

A regional approach is adopted. For the implementation of well-facilitated farmland, The whole country is divided into eight regional types according to climate, topography, water availability, geology and land use conditions (i.e., Northeast Plain Area, North China Plain Area, North Mountain Hilly Area, Loess Plateau Area, Inland Arid and Semi-arid Area, South Plain River Network Area, Southern Mountain Hilly Area and Southwest Plateau Hilly Area), and each region has differentiated focus and requirements.

In terms of implementation of farmland rotation and fallow mechanism, demonstrations are planned to be set up in groundwater depletion area (i.e., Hebei Province), heavy metal polluted area (i.e., Hunan Province) and ecologically degraded area (i.e., Gansu, Guizhou and Yunnan provinces).

At national level, a multi-sectoral consultation and cooperation mechanism is established with:

- ✓ National Development and Reform Commission in charge of comprehensive coordination
- ✓ Ministry of Finance to figure out funds
- ✓ Ministry of Land and Resources guiding the implementation of land consolidation projects
- ✓ Ministry of Agriculture guiding the implementation of soil improvement and agricultural machinery projects
- ✓ Ministry of Water Resources guiding the water source management, construction of irrigation and drainage facilities and slope farmland and flood control projects
- ✓ The Forestry Bureau guiding the farmland forest network project
- ✓ The Statistical Bureau tracking and monitoring the utilization, outputs, disaster prevention and mitigation effects
- ✓ The provincial people's government bear the overall responsibility for the work of the province.

A diversified financing mechanism is advocated for the implementation of the work. Government arranges funds through public budgets and the role of farmers, farmers' professional cooperative organizations, agricultural enterprises and other business entities shall be given full play.

4. Grassland restoration

4.1 Planned grazing

Article 47 of the Grassland Law stipulates to apply prohibiting or resting grazing mechanism in grassland areas of serious degradation, desertification and salinization as well as ecologically fragile areas. Prohibition of grazing is an approach not allowing for utilization of grassland for a more-than-one-year period, while resting grazing refers to not allowed to graze in a specific period within a year.

The grass-livestock balance mechanism is to determine the amount of livestock by the quantity and quality of forage available (including those obtained from natural grassland, cultivated grassland or forage production base). It combines grassland conservation with animal husbandry production closely, for a well-functioning ecosystem as well as the sustainable development of the animal husbandry. *Article 45 and 46 of the Grassland Law* stipulates that, the administrative department of grasslands under the local people's government at or above the county level shall, in light of the actual local conditions, regularly verify the carrying capacity of livestock in order to prevent overgrazing.

During the 12th Five-Year-Plan period, the eco-compensation mechanism for grassland restoration was established. As a mechanism to stimulate the implementation of prohibiting grazing and grass-livestock balance, subsidies and incentives are given to herdsman for their compliance with the policy. It is estimated that, from 2011 to 2015, the central government has spent more than 13 billion CNY annually for the implementation of grassland eco-compensation mechanism in eight major grassland areas including Inner Mongolia and Xinjiang.

4.2 Development of grass husbandry

In 2011, *Opinions of the State Council on Promoting the Good and Rapid Development of Grassland Areas* brought up the development of water-saving irrigated forage base, to promote a gradual transformation from natural grazing to barn-feeding. Later on, during the 13th Five-Year-Plan period, the government has realized that the key to solve insufficiency in forage grass provision lies in the development of cultivated grassland, and the concept of grass husbandry was then proposed.

Grass husbandry covers several dimensions including natural grassland conservation, grass forage production, and processing of livestock products. Its importance is reflected in China's determination of promoting coordinated development of the ternary planting

structure of grain-cash crop-forage, in which plantation of grass forage is considered in parallel with growing grain and cash crops.

Targets by 2020:

- Total amount of fresh grass from natural grasslands reaches 1.05 billion tons
- Vegetation coverage of natural grassland reaches 56%
- Rate of overloaded key natural grassland to be less than 10%
- Reserved area for cultivated grassland reaches 350 million mu
- Total output of beef and mutton exceeds 13 million tons
- Total output of milk exceeds 41 million tons

Ministry of Agriculture has organized pilot projects on grass husbandry development in 37 counties of 12 provinces including Hebei. Grassland of the whole country is divided into four regions – arid and semi-arid areas in North China, Qinghai-Tibet Plateau, humid and semi-humid areas in North and Northeast China, as well as Southern China, and each region has its priority and development model.

5. Anti-overfishing

5.1 Restriction on offshore fishing

Although as early as the mid and late 1980s, the government adjusted its fishery development strategy from “fishing supplemented by feeding” to “feeding supplemented by fishing”, and a series of policies were proposed for the purpose of reduction in offshore fishing (see the table below), the situation of overexploitation of offshore fishery resources has been getting worse. This is due to the large number of fishery practitioners, the rapid growth of the capacity of fishing vessels, and an unsustainable way of the catching practice.

Year	Policy	Source
1986	Set entry requirements for entities of catching marine fishery resources	<i>Fisheries Law; Rule for Fishing License Management</i>
1987	Limit the total number of fishing vessels; Total power capacity management	<i>Opinions on Control Indicators of Offshore Fishing Vessels</i>
1995	Summer fishing moratorium: prohibit offshore fishing from June to September	

	to protect the reproduction and growth of juvenile fish	
2002	Establishment of a special fund for marine fishermen's transfer to other business	<i>Regulations on the Use and Management of Special Funds for Marine Fishermen's Transfer to other Business</i>
2009	Guarantee that the Special Fund for Stock Enhancement of Aquatic Organisms to be channeled from the Fishery Resource Fee	<i>Regulations on the Management of Stock Enhancement of Aquatic Organisms</i>
2013	Stipulate the minimum mesh size for major marine fishing tool	<i>Notification on the Implementation of the Minimum Mesh Size for Fishing Tool in Marine Fishing</i>

Targets by 2020:

- Total amount of marine fishing controlled at 10 million tons
- Number of fishing vessels controlled under 20,000
- Total power capacity of fishing vessels controlled within 1.5 million kW
- Sign the responsible letter for the total amount management of fishery resources with the respective fishery department, according to the allocated total allowable amount of marine fishing

5.2 Development of aquaculture industry and marine ranching

In parallel with the endeavor of putting restrictions on the offshore fishery, China has been developing its aquaculture industry, and the production of which has exceeded that of offshore fishing since 1990. In 2016, the Ministry of Agriculture started demonstrations on healthy aquaculture activities, and by 2010, the proportion of the area of standardized and healthy aquaculture practice has reached 30%.

Developing marine ranching is another approach to increase aquaculture production. It was proposed in *the 2013 State Council's Opinions on Promoting Sustainable and Healthy Development of Marine Fishery*, which states to strengthen the use of artificial reefs and increase the level of stock enhancement.

According to *the 13th Five-Year-Plan for National Fisheries Development (2016-2020)*:

- Establish 80 new state-level marine ranching demonstration zones
- The number of national aquatic germplasm reserves reaches 550 or above

- The number of aquatic biological nature reserves at or above provincial level reaches 80 or above
- Establish more than 2500 new freshwater aquaculture demonstration farms
- The number of healthy aquaculture demonstration country reaches more than 50
- The proportion of healthy aquaculture demonstration area reaches to 65%
- Coverage of fishery insurance gets expanded
- The net per capita income of fishermen gets doubled as compared to 2010

In terms of financing, it is required by the central government that financial tools such as Modern Agriculture Development funds, policy-driven aquaculture insurances, aquaculture ownership mortgage loans and relevant subsidies should incline towards eligible demonstration counties and farms.

6. In-situ conservation

6.1 Biodiversity for agriculture

In situ conservation of crop germplasm resources

With the acceleration of urbanization, industrialization, climate change, environmental pollution, and invasion of alien species, the unique germplasm resources of crops in China have been seriously lost. For example, In Guangxi Zhuang Autonomous Region, there were 1342 wild rice distribution spot, and only 325 were currently left.

According to *the Medium and Long-term Development Plan for the Conservation and Utilization of Crop Germplasm Resources (2015-2030)*, the conservation of germplasm resources in China adheres to the principle of combining ex situ preservation with in situ conservation. In situ conservation is to protect the centralized distribution area of wild crop relatives as well as wild germplasm resources with important economic value, and to monitor their vitality and generic integrity regularly.

Forage and livestock generic resources conservation

Grassland nature reserve is a law-protected special area for the conservation and management of representative natural grassland ecosystems, such as concentrated distribution areas of rare and endangered wild animals and plants, as well as grasslands with important ecological functions and economic value. Activities such as felling, hunting, collecting medicine, reclamation, and burning grass are prohibited in the nature reserve. Grasslands that have been reclaimed in the nature reserve must be rehabilitated and managed with the grass-livestock balance principle.

Meanwhile, there are conservation farms and protected areas established in situ for livestock and poultry genetic resources conservation.

Fishery germplasm resources conservation

From 1997, aquatic flora and fauna nature reserves were established for the conservation of aquatic flora and fauna species, especially the rare and endangered species with scientific, economic and cultural values and their natural habitats. By the end of 2017, there are 24 aquatic flora and fauna nature reserves nationwide, including 7 marine nature reserves.

Since 2011, aquatic germplasm resources reserves were established in main breeding areas (such as spawning ground, feeding grounds, wintering fields, and migratory passages) for the conservation and utilization of the aquatic germplasm resources and their living environment. As of the end of 2017, there are 492 aquatic germplasm resources reserves nationwide, including 50 marine reserves.

Governance arrangements

According to *the National Nature Reserve Regulations*, nature reserves in China are managed by the government. Funds required are requested to be arranged by the government at the country level where the nature reserve is located (or above). For the national level nature reserves, the national government also grants some financial assistance. Tourism is allowed but must be carefully managed under the premise of not affecting the well-functioning of its ecosystem.

6.2 Negative validation rule for industries accessing the key ecological-function zones

In December 2010, the State Council issued *the National Main Functional Area Planning*, which divided China's national land space into four categories: optimized development area, key development area, restricted development area, and prohibited development area. Among them, the restricted area is further divided into two categories: key ecological-function zone and major agricultural production zone.

The key ecological-function zone is the area of great importance to ecological security but undergoing certain extent of ecosystem degradation. It is restricted from large-scale and intensive development activities for the recovery of its ability in providing ecosystem products and services. Four major types of ecosystem functions divide them into four types –water source conservation type, soil and water conservation type, wind prevention and sand fixation type, and biodiversity conservation type.

In 2015, the 13th Five-Year Plan put forward a request of compiling the “negative validation rule for industries accessing the key ecological-function zones”. One year later, the measures for its implementation came out, which stipulates the people’s government at county or municipal level to sort out the situation of industrial development in their respective administrative regions, assess the status of the ecological environment, and propose a negative list of industries to be involved in the local development. This negative list shall include industries restricted or prohibited. For the restricted, the scale of production, its location or scope, and the process of production should be clearly identified, while the prohibited industries should be totally banned. Then, the negative list shall be validated by the respective provincial development and reform commission and report to the central government before being put into implementation.

7. Sustainable consumption

China’s construction structure is undergoing profound changes, leading to the upgrade of related industries which expands new space for future development. Sustainable consumption is characterized by the purchasing behavior taking into consideration of resource-saving and environmental protection, such as reducing loss and waste, choosing more efficient and environmentally friendly products and services. In 2016, National Development and Reform Commission, Ministry of Finance and together with other 8 line ministries released the *Guidance on Promoting Sustainable Consumption*, aiming to speed up the transformation.

Pathways related to agriculture include

- Promoting sustainable consumption concept by strengthening publicity and education
- Guiding consumption behavior, such as guiding the use of pesticides and fertilizers with low ammonia and volatile organic pollutants emissions
- Promoting green products and setting strict standards for market access
- Accelerating the certification of low-carbon or organic products

8. Yunnan’s devotion in geographically indicated green food products

Relying on its climate, water and biological resources, as well as the advantages in crop variety innovation, Yunnan province plans to vigorously develop its green food industry, promoting geographically indicated green food products (*the Green Food Programme*). The Programme aims to integrate green concept into all links of the whole value chain, including biological variety breeding/selection, planting, processing, manufacturing, as well as enterprise and brand building. The Programme puts development of agricultural processing and manufacturing at the core of its success, and eight industries were

proposed as the focal industries, they are tea, flowers, fruits, vegetables, nuts, coffee, Chinese herbs, and beef cattle. By 2020, Yunnan government will strive to achieve the national average ratio of agricultural product processing output value to agricultural total output value, while by 2025, to achieve the ratio to more than 3:1.

Pathways for developing its agriculture processing and manufacturing:

- Optimizing the industry layout by i) locating the processing and manufacturing industries close to the production areas, ii) supporting the construction of raw material storage base and establishment of logistics system, and iii) establishing new marketing platforms such as e-commerce.
- Improving the processing level of agricultural products by i) supporting farmers' cooperatives and family farms to improve their primary processing facilities such as storage, fresh-keeping, drying, sorting, packaging, etc., ii) supporting processing enterprises to speed up technological upgrading and improve the level of intensive processing.
- Enhancing the capacity of scientific and technological innovation by i) establishing R&D systems as well as technological demo-bases for agricultural processing, ii) promoting the effective match between research entities and enterprises, and iii) encouraging scientific and technical personnel to join enterprises as a technical shareholder.
- Creating well-known product brands by i) formulating production as well as product quality and safety standards, ii) establishing management system for green, eco-safe agricultural products; iii) supporting enterprises to apply green food or organic food certification as well as geographical indication (GI) registration; and iv) strengthening the registration and protection of trademarks, and punishing violation of intellectual property rights.
- Strengthening human capital by i) brining in talents, ii) introducing relevant courses (such as food science and engineering, agricultural products processing) in colleges and universities, and iii) carrying out vocational skills and entrepreneurship training.
- Providing attractive investing environment by strengthening financial, fiscal, land use and tax policy support. For example, from 2018-2022, Yunan government will strive to grant loans of more than 30 billion yuan annually to agricultural products processing enterprises at all levels.

In terms of approaches for implementation, Yunnan plans to establish 20 demo-counties – each county cultivate one leading industry. Smallholder farmers are considered as an important force in the landscape.

Pathways:

- Accelerating land tenure transfer and carrying out well-facilitated farmland construction
- Guiding new type agricultural operating entity to build scaled processing facilities
- Promoting standardized management and reasonable use of agricultural inputs for the control of non-point source pollution
- Delimiting key development areas for green or organic agriculture, and establishing protecting mechanism for green and organic agricultural products
- Expanding the scale of green and organic certification by i) organizing, guiding and serving the transformation towards organic origin, and ii) facilitating the introduction of organic agriculture certification agencies from the EU, U.S., and Japan into Yunnan
- Establishing green and organic alliance for i) promoting the unification of production and product standards, ii) a better propaganda, iii) improving the ability of alliance members to deal with market risks, and iv) enhancing added-value.

For a duration of three years, 30 million yuan of subsidies annually will be allocated by the provincial finance to each demo-county. The subsidy funds are planned to be used in public infrastructure construction, promotion of green or organic certification, Internet of Things (IoTs) demo-base construction, product quality traceability system construction, technical upgrading, brand building, R&D, and loan discount.

9. Policies on cross-cutting or enabling conditions

9.1 Eco-compensation mechanism

China started its eco-compensation practice as early as the beginning of this century when the Grain for Green Program was put into implementation. With years of implementation of this program and some other pilot projects, the eco-compensation mechanism has been regarded as an important approach to motivate different stakeholders for ecosystem conservation. However, generally speaking, the scope is relatively small, and mainly adopts the form of vertical transfer payment, while the use of horizontal transfer payment mainly focuses on the trans-river basins practice.

In order to establish a diversified eco-compensation mechanism and to expand its scope, the State Council issued *the Opinions on Improving the Ecological Compensation Mechanism* in 2016, which sets a target that, by 2020, to achieve a full coverage of eco-compensation in key ecosystems (including forest, grassland, wetland, desert, ocean,

river and arable land) and key areas (i.e., prohibited development area and key ecological-function zone).

Key ecosystems	Compensation practices
Forest	Stop commercial harvesting of natural forest
Grassland	Prohibit grazing Achieving grass-livestock balance
Wetland	Retrieve wetland from cultivated land
Desert	Enclosure and protection of desertified land Desertification prevention and control
Marine	Fishermen's career transfer Stock enhancement Aquaculture eco-restoration
Water streams	Soil and water conservation
Arable land	Rotation and fallow cultivation Retrieve forest/grassland from cultivated land Use of organic fertilizer and low-toxic pesticides

Horizontal eco-compensation relationships are encouraged to be established between beneficiary areas and eco-protected areas, through means of financial compensation, talent training, industrial transfer and so on. Typical watersheds with either important ecological functions, or with water supply and demand contradiction, or suffered from serious pollutions are prompted as priority areas for pilot eco-compensation projects, for example, 1) Yellow River and Yangtze River, 2) Water source area of the middle route of the South-to-North Water Transfer Project, 3) Beijing-Tianjin-Hebei water conservation area.

Eco-compensation practices are highly government driven, through inter-ministerial coordination mechanism, leading by National Development and Reform Commission and Ministry of Finance. Transfer payments from central finance will be strengthened in the coming years; the scope of resource tax will be expanded and allowed to be used for the eco-compensation purpose. At the same time, the government aims to establish a standard system for the eco-compensation mechanism, develop the monitoring capacity, form an information release system, and finally, promote its legalization.

9.2 Land tenure transfer and moderate-scale management

The household contracting responsibility mechanism, which was put into implementation since the 1980s, much mobilized the enthusiasm of hundreds of millions of farmers for agricultural production by separating the right of contracted land management from the collective-owned land ownership. At the present stage, with more and more farmers

migrating to urban areas as well as the gradually improved level of the use of agricultural technology and machinery, the right of contracted land management is further divided into the right of land contracting and the right of land management.

The division of the two rights accelerated the transfer of the right of land management to large professional households, family farms, farmers' cooperatives as well as leading enterprises. An estimation in 2017 showed that, there were more than 870,000 family farms nationwide, 1.888 million farms' cooperative legally registered, 386,000 agricultural industrialization organizations (including 129,000 leading enterprises), and more than 1.15 million agricultural social service organizations in existence². These new types of agricultural management entity have become a driving force for the development of moderate-scale management—an initiative highly advocated by the government to optimize the allocation of land resources and increasing land productivity.

Several principles have been highlighted by the government to advance the development of new types of agricultural management entity:

- Household-level agricultural management will still account for the majority, and it is important to foster family farms engaged in specialized and intensive agricultural production
- To explore new modes of collective-level agricultural management, for example, the land joint-stock cooperative organizations in which farmers can contract their lands into shares and involve in the management by ways of self-employment or entrusted management
- To encourage cooperation between household-level entities through a variety of linkages including labor, technology, machinery, financial capital, products and marketing.
- To foster business service organizations of all kinds of agricultural production, such as soil testing and formula fertilization, concentrated treatment of manure, large-scale pest prevention, and seedlings breeding
- To develop modern circulation service such as e-commerce, and support the construction of relevant infrastructure such as warehouses and grain drying sheds
- To guide the improvement of the benefit sharing mechanism
- To increase the financial support to the new types of agricultural management entity in ways of providing subsidy, reduction in taxes, enhancing financial credit support, and expanding insurance coverage

² http://www.xinhuanet.com/2017-06/01/c_1121070752.htm

- To implement the new farmer training project for the development of their agricultural skills as well as management capacity

9.3 Science and technology innovation

Recent years, the main challenge of agriculture has changed from the insufficiency in the total amount of output to the so-called structural dilemma, represented by the co-existence of over and insufficient-supply. This put forward higher requirements on the improvement of the quantity, quality, efficiency as well as sustainability of agricultural development.

Since *the 12th Five-Year-Plan* period, science and technology innovation has been greatly valued by the government in their efforts addressing the challenges of food security, food safety and ecological security. It is reported that the contribution rate of agricultural science and technology to the Gross Agricultural Output Value was increased to 56% in 2015 from 52% in 2010, while the target of this rate set for *the 13th Five-Year-Plan* period is 60%. By 2020, the number of high-tech agricultural enterprises is expected to be increased to more than 10000, while the target number for national agricultural high-tech industry demonstration zones is 30. The table below shows some examples of the prioritized areas for science and technology innovation in the coming period.

Category	Prioritized areas for science and technology innovation
Agricultural green development	<ul style="list-style-type: none"> • Water-saving agriculture • Circular agriculture • Comprehensive prevention and control of agricultural non-point source pollution and farmland heavy metal pollution • Agricultural disaster prevention and mitigation • Green logistics of agricultural products
Effective agricultural supply	<ul style="list-style-type: none"> • Improvement of farmland quality • Green grain storage • Prevention and control of major pests and diseases • Safety and efficient breeding of livestock and poultry • Forage and grass husbandry development • Healthy development of freshwater fishery
Modern marine agriculture	<ul style="list-style-type: none"> • Offshore fishery resource conservation and development of marine ranching • Eco-friendly fishing

	<ul style="list-style-type: none"> • Green processing and high value utilization of seafood • Marine eco-environment assessment and restoration
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Government also plans to work on a number of enabling conditions for science and technology innovation, including

- ✓ To cultivate enterprises, research institutes, universities, and social organizations as the main body for science and technology innovation
- ✓ To layout inter-regional innovation bases
- ✓ To establish a service system that accelerates the transformation and application of achievements
- ✓ To improve the incentive mechanism
- ✓ To facilitate buy-in of social resources
- ✓ To improve the intellectual property management
- ✓ To establish a fault-tolerant and error-correction system

10. Conclusions and Implications

China has a very systematic policy system, which evolved. The above narrative of policies on the eco-agri-food systems shows its problem-driven and highly planned nature. For each policy stream, clear policy targets are set for a specific interval of time (e.g., five years), and pathways to achieve them are proposed. Meanwhile, the system keeps a certain level of flexibility for adapting to the latest situation. An excellent example of this is the phased suspension of the Grain for Green Program to slow down the trend of rapid reduction in grain production – a policy response to ensure the country’s food security. During the suspending period, policy focus had been shifted to the improvement of farmland productivity. Currently, these two policy streams are implemented coordinately.

In terms of policy implementation, China adopts a phased and regionally-differentiated approach. It usually begins with establishing demonstration pilots to test out the best practical model for the further up-scaling, and at the same time taking into full account of the diversities among regions so that the models are customized to local circumstances and thus differ from each other. Incentive approaches, such as reductions in taxes or provision of subsidies, have been used more and more frequently to guide the practices in recent years. Although government finance is still the leading source for policy implementation, China is now exploring the use of multi-source financing, for example, credit funds and business funds.

The following table examines the target policy streams by the TEEB AgriFood framework, which highlights the importance of paying attention to all four kinds of capital and their respective ecosystem services in formulating policies. A preliminary estimate of the level of linkage of the target policies to the respective capital and its ecosystem services flows are indicated in the table (being classified as strong, moderate and weak), based on a desk review of relevant policy documents.

	Policies	Level of linkage			
		Natural capital	Produced capital	Social capital	Human capital
1	Anti-agricultural non-point source pollution	Strong (freshwater, nutrient cycling...)	Strong (infrastructure, R&D fertilizers & pesticides)	Strong (land tenure, social networks)	Moderate (labor & knowledge)
2	Grain for Green Program	Strong (biomass growth, soil and water)	Moderate (finance)	Strong (land tenure, social networks)	Strong (labor & knowledge)
3	Well-facilitated farmland	Strong (biomass growth, freshwater...)	Strong (machinery and infrastructure, R&D...)	Strong (land tenure, social networks)	Moderate (labor & knowledge)
4-1	Planned grazing	Strong (biomass growth)	Moderate (finance)	Moderate (land access)	Weak
4-2	Development of grass husbandry	Strong (biomass growth)	Moderate (R&D, finance)	Moderate (land access)	Weak
5-1	Restriction on offshore fishing	Strong (biomass growth)	Strong (machinery, energy)	Moderate (land access)	Weak
5-2	Aquaculture industry & marine ranching	Strong (biomass growth)	Strong (infrastructure, energy, R&D, finance)	Moderate (land access)	Moderate (labor & knowledge)
6	In situ conservation	Strong (biomass growth)	Strong (infrastructure, R&D, finance)	Moderate (land access)	Weak
7	Sustainable consumption	Weak	Weak	Strong (networks, cultural knowledge)	Strong (knowledge)
8	Yunnan's green food programme	Moderate (green production)	Strong	Strong	Strong

			(machinery & infrastructure, finance, R&D)	(networks, land access)	(labor, knowledge)
9-1	Eco-compensation	Strong (ecosystem services)	Strong (finance)	Strong (institution)	Strong (knowledge)
9-2	Land tenure transfer & moderate-scale management	Weak	Strong (infrastructure)	Strong (networks, land access)	Strong (labor)
9-3	Science & technology innovation	Weak	Strong (infrastructure, R&D, finance)	Moderate (networks)	Strong (knowledge, labor)

Generally speaking, the current eco-agri-food policy system has the strongest linkage with natural capital and its respective ecosystem service flows, as policies usually start with tackling the immediate and direct cause of the problem, for example, to prohibit grazing for grassland restoration (i.e., to ensure biomass growth). Finance, as one flow from the produced capital, appears in almost every policy streams and is a prerequisite for policies to tackle on. Other aspects related to the produced capital are also accounted. The most representative one is the well-facilitated farmland construction, in which the construction of irrigation and drainage system as well as field roads are highly valued. Furthermore, with a strong willingness from the government to advance its science and technology innovation, research and development penetrate across several policy streams.

When it comes to the social capital, the linkages have become less intense. Current policy entry points in this regard are mainly attributed to the transfer of the land management right, as well as the advocacy of developing new types of the agricultural management entity, in which social ties play a vital role. Human capital is the weakest dimension that policies have paid attention to. Actually, it is only until recent years and with the proposal of developing the “modern agriculture” that educating farmers and households is being mentioned by some policies.

In addition, from the information gained, China’s eco-agri-food policy systems still lack a value chain perspective. Policies are mainly tapping on the agricultural production, while their implications to other value chain aspects (manufacturing and processing, distribution, marketing and retail, and household consumption) are rarely reflected.

By reviewing China's policies on eco-agri-food systems, people could find how complicated the reality might be – this highlights the need to have the issues assessed by a comprehensive and systematic framework so that policymakers could be better informed. And we believe this is where TEEB AgriFood could provide assistance.

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