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China, Factor 6: Sustainable Agriculture

### **China: Sustainable Land Use on Sanjiang Plain**

Located in the northeast corner of China, Sanjiang Plain is in the administrative divisions of Heilongjiang Province. Amur River, Ussuri River and Songhua River joining together, with their waves impacting the soil, formed this flat and fertile alluvial plain whose total area is 108,900 square kilometers. The surface is wet and always has surplus water because of the broad and flat terrain. The cold and wet climate condition causes heavy precipitations in summer and autumn. Rivers run slowly with sudden flood peak periods. Seasonal freezing-thawing soil covers the whole plain. All those account for large areas of swamp water and vegetation which involves 2.4 million hectares of swamp and marsh soil, ranking China's largest swamp area. Ten wetland nature reserves were set up, attracting many international ecological and environmental protection organizations. The region, which is covered with 10 to 15 cm of water and the total quantity is 18.764 billion cubic meters, is home to many first-class national protected animals. For instance, the red-crowned cranes in the IUCN (World Conservation Union) red list, the Chinese merganser and the Siberian tiger all find their habit in this plain. Sod layer soils are thick, generally 30 to 40 cm. In the area lies the most fertile black earth in China, and it's one of the three black earth terrains in the world. High in organic matter, the organic matter is 3% to 10%. The folk adage in the Northeast "one pound of soil, two pounds of oil" highlights the fertility of the plain.

Sanjiang Plain is known as the North Warehouse, that is to say it is an important commodity grain base in China. There's one figure to prove this: its merchandise rate of grain is as high as 70%. Rice, corn and wheat all grow well there, and the climate is especially suitable for growing high-oil soybean and good quality wheat. The land provides an annual output of 15 million tons of grain, processes intensive agricultural production scale, and enjoys a good fame of being the top ONE in agricultural mechanization throughout China. There are more than 3.07 million hectares of previously cultivated land, more than 50 large state farms, and four administrations of state farms. The per capita cultivated land of Sanjiang Plain is approximately four times as large as the national average. Lying in the center of this blessed land, Heilongjiang province, Yalu River farm has a total of 30 thousand hectares of farmland, and among the rest there is 27 million hectares of rice-planting area. Residents have activated 800 hectares of high standard fields, hence, every hectare of field can increase its rice yield by 1,500 kilograms, and that amounts to earning 3.36 million Yuan more per year. Total output of grain in 2015 is expected to be more than 248 thousand tons. By now, agricultural mechanization rate has become 98.5%, and science and technology contribution rate 76%. Besides, asset-liability ratio has declined year by year, from 124.47% in 2010 to 82.80% in 2015. Meanwhile, per capita income has risen to 26 thousand per year. *Chinese National Geography* rated it as one of the ten "new paradises" in 2008.

The Gu family, living in Jixi City, Heilongjiang Province, is a typical farmer family in this flat and fertile plain. They mainly grow soybeans. The family holds a big farm of 20 thousand square meters, which is now operated mainly by machines: sowing and harvest by robot hands. Machines spraying herbicides help the farmers to weed, too. Nevertheless they still need to use their own hands when it comes to daily watering; they collect water from a motor-pumped well and then lead the necessity for the crops to them by long canals. Gu Xin's parents are authentic Chinese farmers, and as for him, he is now working in another province, away from his hometown and his family. He has a daughter, 14-year-old Gu Wenduo, who is in junior middle school. The old couples only got little education with no more than six years in primary school while Gu Xin received junior middle school education. All the

members in this family have joined the rural co-operate medical care. The soil gives them enough food to eat; their daily diet includes rice as a staple, potato, eggplants and green onions to go with rice. However, even the fertile and flat land can't guarantee them enough family income. Seeing that it's hard to support the family only by farming, Gu Xin and his sister both go out to work, leaving the old and the young home. Though capable to stay with their land and home, the old couple is more and more worry about their source of livelihood, as the expansion of urbanization encroaches on the farmland, and the decline of soil fertility causes the output of soybean decreasing year by year.

We can see some clue from Gu's case that unsustainable use of land resources is severely endangering Sanjiang Plain.

First of all, serious soil erosion brings a widespread decrease in crop production. The Northeast has some cultivated land located in gently hilly regions, with a slight slope (generally between 3 to 15 degrees) as well as a long slope length (usually more than 100 meters, some slopes in the black earth as long as several hundred or even a thousand meters), which makes it easy for the rainfall, the wind and the climate to damage the soil. Chen Wenfu, a member of the Chinese Academy of Engineering, a professor in Shenyang Agricultural University, once said: "It takes 0.3 billion years for 1 cm of black soil to take shape, but now the soil is degrading by 1 cm one year." At first the layer was as thick as 1 meter, by now it has been reduced to 30 to 40 cm. What worse, if not managed in time, the whole of it will be exhausted in 40 or 50 years. According to the statistics collected by the Water Conservancy Department of Heilongjiang Province, soil erosion area in the province is 13 million hectares, accounting for 30% of the total area. 3 million hectares of farmland which takes part of 25.2% of the total is included. Moreover, the new soil erosion area in 2011 increase by 330 thousand hectares in 2007. Every year due to the serious situation of the land, there is a decrease in food production for about 2.25 to 2.5 billion tons. Supposing each day each person needs 500g of grain, all of those above can support 13 million people for a whole year.

Secondly, arable land pollution is directly related to human health. Sanjiang Plain is cold and wet with a long unbearable winter when the activity of the soil microbes is weak. This leads to a lower decomposition of the soil to chemical substance and a weak soil ability of self-renewal. At the end of 2013, China's Ministry of Land and Resources and other ministries jointly issued *The Communique of the Main Data of the Second National Land Survey Result*, revealing that the moderate and severe polluted land which cannot be cultivated in China is now as wide as 33 million hectares, while the Northeast is among the most threatened areas. According to the survey, in 1970s farmers only used 10 kilograms of chemical fertilizers in one hectare of soil, however, now it is almost 100 kilograms, ten times as much as before. In 2003, pure investment of chemical fertilizer was 13 million tons; In 2011, the number reached 23 million, so the latter has increased by 81.7% compared with the former. Over use of plastic mulch, pesticides and chemical fertilizers is sure to pollute the soil, and once being polluted, the soil becomes dependent on those chemicals, so the farmers need to increase the amount again and again in order to insure the output. Then the soil is even more polluted and that creates a vicious circle which is like curing a patient by opium. The pollutant in soil will accumulate in the plant, and through the food chain, the contamination will in the end come into human bodies, harming our health, and causing a variety of diseases. Taking nitrogen application as an example, Zhang Weili, the Vice President of China Association of Soil, researcher at Chinese Academy of Agricultural Sciences, once said: "When excess nitrogen gathers in the soil, nitrogen will convert to nitrate, then the products will enter the human bodies through water and vegetables, and turn to nitrosamines which could do serious harm to human health. Through a large number of animal experiments, scientists have confirmed that it is a kind of strong carcinogen, and can lead to cancer in the next generation through placenta and milk. Epidemiological investigation in the crowd suggests that certain kinds of human cancers are connected with it, such as gastric cancer, esophageal cancer, etc.

What's more, excess reclamation of waste land damages the natural wetlands ecosystem, which is especially bad for the birds to live. Due to people's unawareness of the importance of the wetland, local people drain away water to make more cultivated land without limits; no wonder that Sanjiang Plain has lost 13 thousand square kilometers of wetland in only 50 years. Its area proportion has dropped from 52.49% to 15.71%. Meanwhile, red-crowned cranes are enduring a nightmare, for they breed mainly in the swamp or the reed of Sanjiang Plain. Once their breeding place is destroyed, they will be in great danger. As the migration route is really long for most birds, it will be impossible for them to fly straightly across the Pacific Ocean. Therefore, China's tidal wetlands along the long coastline are their important stopover sites. Director of ecological environment in Shenyang University, a famous bird and ecological photographer, Zhou Haixiang warned: "Shorebirds can hardly swim. They can only find food on the tidal wetlands. If the wetlands are mostly ruined, there will be a serious problem in the migration of these birds, owing to the lack of food."

Several reasons caused the unsustainable use of the land resources. Firstly, the "GDP ONLY" idea of quickly building the economy misguides the farmers. What must be paid enough attention to is that the predatory exploitation has already become the restrictive factor for sustainable development of local economy and society, and it is also causing irreversible harm to the soil. Secondly, the regulatory and legal system is not well established as to adapt to the demand of market economy. According to the recordation, an anonymous farmer once reclaimed cultivated land in the Ussuri River Wetland Nature Reserve without permission, or to say, illegally. So the staff from the local Environment Protection Department tried to stop him, but it was no use because they could not punish him, for they had no rights to perform *the Nature Reserve Management Regulations of the People's Republic of China*. According to the regulations of the law enforcement, they have been informed, that it is only the staff in the local nature reserve management committee who have got the right to enforce the law. However, the huge Ussuri River Wetland Nature Reserve is in the charge of only one person, Cheng Xianyou, the director of the Environmental Protection Division who is the proxy of the whole 3,900 hectares of land. From this example, we can see that the flaws also exist in the wetland management and legislation aspects. In addition, peasants are the subject of building the new countryside; their lack of scientific literacy affects the development of agriculture modernization. In the countryside, farmers still take flood irrigation as the common way of watering their crops; the organic matter which weighs less is generally washed away by the water, and that cause loss of the soil nutrient year by year. Being lacking in a correct understanding on wetlands value the farmers think that wetlands are equal to uncultivated land, and to leave these areas unused is a waste of resources. When the administrative staff try to stop them from doing harm to the wetland ecosystem, many of them even asked confusedly about why they cannot make use of the vacant land to grow more rice in order to feed more people. Apparently, it will be useless if they are only told that the wetland value can include natural resource value, ecological environmental value, special protection value, and scientific research and education value, or that the wetland is called the kidney of the earth, all of which are abstract, and seems not as meaningful as telling them how to increase the per unit area yield of grain. That's also why it is so hard to improve the scientific quality of the farmers who are not well-educated in China. Furthermore, by practical investigation and theoretical analysis, the study concludes that the factor restricting farmers' scientific accomplishment is the long-term urban-rural dual system, which is a serious obstacle in China's economical and social development. It leads to such problems as a household registration barrier between urban and rural areas, two kinds of resource allocation system, and other problems based on the urban-rural dual system. To put it easy, urban-rural dual system means the differences between urban and rural areas and citizens and farmers. So it is extremely hard for farmers to get formal training for their job as the citizens do before going to work. Certainly, The wet and cold climate makes it hard for the soil pollutants to be degraded and this leads to a long-term potential threat to the soil.

Fortunately, Sanjiang Plain is gradually coming back to life. On April 16, 2015, the State Council of China issued *the Water Pollution Prevention Action Plan*, in which the government emphasized a comprehensive recovery of the function of the water ecosystem, and a total recovery of the wetlands

on Sanjiang Plain. Heilongjiang Provincial Government has also carried out a second wetland resources investigation, reminding the public to pay enough attention to the worrying situation of the wetland environment. There are more and more people on the Internet who have realized the important position of sustainable agriculture appealing to all others to improve their enthusiasm for protecting land resources. On May 20, 2015, the Ministry of Agriculture united with the other ministries issued *the National Agricultural Sustainable Development Plan(2015-2030)*, and when it comes to the principle of regional layout of the Northeast, the organizers point out emphatically that in the typical black soil zone, the authorities should intensify the construction and preservation of the conserving forests at the water sources of the river valleys, integrally control soil erosion, and carry out the practice of protective cultivation so as to improve soil fertility, increase organic manure fertilizer application, and introduce rice-soybean crop rotation, As for the main production area of rice, like Sanjiang Plain, the government advanced a theory of controlling the area of paddy field to limit the exploitation of the groundwater, and change well irrigation to canal irrigation. On the Third Plenary Session of the 18th Session of the Central Committee of the Communist Party of China, *The Decision on Major Issues Concerning Comprehensively Deepening Reforms* was issued. It reads that urban-rural dual system is the main obstacle of the harmonious development of the rural areas and cities. Therefore, measures must be taken to build a new long-term system and mechanism in which agriculture shall be promoted by industry and the countryside by cities, so that reciprocity of workers and farmers and a unification of the urban and rural development will form. And this system shall enable the farmers to participate in the modernization process and share the fruits of it.

With all this above, some suggestions of helping the sustainable agriculture to develop healthily on Sanjiang Plain have been brought up.

a. The government should strive to develop high efficiency, low toxicity, no pollution and low residue scientific farming techniques and biological control technology; it should give allowances to the system of rice-soybean crop rotation to face problems like soil hardness; it should harshly supervise and punish the illegal acts to insure the quantity and quality of farmland while taking stronger measures to protect the wetlands and to avoid damaging wetlands to increase the crop output; it should also improve the civil awareness by publicity and education like setting up National Land Resources Protecting Day.

b. For the international organizations, they are supposed to improve the communications about agricultural modernization between countries to keep the information circulated around the globe, and unite all countries to fight against the global food crisis.

c. As for the farmers themselves, they should not only master the laws but also obey them; they should introduce new ways of cultivation and irrigation, and turn to using farmyard manure; they should learn to respect the nature, live together with other animals and protect the wetland resources: at the same time they should give suggestions about improving the sustainable agriculture to the authorities to make their own contributions.

All in all, Sanjiang Plain is a rich and fertile area. It not only provides much food to feed a large number of Chinese people, but also processes beautiful wetlands to balance the ecosystem of the country. However, the situation is worrying: the cultivated land is being damaged by improper exploitation and serious pollution; the wetland is being ruined by cultivation and its function is reduced. Although the things become better with the lead of the government, the people will face an irreversible disaster without quickening steps. The causes of this result are complicated: the wrong idea of developing the economy as quickly as possible, an improper system, the low efficiency of managing and supervising, an insufficient technology level, unconsciousness of people, and the wet

and cold climate of the Plain. Accordingly, the government should lead aright and supervise harshly; the international organizations should advise countries to work together; the farmers living on this land should improve their scientific accomplishment. All sides should strive together to protect this endangered land and be guardians of the food and land security.

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